9TH CONFERENCE ON COMPETITION AND OWNERSHIP IN LAND TRANSPORT

CONSEQUENCES OF ON-TRACK COMPETITION IN RAILWAYS BY USE OF SIMULATIONS*

Authors:
Kjell Jansson, AF-Infrastruktur AB
Roger Pyddoke, Swedish Institute for Transport and Communications Analysis

1 INTRODUCTION

In many countries direct competition on the tracks have been debated but so far not implemented in many places. In Great Britain the first ambitions to implement such competition was replaced by competition for the tracks, i.e., competitive tendering. The turbulence in Great Britain in the railway sector have been extensively debated and described. Two examples of critical analyses are found in Nash and Preston (1991) and Nash (2003).

In Sweden a parliamentary Rail committee (Järnvägsutredningen) has proposed free on-track competition on specific segments of the railway network, e.g., between the two largest cities Stockholm and Gothenburg. Some regional public transport authorities have also expressed their wish to take over some of the routes that belong to the Swedish State Railways (SJ) and operate them as regional routes with special discount fares.

The Swedish Institute for Transport and Communications analysis (SIKA) has financed this work, aiming to find possible consequences of these two examples for ”on-track competition”. The method used is simulations by the network program Vips. The work does not cover all possible expressions that competition may take, but provides indications of what may happen if the chosen assumptions on competition would come true.

We take into account that passengers are not homogenous. Different groups meet different prices and they have different valuations of travel time saving. Each passenger group is given its own price structure in terms of a base fare and a non-linear kilometre fare. We are then able to assess the effects for each respective passenger group in terms of consumer surplus.

* The Swedish Institute for Transport and Communications Analysis financed this work.

Other effects that are taken into account in our cost-benefit analysis are the operators' revenues and costs, external effects and the finances of the public sector.

2 ASSUMPTIONS

2.1 Case study 1

The reference alternative (denoted RA) is the existing situation that all trains between Stockholm and Gothenburg, along two different, north and south, corridors, are operated by the state monopoly SJ.

The competition alternative (denoted CA) is assumed to mean:

- that both paths are operated by SJ and a private operator,
- that both operators apply the same price,
- that both operators take half of the departures each
- that times of departure (slots) are uniformly distributed between the operators

The table below show the routes and itineraries and intervals today and for the competitive situation, where the private operator is denoted PR. The different ride times along the south corridor are due to different stop patterns.

Table 2.1.1 Routes and itineraries of trains Stockholm-Gothenburg

			Today	Competition	
Route	**Route itinerary**	**Ride time Stockholm-Gothenburg**	**Interval minutes**	**Interval minutes**	**Interval minutes**
57a	Stockholm - via north corridor - Gothenburg	4 hours 8 minutes	120	SJ 240	PR 240
60a	Stockholm- via sourth corridor - Gothenburg	2 hours 56 minutes	480	SJ 960	PR 960
60b	Stockholm- via sourth corridor - Gothenburg	3 hours 8 minutes	96	SJ 192	PR 192
60c	Stockholm- via sourth corridor - Gothenburg	3 hours 7 minutes	160	SJ 320	PR 320

Note that each operator is assumed to apply constant intervals between departures of their own trains but that departure times between the trains of the two operators are uniformly distributed. Without any other knowledge this seems the most plausible assumptions since co-ordination would probably need government intervention and here we assume non-intervention.

At present SJ is co-ordinating at certain stations transfers between trains and between trains and country-controlled regional bus services. With competition it is assumed that SJ maintains these co-ordination. There is, however, no co-ordination between trains of the private operator and trains of SJ and regional buses. The reason is that it is assumed more difficult to achieve co-ordination when operators are competing.

With respect to operating costs a critical assumption is whether trains can be used all time, except for necessary layover when changing direction, or whether they stand still waiting for the next return departure. Hereby we assume two cases, one that they are waiting (poor usage) and one intermediate case, the average of waiting all time and no time (good usage).

