ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

International Transport Forum

18TH MADRID 2009
INTERNATIONAL TRANSPORT RESEARCH SYMPOSIUM

Discussion Paper No. 2009-23

November 2009

The Future for Interurban Passenger Transport
Bringing Citizens Closer Together

SESSION 3: COMPETITION AND REGULATION OF INTERURBAN TRAVEL: TOWARDS NEW REGULATORY FRAMEWORKS?

Competition for Long Distance Passenger Rail Services: The Emerging Evidence

by

Professor John Preston

Transportation Research Group
School of Civil Engineering and the Environment
University of Southampton

U.K.

SUMMARY

1. INTRODUCTION

Railways were initially envisaged as open access facilities with head-on competition between service providers (Lardner, 1850). However, concerns about safety quickly resulted in railways being largely developed as vertically integrated monopolies at a route level but with significant competition between these route-based companies. Over time, competition from other modes reduced the scope for internal competition and led to the rationalisation of duplicated routes and the merger of railway companies. In most countries, long distance passenger rail services[i] became a state-owned monopoly but in recent years there has been renewed interest in competitive provision (see, for example, Gomez-Ibanez and de Rus, 2006).

Although route competition has remained a feature in countries such as Japan (Mizutani, 1994), on the tracks competition between passenger rail operators has been limited. However, in Great-Britain, the 1993 Railways Act promised open access competition between rail operators. In the event, regulatory intervention heavily moderated competition up to 2002. Nonetheless, some open access competition has emerged in Britain with three passenger train operators having entered the market (Griffiths, 2009). There has been open access competition in passenger rail markets elsewhere – most notably, in Germany where open access has been permitted since 1999. There have been around ten instances of entry of which four were still operating in 2009, centred on Berlin (Séguret, 2009), but accounting for less than 1% of services.[ii] The liberalisation of long distance passenger services has seen the incumbent operator Deutsche Bahn (DB) withdraw from secondary markets, with some 23 medium sized cities losing long distance train connections between 1999 and 2009. When permitted, niche competition has emerged in other rail markets such as St Petersburg - Moscow in Russia (Dementiev, 2007). The Netherlands has had some experimentation with open-access, most notably the ultimately ill-fated Lovers Rail services (1996-1999), with the Dutch government subsequently favouring off-the track competition (van de Velde, 2009). Within the European Union (EU), open access for international passenger rail services, with domestic cabotage, will be implemented in 2010 (Directive 2007/58). Nash (2009) reports that in preparation for this SNCF has set up a subsidiary, Nuovo Trasporti Viaggiatori, to operate in Italy, whilst TrenItalia is believed to be planning retaliatory action. Air France and Veolia have established a partnership, possibly with a view to competing with Thalys services, whilst DB are believed to be considering competing with Eurostar services. On a domestic level, Sweden is considering open access for its rail services in 2010/11 (Alexandersson, 2009)

Off-track competition, in the form of competitive tendering and franchising is more common in the passenger rail industry than on track competition (Thompson, 2006). In Europe, the pioneers were Sweden, where competitive tendering for local services began in 1990 and extended to regional services (many of which are long distance) in 1993, although key intercity services remain a commercial monopoly. This model has also been adopted in countries such as Denmark, Germany and the Netherlands and further afield in countries such as Kazakhstan (Sharipov, 2009). The EU's subsequent intention was for a widespread roll out of competitive tendering but this met opposition from some member states and Regulation 1370/2007 merely requires clear and transparent contracts. In Latin America, urban and suburban services were privatised through concessions, with the Buenos Aires commuter network in Argentina being transferred to the private sector in 1992, as was the Rio de Janeiro Metro and commuter services

(Flumitrens) in Brazil in 1997/8. These arrangements build on similar models in the United States where commuter rail services have been contracted out in cities such as Boston, Baltimore/Washington, Chicago and Los Angeles (Preston *et al.*, 2001) and have been extended to other urban rail systems, most notably in Melbourne, Australia (Kain, 2006). However, contracting out of long distance passenger services is relatively rare. In Argentina, it did not prove possible to find private operators for the long distance services and 70% of such services were discontinued, with the remainder taken over by regional governments. The main exception is Great-Britain where all passenger services were franchised in 1996/7, with five out of 25 Train Operating Companies being particularly focused on long distance services (Cross Country, East Coast Mainline, Great Western Mainline, Midland Mainline and West Coast Main Line).

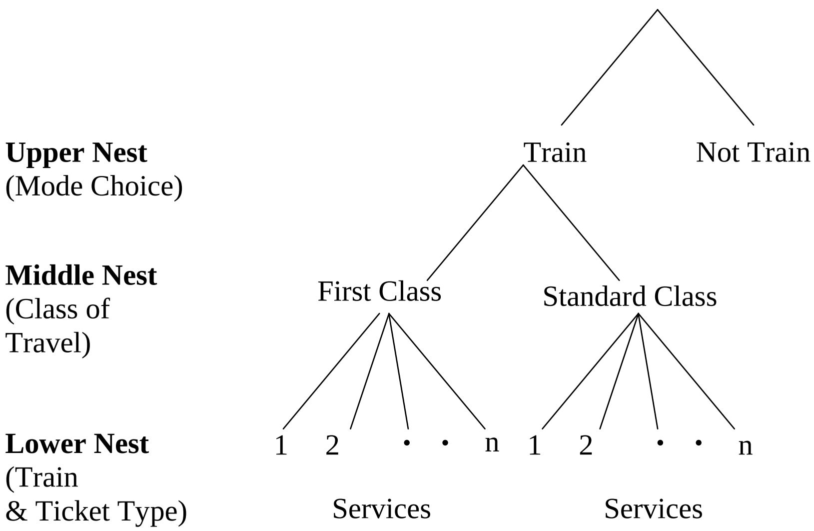
The aim of this paper is to review the emerging evidence on competition in the long distance passenger rail service. This draws on the three bodies of evidence. In section 2, we examine the ex-ante evidence from theoretical models based on Preston (2008a). In section 3, we examine the ex-post evidence on competition for the market, with particular emphasis on the East Coast Main Line franchise in Great-Britain, drawing in part on Preston (2008b). Likewise, in section 4, we consider recent evidence on open access services that are competing in the market in Great-Britain, drawing on Griffiths (2009). Finally, we shall draw some conclusions.

