

THE ARLANDA AIRPORT RAIL LINK –

LESSONS LEARNED FROM A SWEDISH PPP CONSTRUCTION PROJECT*

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2006-03-28

Abstract: The Stockholm – Arlanda airport rail link is a public-private build-operate-transfer project opened for traffic in late 1999. The 1993 decision to initiate the project was seen as a role model for funding rail infrastructure. In particular, it infused private money into the sector and it broke up the incumbent's train service monopoly, opening the sector for ideas and impulses. 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, some six years after that traffic started. It 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 losses of allocative efficiency due to that the number of passengers on the line is below expectations. 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.

* The authors 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 made 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 except for when additional material compared to that report is being used. We are grateful for research assistance from Nils Enberg.

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1. Introduction

Sweden and the United Kingdom launched several regulatory reforms of 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 address regulatory issues and the development of partly novel regulatory remedies against abuse of monopoly power, including price caps, forward-looking cost-based prices, etc. (Laffont & Tirole 1993 summarise 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 that it is made owner of both infrastructure and of an incumbent operator. This makes it necessary to have a premeditated position with respect to investment in and funding of infrastructure projects and 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 is an odd element. One reason is that – in contrast with the industry at large – for this particular project the owner is responsible for both infrastructure and operations. In addition, it is a public-private partnership based on a build-operate-transfer contract. Contracting with a private party in order to provide for (partial) off-budget funding of infrastructure was (and still is) not commonplace.

Arlanda airport is situated half-ways between Stockholm City and Uppsala, where a 75 km double-track 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 a bus shuttle.

A qualification for the Arlanda project was that track capacity on section A in Figure 1 below was constrained. To make it feasible to operate a dedicated Arlanda service it was therefore necessary to have another two tracks built on this section at an earlier point of time than would otherwise have happened.

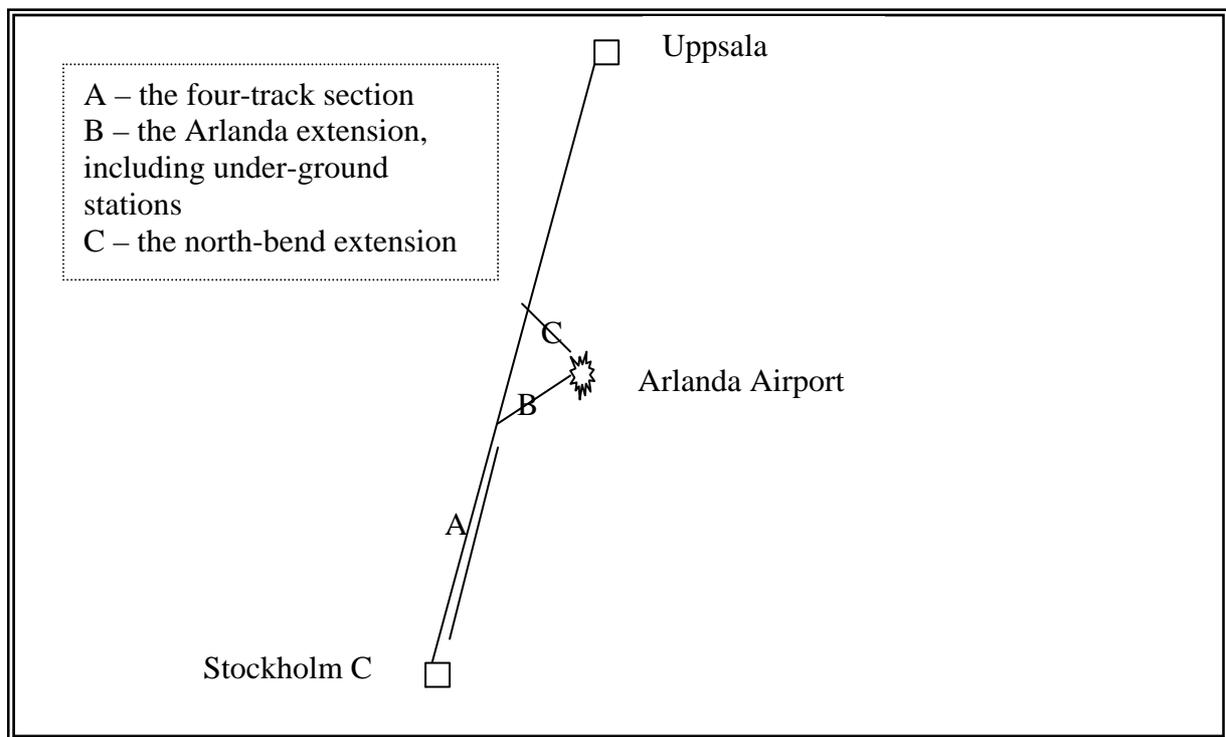


Figure 1: Schematic description of the prime components of the Arlanda airport rail link.

