COMPETITION AND THE STRUCTURE OF LOCAL BUS MARKETS

By Andrew Evans*

1. INTRODUCTION

The main provision of the British Transport Act 1985 was to allow operators to compete freely in providing commercial local bus services, except in London. It was believed that, whether there was active competition or not, incumbent operators would be so disciplined by the threat from potential entrants that they would always provide the best possible pattern of services and fares.

The purpose of this paper is to consider the performance of the competitive market for commercial bus services three years after the start of deregulation in October 1986. We begin by examining some case studies of active competition. Although active competition has occurred on only a minority of routes, it provides insights into the whole market, because the effectiveness of the entry threat held over incumbents everywhere by potential entrants depends on what would happen if the threat were carried out. The case studies of active competition provide illustrations of what might happen.

The paper continues as follows. Section 2 presents the empirical evidence from case studies of competition. Section 3 analyses the economics of typical competitive routes before, during and after competition, considering both their profitability for operators and their benefits to users. Section 4 considers, first, the implications of the profitability of such routes for operators' strategies, and, secondly, how operators' strategies then affect the performance of the free market in the provision of local bus services. Each section has its own conclusions, and Section 5 is the conclusion of the whole paper.

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2. EMPIRICAL EVIDENCE ON COMPETITION

As mentioned above, active competition has occurred on only a minority of routes. About 3 per cent of bus-kilometres were involved in direct "on the road" competition immediately after deregulation (Gomez-Ibanez and Meyer, 1987); this figure increased about threefold in the following year (Balcombe *et al.*, 1988), but now appears to be declining. Active competition has therefore always been the exception rather than the norm, and now seems set to remain so. Nevertheless, active competition has been common enough and varied enough to provide the industry with a wide range of experience. However, not many cases have been documented comprehensively enough for economic analysis; in particular, few case studies have yielded an estimate of the effect of competition on bus patronage. In this paper we use the studies where such an estimate has been made.

The three best-documented case studies of serious competition are of the towns of Preston, Lancaster (including Morecambe) and Stockton-on-Tees. These are the principal ones on which we base our conclusions. All three towns saw town-wide bus competition between major operators lasting at least a year. All three have municipal operators, and it happens that all three are in the north of England and have populations between 100,000 and 200,000. Preston was studied by Mackie and Preston (1988), from which all the results presented here are taken. Lancaster and Stockton were studied by the author; some of the empirical results shown here are also presented in more detail with other case studies in Evans (1990), and some are new.[1]

2.1 Principal case studies

We now consider the principal case studies of Preston, Lancaster and Stockton, beginning with a thumbnail sketch of the competition in each place.

Preston

Preston has a population of 125,000, and abuts other built-up areas with the same population again. Before deregulation, bus services in most, but for historical reasons not all, of Preston were provided by a municipal operator, Preston Borough Transport (PBT). Services in the rest of the town and in most of the remaining built-up area were provided by Ribble, a subsidiary of the National Bus Company (NBC), which was subsequently sold to its management. After deregulation both companies remained without competition in their previous territories until April 1987, when the town was entered by "Zippy", a subsidiary of United Transport Buses (UTB), which was in turn a subsidiary of the multinational company

[1] Other case studies of competition where patronage data have been published are: Glasgow–Easterhouse (Scottish Development Department, 1988); Whitehaven (James and Hopkin, 1989); St. Austell–Fowey (James and Hopkin, 1990); Blackburn–Accrington (Alamdari and Cross, 1988); Rhymney Valley (Table 6 in this paper); and Hereford (Mills, 1985, quoted in Evans, 1988). Some other studies describe service developments without patronage data: for example, Aberdeen (Hawthorne, 1988) and Manchester (Pickett and Greenshields, 1988).

United Transport International. UTB had also entered South Manchester on a large scale. Zippy initially deployed about 50 minibuses in competition with PBT. PBT responded strongly to the competition, rapidly acquiring a fleet of minibuses of its own to compete with Zippy. Zippy then expanded into competition with Ribble, then reduced operations against both operators, and finally sold out to Ribble about one year after entering, having made an operating loss of the order of £1 million.

Lancaster

Lancaster, together with the neighbouring seaside town of Morecambe, has a population of 130,000. Before deregulation Lancaster's bus services were provided jointly by a municipal operator, Lancaster City Transport (LCT), and Ribble, the same NBC company as in Preston. LCT operated 44.5 per cent and Ribble 55.5 per cent of the joint non-seasonal bus-kilometres. The services were so integrated that, in the words of LCT's managing director, "neither operator had services that it could call its own". Moreover, LCT was given legal advice that it could not maintain a dialogue with Ribble in the run up to deregulation (Knowles, 1987). The result was that after deregulation the operators began competing, each separately providing most of the routes and frequencies that had previously been shared. In 1987 Ribble converted about half its routes to minibus operation with increased frequencies. LCT countered with some higher conventional bus frequencies, and also competed in territory where Ribble previously had a monopoly, in Kendal and on the inter-urban routes serving Lancaster. The competition between the two operators reached its peak in 1988. In 1989 Ribble was bought from its management by the large Stagecoach company. LCT and Ribble then ended the competition by designing a joint timetable for the city, with effect from October 1989. LCT also withdrew from the former Ribble territory. The competition had lasted about three years.

Stockton-on-Tees

Stockton, including Billingham and Thornaby, has a population of 175,000; it abuts Middlesbrough and other urban areas of Teesside, which together have a population of about half a million. Before deregulation, bus services in Stockton were provided by a municipal operator, Cleveland Transit, and United, a subsidiary of the NBC. United provided most of the inter-urban services to and from Teesside, and also had an important local role, particularly in Middlesbrough. Although United and Cleveland Transit had no identical routes before deregulation, their routes were intermingled. After deregulation these two operators largely (but not entirely) avoided commercial competition with each other. However, from the first day of deregulation strong competition came from independent entrants, particularly to Cleveland Transit. The largest entrant was Trimdon Motor Services, which was reported to be among the most consistently profitable bus companies in Britain, though it had a small capital base (*Bus Business,* 51, 18 May 1988). Trimdon also entered the commercial market in Tyne and Wear; it had previously operated inter-urban services. In addition, a number of smaller operators entered the Stockton market: they operate on few routes, but some have seen acute competition. Competition peaked in 1988; it

TABLE 1

Indices of Scheduled Bus-Kilometres

Date Relative to Start of Deregulation (or Competition if Different)	*Preston (all bus-km/week)*	*Lancaster (daytime bus-km/hour)*	*Stockton (daytime bus-km/hour)*	*English Shire Counties (bus-km/year)*
	Before deregulation/competition = 100			
Before	100	100	100	100
2 months after	231	157	135	112
8 months after	224	–	–	–
1 year after	200	219	157	119
2 years after	†	240	173	124
3 years after	†	162*	171	–

† Not available; the competition in its original form had then ceased.
* Competition ceased.
Sources: Preston: Mackie and Preston (1988, table 1); Lancaster and Stockton: author's calculations from timetables; England: Department of Transport (1989, Table 1.2).

eased only slightly in 1989. However, at the end of 1989 Trimdon announced the sale of its Tyne and Wear operation to an incumbent, and was about to sell its Stockton operation to Caldaire, the parent company of the privatised United (*Bus Business*, 91, 29 November 1989).

2.2 Service levels

Table 1 shows indices of scheduled bus-kilometres in Preston, Lancaster and Stockton at various times before and after the start of competition. The table shows that competition led to a dramatic increase in bus-kilometres, typically doubling them. If also shows for comparison the index of bus-kilometres for all the English shire (non-metropolitan) counties; this also increased substantially, though to a smaller degree than in the competitive towns. Some important contributors to this increase are competition, as illustrated by the three towns, and widespread conversions elsewhere of routes from conventional buses to high frequency minibuses.

