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- LESSONS LEARNED FROM A SWEDISH PPP CONSTRUCTION PROJECT*

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THE ARLANDA AIRPORT RAIL LINK –

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Abstract: The Stockholm – Arlanda airport rail link is a public-private build-operate-transfer project (sometimes referred to as PPP), opened for traffic in late 1999. At the time of decision in 1993, the project was seen as a role model for funding rail infrastructure; it infused private money into the sector, with a hope of improving cost efficiency performance; it broke up the train service monopoly of the national railway company; and it opened up the sector for ideas and impulses from a new actor. The paper seeks to identify the costs and benefits of providing a private company with a monopoly franchise over one particular section of the network. It also highlights tradeoffs present in public-private partnerships and in creating facility-based competition within the railroad industry without ex ante regulation of access. Evidence indicates that losses of allocative efficiency, due to that the number of passengers is far below expectations, are substantial. Since available information about construction costs, due to commercial secrecy, is scarce it is not possible to say whether the overall result of this particular PPP project is efficiency enhancing or not. Our best guess is, however, that a radical change in the present pricing strategy may not mean a financial disaster and would boost the prospective of ex post efficiency.

[*] The authors of this report have had the following previous involvement in the Arlanda link project: Nilsson was part of a 1986 committee that first suggested having the project built. He was subsequently employed at *Banverket* when the project was suggested to be part of its 10-year investment programme. Karlström was politically appointed advisor at the Ministry of Transport and Communication between 1991 and 1994 and part of the project procurement process. In year 2000 Hultkrantz made an assessment to the Parliament Audit of the background material for starting the project. Hultkrantz and Nilsson have co-authored an ex post assessment of the investment for National Audit (Enberg, Hultkrantz and Nilsson 2004). The present paper is based on the latter report and also the subsequent audit report (Riksrevisionen 2004); no further references to sources to background material are given. We are grateful for research assistance from Nils Enberg.

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1. Introduction

Sweden and the United Kingdom launched several regulatory reforms for previous public monopoly industries in the 1980´s and early 1990´s. For instance, British Telecom (BT) was privatised in 1984 and the Swedish Railways (SJ) was vertically separated in 1988, changes which both became role models for pro-competitive reforms that followed in other European Union countries. The subsequent industrial reforms involved a broad range of measures, including new legislation, structural break-up of the monopoly operator, change of ownership and gradual opening for market entry.

Much of the economic literature on these reforms focuses regulatory issues and the development of partly novel regulatory remedies to abuse of monopoly power, including price caps, forward-looking cost-based prices, etc. (Laffont & Tirole 1993 eloquently summarises the core of "the new regulatory economics"). However, the government's role in railway sector reforms extends beyond that of being legislator and regulator. In the position as owner of infrastructure, it must also have a premeditated position with respect to investment in and funding of infrastructure projects. Being the owner of an incumbent (monopolist) operator it must also have a clear view of its sector policy on competition.

With Sweden going for vertical separation of its railways, the Arlanda airport rail link outside Stockholm, a public-private partnership build-operate-transfer project, is an odd element in at least two dimensions. One idiosyncrasy pertains with respect to signing a contract with a private party in order to provide for (partial) off-budget funding. In addition, the project made the private partner responsible for both infrastructure and operations.

This paper describes some aspects of the process that lead to the 1994 decision, it details the contracts that regulate the respective duties of state and private company and it also summarises some experiences from a year 2005 perspective. The prime purpose is to highlight essential tradeoffs present in public-private partnerships at large from the specific

process that has resulted in a high-standard rail shuttle between Arlanda airport and downtown Stockholm. We also provide some insights into the problems of creating facility-based competition within a railroad industry which is otherwise vertically separated.

The paper proceeds with a presentation of the project (section 2), section 3 sets out ex ante expectations, and section 4 attempts at an ex post assessment of the project. Section 5 considers the Arlanda project as an alternative model for organising the industry at large, and section 6 concludes.

2. The Arlanda link project

A first formal proposal for a railway link to Arlanda airport was made in a committee report from the mid-1980ties. A couple of years later, the railway industry was vertically separated. One consequence was that, in the same way as for roads, investment in railway infrastructure came to be funded by government appropriations. A 10-year investment programme established in 1989 by the infrastructure holder, the National Railway Administration (*Banverket*), subsequently gave the project top priority.

The then social democratic government responded by asking *Banverket* to assess the possibility to have the project built as a fully private investment. The agency's estimate was, however, that future revenues from train services would not be sufficient to recover costs for both operations and infrastructure investment. The 1991-1994 non-socialist government still wanted to have the project built and at least partially financed by the private sector.[2] In June 1994, the parliament – *riksdagen* – assumed a law that initiated the construction of a new railway line to Arlanda airport under the control of a private consortium. Services were subsequently opened in November 1999, one year before schedule.