The table below shows the assumed values of time for the passenger segmentation chosen, expressed in € per hour. It also shows the applied weights for wait time, transfer time and walk time in relation to ride time.

Table 2.1.2 Applied values of time and weights

	VoT	**Weights in relation to ride time**		
	€/hour	Wait	Transfer	Walk
Interregional private	9	0.5	2	1.6
Interregional business	50	1.2	2	1.6
Regional private	5	0.8	2	1.6

2.2 Case study 2

It is assumed that route 92b Växjö-Copenhagen is taken over from SJ by the regional authorities, which means that it would compete with the remaining SJ routes. The table below shows the routes that run partly parallel with route 92b Växjö-Copenhagen.

Table 2.2.1 Routes that run partly parallel with route 92b

Itinerary	Train type	Route number
Stockholm - Copenhagen	Inter City	80a
Stockholm - Malmö	Fast train	80b
Stockholm - Malmö	Fast train	80c
Stockholm - Copenhagen	Night train	80Na
Kalmar - Copenhagen	Regional train	92a
Växjö - Copenhagen	Regional train	92b

The following four competition alternatives with respect to route 92b are assumed and simulated:

CA1: The route is abolished,
CA2: The frequency is doubled,
CA3: The prices for regional work trips are reduced by 20 %,
CA4: The prices for regional business and other trips are reduced by 20 %.

The table below shows the assumed values of time for the passenger segmentation chosen, expressed in €. per hour. It also shows the applied weights for wait time, transfer time and walk time in relation to ride time.

Table 2.2.2 Applied values of time and weights

	VoT	Weights in relation to ride time		
	€/hour	Wait	Transfer	Walk
Interregional private	9	0.5	2	1.6
Interregional business	50	1.2	2	1.6
Regional work	5	0.8	2	1.6
Regional leisure	4	0.8	2	1.6
Regional business	33	1.2	2	1.6

4 RESULTS OF CASE STUDY I

3.1 Demand

On national level the simulations say that rail travel demand would be reduced by 1.3 per cent while demand for air transport would grow by 2.1 per cent. Most of the rail passengers would shift to car. The demand for regional buses decreases due to complementarities (buses feed trains).

The table below shows the estimated demand changes in terms of boarding passengers for the routes between Stockholm and Gothenburg.