The main effect of high service levels is to reduce passenger waiting times, at least in theory. Table 2 presents theoretical calculations of town-wide average waiting times in Lancaster and Stockton, on the assumptions that buses run to time, and that passengers do not know the timetables and arrive randomly at bus

TABLE 2

Theoretical Passenger Waiting Times

Date Relative to start of Competition	*Average Passenger Waiting time (mins)*	
	Lancaster	*Stockton*
	Minutes	*Minutes*
Before	12.3	10.0
2 months after	10.5	7.7
1 year after	6.5	6.9
2 years after	6.5	6.6
3 years after	8.0*	7.0

* Competition ceased.
Source: calculated from timetables.

stops. These show falls of one third to one half at the height of the competition. In Preston, Mackie and Preston (1988) used survey data to conclude that waiting time was "reduced dramatically". They also found that walking time was reduced as a result of new sections of route and "hail-and-ride" services.

For a given average frequency, average passenger waiting times are longer if buses are bunched than if headways are regular. The average waiting times in Table 2 take headway irregularities into account. "Scheduling efficiency" shown in Table 3 is the theoretical average passenger waiting time if buses have regular headways expressed as a percentage of the average waiting times with bus timings as they were. Completely regular headways would give 100 per cent scheduling efficiency; two competitors operating exactly matched schedules would give a 50 per cent efficiency.

Table 3 shows that 100 per cent scheduling efficiency is not achieved in large urban areas, even without competition. This is because some markets are served by several bus routes, and their schedules cannot be meshed perfectly everywhere. The table also shows that scheduling efficiency falls under competition, though in these cases only by a few percentage points. This implies that headways become more irregular under competition, but close schedule matching is uncommon. One reason is that competing operators often provide different frequencies; each operator separately schedules his or her own buses at equal headways, but when the two services with different headways are superimposed the combined service has irregular headways.

2.3 Fares

All three towns had standard distance-related fare scales before deregulation. Surprisingly, these fare scales were almost perfectly preserved under competition.

Competing operators had the same fares, adopted the pre-existing fare scale, and co-ordinated their general fare increases. Routes with higher demand did not have lower fares, as was expected by the Government (Department of Transport, 1984) and as would be expected by many economic models of competition; nor did actively competitive routes have different fares from non-competitive routes. The main exception in the principal case studies was a brief fares war on one competitive route in Stockton, which left a legacy of sub-standard fares on that route. There was also a brief war on return fares in Lancaster. Elsewhere in Britain, fares wars have sometimes occurred (see Table 6), but they have tended to be on a small scale and short-lived.

Table 4 gives fare indices for Lancaster, Stockton and the shire counties of England. Fares in Lancaster and Stockton were not increased at the time of deregulation, and so fell slightly in real terms; but they were subsequently increased faster than inflation, and were a few points ahead of it after three years. The shire county index had risen much in line with inflation after two years; it will be interesting to see whether it has accelerated when the next figure is available. Table 5 gives single fares in real terms for comparable distances in Lancaster and Stockton; it shows that fares in Lancaster are higher than in Stockton, especially for the longer urban journeys. The increases in real fares over time are small compared with the differences between the towns.

2.4 Bus patronage

As mentioned above, information on bus patronage in competitive situations is hard to come by, because it is commercially valuable. Most of the available information has come from special surveys. In Preston, surveys were carried out by Leeds University (see Mackie and Preston, 1988). In Lancaster and Stockton (and in several other places) surveys were carried by the MVA Consultancy under contract to the Transport and Road Research Laboratory (TRRL), who kindly made the data available to the author. In Lancaster and Stockton, roadside observers stationed at each of several sites recorded the number of passengers in each passing bus, together with its route, operator, and other details. These surveys were carried out for about six or eight hours on one day in the week preceding deregulation, and then on about one day per month over the following year, until October or November 1987. In Lancaster and Stockton this produced about 8,000 usable records for each place, though only a few hundred relate to the situation before deregulation. The inadequacy of pre-deregulation data is the most serious weakness of the surveys.

Table 6 gives the main estimates of patronage changes after competition, both for the principal case studies and for other case studies where patronage was estimated. Lancaster and its neighbour, Morecambe, were analysed separately for this table because Morecambe, as a seaside resort, has a pronounced seasonal pattern, both in services and in patronage. The first column of the table gives the service change at the sites or areas where patronage was estimated; the second gives the estimated patronage change; the third gives the implied percentage change in the average number of passengers per bus; the fourth notes whether or not competition was accompanied by a substantial fare reduction. The changes

TABLE 3

Scheduling Efficiency

Date Relative to Start of Competition	*Scheduling Efficiency†*	
	Lancaster	*Stockton*
Before	92	90
2 months after	87	86
1 year after	84	83
2 years after	84	84
3 years after	98*	85

† Scheduling efficiency is the theoretical average passenger waiting time if buses had regular headways on every route as a percentage of the corresponding figure with bus times as they were.
* Competition ceased.
Source: calculated from timetables.

TABLE 4

Indices of Real Fares

Date Relative to Start of Deregulation or Competition	*Lancaster*	*Stockton*	*English Shire Counties*
	Pre-deregulation/competition = 100		
Before (Nov 1985)	100	100	100
Just after (Nov 1986)	97	97	102
1 year after (Nov 1987)	100	99	102
2 years after (Nov 1988)	101	102	101
3 years after (Nov 1989)	105	104	–

Sources: Lancaster and Stockton: author's calculations from faretables; England: Department of Transport (1989, table 3.1).

are based on comparisons of bus services and patronage averaged over all pre-competition periods for which data are available (in most cases, one) with bus services and patronage averaged over all post-competition periods (which typically cover one year). The table also shows for comparison service and patronage changes in all the English shire counties.

Table 6 shows the unexpected result that competition is estimated to have produced almost no increase in bus patronage in any of the principal case study towns, in spite of the doubling of service levels and the consequent reductions in waiting time. In consequence, the average number of passengers per bus was about halved. The remainder of the table shows a much wider spread of experience elsewhere, though some of the estimated patronage changes are based on very flimsy evidence. The most robust counter-example to the principal case studies is probably Glasgow–Easterhouse, where there was an estimated 21 per cent increase in patronage in response to a 50 per cent increase in service; that gives an elasticity close to the conventional figure of 0.4. However, the results of the principal case studies are consistent with the results for the English shire counties, where bus-kilometres increased by 24 per cent over the three years from 1985–86, but patronage fell by 7 per cent. Much of the 7 per cent can be attributed to the secular trend; but that still leaves a response of zero to the increase in service level, over a period when real fares changed only slightly. This gap between estimated and expected patronage is a puzzle, both at the national level and at the level of the case study towns: we return to it in sub-section 3.3.