2. THEORETICAL MODELS OF RAIL COMPETITION

Rail competition, where it occurs, is likely to be small group in nature. Market demand is often too thin to support a large number of operators, whilst there may be some economies of scale and density that limit the optimum number of firms in rail markets (see, for example, Smith and Wheat, 2009). The relevant industry structure is therefore that of oligopoly competition. Classical models assume competition occurs either in the price dimension (Bertrand competition) or in the service dimension (Cournot competition). The conventional wisdom is that where capacity is difficult to increase (*e.g.* rail) competition will be of the Cournot type but where capacity can easily be increased (*e.g.* bus) competition will be of the Bertrand type (Quinet and Vickerman, 2004, p.263). However, this ignores demand side aspects. The urban rail market has turn-up-and-go characteristics which mean that passengers will tend to board the first train to arrive. Price competition is more effective in book-ahead markets such as long distance rail services. Indeed, price competition was a strong feature of the competition between British Coachways, National Express and British Rail in the early 1980s (see Douglas, 1987). However, Kreps and Scheinkman (1983) show that with appropriate quantity pre-commitment (which is likely to be the case in rail) Bertrand and Cournot competition can be equivalent.

Economic models of competition in rail have focused on the development of route based models in which the impacts of particular timetables (schedules) are examined and have some similarities with the dynamic schedule-based approaches developed by others (Wilson and Nuzzolo, 2004). An example is the PRAISE (PRivatisation of Rail SErvices) model (see Preston *et al.,* 1999, 2002). A similar modelling approach was adopted by SDG (2004) in modelling rail competition on the Brussels-Cologne and Madrid-Barcelona. The demand module of PRAISE assumes that individuals make their travel decisions at three linked stages (shown in Figure 1). At the first level (lower nest), the traveller's choice of service and ticket type is modelled, next the traveller's choice of class of travel is assessed in the middle nest and finally, the choice of travelling by train and not travelling by train is modelled in the upper nest. The model is therefore capable of distributing demand between trains and ticket types and allows for the overall rail market to expand or contract in response to fares and service level changes.

Figure 1: **Schematic Representation of the PRAISE Demand Model**



The choice of service and ticket type on the outward and return legs of the journey are assessed in the lower nest of the model. For a given individual with a given set of tastes (attribute values) and preferred departure times for the outward and return legs of the journey, we can allocate a "utility weight" to each available train and ticket type combination. Choice probabilities are then estimated for the best nine return-trip combinations using a multinomial

$$P_{ij} = \exp(\lambda U_j) / \sum_{j=1}^{9} \exp(\lambda U_j)$$

logit formula.

where P_{ij} is the probability that individual i will choose service and ticket combination j, and U_j is a utility weight typically based on fare, adjustment time (*i.e.* the difference between when a person would ideally like to travel and the scheduled departure time), journey time, advanced purchase requirement and interchange, though it can include other rail attributes such as rolling stock quality. λ is a spread parameter that governs the sensitivity of choice between services and ticket combinations.

The middle nest of the model examines the choice between first and standard class travel. This is done by estimating a representative measure of utility for each class of service by way of

$$EMU_{class} = \frac{1}{\lambda} \ln \sum_{j=1}^{9} \exp(\lambda U_j)$$

the expected maximum utility (EMU).

The choice between first and standard class of travel is then determined by the binary logit

$$P_{First} = \exp(\theta EMU_{First}) / (\exp(\theta EMU_{First}) + \exp(\theta EMU_{\text{Standard}}))$$

model.

where θ is a scaling coefficient that determines the sensitivity of choice between first and standard class travel. Different θ values are estimated for different journey purposes.

The final stage of the model represents the individual's choice between travelling by train and not travelling by train. This is done by estimating a representative value of rail travel for the individual (EMU_{train}) and allocating market shares using another binary logit model.

$$EMU_{Train} = \frac{1}{\theta} \ln(\exp(\theta EMU_{First}) + \exp(\theta EMU_{\text{Standard}})) \text{ and}$$

$$\mathrm{P_{Train}} = \exp(\gamma \mathrm{EMU_{Train}}) / (\exp(\gamma \mathrm{EMU_{Train}}) + 1)$$

Initial versions of the model involved setting the utility of not travelling by train equal to zero and estimating two separate γ values to restrict the fare elasticity of demand for business and non-business travel in Britain at -0.5 and -1.0 respectively (consistent with British Railway Board, 1990). In the Swedish application, elasticities of -0.4 for business travel, -0.6 for commuting and -0.9 for leisure were used (supplied by the state operator SJ). The British version of the model was based on a business value of time of 60 pence per minute and a non-business value of three pence per minutes (rebased to 2000 prices), based on local survey data (Preston *et al.*, 1999). The Swedish version of the model was based on a business value of time of approximately 16 pence per minute and a non-business value of approximately eight pence per minute (again in 2000 prices) based on national values and the work of Rosenlind *et al.* (2001). Based on existing demand patterns, the model determines ideal departure times and the penalties for travelling earlier or later than the desired time. Changes in timetables will change the extent of these penalties. These ideal departure times are used to determine choice sets and reduce some of the concerns stemming from the independence of irrelevant alternatives property of multinomial logit models (Jansson and Mortazavi, 2000).

For a given route, the cost module is based on a fully accounted cost formulation which took the following general form:

TC = (1 + A) (aV + bVH + cVKM + dPKM)
where

TC	=	Total cost
A	=	Administrative mark-up
V	=	Vehicles
VH	=	Vehicle Hours
VKM	=	Vehicle Kilometres
PKM	=	Passenger Kilometres.

Such a linear function is clearly a simplification of more complex relationships but has been widely used in the rail industry (Rosenlind *et al.*, 2001) and has some empirical support (Jörgensen and Preston, 2003). Parameters for the cost module were provided by the incumbent operators. A crucial difference relates to track access charging. In Great-Britain, the track authority is a commercial enterprise (Railtrack from 1996 to 2002, Network Rail thereafter) and charges are based on the principle of full cost recovery. In Sweden, the track authority (Banverket) is a public body and charging is based on short run marginal costs. The upshot is that, at 2000 prices, track access charges were around GBP5 per train km in Great Britain compared to 65 pence per train km in Sweden.

The appraisal module calculates profit as the difference between total revenue and total cost and calculates changes in consumer surplus using the rule of half. Change in welfare is simply the sum of the change in profits and in consumer surpluses.

Tables 1 and 2 summarise the findings of the PRAISE model in applications to a broadly hourly inter city service in Great-Britain (Route GB1), with approximately 2 million passenger journeys per annum. This route links two major cities but has substantial commuting at either end of the route. It is assumed that both the existing (incumbent) operator and the new (entrant) operator use the same rolling stock so that the quality of service is the same and, with the same stopping patterns, the speed of services is also the same. In reality, it is likely that competition will occur with respect to the quality of service as well as with respect to the quantity of service and fares, but this would require detailed modelling of the rolling stock market.