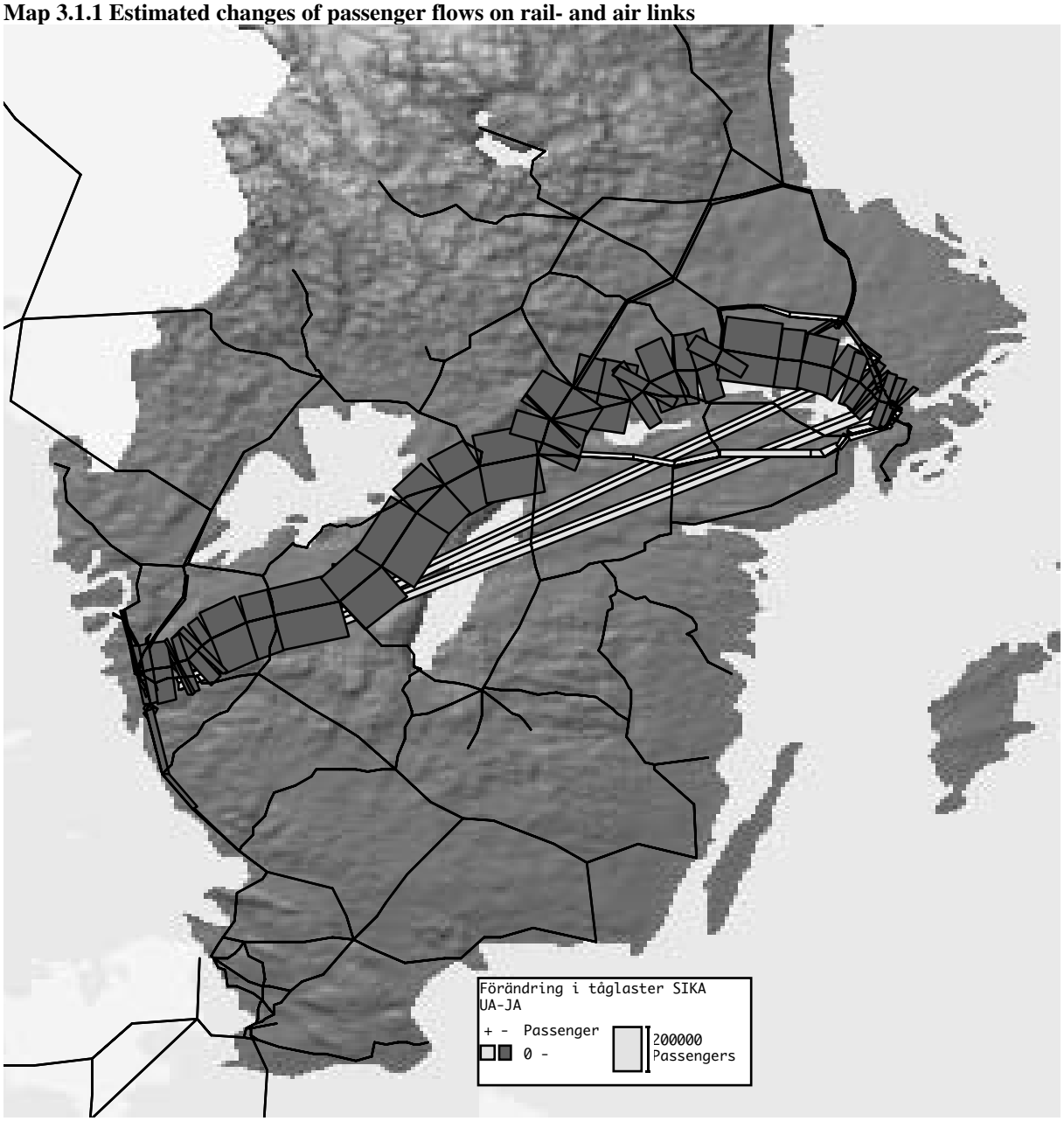
Table 3.1.1 Changes of demand due to competition

RA		CA		Differences		
Route	**RA Boardings**	**Route**	**CA Boardings**	**Route**	**Difference Boardings**	**Difference %**
57a	3 206 652	57a-SJ	1 372 446	57a	-525 684	-16
		57a-PR	1 308 522			
60a	104 295	60a-SJ	59 573	60a	14 839	14
		60a-PR	59 561			
60b	1 010 120	60b-SJ	508 782	60b	-8 538	-1
		60b-PR	492 800			
60c	564 641	60c-SJ	309 568	60c	6 667	1
		60c-PR	261 740			
Total SJ	4 885 708		2 250 369		-2 635 339	
Total PR	0		2 122 623		2 122 623	
Total	4 885 708	Total	4 372 992	Total	-512 716	-10

In the aggregate the routes Stockholm-Gothenburg lose about 10 % of the passengers, most of which change to air services. On all routes SJ would get more passengers than the private alternative due to the assumed co-ordination of SJ services.

The map below illustrates the changes of flows on rail and air links.

Map 3.1.1 Estimated changes of passenger flows on rail- and air links



3.2 Passenger benefits and costs

The table below shows the calculated changes of price of travel and time of travel plus the total in terms of consumer surplus.