Because the conclusions on patronage are important, it is worth presenting the monthly figures for Lancaster, Morecambe, and Stockton, to indicate their likely degree of accuracy and to avoid claiming too much. Table 7 does this: it gives indices of scheduled bus flows and estimated patronage on the relevant routes, averaged over all the observation sites in each town. All the observations at each site are based on the same periods of the day, though these are not the same at different sites. The bottom row shows the averages over all post-deregulation periods, which were carried into Table 6. The problem about these results is that there are sometimes relatively large fluctuations in the monthly figures (larger than mere sampling fluctuations). Some of these are explicable and some not. For example, the high flows in Morecambe in the summer are seasonal. The fluctuations do not matter much in the post-deregulation observations, because they are averaged out, but they do matter in the single October 1986 pre-deregulation observation. If the patronage on that date were unusually high or low, it would directly affect our estimate of the change due to competition. We have no means of knowing this: all we can do is to note that the standard deviations of the patronage indices in Lancaster, Morecambe and Stockton are 10, 19 and 9 per cent respectively. If the October 1986 figures are subject to the same fluctuations, then these figures are the minimum possible standard errors in our estimates of the patronage changes due to competition (more precisely, they are less than the minimum possible standard errors). This means that we cannot rule out the possibility that really there was some increase in patronage in these places, though we can rule out increases of the order expected on the conventional elasticity, except just possibly in Morecambe. In Preston, patronage may have been estimated more accurately than elsewhere, because the authors had access to some of the Preston Borough Transport's data.

What about the patronage of the separate operators? Table 8 gives the observed average number of passengers per bus in Lancaster, Morecambe and Stockton by operator. The results for Lancaster and Morecambe are based on all routes; the results for Stockton are confined to routes operated almost identically by entrants

TABLE 5

Average Real Single Fares
(Pence at 1988–89 Prices)

Date Relative to Start of Deregulation or Competition	*Lancaster*			*Stockton*		
	Journey Length			*Journey Length*		
	3km	*5km*	*8km*	*3km*	*5km*	*8km*
Before (Nov 85)	40	59	87	33	45	62
1 year after (Nov 87)	39	58	86	33	45	63
2 years after (Nov 88)	39	58	87	34	47	65
3 years after (Nov 89)	41	61	91	35	47	65

Source: Regression equations of fare on distance.

TABLE 6

Case Studies of Bus Competition:
Changes in Service Levels, Patronage and Bus Occupancy

Area or Route	*Service Level*	*Patronage*	*Bus Occupancy*	*Fare Reduction?*	*Source (see below)*
	%	%	%		
Principal Case Studies					
Preston	+118	+4	−52	No	(1)
Stockton	+76	0	−43	No	(2)
Morecambe	+107	−2	−53	No	(2)
Lancaster	+111	−8	−57	No	(2)
Other Case Studies					
St. Austell–Fowey	+100	+214	+57	Yes	(8)
Whitehaven	+237	+99	−41	Yes	(3)
Hereford	+60	+30	−18	Yes	(4)
Glasgow–Easterhouse	+50	+21	−20	No	(5)
Blackburn–Accrington	+57	−7	−41	Yes	(6)
Newport–Rhymney Valley	+100	−26	−63	Yes	(2)
All English Shire Counties					
1985-86 to 1987-88	+19	−3	−19	No	(7)
1985-86 to 1987-88	+24	−7	−25	No	(7)

Sources: (1) Mackie and Preston (1988); (2) author, from data provided by TRRL; (3) James and Hopkin (1989): (4) derived from Mills (1985), quoted in Evans (1988); (5) Scottish Development Department (1988); (6) Alamdari and Cross (1988); (7) Department of Transport (1989); (8) James and Hopkin (1990).

TABLE 7

Indices of Hourly Scheduled Buses and Passenger Flows at all Counting Sites in Lancaster, Morecambe and Stockton

Month	*Lancaster*		*Morecambe*		*Stockton*	
	Buses	*Passengers*	*Buses*	*Passengers*	*Buses*	*Passengers*
			October 1986 = 100			
Oct 86	100	100.0	100	100.0	100	100.0
Nov 86	177	106.3	–	–	–	–
Dec 86	149	80.4	–	–	–	–
Feb 87	–	–	173	64.9	–	–
Mar 87	190	84.2	189	103.1	183	93.4
Apr 87	199	84.4	185	82.3	192	91.7
May 87	242	108.7	225	94.6	186	118.3
Jun 87	233	90.5	225	96.7	175	85.5
Jul 87	232	97.9	222	133.0	175	103.4
Aug 87	232	94.5	222	118.4	168	105.6
Sep 87	224	82.2	223	103.3	171	103.8
Oct 87	235	86.6	202	89.1	165	102.2
Nov 87	–	–	–	–	167	98.8
Average post-deregulation	211	91.6	207	98.4	176	100.3

Source: author, from data provided by TRRL.

and by the incumbent, Cleveland Transit. Table 8 confirms the dramatic falls in bus occupancy shown in Table 6. It shows that in Lancaster and Morecambe the two incumbents, Lancaster City Transport (LCT) and Ribble, had similar levels of bus occupancy, with LCT faring perhaps slightly better, though it operated fewer bus-kilometres. However, in Stockton, the incumbent achieved about 50 per cent more passengers per bus than entrants on the same routes. This difference persisted over time and applied at all sites. The source of Cleveland Transit's advantage is not clear. All the operators had similar access to the main boarding points; there was a lot of tactical manoeuvring in Stockton High Street, with buses standing at the stops to attract custom (later forbidden by a Traffic Regulation Order), but there is no reason why the incumbent should be better placed than entrants in this kind of warfare. In Preston, Mackie and Preston (1988) suggest that the incumbent, Preston Borough Transport, was also at an advantage relative to the entrant, and was able to break even at a time when the entrant was making losses. They suggest that some sources of the incumbent's advantage were: better local

TABLE 8

Average Number of Passengers per Bus

Location and Operator	*Average Passengers per Bus*	
	Before Competition	*In First Year of Competition*
Lancaster		
Lancaster City Transport	26.0*	11.6
Ribble		11.0
Morecambe		
Lancaster City Transport	16.2*	8.3
Ribble		7.4
Stockton: directly competitive routes only		
Cleveland Transit	24.4	14.9
Entrants	–	9.7

* Joint service.
Source: author, from data provided by TRRL.

knowledge; a better location in the bus station; a different financial environment; and a more widely usable and therefore more attractive travelcard. Of these reasons, only the last might account for the Stockton result; Cleveland Transit might also have had a more favourable financial environment than the entrants, but that would not explain why its passenger loadings were 50 per cent higher than those of its competitors on the same routes.

2.5 Bus operating costs

We have no specific information on bus operating costs for our case studies, because the information is confidential. Mackie and Preston (1988) had enough information to estimate the fall in the operators' profits under competition in Preston, but they did not publish costs. In the absence of anything more specific, all we have are the official statistics of the average operating costs of the English operators outside London, excluding the metropolitan public transport companies. Table 9 presents these. They show a fall of 30 per cent in the cost in real terms per bus-kilometre over three years from 1985-86, excluding depreciation. However, we should be cautious about accepting this at face value. White and Turner (1990) estimated that about one third of the reduction in costs over the first two of these years was due to the increasing proportion of minibuses, since their operating costs are only 60 per cent of those of a full-size bus. Heseltine and Silcock report in this issue that former NBC operators in the metropolitan counties claim to have reduced their operating costs per bus-kilometre by 15–20

per cent since deregulation. Therefore, we might discount the official cost reductions by one third for comparisons on a like-for-like basis, to give a 20 per cent fall over the three-year period.

2.6 Conclusion: the typical case of serious bus competition

We summarise the evidence from the principal case studies by describing a typical case of serious competition:

(a) Bus-kilometres double.

(b) Headways become irregular, but scheduling efficiency falls by only a few percentage points, and average passenger waiting times fall by 30–40 per cent.

(c) The operators match fares, and tacitly collude to maintain the pre-existing fare structure. The operators also tacitly collude to increase fares simultaneously at a rate at least as fast as inflation. Fares remain the same on high-demand as on low-demand routes, and on actively competitive as on non-competitive routes.

(d) There is no increase in total patronage.

(e) As a consequence of (a) and (d), the average number of passengers per bus is halved.