Table 1. **Sample Fringe Competition Results – Route GB1**

Model Run	Fares	Entrant Service Pattern	Inter-availability of tickets	Incumbent Share (%)	Rail Market Growth (%)
1	A*	1*	Yes	93.9	0.6
2	A*	1*	No	94.6	0.4
3	B*	1*	Yes	88.9	2.5
4	B*	1*	No	87.4	1.8
5	C*	1*	Yes	93.3	10.8
6	C*	1*	No	94.3	10.4
7	A*	2*	Yes	89.8	-2.6
8	A*	2*	No	89.6	-3.1
9	B*	2*	Yes	86.0	-0.3
10	B*	2*	No	84.3	-1.1
11	C*	2*	Yes	88.7	7.3
12	C*	2*	No	88.6	6.6

Notes:

1* Entrant provides two additional express services in the morning and evening peak periods in both directions of travel.

2* System is at capacity, the entrant replaces two of the incumbent's services in the morning and evening peak periods in both directions of travel with express services.

A* Entrant price matches incumbent's base fare levels

B* Entrant discounts fares by 20%

C* Both operators discount fares by 20%

Table 1 examines the possible demand impacts of fringe competition. It indicates that two additional peak services provided by a new entrant may attract between 6% and 12% of the market and grow the market by between less than 1% and more than 10%, depending principally on whether there is fares competition or not. When the entrant replaces two of the incumbent's peak services, it can capture up to 15% of the market but the overall market size decreases slightly. This is because it is in the entrant's interest not to serve some intermediate stations previously served by the incumbent but an abstractive service of this type is unlikely to be in the public interest.

Table 2 indicates that with matching competition, in which the entrant provides the same service frequency as the incumbent, the entrant can capture between 45% and 57% of the market. However, the overall market will only grow by between 6% and 19%. Again, this is largely because the entrant will not serve some intermediate stations. However, the incumbent also has an advantage in that its existing timetable should have been designed to best match customers' preferred arrival times.

Table 2. **Sample Head-on Competition Simulation Results – Route GB1**

Model Run	Fare Incumbent	Fare Entrant	Inter-availability of tickets	Incumbent Share (%)	Rail Market Growth (%)
13	0	0	Yes	54.8	8.6
14	0	0	No	54.0	6.1
15	0	-10%	Yes	48.7	11.2
16	0	-10%	No	43.6	8.6
17	-10%	-10%	Yes	55.1	13.6
18	-10%	-10%	No	54.4	11.1
19	-10%	-20%	Yes	48.9	16.3
20	-10%	-20%	No	43.8	13.6
21	-20%	-20%	Yes	55.3	18.7
22	-20%	-20%	No	54.8	16.1

Note: Entrant matches service frequency of incumbent

Similar work in Sweden modelled the effect of various competitive scenarios for two lines. The results are shown by Tables 3 and 4 which summarise the findings with respect to a high frequency inter city service, with an average service frequency of less than one hour (Route S1), and a low frequency inter city service, with an average service interval in excess of two hours (Route S2) respectively. Route S1 has approximately two million passengers per annum, with commuting at both ends of the route, whereas Route S2 has only around 0.25 million passengers per annum, with commuting at only one end of the route. Two service options are examined: the entrant matches the number of services provided by the incumbent or the entrant only runs one train in each direction in the peak periods (two trains for the high frequency service). This is referred to as fringe competition. With respect to fares it is assumed that the entrant matches the incumbent's fares or introduces 10% or 20% reductions across all ticket types. The incumbent either maintains existing fare levels or matches the entrant's fare reductions. It is assumed that tickets are not interavailable between operators.

Table 3. **Competition on a High Frequency Inter City Route S1**

Fare Incumbent	Fare Entrant	Service Incumbent	Service Entrant	Total Patronage Base=100	Incumbent Market Share	Entrant Market Share
As Now	Match	As Now	Match	112	47%	53%
As Now	-10%	As Now	Match	126	15%	85%
As Now	-20%	As Now	Match	139	6%	94%
-10%	-10%	As Now	Match	130	47%	53%
-20%	-20%	As Now	Match	144	47%	53%
As Now	Match	As Now	Fringe	101	99%	1%
As Now	-10%	As Now	Fringe	103	95%	5%
As Now	-20%	As Now	Fringe	105	85%	15%
-10%	-10%	As Now	Fringe	122	99%	1%
-20%	-20%	As Now	Fringe	136	99%	1%

Table 3 shows that for Route S1 if an entrant matches the incumbent's fares and services it gains a 53% market share. This is greater than 50% because the entrant can design a timetable to give particularly good coverage of the busiest times of day. In practice, the incumbent would adjust its existing departures in the light of the entrant's timetable, initiating an iterative process that might be expected to result in equal market shares. Fares competition from the entrant can have a dramatic effect on the incumbent's market share – reducing it from 47% to 6%. Fares competition has a greater impact on the high frequency route because the fare reductions more than compensate for the adjustment of schedules. Fringe competition from the entrant has a minimal impact, capturing 1% of the market without fare reductions, rising to 15% of the market with a 20% fare reduction. If the incumbent matches the entrant's fare reductions, it reduces the entrant's market share back to 1%. In this instance competition may not be academic. Both matching and fringe competition can be profitable for both parties.

Table 4 shows that for the low frequency service (S2) an entrant that matches the incumbent's fares and service levels can capture 56% of the market. This is greater than 50% for the same reasons as for Route S1, but in the low frequency case there are more gaps in the timetable at busy times of day for the entrant to fill. Fares competition from the entrant can reduce the incumbent's market share further from 44% to 30%. If the incumbent matches the entrant's fare cuts, it returns to obtaining a 44% market share. With fringe competition, the entrant can capture 23% of the market without fare cuts, rising to 31% with a 20% fare reduction. If the incumbent matches these fare cuts, the entrant's market share is reduced back to 23%. It should be noted that for such a low frequency route, competition may be largely academic as none of the scenarios examined revealed a profitable entry opportunity.

Table 4. **Competition on a Low Frequency Inter City Route S2**

Fare Incumbent	Fare Entrant	Service Incumbent	Service Entrant	Total Patronage Base=100	Incumbent Market Share	Entrant Market Share
As Now	Match	As Now	Match	122	44%	56%
As Now	-10%	As Now	Match	127	37%	63%
As Now	-20%	As Now	Match	133	30%	70%
-10%	-10%	As Now	Match	131	44%	56%
-20%	-20%	As Now	Match	140	44%	56%
As Now	Match	As Now	Fringe	108	77%	23%
As Now	-10%	As Now	Fringe	110	73%	27%
As Now	-20%	As Now	Fringe	112	69%	31%
-10%	-10%	As Now	Fringe	116	77%	23%
-20%	-20%	As Now	Fringe	125	77%	23%

PRAISE is not an equilibrium model. Instead it is a model that is used to assess the impact of a number of scenarios. An example for Route GB1 is given by Table 5. This analysis suggests that matching competition is not feasible in most instances. However, Table 5 suggests that fringe competition may be feasible in certain circumstances (for example, if there is regulation to ensure interavailability of tickets – model run 5). However, in most cases welfare does not increase, with the exception of model run 11.