[2] After having held majority since 1982, social democrats were ousted in the 1991 election. The non-socialist majority lasted for three years, social democrats making a comeback in the fall 1994 election.

Arlanda airport is situated half-ways between Stockholm City and Uppsala, where a 75 km double-track railway line since long connects the cities. The old line is at a distance of about 3 km (as the crow flies) from the airport. Public transport between Stockholm and the airport (42 km) was (and still is) provided by high-frequent bus shuttles.

A further qualification for the Arlanda project was that track capacity between Ulriksdal and Rosersberg – section A in Figure 1 below – was highly constrained, creating a strong need for capacity expansion. A prerequisite for a dedicated Arlanda service was therefore to have another two tracks built on this section.

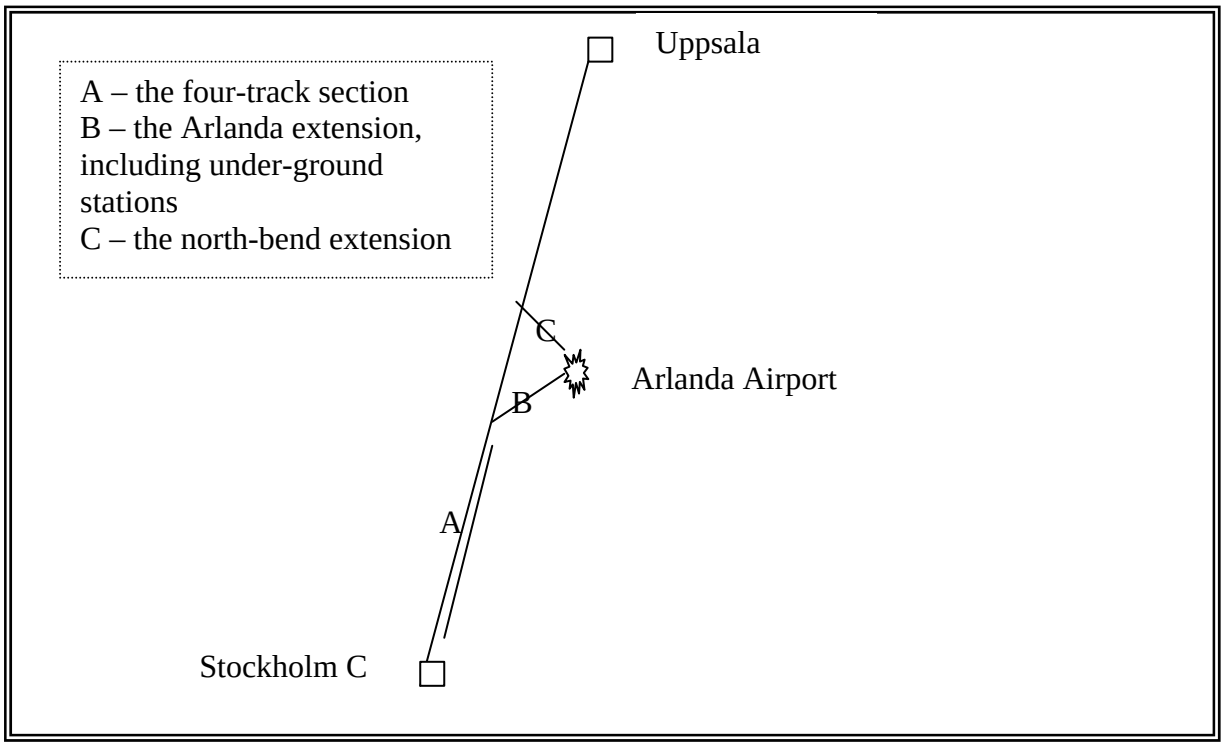

Figure 1: Schematic description of the prime components of the Arlanda airport rail link.

The section linking the airport to the original tracks from the south, including a station at the airport (section B in Figure 1), is the core of the Arlanda project. A third component is “the northern bend”, linking Arlanda to the main line also to the north (section C). While section B was a prerequisite for the airport shuttle, section C was designed to provide a link between the

airport and northbound railway services on the national network, i.e. it has benefits outside the core purpose of connecting the airport to Stockholm.

In early 1993, *riksdagen* took a framework decision to have the four-track and the northern bend sections (i.e. A and C in Figure 1) built and paid for over the government's budget. The subsequent procurement process included extensive efforts to induce more than one bidder to enter the contest for building section B and for operating the subsequent train services. There were grave concerns that it would otherwise be a foregone conclusion that the consortium formed by the incumbent, state-owned monopoly operator would be the winner, deterring competitors from submitting bids. The procurement process included a pre-qualification round where about 30 firms submitted bids for all or parts of the project. A final round comprised four bidding consortia, partly formed after an initiative from the ministerial working group. In April 1994, the government nominated Arlanda Link Consortium as the winning bid and in June, *riksdagen* accepted the government's proposal. [3]

The private consortium subsequently established itself as A-Train. A state-owned company (subsequently referred to as A-Track) was established to act as the government's agent and most contracts etc. were administrated through this company. A-Track is owned by *Banverket* and *Luftfartsverket* (the Swedish Airports and Air Navigations Services, a government agency subsequently referred to as the airports agency).