(f) Entrants do not get any more passengers per bus than the incumbents, and often get fewer.

(g) In the absence of specific information, we may suppose that operating costs fall in line with costs generally: that is, by about 20 per cent over three years on a like-for-like basis.

3. THE ECONOMICS OF COMPETITIVE ROUTES

3.1 Analysis based on Lancaster and Stockton

We now consider the costs, profits, and user costs of typical competitive bus routes in Lancaster and Stockton. We have not enough specific information about the competitive routes observed in these case studies to assess their particular economics, but by linking national statistics with the evidence on competition in the previous section we can estimate the economics of typical competitive routes.

Consider a very simple model to compare the economics of a route before, during and after competition. The model is unusually simple because, on the evidence of the previous section, both patronage and real fares remained approximately constant during competition, and therefore so also did real revenue. The variable quantities were frequencies, scheduling efficiency, and the cost per bus-kilometre.

Let c be the operating cost per bus-kilometre;
f be the frequency;
k be the round trip length of the route;
q be the number of passengers per hour (both directions combined);
p be average passenger receipts per journey;
s be scheduling efficiency (defined in subsection 2.2);
v be the value of passengers' waiting time.

TABLE 9

Bus Operating Costs: England

Date relative to Start of Deregulation	*Cost per Bus-km excl. Depreciation*	
	Pence at 1988–89 prices	*Index (pre-deregulation = 100)*
Before (1985–86)	85	100
During (1986–87)	75	87
1 year after (1987–88)	65	76
2 years after (1988–89)	60	70

Source: Department of Transport (1989, table 4.1). The data are for the English operators outside London, excluding the metropolitan public transport companies.

Then the operating cost of the route is cfk per hour. Revenue is pq per hour, and profit is $(pq - cfk)$ per hour. The average waiting time per passenger is $1/(2sf)$, where s modifies the usual half-headway formula to allow for irregular headways, as explained above. The value of passenger waiting time per hour is $(vq)/(2sf)$. We ignore any effect of competition on in-vehicle times and on passenger walking times, because changes in journey times and routes were slight in Lancaster and Stockton. Then the sum of variable operators' and users' costs per hour is:

$$cfk + (vq)/(2sf) \tag{1}$$

Reductions in this quantity from its pre-competition value determine whether economic welfare has improved. We note that, if all the other quantities are fixed, the frequency, f, has an optimum value, namely,

$$f = \sqrt{(vq)/(2sck)} \tag{2}$$

We consider two representative routes, A and B, differing somewhat in their demand levels. We consider them before, during, and after competition. "After competition" means a phase, such as November 1989 in Lancaster, when competition had ceased, and frequencies are less than during competition but higher than before it started. We adopt the following values of variables for both routes A and B:

cost per bus-km, c: 85p before competition and 68p during and after competition (from Table 9, with the lower figure taken as 20 rather than 30 per cent below the higher, for the reasons given in subsection 2.5);
round trip length, k: 12 km;
passenger receipts per journey, p: 31.9p (discussed below);
scheduling efficiency, s: 92 per cent before competition, 85 per cent during competition, and 92 per cent after competition (from Table 3);
value of waiting time, v: 394 pence per hour (discussed below).

We suppose that the fixed level of demand, q, is 200 passengers per hour on Route A (that is, an average of 100 per hour in each direction, though not necessarily balanced) and 250 passengers per hour on Route B. Both these figures are within the range of observed daytime flows on sections of major competitive routes near the centres of Lancaster and Stockton. We consider different frequencies on each route in each phase of competition. All monetary quantities are at 1988–89 prices.

The figure for receipts per passenger journey, 31.9p, is the average of passenger receipts per passenger journey among municipal public transport companies from 1985-86 to 1988-89 at 1988-89 prices (from Department of Transport, 1989, Tables 2.2 and 5.2). The yearly average changed little in real terms over this period. Passenger receipts include concessionary fare payments from local authorities; but the average receipts per journey are well below the average adult single fare because of the use of commercially discounted tickets, such as return tickets, season tickets, travelcards, and children's fares. The national evidence (Department of Transport, 1989, Tables 3.3 and 5.1) suggests that average receipts per journey outisde the metropolitan areas are about 80 per cent of the average adult single fare. If this relationship applies to the municipal operators, their average adult fare is about 40p. The data on adult single fares in Table 5, together with scraps of information on average journey lengths, suggest that the average adult fare in Stockton is slightly less than this, and that in Lancaster is somewhat more. It is worth noting that the welfare assessment of competitive routes is independent of average receipts, because p does not enter expression (1), but profits do depend on p. The value of waiting time, v, is derived from the study of the value of travel time savings by MVA *et al.* (1987, Table 8.2). Their recommended value of the in-vehicle time of bus users with incomes in the £5,000 – £10,000 p.a. range is 2.6p per minute at mid-1985 prices. We have doubled this, in accordance with the convention that waiting time is valued at twice in-vehicle time, and uprated it to 1988 values, using the index of average earnings.

Table 10 gives results for routes A and B. We suppose that before competition frequencies were 4 buses per hour on route A and 6 on route B. These figures are representative of pre-competition frequencies in Lancaster and Stockton. To show this, we note that these frequencies, together with the passenger flows assumed, imply average bus occupancies on routes A and B at the densest points of the routes of 25 and 21 passengers respectively. These figures are consistent with the pre-competition occupancies observed in Lancaster and Stockton, summarised in Table 8.

Occupancies of this order imply substantial profits, even at pre-deregulation operating costs, both in practice on these kinds of routes, and on the modelled routes A and B. To show this in practice, we note that if operating costs are 85p per bus-km, passenger receipts are 31.9p per journey, and the average journey length is, say, 3km, a bus needs an average occupancy of 8 passengers to break even. The observed pre-competition occupancies on the major routes were about three times this figure, say 24, though the observations were at the inner ends of routes, where occupancies are highest. If the average occupancy along a route is half its highest value, the buses will still be making a 50 per cent profit. The

TABLE 10

Economics of Illustrative Competitive Routes

	Frequency Buses per Hour	*Scheduling Efficiency*	*Cost per Bus-km*	*Cost per Hour*	*Profit per Hour*	*Passr. Wait Time per Hour*	*Change in Welfare per Hour**
		%	p	£	£	£	£
Route A							
(200 passengers per hour)							
Before competition	4	92	85	40.8	23.0	107.2	
During competition	8	85	68	65.3	−1.5	58.0	+24.7
After competition	6	92	68	49.0	14.8	71.4	+27.6
Route B							
(250 passengers per hour)							
Before competition	6	92	85	61.2	18.5	89.3	
During competition	10	85	68	81.6	−1.8	58.0	+10.9
After competition	8	92	68	65.3	14.5	67.0	+18.2

* Compared with before competition.
Source: see text.

pre-competition profits on the modelled routes A and B, shown in Table 10, reflect this reasoning: they are 56 and 30 per cent of costs, respectively. That routes of this kind should have been profitable before deregulation is not surprising: these were "good" routes, generating profits for vehicle replacement, overheads, and cross-subsidy. It is also consistent with the fact that they were later able to sustain much higher frequencies under competition.

Under competition we suppose that operating costs fall by 20 per cent, and that frequencies rise to the point at which profits are driven down to near zero. This increases the frequency on route A from 4 to 8 buses per hour, and on route B from 6 to 10; these increases are consistent with the actual increases under competition (summarised in Table 1), which again confirms that this analysis is representative of practice. The rises in frequency reduce average passenger waiting times by 46 per cent on route A and by 35 per cent on route B (consistent with the results in Table 2). The value of these falls in waiting time exceeds the loss of profits, so there is a net increase in welfare under competition, which is shown in the final column of Table 10. The main source of this welfare gain is the fall in operating costs; with fixed costs the possible welfare gains would have been smaller, because they could arise only from shifts in frequency. However, there would still have been gains on both routes, because competition

would have forced frequencies from initially sub-optimal levels closer to the optima given by expression (2).