Table 5. **Example Results from the PRAISE Model – Inter City Route GB1 (per day)**

Model Run	Fares	Entrant Service Pattern	Inter-availability of tickets	Incumbent Profit (#)	Entrant Profit	Consumer surplus change (Business)	Consumer surplus change (Non-business)	Welfare Change
1	A*	1*	Yes	30,815	1,267	1,528	82	-9,051
2	A*	1*	No	31,962	-847	891	82	-10,657
3	B*	1*	Yes	12,419	16,670	4,686	791	-8,178
4	B*	1*	No	17,799	10,379	3,510	512	-10,544
5	C*	1*	Yes	23,545	528	12,741	4,548	-1,383
6	C*	1*	No	25,017	-2,135	12,055	4,483	-3,326
7	A*	2*	Yes	29,591	11,381	-3,578	-1,046	-6,397
8	A*	2*	No	29,553	9,183	-4,603	-1,153	-9,765
9	B*	2*	Yes	20,050	18,888	446	-210	-3,570
10	B*	2*	No	22,158	14,700	-845	-507	-7,239
11	C*	2*	Yes	23,241	10,259	7,592	3,380	1,727
12	C*	2*	No	23,240	7,999	6,466	3,230	-1,810

Notes:
1* Entrant provides two additional express services in the morning and evening peak periods in both directions of travel.
2* System is at capacity, the entrant replaces two of the incumbent's services in the morning and evening peak periods in both directions of travel with express services.
A* Entrant price matches incumbent's base fare levels
B* Entrant discounts fares by 20%
C* Both operators discount fares by 20%.
Incumbent base profit GBP42,746

Route GB1 is paralleled by a slower Route GB1A, with end to end journey times one hour longer. It was found that if fares on Route GB1A were set at 50% of those of GB1, then Route GB1A could capture 25% of the end to end market. We were not able to undertake a welfare analysis of this scenario, as we did not have full demand and cost data for Route GB1A. However, this analysis suggests that route competition based on product differentiation may be possible and has been a feature of a number of origin and destination pairs, most notably between London and Birmingham.[iii]

An example of the PRAISE model results for the Inter City Route S1 in Sweden is given by Table 6. It should be noted that this route is paralleled by the slower services of Route S1A, which has end to end journey times that are around an hour longer. Route S1A has around one million passengers per annum. This Table shows that, with a 20% cost reduction and no interavailable tickets (arguably the most likely competitive scenario), fringe entry (scenarios 68 to 72) is profit enhancing in that it encourages a shift from Route S1A services with low profit margins to Route S1 services with relatively high profit margins. Head-on competition (scenarios 63 to 67) reduces overall profits by up to 30%, although the Route S1 services remain profitable in total. The demand for Route S1 services, measured in terms of passengers, might increase by over 40% but the change in demand for Route S1 and S1A services combined is more modest (with a maximum growth of 12%). Consumers suffer disbenefits in some scenarios because the increases in service frequency are insufficient to compensate for the lack of integrated ticketing between Route 1A feeder services and Route 1 trunk services. Our analysis suggests that with open entry, the most likely outcome is scenario 67, which involves head-on competition with fare cuts. This leads to an increase in welfare equivalent to 31% of base profits. It should be noted that if the incumbent is forewarned of entry it is likely to blockade such an opportunity by doubling frequency itself. Moreover, it should also be noted that a regulated monopolist in which service levels are reduced slightly but fares are cut by 20% could increase welfare by a greater amount, equivalent to 118% of base profits.

Table 6**. Example Results from the PRAISE Model – Inter City Routes S1 and S1A**

Scenario	Fare Route 1A	Fare Route 1 -Inc	Fare Route 1 -Entrant	Service Route 1A	Service Route 1 -Inc	Service Route 1 -Entrant	Route 1 Pax change	Routes 1 & 1A Profit change	Routes 1 & 1A CS change *	Routes 1 & 1A Welfare Change *
63	As Now	As Now	Match	As Now	As Now	Match	12.3%	-26.0%	-8.6%	-34.6%
64	As Now	As Now	-10%	As Now	As Now	Match	25.5%	-22.7%	12.3%	-10.4%
65	As Now	As Now	-20%	As Now	As Now	Match	38.5%	-27.1%	42.6%	15.6%
66	As Now	-10%	-10%	As Now	As Now	Match	30.0%	-18.9%	20.8%	1.9%
67	As Now	-20%	-20%	As Now	As Now	Match	43.0%	-23.1%	54.4%	31.3%
68	As Now	As Now	Match	As Now	As Now	Fringe	1.6%	42.3%	-20.3%	22.0%
69	As Now	As Now	-10%	As Now	As Now	Fringe	2.5%	42.6%	-19.5%	23.1%
70	As Now	As Now	-20%	As Now	As Now	Fringe	4.9%	41.3%	-16.6%	24.7%
71	As Now	-10%	-10%	As Now	As Now	Fringe	21.8%	54.4%	7.1%	61.5%
72	As Now	-20%	-20%	As Now	As Now	Fringe	36.4%	53.0%	39.3%	92.2%

Note: Inc = Incumbent, Pax = Passenger, CS = Consumer Surplus, * Expressed relative to base profit and a base situation in which tickets are interavailable.

Overall, on Route S1, of the scenarios examined, unconstrained profit maximisation was found to be similar to the welfare maximising scenario. However, both situations require the Route S1A services to be subsidised. This suggests that Route S1 services operated as a regulated monopoly for high speed services may promote static efficiency, provided there is fringe competition from Route S1A conventional services in receipt of appropriate amounts of subsidy and inter-modal competition from car, coach and air. Also, there appears to be a strong welfare case for lower fares on Route S1 services compared to the current situation.

Further analysis indicated that, where tickets are not interavailable, it is still possible for two operators to be profitable with head-on competition but matching fare reductions of around 10% are more likely. With cost reductions, competition becomes more feasible but is still undesirable, although to a reduced degree. Although it is possible for two Route S1 operators to be profitable with head-on competition, even with interavailable tickets, the increase in welfare is only around one half of the maximum we have found. If tickets are not interavailable, the increase in welfare is only around a quarter of the maximum we have found. Welfare is maximised where fares are reduced by 20% and service levels are reduced slightly on route S1 whilst fare and service levels on route S1A are unchanged.

For the low frequency Inter City Route S2, in the base it is found that the service is loss making with a cost recovery ratio (expressed as a percentage) of around 60%. However, this is based on fully accounted costs where administration costs comprise 15% of total costs, whilst revenue calculations do not take into account contributory revenue elsewhere on the network and off train revenue. When these facts are taken into account we find that the service is close to break-even with current costs and will be profitable with the introduction of new rolling stock.