3. Ex ante considerations

The underlying purpose of the Arlanda link PPP was to open up for private-sector participation in the financing of what is otherwise handled as a public sector responsibility.

[3] The focus of the recent audit report, i.e. Riksrevisionen (2004), was to make an ex post assessment of whether or not the parliament's decision of 1994 had actually been implemented: Does the government and the agencies involved operate according to this decision and has the parliament been adequately informed about the outcome after that this decision was made? The auditors expressed concerns with respect to poor feedback information and in particular with respect to the way in which A-track had been managed.

Both the strained budget situation of the time, in combination with the growing demand for public money at large, have made governments of both socialist and non-socialist leaning interested in off-budget funding mechanisms.

The parliament's 1994 decision made explicit reference to the project's economic rationale, established in *Banverket's* early Cost-Benefit Analysis. The investment's benefits – time savings, ticket revenue, lower emissions and reduced congestion from cars and busses due to a switch of mode etc. – exceeded its costs, even if ticket revenue was not sufficient to recover investment costs.

The parliament established that Arlanda was to become an inherent component of the national railway grid; this was the thought behind including section C in the project. A further objective, expressed by the 1994 non-socialist government, was to open up the national railway market for competition and to make it possible for a new actor to test novel infrastructure designs and new ways to operate the services.

From a contractual perspective, the Arlanda link investment is a Build-Operate-Transfer agreement between Sweden's government and a private consortium. In return for that private money pay for parts of the investment costs, the consortium is given control over revenue generated by railway operations for a 45 year period, with an option for a 10 year extension. After that, the infrastructure is to be handed over to the government. The contract can be terminated by the government in 2010, provided that certain objectives concerning traffic volumes have not been achieved; more on this below.

In its design of the contracts the government sought to make a clear distinction between the parties' – the government and the private contractor, respectively – financial responsibilities and in particular to allocate risk in a conscious way. The purpose was to induce the winning consortium to optimise the project's lifetime costs. A-Train could therefore design and build links B and C according to its own interests, but it did at the same

time have to accept all risks related to costs overruns during both the construction phase and during subsequent operations. The consortium also had to shoulder the full market risk, meaning that it would have to bear below-target revenue due to slumps in air travel. The private consortium would only be compensated for cost overruns induced by national or regional assemblies making decisions (ordinances or laws) with direct bearing on the project, or if un-planned archaeological excavations had to be made.

The following core components of the arrangement were established by the June 1994 parliamentary decision.[4] First, the state committed itself to pay for the northern bend (link C) and for at least 50 percent of the costs for connecting links B and C to the main line.

Second, the state through *Riksgäldskontoret* (the Swedish National Debt Office) granted A-Train a SEK 1 billion loan[5], provided that (a) at least 75 percent of total costs for link B were paid for outside the state budget and (b) that the consortium could raise at least SEK 0,6 billion or 15 percent of the total project cost in the form of risk capital. [6] This loan has lower priority than A-Train's other debt, and the state has no securities for it. *Banverket* pays the rent on the loan to *Riksgäldskontoret*. The loan is to be amortized after that revenue from operations have paid for operating costs plus rents on external loans, and after that it has paid some return on the owners' risk capital. If and when the aggregate payments from the project have been large enough to repay the whole loan before the termination of the BOT agreement, *Banverket* shall also be compensated for its rent payments. In practice, the loan can be seen as government share capital.

A third contractual component was A-Train's commitment to operate at least 4 trains per hour and direction between the airport and Stockholm city during most of the day. The consortium was, in addition, given property rights for 6 time-slots per hour. Except for its

[4] These principles were publicly known for bidders during the procurement process during winter and spring 1994, while the parliament confirmed the construction by way of its decision in June, 1994.
[5] This loan is the only contract where A-Track does not operate as the government's representative.
[6] When this is written in 2005, the exchange rate is €1=SEK 9,10 and $1=SEK7,50.

share of investment costs, it was also to pay for rolling stock and its maintenance as well as the maintenance costs for sections B and C of the infrastructure investment.

4. The project five years after opening

To contrast what has happened with ex ante expectations, we start with a comparison of projected and realised costs (4.1), also providing some further detail of the financial structure of the agreement. Section 4.2 contrasts traffic flows ex ante and ex post and discusses A-Train's financial result. The fate of the politically formulated objectives behind the project is addressed in section 4.3 and the scope for renegotiation of the contract in section 4.4.