Nevertheless, given the falls in operating costs, competition can also force frequencies above the optimum, especially on the higher-demand routes, such as B. This is illustrated by the "after competition" phase on each route, in which we have assumed that frequencies are lower than during competition but higher than before competition, as they were in Lancaster. Table 10 shows there is a further welfare gain on both routes A and B in this phase, though welfare moves from users to operators, as operators make profits again. The source of the small welfare gain on route A is the increase in scheduling efficiency after competition; the optimal frequency on that route is about 7 buses per hour, so the shift from 8 to 6 makes little difference. On rotue B, the optimal frequency is 8, so the shift from 10 to 8 improves welfare; so does the increase in scheduling efficiency.

3.2 Preston

Mackie and Preston (1988) were able to make a specific town-wide welfare assessment of the competition in Preston. Their analysis was similar to that above: they compared the reductions in operators' profits with the benefits of time savings to users. As mentioned previously, they estimated that the entrant, Zippy, made substantial losses, but the operators' losses were more than counterbalanced by the benefits to passengers, so that net welfare increased slightly under competition. This is a similar finding to those in the examples above, though perhaps somewhat less favourable to competition. The difference may lie in a different treatment of operating costs, which the authors do not discuss, or it may be that frequencies were more excessive on competitive routes in Preston than on our routes A and B, so they were further from the optimum.

3.3 The patronage puzzle

However, our analysis above, and also that of Mackie and Preston, are open to the serious objection that they do not account for the surprising empirical finding that bus patronage did not increase on competitive routes (or increased little). Our analysis implicitly assumes that the elasticity of demand with respect to the generalised cost of bus travel (fare plus value of time) is close to zero. If that is not so, the conclusions are undermined. On the other hand, if it were so, it would contradict well-established general experience (see, for example, Transport and Road Research Laboratory, 1980).

Consider a conventional demand model for bus travel,

$$q = q(g)$$

where q is patronage and g is the generalised cost per journey, given by

$$g = p + vw(f)$$

where p is the fare, v is the value of waiting time, f is the frequency (all as pre-

viously), and w is the average passenger waiting time as a function of frequency. Previously we had $w(f) = 1/(2sf)$, but we now generalise this. Using this model, we can write down the approximate change in patronage, Δq, resulting from a change in frequency, Δf:

$$\Delta q = \frac{\mathrm{d}q}{\mathrm{d}g} \, v \, \frac{\mathrm{d}w}{\mathrm{d}f} \, \Delta f. \tag{3}$$

The empirical evidence from the principal case studies in Table 6 is that a large value of Δf was associated with an almost zero value of Δq. The same is also true for the shire counties as a whole, though with a smaller value of Δf. If we accept this zero value of Δq, it follows from (3) that at least one of $\mathrm{d}q/\mathrm{d}g$, v, or $\mathrm{d}w/\mathrm{d}f$ must be close to zero. All seem unlikely to be zero; that is why the patronage results are a puzzle. The first implies that the elasticity of demand with respect to generalised cost is zero; the second implies that the value of passengers' waiting time is zero; and the third implies that the frequency changes did not reduce waiting time, in spite of the calculations in Table 2. To accept either of the first two would be to accept general conclusions contrary to widely accepted experience. For this reason, it seems most reasonable to accept that $\mathrm{d}w/\mathrm{d}f$ was zero. This implies that the frequency increases under competition did not reduce passengers' waiting times, or, if they did, that there was an offsetting addition. The obvious candidate for the offsetting addition is the uncertainty caused to passengers by irregular headways, frequently-changing timetables, and buses running early or late for competitive reasons.

Unfortunately, if one accepts this conclusion, the previous welfare analysis collapses. There are then no time savings to passengers, and therefore no benefits. We are left simply with increased costs. The same would be true if we accepted that $v = 0$. We can retain the previous welfare conclusions only by accepting that the elasticity of demand with respect to generalised cost is zero, which we do not, or by rejecting the findings on patronage. We might do that, because, as discussed in subsection 2.4, the patronage results in Lancaster and Stockton are not well established and are contradicted at least by Glasgow–Easterhouse. However, they are consistent with the national results (bottom of Table 6), where the same issue arises, and those are much more difficult to reject.

3.4 Conclusions

This leaves us with a range of possibilities. On the most favourable interpretation, the intense commercial competition wiped out the substantial previous profits on the relevant routes and gave benefits of greater value to passengers in the form of reduced bus waiting times, so there was a net gain in welfare and a net transfer from operators to users. On the least favourable interpretation, profits were still wiped out, but there were no counterbalancing benefits to passengers. This interpretation is based on the evidence, which is supported by the national statistics, that competition generated few extra passengers, and therefore must have generated few passenger benefits.

4. OPERATORS' STRATEGIES

We now consider explanations of the results that we have seen from competitive local bus markets. The main decision-makers in the commercial bus market are the operators, so it is their decisions and strategies which determine the outcomes. The appropriate theoretical framework for considering these is oligopoly and game theory. This is because in practice there are never more than a few operators providing commercial services in any one place. Two types of models are relevant: first, models of the entry process, in which the decision-makers are a monopoly incumbent and a potential entrant, and, secondly, models of competition, in which the decision-makers are two competing operators. The two situations are related, because if the entrant in the first one decides to enter, it is thereby transformed into the second. Dodgson and Katsoulacos (1988, 1990) have reviewed both types of models as applied to the bus industry. Preston (1990) considers applications of game theory in this context. We here consider only those models which seem most relevant to the empirical data. We first consider the entry process, then models of active competition, and we then return to entry in the light of conclusions from competition.

4.1 Entry 1

Models of the entry process consider markets with a monopoly incumbent and a potential entrant. We begin with an empirical sketch of the typical pre-entry position of an incumbent and entrant when the transitional phase at the start of deregulation was over. We consider a "good" (that is, a moderate- or high-demand) urban route, such as route A or B in secion 3.1, but still operated as a monopoly by the original incumbent. Frequency either is the same as before deregulation, or has been increased modestly. The fare structure and the real level of fares are the same as before deregulation. Patronage has declined slightly in line with secular trend. The incumbent's costs have fallen in line with those elsewhere. The route earned super-normal profits for the incumbent before deregulation, and, because nothing has happened subsequently to change this, it still does. The entrant is therefore considering whether to enter the route and earn a share of these profits.

Is this a realistic picture? Monitoring by the Transport and Road Research Laboratory over the first year of deregulation, summarised in Balcombe *et al.* (1988), indicates the general absence of active commercial competition in most places, the continuity of the larger operators, and the maintenance of fare structures. This is generally consistent with the findings of case studies. The story is taken forward in the national statistics for the shire counties, which were given in section 2. (The statistics for metropolitan counties are less helpful for our purpose, because they were influenced by factors other than deregulation.) The belief that good routes earned super-normal profits before deregulation comes partly from the calculations in section 3.1, and also, perhaps more convincingly, from various studies of cross-subsidy, summarised in the White Paper *Buses* (Department of Transport, 1984). After deregulation, the possible increase in frequency and decline in patronage will have acted to reduce profits, but the fall in costs will have counteracted this, so good routes will still be earning super-normal profits. The simplest way in which the super-normal profits could have

been wiped out would have been through the emergence of route-specific fares, with lower fares on the good routes and higher fares on others. But the evidence is that this has not happened; it did not happen even under active competition in the case studies. We should note here that the survival of the fare scales is incompatible with the theory that the market is contestable. We return to this in subsection 4.4.