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).

This paper describes some aspects of the process that lead to the 1994 decision to initiate the project, 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 deliberations made before the contract was signed (section 2) where after an ex post assessment of the project is given (section 3). Section 4 considers the Arlanda project as an alternative model for organising the industry at large, and section 5 concludes.

2. Ex ante considerations

We discuss the considerations that lied behind the signing of the PPP contract under three separate headlines; the process itself (2.1), the political restrictions on the project (2.2) and the content of the contract (2.3).

2.1 The process

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 being 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 Arlanda project top priority.

The then social democratic government responded by asking *Banverket* to assess the possibility to have the project built and financed by the private sector. The agency's estimate was, however, that future train ticket revenue 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 For this reason, it established a working group within the ministry, chaired by a retired business CEO and manned by private-sector experts with an experience from working with complex contracting projects and also a political representative; neither the incumbent operator nor the infrastructure agency were seconded. An international investment bank was hired to provide advice during the process.

The procurement process included extensive efforts to induce more than one bidder to enter the contest, not least from the international arena. The design of the working group, in combination with active marketing, signalled the Swedish government's commitment to a truly open bidding process. If these precautionary measures had not been taken, there were concerns that the incumbent's consortium would be considered to be the obvious winner, deterring competitors from submitting well-prepared bids. The government moreover gave the working group an open mandate, and committed itself not to get involved in the choice of winning consortium or the details of the deal to be negotiated other than in one respect: To say yes or no to the group's final proposal for solution.^{3,4}

In early 1993, *riksdagen* (the Parliament) 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. A pre-qualification round saw about 30 firms submitting bids for all or parts of the project. The final round comprised four bidding consortia, partly formed after an initiative from the working group, each receiving a SEK 1 million in compensation for

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.

³ It turned out that the pressure on the group to award the contract to a domestic bidder became fierce. The government did, however, not budge from its commitment.

⁴ Cf. the discussion about the US Congress giving "fast track authority" to the government in trade negotiations, interpreted from the point of view of transaction cost economics in Dixit (1996), in particular section 2.3.

preparing a bid.⁵ In April 1994, the government submitted its Bill (prop. 1993/94:213) concerning basic contracting principles to *riksdagen*. The working group continued its deliberations with the bidders during spring and in June *riksdagen* approved the Bill.⁶

Arlanda Link Consortium was publicly made preferred bidder in July, and the contract was signed in August, one month before the election. The private consortium subsequently established itself as A-Train. A state-owned company, in the sequel 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 the Swedish Airports and Air Navigations Services Agency (subsequently referred to as the airports agency). Train services were opened in November 1999.

2.2 The political considerations

One starting point for the political process to establish a train service to Arlanda was the airport agency's plans to have a third runway built at the airport. The permit for doing so was conditioned on that emissions of NO_x and CO₂ from the airport and its surroundings should not exceed emission levels of 1990, the train service considered to be an important tool to meet this objective. The emission cap means that the airport agency has a direct interest in slowing the growth of bus and car traffic to the airport in order to provide scope for growth in air travel.

Another political objective for the process was to open up for private-sector participation in the financing of what is otherwise handled as a public sector responsibility. The growing demand for public money at large in combination with a severe budget crisis in

⁵ When this is written in 2005, the exchange rate is €1=SEK 9,10 and \$1=SEK7,50.

⁶ 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 1994 decision 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.

the early 1990ties, made governments of both socialist and non-socialist leaning interested in off-budget funding mechanisms. The non-socialist government of the day also saw the use of a private contractor as a means 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.