4.1 Costs and the financial construction

Our best estimate is that total costs for sections A-C by the early 1990ties were expected to land around 6 billion SEK. Of this sum, the private consortium would be responsible for investment in section B, calculated to cost SEK 2,6 billion (see table 1).

Table 1: Ex ante and ex post costs for the Arlanda link project. Million SEK; (year of estimate).

Section	Ex ante (1992)	Ex post (1999)
A	1 900	2 400
B	2 600	2 700
C	850	850
Rolling stock	600	850

The table indicates that the estimate was not far off the actual outcome. Several qualifications should however be borne in mind. First, the numbers are in different price levels but since the inflation rate over the period was very low, 1992 costs have not been inflated. The low inflation was the mirror image of a sharp downturn of the business cycle. It is reasonable to

expect that a depression of the sort that Sweden lived through should result in substantial cost savings compared with projections being made for a situation with average aggregate demand relative to capacity of the construction industry.

Secondly, what seems to be a cost overrun for section A may be rationalized by that the ex post number also includes a component for connecting the new to the existing line; we do not know if this cost was anticipated in the ex ante estimate. Third, no information about the costs for building section C is available. The entry is the lump sum paid by the government to the private consortium for simultaneously building sections B and C.

Fourth, caution is also necessary since cost projections in reality were for a different project than the one that came to be built. In particular, several different designs of the Arlanda station were considered during the planning process, some at the surface some distance from the terminal buildings and with a complementary bus shuttle, others submerged. Moreover, different alternative designs of the underground option were contemplated; more on this later.

It has not been possible to establish what the ex ante cost expectations for the Arlanda link project that came to be built really were, and the parliamentary decision did not make any reference to a target cost. In addition, and much due to commercial confidentiality, A-Train's cost fallout for building sections B and C has never been made public.

Cost overruns are endemic in public-sector projects, either because of making a project more sophisticated between taking the decision to initiate a project and the day that the shovel is first put into the mud, or because of poor handling of the construction process. The absence of cost overruns can be due to that there were none or that A-Train has never made them public. All in all, we don't know anything about the cost efficiency properties of this particular PPP contract.

To summarise, the core (infrastructure) cost component footed by the private partner of the Arlanda contract was SEK 2,7 billion out of which SEK 1 was a loan from the state. The consortium borrowed another SEK 1,1 billion in banks, its share capital was SEK 400 million and in addition, its partners gave A-Train a loan of SEK 200 million.[7] Except for that, rolling stock was leased on a contract costing about SEK 700 million.

The private risk money spent on the Arlanda project was well below the core project's cost, a feature clearly spelled out in *riksdagens* 1994 decision. Moreover, the venture benefited from a soft loan directly from the public sector. It is not equally obvious that the possibility of below-target performance, and the implications of the public sector sitting with a loan with very low priority in case of failure, was taken into account before taking the decision.

The government has not had to face any extra payment due to cost overruns. The deal has therefore been a financial success, reducing the need to raise tax revenue or to sell bonds by SEK 1,7 billion in return for a project opened ahead of time. A conclusion that goes beyond the Arlanda link project is that the costs for the design of the project in its final version should be carefully registered, in particular when non-conventional financial constructions are put into use. If not, it is difficult ex post to assess the merits of, and problems with the financial solution used and transparency is jeopardised.

4.2 Traffic

The market for an airport shuttle directly depends on the number of airport employees and, in particular, of airline passengers. An official passengers forecast was made in 1990,

[7] Riksrevisionen (2004), in the audit report, emphasises that companies fully owned by the government were partners in the consortium. Moreover, several of the loans were given by government-owned banks, adding to the risks that at the end of the day had to be carried by the public sector. On the other hand, the participation of public-sector commercial firms in commercial deals could be considered to be just like any commercial financial construction.

summarised in table 2 together with the actual number of passengers. Another forecast was made during the government's preparations but kept confidential. In addition, each consortium must have made its own estimate of patronage and pricing policy before submitting a bid.

Table 2: Million airline passengers at Arlanda airport. 1990 forecast and outcome.

	Forecast no of passengers		Actual no. of passengers
	without train	with train	
1988			10,8
1998			16,1
1999			17,1
2000	20,2	21,6	18,3
2001			18,1
2002			16,4
2003			15,1
2020	31,5	33,5	

The forecast for year 2000 overestimated the turnout with up to 18 percent. It is furthermore obvious that the combined effects of September 11, the Sars epidemic etc. has hit subsequent total travelling hard, in Sweden as in most countries. This has had a significant effect on the train shuttle's market.