Overall, the modelling for route S2 indicates that competition is not feasible with current cost levels. Welfare is maximised when there are substantial fare reductions and modest service reductions. Losses are reduced by more than a third. By contrast, profit maximisation would involve substantial fare increases and service reductions that would lead to a halving of losses but an increase in welfare of only one sixth of the maximum found. With cost reductions of 20%, the profit maximising scenario and the welfare maximising scenario remain dissimilar in their welfare impacts, although the service can get close to break-even. If tickets are interavailable, there may be scope for some fringe competition on peak days (Fridays and Sundays when demand is double average weekday levels – see for example Jansson, 2001) but this reduces welfare.

It is possible to generalise the results of these computer simulations. A generic version of the PRAISE model was developed for the Strategic Rail Authority (Whelan, 2002) and meta-analysis of model runs has been undertaken to determine reaction functions. These results indicate that in Great-Britain with prevailing track access rates, head-on competition is not commercially feasible, even if sufficient capacity was available. However, cream skimming entry with train movements focussing on the peak times and directions of travel and/or niche entry through various forms of product differentiation could be commercially feasible, particularly if there was regulation to ensure inter-availability of tickets. Moreover, competition would lead to service withdrawal from thinner markets (in this case lightly used intermediate stops) and a concentration on thick markets - a phenomenon also observed in the deregulated express coach market (Cross and Kilvington, 1985) and in the German passenger rail market (Séguret, op cit.).

By contrast, the work in Sweden indicated that with lower track access charges, head-on competition was commercially feasible on the busiest routes, although it might not be technically feasible because of capacity constraints. However, such competition was not desirable because it led to too much service, at too high fares, compared to the welfare maximising configuration which involved substantial fare reductions on the busiest route. An interesting feature was the importance of competition between parallel routes. If the slower route was subsidised so that fares and frequency were set at the welfare maximising level then a profit maximising monopolist on the fast route would probably produce at a fares-frequency combination that was close to the welfare maximum. Competition was not found to be feasible for thinner routes in Sweden.

The overall conclusion from models of this type is that competition in long distance rail markets, where it occurs, is not characterised by oligopoly (either of the Cournot or Bertrand type) but is likely to take the form of oligopolistic competition of the type described by Salop (1979) and Novshek (1980). This will involve too much service at too high fares, but also with spatial and temporal bunching.

The finding that competition in rail markets does not generally enhance welfare requires numerous qualifications. The first is that it is assumed that firms are already cost efficient. Where this is not the case, competition may be a powerful tool to promote cost efficiency. The second is that dynamic efficiency is ignored. There may be an argument that competition promotes innovation, particularly with respect to product differentiation, and this has not been taken this into account. A third, and related point, is that uniform pricing is assumed, at least for individual segments. Competition may particularly promote innovation in pricing, stimulated by technological developments in delivery channels such as the internet, smart cards and mobile telephony. As a result, modelling work is now focusing on intra-modal and even intra-firm competition between ticket types (Wardman and Toner, 2003).

3. OFF TRACK COMPETITION

It was noted in the introduction that off track competition for long distance rail service has been limited. In part, this may be because such services already face competition from car and coach for shorter distances and from air for longer distances. It also reflects that the case for subsidising long distance rail services is not strong. First best arguments for subsidisation related to user benefits increasing with service output (the Mohring effect) are limited for infrequent services where passengers time their arrival to match train departure times, whilst second best arguments related to the relief of road congestion are also diminished. As a result, there may be predilection for competition in the market for long distance services, as reflected by EC Directive 91/440. However, a combination of institutional inertia and limited commercial opportunities means that the development of such competition has also been limited.

The evidence of competition for the market in Great-Britain is therefore relevant. Here, there have been three broad rounds of franchising (see also Preston, 2008b). The first round, organised by the Office of Passenger Rail Franchising, was undertaken between 1996 and 1997 and based in the main around seven year net cost contracts, with minimum service levels specified and around 50% of fares regulated. An important exception was the West Coast Main Line where a 15 year franchise was let, as the infrastructure was to undergo an upgrade to permit 200 km per hour tilting Pendolino trains, an upgrade which was only completed in 2008.

The second round, associated with the Strategic Rail Authority, saw some eight franchise re-let. Initially the focus was on longer franchise for 20 years in which the operator was given greater commercial freedom. In the event only two such franchises were let – for the urban services centred on Liverpool (Merseyrail) and for Chiltern Rail (which does include some long distance services from Birmingham (and beyond) to London). The rest of the re-let franchises were in response to the financial meltdown in the industry that resulted from the Hatfield accident in 2000 and the subsequent failure of Railtrack and some 13 of the 25 Train Operating Companies (Nash and Smith, 2006). Thompson (2006) notes that of these 13 failures only two were long distance operators whose holding company (Virgin Trains) had been affected by the delays and cost over-runs on the West Coast Main Line. Partly as a result of these franchise failures, there was a switch back to more tightly specified, shorter franchises.

The third phase of franchising – run by the Department for Transport (DfT) since 2005 – has seen ten further franchises re-let. A feature of this round is that the distinction between long distance intercity franchises and suburban and regional franchises has become blurred, with the Great Western incorporating the former Thames (London commuter services out of Paddington) and Wessex (regional services in the South West) franchises. Similarly, the Midland Main Line franchise was merged with some regional services to form East Midlands Trains. One feature of the third round is the cap and collar incentive regime which shares commercial risk between the franchisor and the franchisee. This typically means that after the first four years of the franchise contract have passed: 50% of any fares revenues in excess of 102% of the TOC's original forecasts are shared with DfT; DfT makes a contribution equivalent to 50% of any revenue shortfall below 98% of the TOC's original forecast; and for any short fall below 96%, DfT's contribution increases to 80%. This revenue risk-sharing mechanism is intended to constrain overzealous bidding, something that was a particular feature towards the end of the first round (see Preston *et al.*, 2000). However, it may encourage backloading in which bids are more aggressive in later years when the risk sharing comes into force.

One initial concern about off track competition was that it may not prove to be very competitive (Preston, 1996). This has not proved to be the case given that the privatised bus companies have been heavily involved in bidding from the start, whilst interest from international organisations has grown so that currently organisations from France, Germany, Hong Kong and the Netherlands have stakes in franchised rail operators. In the first phase, there were an average 5.4 bids per franchise. This has reduced slightly so that there were 4.2 bids per franchise in the second phase and 3.8 bids per franchise in the third phase. There is some concern that high bidding costs (which are estimated at around GBP5 million per bidder) may be deterring entry.