Therefore the questions to be considered are: (1) given the continuation of super-normal profits on good routes, and given the presence of competent potential entrants, why do the entrants generally not enter? (2) What conclusions can we draw from the answer to (1) about the effectiveness of the free market for local bus services? We now consider what would happen if the entrant *did* enter. This takes us back to the empirical evidence on competition and to models of competition.

4.2 Active competition

We again start with an empirical description of what might happen after entry, based on the conclusions of sections 2 and 3. First, there would be a large increase in frequency, caused both by the entrant's services and by possible frequency responses by the incumbent. The entrant would adopt the pre-existing fare structure. There would be little increase in patronage (though this is not an important issue in this context). The entrant would gain a market share that was at best proportional to his or her proportion of the total frequency, though it might be less. The increase in frequency would drastically reduce average bus occupancy, and wipe out the super-normal profits. However, the route would generate enough revenue to enable the two operators to keep going, though probably not enough to enable them to replace vehicles or contribute to overheads. The competition would eventually cease with the withdrawal of one of the two contestants, or with one being bought out, or with an agreement between them to reduce frequencies and share the profits.

We now consider economic models of competition. Dodgson and Katsoulacos (1990) have reviewed them theoretically, and Evans (1990) has tested them against data from case studies. There are two classes of models: models of competition between different qualities of bus service at different fares, or "vertical" competition, and models of competition between buses leaving at different times, or "horizontal" competition. Although vertical competition was discussed more than horizontal competition in the pre-deregulation debate (Glaister, 1985, 1986; Nash, 1985; Galvez, 1986), it has not emerged in practice, so we say no more about it here. The main model of horizontal competition applied to bus services is that of Evans (1987), which applies a spatial economic approach to bus competition, using the analogy between bus departure times and the location of activities in one-dimensional space. Models of differentiation on industrial products also use this analogy (Greenhut *et al.*, 1987). The reason why these models are relevant is that buses leaving at different times are indeed differentiated products, appealing to different but interacting markets. It they were not differentiated products, there would be no reason to run buses at different times and no benefits from higher frequencies. Greenhut *et al.*, (1987) make the general point that the

simple propositions of non-spatial microeconomics often do not hold in product-diferentiated markets, so they will also often not hold in competitive bus markets. In particular, prices are determined differently, because every supplier has some market power in his or her locality.

The main difference between the predictions of Evans's spatial model and the empirical sketch above relates to fares. In Evans's model, operators were presumed to set their fares so as to maximise profits in the expectation that their competitor(s) would maintain their own current fares. This leads to a Nash equilibrium in which all operators have the same fares, but fares for the same distance differ between routes. This has not happened. The obvious alternative is to presume that operators set their fares in the expectation that their competitor(s) will match any change they make. This also leads to an equilibrium, but with higher fares: in fact revenue-maximising, or monopoly, fares. This is because on this assumption operators never gain or lose passengers to their competitors, so they maximise revenue in a fixed market. This has not happened either. Although the 1989 evidence from Lancaster and Stockton (Table 4) suggests that real fares are creeping upwards, they were not then revenue-maximising. The most plausible explanation for fare setting in practice is that operators expect fare matching for downward revisions, but not for upward revisions. The presence of a pre-existing general fare scale helps to simplify what might otherwise be a complicated problem of tacit co-ordination. The effect of this fare-setting process is that fares are historically determined. They are what they were at the start of competition, plus any real increase which the competitors have tacitly agreed.

Could the entrant do better than compete in this way? The obvious alternative would be a more aggressive strategy, including reducing fares and matching schedules. Such a strategy would provoke a response from the incumbent, and the fight would then be more damaging to both operators. There is no reason to suppose that the entrant would do better in this fight, unless (s)he had some special advantage. On the contrary, since the incumbent is likely to be better informed than the entrant, the entrant might do better by being less aggressive while building up experience.

The conclusion is that the prospective entrant could expect competition to develop in the way sketched at the start of this section. So long as the competition lasted, the profit to the entrant would be at best zero, and possibly negative. Therefore the main hope for the entrant, and the reason for entering, would be to get a share of the monopoly profits after competition had ceased. With this conclusion, we return to the entry process.

4.3 Entry 2

What are the prospects that the entrant will get a share of the monopoly profits after a period of competition? There is no comprehensive empirical evidence, but the anecdotal evidence is that entrants' prospects are poor. We begin with the two examples of major entry in our principal case studies: Zippy into Preston, and Trimdon into Stockton. (In Lancaster, both competitors were incumbents.) Zippy was a well-financed subsidiary of a multinational company, UTB, but

withdrew from Preston after a year, presumably believing that it would not succeed in getting a share of the profits. According to Mackie and Preston (1988), Zippy's management made mistakes. But it is unlikely that these were decisive: UTB entered South Manchester on a bigger scale than Preston, reportedly managed the operation well, but also withdrew. Trimdon has kept going in Stockton for three years, but is about to sell out. On the basis of the illustrative calculations in section 3, Trimdon's Stockton services cannot have been very profitable, in spite of the reported profitability of the firm. Trimdon was able to keep going because it was a low-cost operator and because before deregulation it had astutely bought a fleet of elderly second-hand buses at prices only a few per cent of those of new ones (*Bus Business,* 56, 27 July 1988). However, these could not be replaced at the same prices. Trimdon appeared to be waiting to see whether any of the larger operators would withdraw to leave it some of the monopoly profits – but they did not. More generally it has been observed that frontal assaults – the introduction of a rival network of services against an established operator – failed virtually without exception (*Bus Business,* 88, 18 October, 1989). Being bought out appears to be the best that can be achieved by such an attack.

Why have entrants not succeeded? The first possibility is that incumbents have some advantages over entrants in the conduct of the competition. A second, equally important, possibility is that there may be strategic reasons why entrants give up competitive fights. What advantages do incumbents have over entrants in the conduct of competition? The most widely suggested one is that they may be better informed about any or all aspects of providing the services, and so make better tactical decisions. An indication of the importance of this is that entrants often hire former staff of incumbents, as in both Preston and Stockton. However, this may not be enough to overcome their disadvantage (Mackie and Preston, 1988).

Another suggested advantage is that the incumbent's services are better known to customers: a hint is provided by the fact that entrants often choose the same route numbers as incumbents, so as to reduce this disadvantage. Trimdon initially did not do this, but later changed many of its route numbers to conform with Cleveland Transit. Against this is the widely accepted view that most passengers get on the first bus going to their destination, whoever is running it. Another advantage for incumbents may be that they have a wider network than entrants, and so are able to offer more attractive travelcards. They may also have had first bite at the best terminal positions, as in Preston, but not in Stockton. However, none of these reasons, even the first, seem enough to explain why the incumbent in Stockton, Cleveland Transit, should have achieved average passenger loadings 50 per cent greater than others of its competitors in the first year on the same routes and at the same fares (Table 8). So the incumbent may have had some other unidentified advantage in this case.

The important strategic reason why an operator might give up the competition relates to the financial position of the competitor. The obvious case is where the competitor has a "long purse" or weaker bankruptcy constraint, usually because it is bigger and can cross-subsidise competitive services from super-normal profits elsewhere. In that case, the financially weaker competitor might conclude that the

other would never be forced out and would never have reason to share the route. His or her best strategy could then be to withdraw at once to avoid any further losses or bare survival in competition. That could be true even if the financially weaker operator was winning the tactical fight. The stronger operator could hasten this outcome by buying out the competitor, as Midland Fox bought out Gilbert Kinch of Loughborough (*Bus Business,* 88, 18 October 1989). Another example is Whitehaven, where the competition ended with the buyout of the entrants.