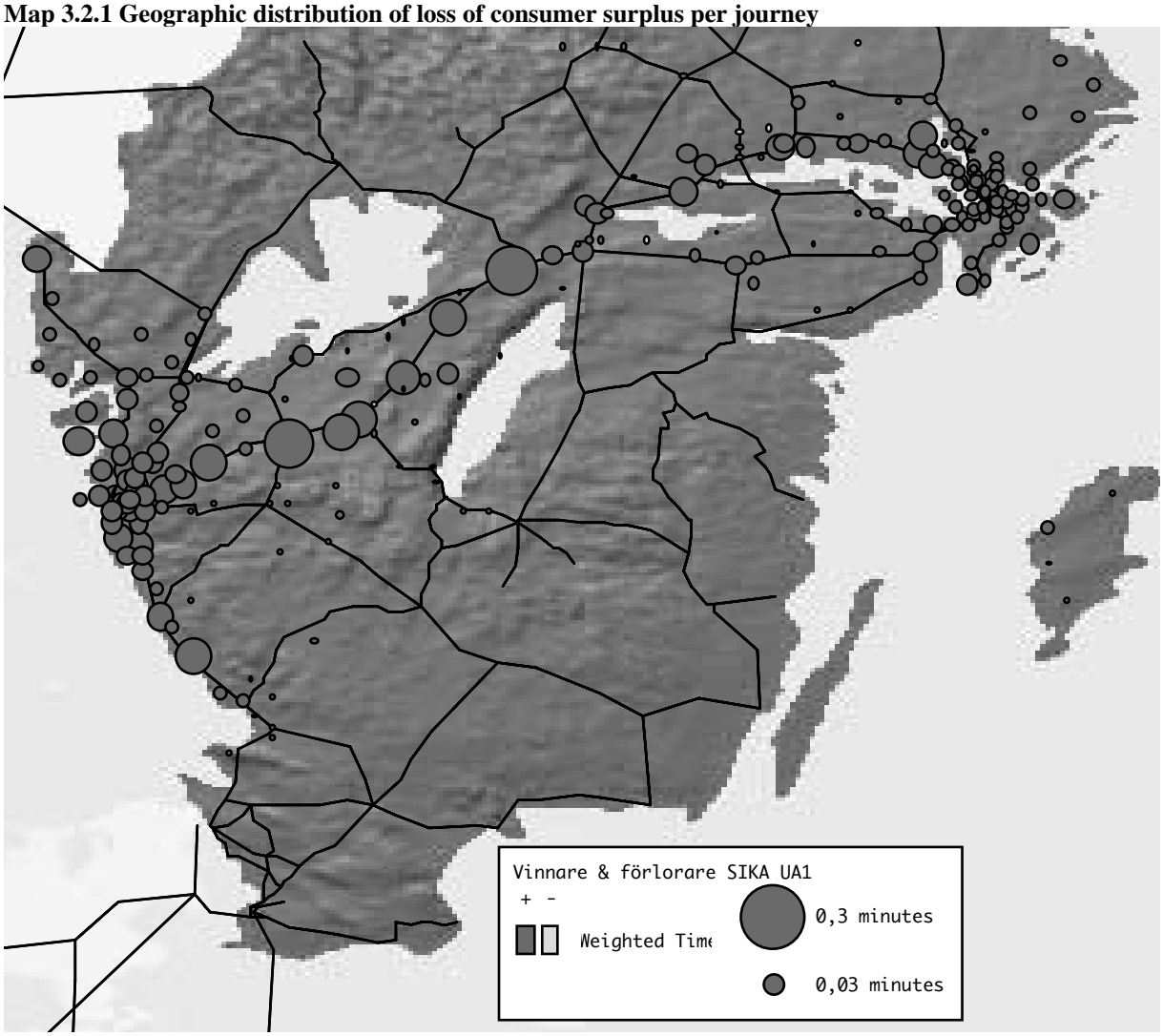
Table 3.2.1 Estimated changes of consumer surplus

	Private regional 5 €/hour	**Private interregional 9 €/hor**	**Business interregional 50 €/hour**	**Sum M€/år**
Consumer surplus	0	-4	-13	-16
of which fare	0	-2	-1	-3
of which time	0	-1	-12	-14

Regional private journeys seem to be unaffected while interregional travellers make losses.