Table 7. **The East Coast Franchise**

	Date Started	Expected Duration	PVNP 1st year (GBPm)	PVNP Final year (GBPm)
GNER	April 1996	7 years	65[1]	0
GNER	May 2005	10 years	(50)	(219)
National Express	Dec. 2007	7 ¼ years	7	(311)

PVNP = Present Value of Net Payments. Figure in brackets denote premia paid.
[1]Out-turn.
Source. Preston and Root (1999) and www.dft.gov.uk

An interesting case study is provided by the East Coast Franchise, the core of which is long distance intercity services between London King's Cross and Leeds/Edinburgh. Table 7 gives some basic data. In the first round of franchising, the winning bid for this franchise was from Great North Eastern Railways (GNER), a subsidiary of the shipping company Sea Containers. This service required some GBP65 million of subsidy in the first year of operation falling to zero subsidy in the seventh year. Given the relatively good performance of GNER and uncertainties following Hatfield a two year extension was negotiated, prior to refranchising in 2004. The incumbent operator put in a robust bid which involved paying a premium of GBP50 million in the first year, rising to GBP219 million in the tenth year, indicating some backloading. However, the trade press indicated that the incumbent's bid was only a little higher than the second highest bid. This bid was accepted and GNER started operating its renewed franchise in May 2005. However, this bid was quickly overtaken by a series of events. GNER had not anticipated the upsurge in fuel costs that occurred in 2005/6, revenue was hit by the 7th July 2005 bombings in Central London and entry by an open access operator, Grand Central, would abstract some revenue from GNER, particularly at York. To confound matters, GNER's parent company was also in financial difficulties. It quickly became clear that GNER could not meet its premium payments and there was still three years before the cap and collar scheme came into force. In December 2006, GNER entered into a Management Agreement with the DfT, based on an incentive if revenue growth exceeds an agreed target. Almost immediately, the process of re-letting the franchise was begun.

The bids for these were submitted in June 2007 and the award announced in August. The winning bid came from the National Express Group, who began operations in December 2007. Again, the bid was a robust one. Although for the first year of operation a subsidy of GBP7 million was required this would quickly convert into a premium of GBP311 million some seven years later – again indicating backloading. There was some concern that National Express was buying in work given that it had lost a number of franchises (including Central, Midland Mainline and Scotrail) but the trade press also indicated that National Express was not the highest bidder. Once again, the bid was overtaken by events. In the light of the credit crunch, the 10% per revenue growth on which the bid was predicated was unlikely. In the light of this, and problems with the parent company, in July 2009, National Express East Coast announced that it would only be able to meet it contractual obligations up to the end of 2009. Mindful of evidence that re-negotiations would lead to cost increases of the order of 23-28% (Smith and Wheat, 2009), the Government fulfilled its earlier commitment not to negotiate and prepared to exercise its operator of last resort powers, a role it had previously exercised for South East Trains (formerly operated by Connex) between 2003 and 2006. National Express East Coast will surrender a GBP32 million performance bond and in combination with accumulated losses will face an exposure of some GBP100 million. The Government is also minded to enforce cross-default provisions so that National Express will have to give up its other two (profitable) franchises. However, there is some uncertainty over the future of National Express as a whole, with at the time of writing, Stagecoach plc (the operator of two franchises and the part owner of another) considering a take-over bid.

One of the dangers of contracting-out, particularly in railways, is related to the gaming behaviour that can occur. In particular, there is the practice of low-balling in which bidders post an initial high bid in the belief that they can then re-negotiate or chisel on the offered level of quality. The performance regime for railways in Britain (with financial penalties for poor reliability and overcrowding) largely precludes the latter option. Re-negotiation is a high risk strategy and one that might involve a loss of reputation, but is predicated on at least three points. Firstly, the private sector is gambling that no Government could afford to let the railways (or a part of it) go bust. Secondly, in circumstances of a likely franchise failure, re-negotiations may be less costly (and speedier) than re-franchising. Thirdly, the private sector is assuming that in any re-negotiations it will exhibit better negotiation skills (and be able to devote more resources to this task) than the public sector. In so doing, it may be assisted by information asymmetries. There is some evidence that low-balling occurred in the first round of franchising, albeit it unsuccessfully in the case of Connex but perhaps with more success in the case of Virgin. Thompson (2006) notes that low-balling has been a feature of rail franchising elsewhere, particularly in Australia and Latin America. In the third round of franchising, low-balling does not seem to be effective given the Government's firm stance on no renegotiations, implementation of cross-default provisions and recovery of a performance bond. However, the failure of the East Coast franchisee twice in three years is obviously a cause for concern and suggests that there are problems with the winner's curse. Options might involve moving away from net subsidy to gross cost contract (as has occurred for the London Overground franchise) but this would weaken operator incentives to grow revenue or considering flexible length contracts which terminate once a franchisee has made its premium payments in PV terms – in effect a variant of the least present value of revenue approach advocated by Engel *et al.* (2001).

4. ON TRACK COMPETITION

As indicated above, open access competition in Britain has been moderated by the Office of Rail Regulation. In the first phase of moderation, open access competition was restricted to origin and destination pairs that constituted less than 0.2% of a franchisee' revenue – effectively limiting competition to where franchises overlapped (see Shaw 2000). In the second phase, which operated up to 2002, franchisees could register revenue flows and could only face competition on 20% of registered flows but all unregistered flows would be open to competition. In the third phase, from 2002 onwards a more case by case approach has been adopted where services have to demonstrate that they are not primarily abstractive. It appears that the relevant threshold is that generated traffic needs to be at least 30% abstracted traffic (Griffiths, 2009). So far there have been three instances of open access competition, with a further case approved. These are Hull Trains, which has been operating services between Hull and London via the East Coast Main Line since 2000; Grand Central which has been operating services between London and Sunderland, also via the East Coast Main Line, since 2007; and Wrexham, Marylebone and Shropshire Railway, which has been operating services between Wrexham and London since 2008. In addition, Grand Northern has been licensed to provide services between Bradford and London, but has not yet started operation. Three open access proposals have been rejected: a Grand Central service between Preston and Newcastle via Manchester and Leeds; a Hull Trains service between Harrogate and London and a Platinum Trains service between Aberdeen and London. Currently non-franchised operations[iv] account for 0.1% of passenger journeys, 0.6% of passenger revenue 0.8% of passenger kms revenue and 1% of train kms on the national network. (ORR, 2009).