The strategic position of one competitor can change drastically when the other changes ownership. This happened to Lancaster City Transport (LCT) when Ribble was acquired by the large Stagecoach group, though LCT still has a share of the now-joint timetable. Another version of strategic financial differences between operators is when one of the operators is not a profit maximiser, or not required to make profits (Thompson, 1987). This gives it an advantage over those who are. That could apply to any of the municipal operators in the case studies. It might also account for UTB's exit from Manchester, where its competitor was a large company owned by a local authority: UTB was not financially weak, nor apparently did it suffer the lack of local knowledge it suffered in Preston, but it still gave up.

Reasons why entrants might lose the competitive battle are also reasons why a potential entrant might choose not to enter. They are thus entry barriers. There could also be other barriers. The obvious one is sunk costs, which are entry costs not recoverable on exit. Once an entrant had paid these, they would not affect subsequent events, and therefore they do not explain why entrants tend to be the losers in competitive battles; but they could explain why many entrants are deterred in the first place. The bus industry has relatively low sunk costs, because the cost of buses is recoverable through sale or use elsewhere, but there are some, as indicated by Mackie and Preston (1988) in Preston: publicity, training, and, perhaps most important, the cost of acquiring enough local knowledge to match the incumbent. There could also be situations where entrants are deterred by incumbents, even though they might have been successful if they had gone ahead. Game-theoretic models of entry deterrence are concerned with this kind of situation. they are reviewed in the context of bus deregulation by Dodgson and Katsoulacos (1988, 1990), who conclude that incumbents might indeed have good reason for strategic entry deterrence, even at the cost of short-run profits, especially where there is asymmetric information. However, it no longer seems necessary to appeal to subtle arguments to explain why entrants do not enter: their prospects in general look poor. Even if a potential entrant did consider that (s)he had an advantage over an incumbent, it might be better to exploit this advantage in negotiation rather than competition. Active competition, like warfare, may happen only where an operator makes a mistake, or where operators misunderstand each other's positions.

4.4 Contestability

We must now briefly discuss the theory that the bus market is contestable, because that was the premiss on which the Government deregulated it. As stated

in subsection 4.1, this section so far has been based on the opposite premiss, that the bus market is *not* contestable. Contestable markets are those in which potential entrants exert such a powerful threat that it is impossible for incumbents to make super-normal profits: they would be displaced, temporarily or permanently, if they tried to do so. If the market were contestable, it would therefore be impossible for any operator to make the super-normal profits which we have presumed to be the objective of the otherwise unprofitable competitive battles.

The theory of contestability is summarised in relation to bus deregulation by Dodgson and Katsoulacos (1988, 1990). The main requirements for a market to be contestable are, first, that entry and exit should be costless (implying that entrants must have no sunk costs), and, secondly, that incumbents cannot change their prices immediately in response to entry. Neither of these requirements is met by the commercial bus market, though, as noted above, sunk costs are low, and in any case perfect contestability is only a theoretical ideal. The Government therefore argued that the market would be close enough to this ideal ("highly contestable", Department of Transport, 1984, p. 52) for potential entry to be an effective discipline on monopolists. However, if fares can be adjusted quickly, even arbitrarily small sunk costs are enough to deter entry. Thus several previous authors, including Mackie and Preston (1988), Gwilliam (1989), and Dodgson and Katsoulacos (1990), have concluded that the market is not contestable. That is also our conclusion: our point of departure in section 4.1 was the empirical evidence that fare structures after deregulation are not compatible with contestability.

The low rate of entry does not provide conclusive evidence: it might be interpreted as showing either that the market is contestable and incumbents are kept so well in line that there are few profitable possibilities of entry or that the market is not contestable and entry is deterred.

4.5 Conclusions

Local bus markets have remained highly monopolised after deregulation. Active competition is relatively rare, and is probably now well past its peak. Our explanation is as follows. Moderate or high demand routes still earn super-normal profits if they are operated by a monopoly operator, as most are. On the other hand, if an entrant competes on such a route, profits are reduced to zero or less so long as the competition lasts. The most long-lasting form of competition appears to be where the competitors both adopt the pre-existing fare scales and compete with the highest frequency that will just cover day-to-day operating costs. This reduces profits by dramatically reducing average bus occupancies. Other strategies for entrants are possible, but none is obviously better. Therefore the payoff to an entrant is not the profit from operating the route competitively, but the possibility that it may drive out the incumbent, or reach an agreement to reduce frequencies and share the super-normal profits. However, entrants have generally failed to do this. It is not entirely clear why, but the main reasons appear to be the better local knowledge of incumbents, which helps in the conduct of the competition, and their often longer purses, which help them strategically. Entrants also incur some sunk costs. That does not disadvantage them after they have entered, but

they may increasingly decide not to incur the risk.

This suggests that, in contrast to the government's expectation, the effect of potential entrants in controlling the monopoly operators is weak. Therefore the monopoly operators could exploit their monopolies. In particular, there seems little to prevent them from raising rares substantially in real terms. If they did so, the welfare consequences would be adverse. However, it must be admitted that so far the industry has had low, not high, profits since deregulation (White and Turner, 1990). As a specific example, Midland Red West, the large monopoly operator in Hereford, having won its competitive battles against small entrants in 1983–85, when Hereford was deregulated experimentally, is now not exploiting its victory, but providing an excellent minibus service at low fares (Evans, 1990).

This empirical counter-evidence suggests that monopoly operators are perhaps being controlled better than the analysis implies. Alternatively, the incumbents may not be profit maximisers: they may be more interested in maintaining their historic market presence, and may be using the super-normal profits on good routes to cross-subsidise low-demand services, as in the past.

5. CONCLUSIONS

5.1 Form of Competition

Since deregulation in October 1986, the number of bus routes on which there is active commercial competition has always been small compared with the number operated as a monopoly. Nevertheless, active competition has been commonplace enough overall to provide a lot of experience. Competition has taken many forms, but the most stable and long-lasting one is the form it took in the three principal case-studies of competition discussed here: Preston, Lancaster and Stockton-on-Tees. All three towns saw serious competition between major operators, covering much of the town and lasting at least a year. However, active competition in its original form has now ended, or is about to end, in all three towns.

The form of competition in these towns was that the competitors matched fares by adopting the distance-related general fare scale which already existed in the town, and tacitly co-ordinating periodic increases to keep fares up with, or ahead of, inflation. They then operated the highest frequencies they could on each competitive route, subject to earning enough revenue at these fares to cover running costs, though not to provide for bus replacement. The attractive routes for competition were those with moderate or high demand in the daytime. These routes had previously been earning super-normal profits. The wiping out of these profits, together with large falls in bus operating costs, permitted dramatic increases in bus frequency: the competitors' combined frequency was typically twice as high as the frequency before competition. Competitors' timings were typically haphazardly related to each other, so the headways of the combined service were irregular. Nevertheless, average passenger waiting times fell substantially, at least in theoretical calculations. This should have been the main benefit to passengers from the competition.

5.2 Welfare and patronage

If passengers benefitted from these reductions in waiting times at standard values of time, the welfare consequences of competition are positive: the benefits to passengers outweighed the loss of profit to the operators. The two sources of this gain are the reductions in bus operating cost, passed on to passengers through the higher frequencies, and the fact that the pre-competition frequencies were too low, though it is possible for competitive frequencies to overshoot the optimal frequency.

