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Summary:

Developing quality contracts for the Norwegian State Railways' intercity market

The existing contracts between the Norwegian Ministry of Transport and Communications (MoT) and the Norwegian State Railways (NSB) consist of three documents: The principal ("timeless") agreement, the 4-year framework agreement and the annual agreement on purchase of PSO services. For the negotiations over a new framework agreement 2003-2006 the MoT considers the introduction of an incentive-based contract. The aim is to launch a performance based contract in which the incentives combine the social benefit maximising objectives of the MoT with NSB's commercial goals. The idea is that this will bring about more efficient resource allocation.

When NSB adjust their service levels according to their own business considerations they will improve service levels only to the point where the cost of the improvement is exactly offset by the increased revenue. From a social point of view this is will lead to an inefficient resource allocation. The reason is the fact that NSB only considers the extra revenue raised and not the fact that quality improvements benefit existing passengers too. An incentive contract seeks to internalise this benefit to existing passengers into NSB's commercial decision criteria, and thus to stimulate to a socially "optimal" level of service.

TOI has further developed a simulation model for public transport, which maximises social surplus for a public transport system with the relevant constrains applied to capacity, fares and total amount of subsidies. The model allows for inclusion of additional benefits related to transfer of car traffic. Formally it is a matter non-linear programming with non-linear constraints.

The model can next be used to estimate a socially optimal subsidy regime. By *optimal subsidy regime* we mean that the arrangement maximises net social (economic) benefit compared to the present situation. Within the model net social benefit comprises:

1. Change in NSB's profit (producer surplus)
2. Change in passengers benefit (consumer surplus)
3. Changes in environmental and congestion costs
4. Resource cost of public funds

A full net social benefit maximisation means that the model determines optimal levels of 7 variables:

- A fare level for 3 types of demand: 1. Passengers in peak periods that use the sections of routes where the total need for capacity is determined (Design capacity demand); 2. Other peak-period demand; and 3. Off-peak demand.
- Train-kilometres produced in 1. basic services and 2. additional peak services
- Capacity provided per train kilometre in 1. basic services and 2. additional peak services

The simulation model has been run to estimate optimal adjustments in NSB's intercity market (3 lines departing from Oslo) given a number of assumptions about NSB's freedom to determine fares and service levels.

Table S.1 shows the model runs. All figures are changes relative to the current situation with respect to fares, service levels, and financial performance. Column III shows the social surplus maximising solution when fare levels are set to today's average of NOK 76. In this situation the peak service frequency is increased by app. 1 service per hour. The seating capacity is also slightly higher than today. These changes bring about some increase in demand and a benefit to passengers of NOK 29m. The value of congestion relief resulting from the modal shift to train is estimated to NOK 2.2 m. The social surplus is reduced by NOK 22 m by the cost of raising public funds. The total estimated welfare gain compared to today's situation is thus NOK 9m per year.

Column IV shows the results when the simulation model is specified to run a profit maximising, rather than net benefit maximising, scenario. Fares are not restricted in this model run. The resulting adjustment by NSB is characterised by particularly high fares, service levels that are dramatically reduced, and reduced seating capacity per train. This provides NSB with a profit that is improved by some NOK 370m, but the change in social welfare is negative, NOK -321m.

Column VII shows how performance based subsidies can combine the social benefit maximising objectives of

the MoT with NSB's commercial goals. By pegging the fare levels to today's level, and offer NSB

- NOK 30 per passenger during the rush hours,
- NOK 24 per passenger off peak,
- NOK 45 per train kilometre for *extra* peak services,
- NOK 29.5 per train kilometre for basic services,
- NOK 0.03 per seat kilometre during the rush hours, and
- NOK 0.08 per seat kilometre off peak,

then NSB, on a commercial basis, will strive towards service levels that to a large degree resemble the social benefit maximising levels in column III.

The passenger compensations can alternatively be NOK 26 per passenger regardless of peak/off-peak. While being far easier to administrate this will only alter the result marginally.

NSB will gain a large operating, which mainly reflects the transfers from the MoT. Performance-based subsidies amount to NOK 404m per year. The net subsidy requirement, if MoT can charge NSB an amount similar to their operating surplus for their right to operate under these performance based subsidies is, however, about equal to the base situation.

In addition we recommend a bonus/malus arrangement for punctuality performance based on passenger delays. This is calculated thus: Change in number of minutes train delays compared to the base year *multiplied by* an agreed average number of passengers per train *multiplied by* passengers' valuation of delay time. Our estimate for the latter is NOK 1.67 per minute.

Cancelled trains are particularly exasperating for passengers. Therefore NSB should be given strong incentives against train cancellations. We recommend a malus per cancelled train-kilometre that is equal to 3 times the subsidy per train-kilometre.

As a "safety net" NSB and MoT should agree on a set of threshold-values, which entitle them to renegotiate the contract. The contract should be renegotiated if the malus reaches its lower limit.

Table S.1: Model runs. All figures are changes relative to the current situation

	III	IV	VII
	W-max, P=76	Profit max	Performance based subsidies
Fare, design capacity rush, NOK	0	+150	0
Fare, other rush traffic, NOK	0	+121	0
Off peak fare, NOK	0	+195	0
Services per hour, basic services	-0,2	-1,6	-0,1
Services per hour, rush hours	+1,1	-1,5	+1,3
Seats per train (capacity), rush	+29	-3	+3
Seats per train off peak	+19	-80	+2
Million passengers per year	+0,2	-3,3	+0,2
Total costs NOK millions	+19,4	-217,3	+15,9
Total revenues NOK millions	+12,5	+152,7	+11,4
Operating surplus NOK millions	-6,9	+370	+399,5
Change in consumer surplus NOK m.	+29,2	-756,4	+25,6
Congestion relief NOK millions	+2,2	-13	+2,2
Change in cost of public funds, NOK m.	-22,4	+448,7	-19,5
Total welfare gain NOK millions	+9,0	-320,7	+8,4
Subsidy for train kilometre NOK m.			+145,4
Subsidy for rush passengers NOK m.			+60,9
Subsidy off-peak passengers NOK m.			+89,6
Subsidy for seat capacity rush NOK m			+17,4
Subsidy for seat capacity off peak NOK m			+90,8
Sum performance based subsidies, NOK m			+404,1

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