Table 8. **Open Access Services Summer 2009**

	Franchisee's trains per day	Open access trains per day	Franchisee super off peak return	Open access Off peak return
London – Hull	1 (19)	7	GBP85	GBP69
London – Sunderland	0 (23)	3	GBP105	GBP71

Table 8 shows some data for the two most established open access operators both of which are providing direct services to London from cities on the East Coast of England with populations of around 250 000 that have traditionally been poorly served by rail. The franchised operator in the main provides indirect services via Doncaster in the case of Hull and via Newcastle in the case of Sunderland. It can be seen that compared to these franchised services, the open access operator only provides 27% of service in the case of Hull and 12% in the case of Sunderland. However, headline fares for the open access operator are some 18% lower in the case of Hull and 32% lower in the case of Sunderland. This has resulted in large increases in demand. Rail travel between London and Hull has grown by some 60%, whilst on the uncompleted Grimsby to London route growth has only been around 10%. In terms of revenue, the first four Hull Trains services were estimated to have a generation to abstraction ratio of 0.7:1. Another feature of open access services is the high percentage of passengers on the main flows travelling on dedicated tickets – well above the 10% threshold used by the Competition Commission (2005) and in some case above 50%.

Table 9. **Economic Benefit of Open Access Services (GBPm)**

	Hull Trains		Grand Central	
	PV 5 years	PV 10 years	PV 5 years	PV 10 years
Economic benefit	47.3.	96.9	18.4	38.2
Net financial cost	29.1	45.4	15.5	24.3
Net Present Value	18.1	51.5	2.9	14.0
Benefit Cost Ratio	1.62	2.13	1.19	1.57

Source: MVA, 2009.

Table 9 shows that there appears to be a strong economic case for both the Hull Trains and Grand Central services, with a ten year benefit:cost ratio in excess of 1.5 for both services.

5. CONCLUSIONS

Competition for long distance rail services remains relatively limited. On track competition, where it has occurred seems to focus on niche markets which the incumbent operator has neglected. However, modelling work indicates that if track access charges are based on short run marginal cost, head-on competition may be feasible for densely trafficked routes but not necessarily socially desirable, with a tendency to result in too much service, at too high fares. Where track access charges are based on fully allocated costs, competition may be more limited, even for densely trafficked routes, and this competition may have some cherry picking characteristics. Again, competition may be feasible (particularly if there are regulations enforcing interavailable ticketing) but not necessarily desirable. By contrast, analysis of the niche open access entry in Britain, based on marginal cost based track access charges, does appear socially desirable. An interesting question is whether the ratio of generated to abstracted traffic is a useful indicator. The most likely outcome for the heavily trafficked route in Sweden (S1- head-on competition, Table 6, Model Run 67) results in a ratio of 0.57, well in excess of the ORR's 0.3 threshold. By contrast, the most likely outcome on the heavily trafficked route in Great-Britain (GB1 - fringe competition, Table 5, model run 1) gives a ratio of only 0.10. With head-on competition and matched fares (Table 2, model run 13) this ratio increases to around 0.18. However, the ratio become difficult to interpret when there are matched fare cuts. For example, with fringe competition and fare cuts (model run 5, Table 5) generated traffic exceeds that abstracted by the entrant. However, this scenario results in an 11% reduction in total revenue and a welfare loss. Interestingly, for Table 5, model run 11 (fringe competition in which the entrant replaces the incumbent fro some services with matching fare cuts), the ratio is 0.6. This option is welfare enhancing despite a 14% reduction in total revenue, although this is partly due to the entrant cutting out some intermediate stops. Some of these results have echoes of the work undertaken by SDG (2004) that found that competition on European high speed rail routes was feasible, provided track access charges were based on marginal costs and provisions were made for interavailable tickets, but the case is not particularly robust.

Off track competition is relatively untested for long distance services, particularly those that are good commercial prospects, with the main evidence coming from Great-Britain. Such a model has been able to attract sufficient numbers of bidders, has coincided with strong demand growth and can result in large premia being paid to the franchisor. However, such competition is vulnerable to the winner's curse which may be exposed by unexpected events (Hatfield, the 7/7 bombings, the credit crunch). Risk sharing mechanisms may reduce this exposure but do not remove it all together and alternative contractual models may be worth considering including flexible term contracts and Vickrey style second best auctions.

Where on track competition provides direct services to new markets, experience from Great-Britain indicates this is commercially feasible and socially desirable, but capacity constraints on the main lines and at key terminals mean that such competition may be limited and there is the wider issue of whether these services are making the best use of limited capacity. There are indications from modelling work in both Britain and Sweden that route competition can be beneficial, but this will be limited by railway geography, although the scope for such competition will increase where new high speed lines are being constructed.

The overall impression is that the evidence in support of competition for long distance rail services, either in the market or for the market, is mixed. Indeed a commercial 'monopoly' may approximate a first-best solution if some conditions are met. First, this monopoly needs to face modal competition, particularly from deregulated coach and air markets. Secondly, where feasible this monopoly should face route competition. This may take the form of product differentiation, with the alternate route being slower but cheaper. Where there is sufficient capacity such differentiation may be provided on track, with express services competing with stopping services. It could be that the slower services are in receipt of subsidy, in which case they should be competitively tendered. Third, where possible there may be some benefits in terms of niche competition in which infrequent direct services compete with frequent indirect services. Of course, if these conditions are met then the commercial operator does not really have a monopoly, at least for significant parts of its market, although it may have some incumbency advantages. Where such conditions can not be met, then some competition for the market might be considered.

ACKNOWLEDGEMENTS

The development of the PRAISE model and the Great Britain rail case study was undertaken at the University of Leeds, with a key role played by Gerard Whelan (now at MVA Consultancy). The Sweden rail case study was undertaken at the University of Oxford, with a key role played by Biao Huang (now at the Asian Development Bank). Numerous other colleagues contributed to this work, including Tim Griffiths of ORR, but the interpretations here (and any mistakes therein) are purely my own.

BIBLIOGRAPHY

Alexandersson, G. (2009) The Complexity Of Market Structure – Prospects for on-The-Track Competition in Sweden. Presented to the 11th International Conference on Competition and Ownership in Land Passenger Transport. Delft, the Netherlands.

British Railways Board (BRB)[v] (1990), *Passenger Demand Forecasting Handbook*, Version 2. London: BRB.

Competition Commission (2005), *First Group/ICEC Merger Inquiry: Commentary on Issues Statement*, Competition Commission, London.

Cross, A.K. and Kilvington, R.P. (1985), The Deregulation of Inter-City Coach Services in Britain, *Transport Reviews*, 5, pp. 225-245.

Dementiev, A. (2007), "Vertical Divestiture as a Competitive Strategy: The Case of Railway Passenger Transport Reform in Russia", Presented to the 10th International Conference on Ownership and Competition in Public Transport. Hamilton Island, Queensland.

Douglas, N. (1987), *A Welfare Assessment of Transport Deregulation - the Case of the Express Bus Market*, Aldershot: Gower.

Engel, E., Fischer, R. and Galetovic, A. (2001), "Least-Present-Value-of-Revenue Auctions and Highway Franchising", *Journal of Political Economy*, Volume 109, pp. 993-1006.

Gomez-Ibanez, J. and de Rus, G., (2006), *Competition in the Railway Industry: an International Comparative Analysis*, Edward Elgar, Cheltenham.