Table 3 summarises market shares for different modes of transport to and from the airport for all destinations. It demonstrates that A-Train has not affected the market share for car and taxi and that the railway service has effectively taken away less than half of the previous patronage for airport coaches. On the sub-market for trips between downtown Stockholm and the airport only – i.e. the core market for the airport train – the market shares for coach and A-train is higher, between 25 and 30 percent for each.

Coaches are today operated as a profitable commercial enterprise. Their policy seems to be to charge half the price for using the train; during spring, 2005, it costs SEK 90 and 180 for a travel time of about 40 and 20 minutes for bus and train respectively. This illustrates that the

deal between the government and A-Train put no restrictions on competition from other modes of transport. It is also obvious that A-Train has chosen to price the service in a high-price segment.

Table 3: Market share (percent) for different modes of transport to and from Arlanda. Based on surveys made by Luftfartsverket.

	1999	2001	2003
A-Train	-	19	19
Other train	-	4	5
Coach (Stockholm)	24	14	13
Coach (Uppsala)	-	2	2
Other coach	-	4	4
Taxi	23	22	21
Car	35	35	35
Other, no answer	18	3	4

Table 4: No. of passengers with A-train; actual numbers and 1993/94 forecast*.

	Passengers	Employees	Total
2000	1 700 000	400 000	2 100 000
2001	2 500 000	400 000	2 900 000
2002	2 400 000	350 000	2 750 000
2003	2 200 000	350 000	2 550 000
2004	2 500 000	365 000	2 865 000
2005			5 100 000*
2020			7 400 000*

Table 4 summarises the actual use of the Arlanda shuttle. It is obvious that the amount of travelling during the first years of service is well below the official 1990 forecast, the actual number of passengers on the train being about fifty percent of the (official) projection made for 2005. We do not know which projections were made by the bidders.

One reason for the discrepancy between projections and actual patronage is probably the high-price policy followed by A-Train. *Banverket's* early CBA analysis assumed a price a par with coaches and that coaches would be virtually eliminated; today's competition between train and coach on the core market is fierce. Moreover, in spite of a discount scheme, less than

5 percent of the total number of daily work trips by airport employees is made by the train shuttle.

On top of this, the slump in airline travel after September 11 has been devastating for revenues, and A-Train's financial result is consequently poor. For year 2004, revenues were SEK 402 (359), and operating costs SEK 314 (310) million. The surplus of SEK 87 (49) million was however not sufficient to pay for net financial costs of SEK 155 (100) million. The balance – SEK 68 (51) – has been added to the company's debt (numbers for year 2003 in parenthesis; see further A-Train 2005). A-Train has consistently been showing red figures over the years and although travelling and ticket revenue is going up, there is still a long way to go to break-even.

The contract has put all revenue risk with A-Train.[8] The company's ability to attract a large enough patronage, and to counter the consequences that external events have had for patronage, has obviously been poor. It is, furthermore, not apparent why A-Train has chosen a high-price policy. A drastic reduction of average price, say down towards SEK 120, in combination with some sort of peak-load differentiation, would presumably attract a large proportion of present coach passengers, even if bus prices were also reduced.[9] A-Train has recently started to run six trains an hour during peak traffic, so capacity must be abundant. Simple back-of-the-envelope considerations would therefore indicate that a radical change of policy could improve the financial result.

It may be difficult to control for business risk due to external demand variations and it is not straightforward to assess price elasticities in different sub-markets in order to design clever multi-part tariffs. A-Train's current policy may moreover be based on private information. Irrespective of which, A-Train must have been aware of the market risk when it

[8] While not hedging against downside risk, the contract has made provisions for a situation with a demand that would be higher than expected; if this would have happened, a specific profit sharing scheme would commence which would repay the government's load faster than under the default strategy.
[9] During summer 2005 it has rather increased the price with another SEK 10 to SEK 190.

submitted its original bid and signed the subsequent contracts. We are therefore not able to rationalise the current pricing strategy based on available information.

4.3 Other aspects on the contract

One point of departure for the political ambition to raise private money for an infrastructure investment was that the project was economically justified. *Banverket's* 1990 ex ante CBA analysis indicated a fairly high rate-of-return but the 1994 parliamentary decision to give the project a green light was not preceded by a CBA. This is noteworthy in view of that the project that came to be built differs from the design considered by *Banverket*.

At that early stage, the intention was to construct one large station in the rock under the airport, opening up several different entrances to airport terminals. The station subsequently built has two separate train tunnels. The through tunnel is used by long-distance trains, stopping at one station. A second, cul-de-sac tunnel, bends off from the main track just before getting submerged and has two exclusive stops for the airport shuttle. Long-distance and shuttle travellers therefore don't use the same stations.

