Reservation charges: how can they contribute towards economic efficiency?

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**Objectives.** To examine the economic rationale for reservation charges and to discuss approaches to estimating their appropriate level.

**Checklist:**
- The case for reservation charges
- Reservation charges in Europe
- Estimating and charging for scarcity costs
- Some tentative answers...
The case for reservation charges

- ECMT Resolution 2002/1: rail infrastructure charges should be **efficient**, **transparent** and **non-discriminatory**

- Allocative efficiency requires that charges be based on Marginal Social Cost (MSC) **although** EC Directive 2001/14 allows non-discriminatory mark-ups for cost recovery purposes (MC+)

- Maintenance, renewal, operation, energy and environmental costs effectively recovered by variable charge on train-kms run

- But **path planning** costs are incurred by infrastructure managers (IM) whether services are run or not

- When paths are allocated to a given service other services may be prevented from running; this external **cost is termed scarcity**
Scarcity vs congestion (definitions)

• **Congestion**
  – Delay to existing services caused by an additional train on the network
  – Can be estimated as a **cost per train-km**, function of capacity utilization along route section
  – Gibson et al (2002) estimate this for the UK
    • Costs as high as 5€/tr-km outside London (even higher within)
Scarcity vs congestion (definitions)

• Scarcity
  – The running of a given service prevents another from operating or requires it to take an inferior path (N.B.: not related to delay)
  – It is the path allocation that causes this opportunity cost, *regardless of whether the path is used or not*
  – Cost can be efficiently recouped by reservation charge.
  – Can be significant when networks close to capacity (hence confusion with congestion)
Scarcity costs – example
(Quinet, 2003)

- Diagram shows 2 types of path: fast and slow
- Opportunity cost of slow service = 3 fast services
- Opportunity cost of 3 fast services = 1 slow service

- Example highlights some difficulties in allocating scarcity costs
Why charge for scarcity?

• So that operators only acquire paths for which their WTP is greater than that associated to competing path allocations

• **Example.** Freight operators, due to the nature of demand, often request more paths than strictly required leaving some unused (*anecdotal*)•
  – Under most charging regimes, unused paths are free
  – No problem if only maintenance costs are incurred
  – But in a congested network there may be a significant opportunity cost for this strategy
### Existing reservation and other scarcity-related charges (ECMT, 2005)

<table>
<thead>
<tr>
<th>Country</th>
<th>Type of charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>France</td>
<td>Reservation charge per path-km (up to 15€/km) and station stop (up to 26€/stop), differentiated by line type and period</td>
</tr>
<tr>
<td>Hungary</td>
<td>Charge per train-path (3 passenger categories and 1 freight)</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>Fixed path reservation fee</td>
</tr>
<tr>
<td>Estonia</td>
<td>Fixed charge per ordered train-km</td>
</tr>
<tr>
<td>Italy</td>
<td>Fixed reservation charge by line type (2 part?)</td>
</tr>
<tr>
<td>Lithuania</td>
<td>Train path reservation fee for freight</td>
</tr>
<tr>
<td>Denmark</td>
<td>Higher charges on special infrastructure points</td>
</tr>
<tr>
<td>UK, Romania, Germany, Austria</td>
<td><strong>Congestion</strong> taken into account in charge differentiation</td>
</tr>
</tbody>
</table>
Summary of charging approaches

- **Path-km/Train-km**
- **Path/Train**
- Differentiation of charges in time and space
- Consideration of speed implications for alternative paths (Italy)
Estimating and charging for scarcity costs

• Auctioning
  – elicit operators' willingness to pay

• Modelling
  – estimate and appraise demand and cost implications of alternative path allocations through models

• Use of proxies for scarcity
  – Eg: congestion; differentiation of charges by time of day and across space

• Long run marginal cost of capacity expansion
Let’s start from the end…

• Long run marginal cost of capacity expansion
  – Based on the concept of avoidable capital cost
  – Is it marginal cost pricing? Not really...
  – Best applied through fixed element of 2-part tariff or as a mark-up on variable charge if deemed applicable

• Proxies for scarcity
  – Fixed reservation charges – very poor representation of scarcity
  – Differentiated charging structures (by type of service, time of day, speed, route section, etc)
    • 'Rough and ready' approach, but hopefully heading in the right direction
Auctioning

• Determining the value of specific path or set of paths is a complex problem...
  – So why not ask operators their WTP?