Griffiths, T. (2009), "On Rail Competition: The Impact of Open Access Entry on the Great Britain Rail Market", Presented to the 11th International Conference on Competition and Ownership in Land Passenger Transport. Delft, the Netherlands.

Jansson, K. and Mortazavi, R. (2000), "Models for Public Transport Demand and Benefit Assessments", In Hensher, D. and Button, K. (Eds), *Transport Modelling*, Pergamon, Oxford.

Jansson, J.O. (2001), "Efficient Modal Split", Proceedings of the 7th International Conference on Competition and Ownership in Land Passenger Transport. Molde, Norway.

Jörgensen, F. and Preston, J. (2003). "Estimating Bus Operator's Short-run, Medium-term and Long-run Marginal Costs", *International Journal of Transport Economics*, Volume 30, Issue 1, pp. 3-24.

Kain, P. (2006), “The Pitfalls in Competitive Tendering: Addressing the Risks Revealed by Experience in Australia and Britain”, ECMT Workshop on Competitive Tendering of Rail Services, Paris.

Kreps, J. and Scheinkman, J. (1983), “Quantity Precommitment and Bertrand Competition yield Cournot Outcomes”, *Bell Journal of Economics*, Volume 14, Issue 2, pp. 326-337.

Lardner, D. (1850), *Railway Economy: A Treatise on the New Art of Transport*, Taylor, Walton and Maberly. London.

Mizutani, F. (1994), *Japanese Urban Railways. A private-public comparison*, Aldershot: Avebury.

MVA (2009), *Assessment of Alternative Track Access Applications on the East Coast Main Line,* MVA, London.

Nash, C. and Smith, A. (2006), “Passenger Rail Franchising – British Experience. ECMT Workshop on Competitive Tendering of Rail Services”, Paris.

Nash, C (2009), “European Rail Reform - The Next Steps”, Presented to the 11th International Conference on Competition and Ownership in Land Passenger Transport. Delft, the Netherlands.

Novshek, W. (1980), “Equilibrium in Simple Spatial (or Differentiated Product) Models”, *Journal of Economic Theory*, 22, pp. 313-323.

Office of Rail Regulation (2009), National Rail Trends, Quarter 1. 2009/10. ORR, London.

Preston, J. and Root, A. (1999), “Great Britain”, In Van de Velde, D. (Ed), *Changing Trains. Railway reform and the role of competition: the case of six countries*, Ashgate Aldershot.

Preston, J., Whelan, G. and Wardman, M. (1999), “An Analysis of the Potential for On-track Competition in the British Passenger Rail Industry”, *Journal of Transport Economics and Policy*, Volume 33, Issue 1, pp. 77-94.

Preston, J.M., Whelan, G., Nash, C. and Wardman, M. (2000), “The Franchising of Passenger Rail Services in Britain”, *International Review of Applied Economics*, Volume 14, Issue 1, pp. 99-112.

Preston, J., Holvad, T., Sykes, N. and O’Reilly, J. (2001), “Review of Empirical and Theoretical Evidence. Deliverable D2, Development of Market Models for Increased Competition in Railroad Passenger Traffic”, Working Paper 906, Transport Studies Unit, University of Oxford.

Preston, J., Holvad, T. and Rajé, F. (2002), *Track Access Charges and Rail Competition: A Comparative Analysis of Britain and Sweden*, European Transport Conference, Cambridge.

Preston, J. (1996), “The Economics of British Rail Privatization: An Assessment”, *Transport Reviews*, Volume 16, Issue 1, pp. 1 – 21.

Preston, J. (2008a) Competition in Transit Markets. Research in Transportation Economics, 23, 75-84.

Preston, J. (2008b), “A Review of Passenger Rail Franchising in Britain: 1996/7 – 2006/7”, *Research in Transportation Economics,* 22, pp. 71-77.

Quinet, E. and Vickerman, R. (2004), *Principles of Transport Economics,* Cheltenham: Edward Elgar.

Rosenlind, S., Lind, G. and Troche, G. (2001), *LIME: Model for Capacity Utilisation and Profitability of a Railway Line.* Stockholm: Royal Institute of Technology.

Salop, S. (1979),” Strategic Entry Deterrence”. *American Economic Review,* 69, pp. 335-338.

Séguret, S. (2009), “Is Competition On-track a Real Alternative to Competitive Tendering in the Railway Industry? Evidence from Germany”. Presented to the 11th International Conference on Competition and Ownership in Land Passenger Transport. Delft, the Netherlands.

Sharipov, T. (2009), “Results So Far and Prospects of Kazakhstan Passenger Rail Franchising”, Presented to the 11th International Conference on Competition and Ownership in Land Passenger Transport. Delft, the Netherlands.

Shaw, J. (2000), *Competition, Regulation and the Privatisation of British Rail,* Ashgate, Aldershot.

Smith, A. and Wheat, P. (2009), “The Effect of Franchising on Cost Efficiency: Evidence from the Passenger Rail Sector in Britain”, Presented to the 11th International Conference on Competition and Ownership in Land Passenger Transport. Delft, the Netherlands.

Steer Davies Gleave (2004), “EU Passenger Rail Liberalisation: Extended Impact Assessment. Report for DGTREN”, European Commission, Brussels.

Thompson, L. (2006), “Competitive Tendering in Railways: What is Experience Telling Us?”, ECMT Workshop on Competitive Tendering of Rail Services, Paris

Van de Velde, D. (2009), Development of Railway Contracting for the National Passenger Rail Services in The Netherlands”, Presented to the 11th International Conference on Competition and Ownership in Land Passenger Transport. Delft, the Netherlands.

Wardman, M.R. and Toner, J.P. (2003) “Econometric Modelling of Competition Between Train Ticket Types”, AET European Transport Conference. Strasbourg, France.

Whelan, G.A. (2002), “Analysing impact of changes in on-rail competition—model development”, Unpublished Report to the Strategic Rail Authority. Institute for Transport Studies, University of Leeds.

Wilson, N. and Nuzzolo, A (2004), *Schedule-Based Dynamic Transit Modelling: Theory and Application,* Boston: Kluwer Academic Publishers.

NOTES

[i] We consider long distance services as serving city pairs that are more than 50 miles (80km) apart, although there may be intermediate stops.

[ii] These were the night ferry service from Berlin to Malmo, the InterConnex service between Leipzig and Rostock (via Berlin), Vogltand – Berlin and Harz – Berlin services.

[iii] Currently, Virgin Trains operate express services between Birmingham New Street and London Euston, with London Midland operating stopping services. Chiltern Trains operate stopping services between Birmingham Snow Hill and London Marylebone.

[iv] Also include Heathrow Express.

[v] Now published by the Association of Train Operating Companies. Version 5 was released in 2009.