However, a large question mark is placed over this favourable welfare assessment by the apparently dismal response of patronage to the reductions in waiting time. The data suggest that the increase in patronage in all three towns was not far off zero, in response to reductions in waiting time valued as equivalent to a halving or more of the fares. The only way in which such a response can be squared with the established general properties of public transport demand is by supposing that the passengers got no benefit from the high frequencies, or that there was an offsetting disbenefit. The most likely offsetting disbenefit is the uncertainty caused by irregular headways and frequently changing timetables. However, if this is accepted, the passenger benefits vanish from the welfare assessment, and we are left with the higher total costs of the high-frequency services as unmitigated waste. An alternative explanation is that the patronage estimates are wrong, because of inadequacies in the data, which were gathered under difficult conditions. That could be true, especially as there are counter-examples of patronage increases elsewhere. However, the results are consistent with the national statistics on patronage, which show an equally dismal response to increases in bus-kilometres. At the national level, the only plausible explanation so far advanced is that it is due to uncertaintly on the part of passengers. That lends support to the same explanation for the competitive towns.

5.3 Operators' strategies

Urban routes with moderate or high demand are still capable of earning supernormal profits, especially given the reduced operating costs after deregulation, provided they are operated as a monopoly. This does not necessarily mean one operator: there could be two operating a joint timetable. However, if the routes are operated competitively in the form described above, there are no profits. Therefore entrants to a route cannot expect to earn any profit so long as the competition lasts; the aim of entry must be to gain all or part of the supernormal profits after competition ceases. This requires either driving out the incumbent or reaching an agreement to share the route. The empirical evidence is that entrants have generally failed to do either; they have given up, been driven out, or been bought out. The reasons for their failure are not entirely clear: two important ones are the greater local knowledge of the incumbents, which helps them tactically in the competition, and their longer purses, which help them strategically. Entrants also face some sunk costs. That does not disadvantage them after they have entered, but it is an additional reason for deciding not to enter. Most of the past competition has stemmed from entrants who entered soon

after deregulation, without the benefit of learning from the experience of other entrants. The experience now available would be an additional deterrent to today's potential entrant, unless the entrant had some specific advantage. Even if it had, it would probably do better to exploit it in negotiation rather than through competition. Active competition therefore seems likely to decline. If so, its welfare consequences do not matter much.

5.4 Policy implications

The main policy implication is that, in contrast to the government's expectation when it deregulated, the effect of potential entrants in controlling monopoly operators is weak. So the monopoly operators, who constitute the great majority, could exploit their monopolies. Specifically, they could raise real fares, and that would have the effect of reducing welfare. They do not seem to have seriously exploited their monopolies yet. It remains to be seen whether they will.

REFERENCES

Alamdari, F. E., and A. K. Cross (1988): *Survey of Bus Passengers between Blackburn and Accrington.* Summary Report. Centre for Transport Studies, Cranfield Institute of Technology (unpublished).

Balcombe, R. J., J. M. Hopkin and K. E. Perrett (1988): *Bus Deregulation in Great Britain: a Review of the First Year.* Report 161. Transport and Road Research Laboratory, Crowthorne, Berkshire.

Department of Transport (1984): *Buses.* Cmnd 9300. HMSO, London.

Department of Transport (1989): *Bus and Coach Statistics Great Britain 1988/89.* HMSO, London.

Dodgson, J. S., and Y. Katsoulacos (1988): "Models of Competition and the Effect of Bus Service Deregulation". In: *Bus Deregulation and Privatisation* (eds.: J. S. Dodgson and N. Topham). Gower, Aldershot.

Dodgson, J. S., and Y. Katsoulacos (1990): "Competition, Contestability and Predation: The Economics of Competition in Deregulated Bus Markets". In: *Proceedings of an International Conference on Competition and Ownership of Bus and Coach Services* (ed.: D. Hensher). Gordon and Breach, London (forthcoming).

Evans, A. (1987): "A Theoretical Comparison of Competition with other Economic Regimes for Bus Services". *Journal of Transport Economics and Policy,* 21, 7–36.

Evans, A. (1988): "Hereford: a Case Study of Bus Deregulation". *Journal of Transport Economics and Policy,* 22, 283–306.

Evans, A. (1990): "Bus Competition: Economic Theories and Empirical Evidence". In: *Proceedings of an International Conference on Competition and Ownership of Bus and Coach Services* (ed.: D. Hensher). Gordon and Breach, London (forthcoming).

Galvez, T. E. (1986): "Competition on an Urban Bus Route. A Comment". *Journal of Transport Economics and Policy,* 20, 101–108.

Glaister, S. (1985): "Competition on an Urban Bus Route". *Journal of Transport Economics and Policy,* 19, 65–81.

Glaister, S. (1986): "Bus Deregulation, Competition and Vehicle Size". *Journal of Transport Economics and Policy,* 20, 217–244.

Gomez-Ibanez, J. A., and J. R. Meyer (1987): *Deregulating Urban Bus Service: Britain's Early Experience and the Lessons for the United States.* National Technical Information Service, Springfield, VA 22161.

Greenhut, M., G. Norman and C-S Hung (1987): *The Economics of Imperfect Competition: A Spatial Approach.* Cambridge University Press.

Gwilliam, K. M. (1989): "Setting the Market Free. Deregulation of the Bus Industry". *Journal of Transport Economics and Policy,* 23, 29–43.

James, H. F., and J. M. Hopkin (1989): *Competition between Bus Companies in Whitehaven.* Working Paper WP(TP)69. Transport and Road Research Laboratory, Crowthorne, Berkshire.

James, H. F., and J. M. Hopkin (1990): *Competition between Bus Companies in the St. Austell Area.* Transport and Road Research Laboratory Research Report (forthcoming), Crowthorne, Berkshire.

Knowles, T. W. W. (1987): "The Battle of the Lune: North Lancashire since Deregulation". *Buses,* December, 530–535.

Mackie, P. J., and J. M. Preston (1988): "Competition in the Urban Bus Market: A Case Study". *PTRC Summer Annual Meeting, Seminar C: Public Transport Planning and Operations,* 157–170.

Mills, K. (1985): *Hereford and Worcester Trial Area.* Unpublished Conference paper. Midland Red West, Heron Lodge, London Road, Worcester WR5 2EW.

MVA Consultancy, Institute for Transport Studies, Leeds and Transport Studies Unit, Oxford (1987): *The Value of Travel Time Savings.* Policy Journals, Newbury, Berkshire.

Nash, C. A. (1985): "Competition on an Urban Bus Route. A Comment". *Journal of Transport Economics and Policy,* 19, 313–319.

Preston, J. M. (1990): "Explaining Competitive Practices in the Bus Industry: The British Experience". In: *Proceedings of an International Conference on Competition and Ownership of Bus and Coach Services* (ed.: D. Hensher). Gordon and Breach, London (forthcoming).

Scottish Development Department (1988): *The Initial Effects of the Deregulation of Bus Services in Eight Areas of Scotland.* Consultants' Report by Transport Operations Research Group, University of Newcastle upon Tyne, Vol. 6.

Thompson, D. J. (1987): "Privatisation in the UK: Deregulation and the Advantage of Incumbency". *European Economic Review,* 31, 368–374.

Transport and Road Research Laboratory (1980): *Factors Affecting the Demand for Bus Services.* Transport and Road Research Laboratory, Crowthorne, Berkshire.

White, P. R., and R. Turner (1990): "Overall Impacts of Bus Deregulation in Britain". In: *Proceedings of an International Conference on Competition and Ownership of Bus and Coach Services* (ed.: D. Hensher). Gordon and Breach, London (forthcoming).