The agreement signed with the government gave A-Train control over the way in which tunnels were constructed as well as over the conditions for giving long-distance services access to Arlanda. A-Train is therefore entitled to charge other operators for using the through tunnel and station. While information on this account is confidential, long-distance trains seem to pay a charge for each stopping train plus a certain amount for each arriving and departing passenger.[10] There are two motives for this arrangement. First, it raises additional revenue for A-Train. Secondly, it blocks the possibility that long-distance operators charge a lower price than A-Train for Arlanda-Stockholm trips, thus undermining its demand.

[10] A-Train's Annual Report has an entry for "other revenue" which was SEK 4 million in 2004, about 1 percent of total revenue, which could be this source of income.

The 1994 parliamentary decision acknowledged that this construction was harmful for competition. To the extent that passengers and/or operators are scared off by charges well above marginal costs, it is a direct loss of allocative efficiency. A-Train's monopoly control over access to Arlanda station was however seen as a price that had to be paid for attracting private money into a joint financing project.

Some long-distance trains have recently abandoned the Arlanda detour in favour of the original, straight line. While the system looses some travellers in this way, A-Train's monopoly franchise may be more harmful for potential passengers living within say 100 km from the airport. If these potential customers contemplate using a rail service for trips to and from the airport, they would have to change trains at Stockholm central station. The extra inconvenience, the non-existence of inter ticketing, and the high price for the shuttle in combination makes the car retain its competitive edge. In addition, the Stockholm region's commuter train services have not been extended to the airport, in spite of that commuter trains would *not* be in direct competition with A-Train's services in view of their frequent stops and consequent longer travel time. Commuter trains would on the other hand probably attract many of today's car users.[11]

The high price for using the airport shuttle, the charges for other operators that want to use the station and the poor interest in promoting complementary commuter-train services, have meant that the Arlanda line has not been integrated into the overall network in the way intended in the political decision, at least not for local and regional trips. The situation is different for long-distance domestic travelling. Several trains to and from regional hubs at a distance of 200 km and more can now stop at Arlanda on their way to the capital. The consequence is that domestic flights between Stockholm and these hubs have been diverted to

[11] Preparations seem to be underway to run commuter trains from Uppsala to the north through Arlanda. Since these trains would also stop at the same station as Stockholm's commuter train, an indirect link to Arlanda is provided to Stockholm commuters. The combination of two separate tickets plus the need to change trains will probably not make this possibility attractive.

interregional trains with several regional airports loosing most of their departures. While this puts a heavy financial strain on these airports, it is less significant for A-Train since the number of departing long-distance passengers at Arlanda is not large enough to make any significant imprint on its revenues (cf. footnote 10 above).

It is reason to return once more to the design of the Arlanda stations, and in particular the fact that two tunnels rather than just one was built. This may have facilitated price discrimination. The "ordinary" price for a Stockholm – Uppsala ticket (cf. Figure 1) is roughly half that for a ticket Stockholm – Arlanda with A-Train. But a passenger who has paid SEK 180 for using A-Train is today not really aware of that also long-distance trains stop at Arlanda.

One reason for designing the Arlanda stations in the way it has been done may be that it indeed was cheaper to build two separate tunnels and three stations rather than one tunnel and only a single, several-tracks-wide station. An alternative or possibly complementary motive could be that this design was chosen to facilitate price discrimination.

A further aspect of the way in which A-Train has chosen to organise its operations is that the trains that are now being operated are not fit to run on the rest of the network, A-Train's platforms being higher than the national standard. The private operator of A-Train services could therefore not readily use its rolling stock to compete with the incumbent, should passenger services be deregulated. This choice of rolling stock may have some relationship with the original consortium partners, one of them being GEC Alsthom, a train builder.

Except for Alsthom, the Arlanda Link Consortium (ALC) comprised three Swedish companies (NCC and SIAB that are construction companies and *Vattenfall*, Sweden's leading producer and conveyor of electric energy), as well as Mowlem, another British company. NCC and SIAB subsequently undertook all construction works and supplied electricity

equipment. Mowlem supplied tracks and switches and GEC Alsthom built the trains and delivered signalling and telecom systems.

In January, 2004, the Macquarie Group acquired 100 percent of the shares in A-Train plus its outstanding debt at a cost of SEK 400 million. The Group invests in infrastructure and related assets in European and other OECD countries. The change of ownership means that the railway services to Arlanda airport are now operated by an owner with deep insights into the appropriate management of this sort of activity, a quality not provided by the partners of the original consortium.[12]

4.4 Renegotiation?

Taken together, the poor integration of Arlanda with the national railway grid at large seems to give Sweden's government ample latitude to re-negotiate the Arlanda agreement when this option opens up in 2010. In view of A-Train's persistent losses since the start of traffic, it would not be surprising if the private consortium would also welcome this.