• Auction environment meant to avoid strategic behaviour

• Some interesting research into relevance of auctioning to the estimation of rail scarcity costs
  – Experimental economics: inexperienced respondents and very stylised networks
  – Yet… serves to illustrate applicability of the concept
• **1\textsuperscript{st} price, 2\textsuperscript{nd} price and one-shot auctions**

• 2\textsuperscript{nd} price auction produced most efficient allocations under experimental conditions (Nilsson, 1999; Isaacsson and Nilsson, 2003)•
  
  – *Winner pays opportunity cost equal to sum of bids of best alternative path allocation*

• But network planning is a complex optimisation problem:
  
  – No guarantee of a global optimum from auction
  
  – Huge transaction costs
  
  – Combination of central planning and auctioning is ideal approach (Quinet, 2003)•
  
  – Nilsson (1999) proposes an iterative procedure
Auctioning (3)

- Any form of auction is still substantially more complicated than existing charging regimes
- So when would auctions be warranted?
  - Where scarcity costs are likely to be high
  - Where there are relatively few competing operators and alternative path allocations
  - Where operators' WTP is unknown
  - What are your views?
- Interesting to estimate distortion introduced by simple reservation charges vis-a-vis a completely disaggregate structure
Modelling

• Auctioning useful where operators' WTP is unknown
• But a well informed regulator can use models to estimate both private and public opportunity costs of alternative paths

• Lower transaction costs
• High information requirements
Case Study – UK East Coast Mainline

- London ‡ Leeds, York, Newcastle and Edinburgh
- Heavily used between London and Doncaster
- London – Peterborough: commuter belt

- 6 peak, 4 off-peak trains per hour from KX
  - Main operator was GNER (now N.Ex)
  - Hull Trains ran 4 services/day
- Up to 40 freight train movements per day on busiest section
The Problem

- Conflicts on ECML:
  - GNER wanted 2 train-paths/hour to Leeds
  - Hull Trains wanted to expand services
  - Capacity needed for freight growth

- Who should get which path and what is the associated opportunity cost?

- Objective: maximise social welfare…
Methodology

- Used the PRAISE model (demand, cost and appraisal) to replace/add slots with services run by alternative operators including freight, and compare the change in **profits** and **welfare**.

- Scenarios
  - Remove 1 peak Leeds / London path 8:05 Slot
  - Replace with additional peak Hull Trains service
  - Remove Leeds/ London 9:05 service
  - Remove 1 off peak Leeds/ London path
  - Evaluate the benefit of a freight path
## Model results (scaled)

<table>
<thead>
<tr>
<th>Service</th>
<th>Op.'s Profits</th>
<th>Net Social Benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td>GNER 8:05 train</td>
<td>7.7</td>
<td>27.7</td>
</tr>
<tr>
<td>GNER 9:05 train</td>
<td>65.4</td>
<td>100</td>
</tr>
<tr>
<td>GNER off-peak</td>
<td>-1.4</td>
<td>2.7</td>
</tr>
<tr>
<td>Hull Trains peak</td>
<td>1.6</td>
<td>6.4</td>
</tr>
<tr>
<td>Freight</td>
<td>8.4</td>
<td>43.7</td>
</tr>
</tbody>
</table>

- Large differences between private and social profitability - **auctioning** without appropriate subsidies would not always give best outcome.
- High value of freight path, but how much capacity would it take out?
Some tentative answers

• What are the implications of high reservation charges for freight vs passenger trains and small vs large operators? (see notes)

• Should a reservation charge be set at opportunity cost?
  – Yes

• Train path, path-km or mark-up
  – Ideally each path or set of paths would be charged its specific opportunity cost

• Levy it everywhere?
  – Absence of reservation charges is most distorting where there's high competition for capacity

• Should it be revenue neutral?
  – For economic efficiency, probably not. But don't forget 2nd best case for subsidy
Quick conclusions

• MSC brings about the need to charge for network planning and scarcity costs – these are best recouped through reservation charges

• Absence of scarcity-related charges can create significant distortion

• Existing reservation charges are relatively rough (exc. perhaps in France)

• Auctioning and modelling offer more sophisticated alternatives though at a cost