The map below illustrates the regional distribution of losses of consumer surplus per journey.

Map 3.2.1 Geographic distribution of loss of consumer surplus per journey



Apparently losses appear in many places along the routes but also in areas quite far from the railway line Stockholm and Gothenburg.

3.3 Finances of operators

The tables below show the calculated outcomes in terms of revenues and costs due to the new competitive scheme.

Table 3.3.1 Changes of revenues and costs with poor usage of trains

Mode	CA-RA Difference Revenues M€/year	CA-RA Difference Costs M€/year	CA-RA Difference Rev. - cost M€/year
Train	-22	32	-55
Flight	17	0	16
Coach	0	0	0
Regional bus	0	0	0
Total	-6	33	-39

Table 3.3.2 Changes of revenues and costs with medium usage of trains

Mode	CA-RA Difference Revenues M€/year	CA-RA Difference Costs M€/year	CA-RA Difference Rev. - cost M€/year
Train	-22	15	-38
Flight	17	0	16
Coach	0	0	0
Regional bus	0	0	0
Total	-6	16	-22

The airlines would gain revenues at constant cost level since there is no need for increased capacity at the calculated level of demand increase.

The railway would lose revenue. It would also experience higher costs due to less efficient use of rolling stock when the intervals between departures are increased. Note that the cost increase is higher with poor usage of trains.

3.4 Cost-benefit results

The tables below summarises the calculated outcome in terms of components of the cost-benefit calculus.

Table 3.4.1 Cost-benefit results for the two assumptions on usage of trains

	Usage of trains	
	Low	Medium
CA-RA	**M€/year**	**M€/year**
Consumer surplus	-16	-16
of whcih fare	-3	-3
of which time	-14	-14
Producer surplus	-39	-22
Tax correction	8	4
Public sector	7	7
Excess burden	2	2
External effects	-2	-2
Net surplus	-40	-27

3.5 Conclusions of case study I

The worsening of exploitation of network effects means a loss of consumer surplus of around 16 M€ per year. A consequence of the poorer level of service is that rail services lose 10 per cent of their passengers and revenues between Stockholm and Gothenburg.

Worsening of exploitation of economies of scale means cost increases between 16 and 33 M€ per year, which implies a loss of producer surplus between 22 and 39 M€.

Another consequence of the poorer level of service is increase of car travel at an estimated environmental cost of 2M€ per year.

All in all this form of competition ”on the track” is estimated to yield a negative net social surplus of the magnitude 27 to 40 M€ per year.

4 RESULTS OF CASE STUDY II

4.1 Demand

4.1.1 CA1: The route is abolished,

Total rail demand on the parallel routes would diminish by 14 per cent in terms of number of boardings but with only 5 percent in terms of passenger kilometres. This means that there are mainly short journeys that are affected. It is mainly the route 92 a, Kalmar - Copenhagen that takes over the passengers from route 92a.

4.1.2 CA2: The frequency is doubled,

With doubling of the frequency total demand increases by 1 per cent in terms of passenger kilometres and by 18 per cent in terms of boardings.

4.1.3 CA3: The prices for regional work trips are reduced by 20 %,

The price reduction means that mainly the SJ operated competitor 92a would lose passengers. Total demand on the routes would increase by 3 per cent.

4.1.4 CA4: The prices for regional business and other trips are reduced by 20 %.

The demand changes are similar to those when work trips get lower prices but it is now regional business and other journeys that are attracted to route 92b.

For all the cases CA1-CA4 some of the routes competing with route 92b function as substitutes. It is however interesting to note that for the supply change cases, CA1 and CA2, some routes also function as complements. It is also found that the effects of the assumed changes of route 92b spread to many other railway lines than those that run more or less parallel.