A further aspect of the possibility to renegotiate is a 1991 decision by the government to allow the airport agency to start building a third airport runway. The permit was conditioned on (a) that a train service to Arlanda was opened and (b) that emissions of NOx and CO2 from the airport should not exceed emission levels of 1990. The emission cap means that the airport agency – which is part owner of A-Track – has a direct interest in reducing the amount of bus and car traffic to the airport in order to provide scope for growth in air travel. More than 90 percent of the cap was utilised in 2002.

A protocol negotiated after that the original contract was signed, instigated by the then re-elected social democrat government in 1995, sets the stage for any premature change of the

contractual relation. The substance of that protocol is that A-Train shall be fully compensated for the consequences of any change of terms. In case of re-nationalisation, the government is required to take over all outstanding loans as well as the contracts for leasing of rolling stock. It shall pay the value of whatever equipment that A-Train may own at the date of the trade-in. In addition, it shall pay compensation for foregone return on the private consortium's risk capital as well as other costs inflicted on A-Train. If A-Track representatives would try to convince A-Train to change its management of the service, the operator could simply refuse, making the change of ownership the only option for managerial reform.

An alternative to nationalisation is that A-Train defaults on its loans and goes bankrupt. The private investors' share capital would then be foregone, the banks would sit with the highest-priority loans and the government's loan has the lowest priority. The subsequent reconstruction would probably mean that some debt was written off and that some (private or public) operator takes over management. A-Track could possibly use its loan to provide some leverage in order to change operations in ways that would attract more usage.

It is obvious that the latitude provided to A-Train in the original contract has come at a high cost. An overriding economic concern is the failure of A-Train to attract coach travellers and car users to an environmentally preferable mode of transport, in particular in view of the abundance of track capacity. The airport authority has a similar problem with the environmental cap around Arlanda which forces it into action within a nearby future. But for the time being, A-Train seems to hold a strong position if the government considers a takeover of the service.

The best for the government may therefore be not to rock the boat, i.e. to let services continue at growing losses. In view of that the contract also put all revenue risk with the operator, and since the deficit is substantial, it may be sooner rather than later that the

[12] However, an anticipated change of ownership of this kind would loosen whatever beneficial effects that may come from the integration of construction and operations into a life-cycle contract. See Dewatripont and Legros

business goes bankrupt. The government would need to secure its position when terms for a reconstructed venture would then have to be negotiated. The big "if" in this consideration is the subsequent trajectory followed by demand for A-Train's services. Only a sharp increase in patronage would make a difference from an efficiency point of view.

5. The search for an efficient industry structure

Sweden's 1988 vertical separation of the railway sector split the state-owned and single operator into two parts: a public sector agency, responsible for the infrastructure, and a state-owned monopoly operator. Freight services have subsequently been deregulated, the incumbent operator now has a monopoly franchise for "commercial" passenger services while "non-commercial" (i.e. regional) services are procured on a lowest-subsidy basis. The bulk of subsidies today go into infrastructure (cf. further Nilsson 2002).

A core component also of the 1993 British reform was a vertical separation of the former British Rail. Passenger operators have competed for franchises and the bulk of subsidies are still channelled to operations (Nash 2002). Following EU directive 2001/14/EG, the rest of Europe has also made the vertical split, although links between the former infrastructure and operation divisions in several instances still are strong, thus reducing the scope for competitive entry.

The reforms should be seen against a background of European experiences of state-owned national monopolies, leaving a legacy of poor cost efficiency and inadequate services. The main motives behind the reforms have also been similar across Europe: To revitalise a sector that has had a persistently declining market share and recurrent financial problems that had required governments to prop up ailing operators ex post. The reforms set off a program to lift the infrastructure's capacity, which at least in Sweden has been forcefully implemented.

(2005) for an analysis of the pros and cons of participation in PPP projects by third party expert creditors.

A further requisite was to improve allocative and cost efficiency in service operations, primarily by way of competition on or for the market.

There is, however, now a growing concern that the vertical separation may have been ineffective. The OECD/ECMT Round Table has, for instance, recently warned that the European reformers may have too easily jumped into conclusions as to the desirability of separating the “natural monopoly” sections of the industry from the competitive segments (Kopp 2004). There may be a severe risk for sub-optimisation because of the vertical separation of responsibilities. Moreover, there are indications that competition for, or sometimes on the tracks may enhance the industry’s static efficiency in that service costs are streamlined at the expense of service quality. Substantial transaction costs have also arisen as a result of the vertical split. These difficulties have not always been possible to overcome by contractual arrangements (Yvrande 2000, Yvrande-Billon and Menard 2005).

In contrast, the US maintains a vertically integrated industrial structure. The freight business seems to be thriving, with services operated over long distances and carrying huge loads compared to the European context. A consolidation process seems to be going on in freight while passenger services with poor profitability are operated over an infrastructure controlled by the freight operators.

The question is therefore if the Arlanda link represents an alternative or rather a complement to the two main models of today, i.e. vertical separation and vertical integration with substantial market power. The Arlanda project points to the possibility to have vertically integrated firms operating their own regional or national infrastructure in parallel to each other. In this way, the economies of scope in jointly operating infrastructure and services, lost in the vertically separated industry, can be retained. Moreover, new infrastructure can be designed according to the wishes of the responsible company. Would facility-based competition in segments be a way forwards for the industry?

An obvious prerequisite for a policy to cut out slices of a national railway network and vertically (re-) integrate infrastructure and operations, would be that demand is high enough in order to pay for fixed costs of this segment. A second requirement is that demand is captive, i.e. that customers have poor alternatives. If not, they would be deterred from using the service, severely limiting the efficiency in using existing resources. Third, the links between the facilities and the rest of the network should be small, so that outsiders' access charges in excess of marginal costs would not distort resource allocation with respect to exchange with other parts of the network.

On most of these criteria, and as of today, the Arlanda link project has failed: The costs were too high for the private consortium to foot the bill for it all; alternatives to the railway services are highly competitive, hampering the possibility to recover costs with user revenue; the charges levied for other services to get access to the airport are prohibitively high, adding to the sub-capacity use of the infrastructure.

It does, however, not seem to be impossible to put the deal on a better track, i.e. to make a better use of available track capacity. A different pricing scheme might in the first place attract many of today's coach passengers, and it is not impossible that this would also be commercially viable. Furthermore, a negotiated deal between A-Train and the operator of commuter services, securing some lump sum payment against allowing commuter trains to the airport, would also dramatically improve the attraction of the service for travellers that today use other modes of transport. In order to avoid the government renationalising the project, a pending bankruptcy might be the only hope for this solution.

An interesting alternative project that could be eligible for vertical integration, would be to put Malmbanan in the hands of its current major customer: LKAB, a mining company in Kiruna in the northernmost part of the country, has poor alternative means to transport its iron pellets to a port (Narvik, Norway to the west) or steel mill (Luleå to the east). It occupies

much of the line's capacity, and the links to other railway operations that might get lost are therefore poor.

There is no such thing as the optimal way of organising competition in industries that have to rely on (monopoly) network facilities. The possibility to combine vertically integrated segments of the infrastructure with an otherwise separated industry should therefore not be dismissed. As competition developed in the telecommunications industry, the institutional and regulatory framework was successively reformed along lines that deviated substantially from the paths that were laid out by the initial reforms in 1984 in UK (duopoly with restricted entry) and the U.S. (regional monopolies). The Arlanda link may provide an example of a path to take for gradual changes also in the railway industry.

6. Conclusions

Designing a contract for an infrastructure investment of Arlanda's type – i.e. with a public sector principal hiring a private sector agent – opens up the standard issues of any optimal contract design problem: How should moral hazard problems with too little effort be dealt with, how should risk be allocated between the parties and how could allocative efficiency – i.e. efficient use of the facilities – be guaranteed?

The contract between Sweden's government and the private contractor is basically of a fixed price nature, providing proper incentives for cost pressure and income generation, leaving all of the risk in the hands of the private contractor. The review has not been able to substantiate any cost savings for building the new railway line. In view of the low revenue from passengers, it is also obvious that mistakes must have been made by the winning consortium with respect to travel forecasts. The slump in air travel the years after that services commenced has also revealed the high price that the owners of A-Train has had to pay for accepting revenue risk.

An obvious benefit of the deal is that taxpayers have not had to stomp up some SEK 1,7 billion for building the infrastructure. The economic benefit from this is that the dead-weight loss of raising this revenue in the standard way has never materialised.[13]

The necessity of considering ex ante what could happen ex post, and to design a contract with this in mind is also obvious. The sunset paragraph currently in place was made part of the arrangement after that the original contract had already been put together and signed. This made it possible for the private operator to construct the renegotiation clauses so that it would get luckily away from any premature termination of the contract. Attracting private funds into railway infrastructure investment obviously comes at the cost of giving much latitude for monopoly pricing.

It is still an open question if the extra funds and the innovativeness introduced by Arlanda's consortium, is worth this price. It has, however, also been demonstrated that the changes of current management principles that would be necessary to make the off-budget construction ex post motivated may not be costly; rather, a radical change of pricing strategy could boost both economic and financial results.

[13] The acknowledged way to handle this in the CBA's undertaken of infrastructure investments is to boost investment costs with 30 percent, which is an estimate of the dead weight loss of marginal variations in spending and therefore also in the need to collect taxes. The economic benefit of *not* having to spend SEK 1,7 billion is therefore (0,3*1,7=) SEK 510 million.

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