4.2 Passenger benefits and costs

The table below shows the calculated changes of price of travel time plus the sum in terms of consumer surplus expressed in money.

Table 4.2.1 Estimated changes of consumer surplus

	Regional work	Regional leisure	Regional business	Interregional private	Interregional business	Sum M€/år
Case CA1						
Consumer surplus	-2,3	0,0	0,0	-0,1	-0,2	-2,6
of which fare	*-1,8*	*0,0*	*0,0*	*0,0*	*0,0*	*-1,8*
of which time	*-0,5*	*0,0*	*0,0*	*-0,1*	*-0,2*	*-0,8*
Case CA2						
Consumer surplus	1,5	0,0	0,2	0,1	0,0	1,9
of which fare	*0,9*	*0,0*	*0,0*	*0,0*	*0,0*	*0,9*
of which time	*0,6*	*0,0*	*0,2*	*0,1*	*0,0*	*1,0*
Case CA3						
Consumer surplus	0,8	0,0	0,0	0,0	0,0	0,8
of which fare	*0,9*	*0,0*	*0,0*	*0,0*	*0,0*	*0,9*
of which time	*-0,2*	*0,0*	*0,0*	*0,0*	*0,0*	*-0,2*
Case CA4						
Consumer surplus	0,0	0,0	0,0	0,0	0,0	0,0
of which fare	*0,0*	*0,0*	*0,0*	*0,0*	*0,0*	*0,0*
of which time	*0,0*	*0,0*	*0,0*	*0,0*	*0,0*	*0,0*

4.3 Finances of operators

The table below shows the calculated outcome in terms of revenues and costs due to the new competitive scheme.

Table 5.3.1 Changes of revenues and costs

	CA-RA Difference Revenues M€/year	CA-RA Difference Costs M€/year	CA-RA Difference Rev. - cost M€/year
Case CA1	-0,16	-1,28	1,11
Case CA2	0,17	1,27	-1,10
Case CA3	0,22	1,32	-1,10
Case CA4	0,22	1,32	-1,10

4.4 Cost-benefit results

The tables below summarises the calculated outcome in cost-benefit terms.

Table 4.4.1 Cost-benefit results for the two assumptions on usage of trains

	M€/year CA1	M€/year CA2	M€/year CA3	M€/year CA4
Consumer surplus	-2,6	1,9	0,8	0,0
of whcih fare	-1,8	0,9	0,9	0,0
of which time	-0,8	1,0	-0,2	0,0
Producer surplus	10,2	-10,1	-0,5	0,5
Tax correction	2,9	-2,9	0,0	0,0
Public sector	0,6	-1,8	-0,1	-0,3
Excess burden	0,2	-0,5	0,0	-0,1
External effects	0,0	0,5	0,1	0,1
Net surplus	11,4	-12,9	0,2	0,2

4.5 Conclusions of case study II

To abolish route 92b seems to be the most socially beneficial action. The reason is that rail services in this case are fairly expensive in relation to passenger benefits and ticket revenues. This action is, however, hardly realistic if the regional authority would take over the service.

If the regional authority would take over the service and double its frequency the social loss is not negligible. The reason again is the high operation costs.

The best solution if a take-over comes true seems to be to keep the supply unchanged and reduce the prices of work journeys. In practice this would mean to sell season tickets substantially cheaper per journey than single tickets.

5 OVERALL CONCLUSIONS

The analyses made here demonstrate that competition ”on the track” is not necessarily socially beneficial. There are both positive passenger network effects and economies of scale effects that partly get lost under this competitive form.

We also learned that the effects of competition may spread over more routes and larger areas than might be anticipated. We have also seen that routes may be both supplementary and complementary.

A conclusion is that it seems wise to analyse in detail any proposal on competition and carry out simulation studies of the kind demonstrated here before decisions on competition are taken.

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