In addition, *riksdagen's* 1994 decision to have the project built made explicit reference to its economic rationale, established in *Banverket's* early Cost-Benefit Analysis. The 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 government's working group was also instructed to have section C built, in spite of the link's limited commercial relevance. This was seen as a way to integrate the airport link with the national railway grid. The winning consortium also had to commit itself to a minimum service supply and also had to accept that other railway services got access to track capacity. Another important prerequisite for the subsequent operation of railway services was that no restrictions were introduced on coach traffic. The government rather saw the presence of competing busses as a disciplining factor for the pricing of track operations.

2.3 The contract

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 the right to charge shuttle passengers 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.

The contract was designed in order to provide for efficiency in construction and service supply and to allocate risk between parties in a conscious way. The winning consortium was therefore induced to optimise the project's lifetime costs, basically by making it residual claimant. A-Train could thus 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. Moreover, the consortium had to shoulder the full market risk, meaning that it would have to bear any below-target revenue due to slumps in air travel. The designated 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 *riksdagen's* June 1994 decision. First, the state pledged to make an upfront payment 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 consortium committed itself (a) to contribute with at least SEK 0,6 billion or 15 percent of the total project cost in the form of share capital, and (b) to raise at least 75 percent of total costs for link B on commercial terms from outside the government budget.

Third, the remaining construction costs were to be provided by a "conditional loan" from the government. This SEK 1 billion loan granted to A-Train was channelled through the National Debt Office.⁷ The repayment is deliberately skewed towards the later part of the contract's life period. It was obvious to the government's working group that the winning consortium's costs would be substantial during the first years of operations while the surplus

⁷ This loan is the only contract where A-Track does not operate as the government's representative.

would become huge towards the end of the contract period when much of the debt had been paid off. The deal was therefore to let *Banverket* pay the interest on the loan to the Debt Office and that the loan would not be amortized until after that external loans had been repaid and after that the owners' had received their dividends. If all outstanding debt was repaid before the termination of the contract, *Banverket* shall also be compensated for the interest paid to the Debt Office.

The loan has lower priority than A-Train's other debt, and the state has no securities for it. In practice, it can be seen as government share capital. It is important to emphasise that the government realised the trade-off between the size of this loan and the degree of monopoly control delegated to the winning consortium. Restrictions on competing bus services might, for instance, substantially have reduced the necessity provide a loan on soft conditions.

A fourth 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 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. It was also compelled to let long-distance trains use the tracks, but it was given an open mandate to charge for this use.

3. 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 (3.1), also providing some further detail of the financial structure of the agreement. Section 3.2 discusses A-Train's financial result. Section 3.3 takes a look at some broader economic perspectives on the project and the scope for renegotiation of the contract is addressed in section 3.4.

3.1 Investment costs ex ante and ex post

Our best estimate is that total costs for sections A-C and the purchase of rolling stock 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 out of which SEK 1 billion was paid for by the guarantee loan (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 section A, built under *Banverket's* auspices, saw a cost overrun of about 25 percent; except for that, the ex ante estimate does not seem to be far off the actual outcome. Several qualifications should however be borne in mind.

First, the numbers are in different price levels but since prices were fairly stable over the period, 1992 costs have not been inflated. The low inflation is 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, at least parts of the cost overrun for section A may be rationalized by that the ex post number 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. 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.

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 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, section A above providing one example. One reason is that projects are made more sophisticated from that the decision to initiate a project is taken to the day that the shovel is first put into the mud; another may be poor management of the construction process (Flyvbjerg et al 2003). The absence of cost overruns can be due to that there were none or that A-Train has never made them public.⁸ All in all, we know very little about the cost efficiency properties of the investment part 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 government loan. 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.⁹ Except for that, rolling stock was leased on a contract costing about SEK 700 million. The government has not had to

⁸ On the other hand, Andersson (2005) alleges that the winning consortium made a substantial profit on its engagement in the construction phase of the project.

⁹ 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

face any extra payment due to cost overruns. The deal has therefore been a financial success, reducing the need to raise tax revenue or sell bonds by SEK 1,7 billion in return for a project opened ahead of time. On top of this, the government has an (insecure) claim of SEK 1 billion from the consortium.

A conclusion that goes beyond the Arlanda link project is that the expected costs for a project in its final version should be carefully registered, in particular when a non-conventional financial construction is being implemented. If not, it is difficult ex post to assess the merits of, and problems with the financial solution used and transparency is jeopardised. On the other hand, one price that may come with off-budget funding is that the private contractor may not want to open the books for external review. The project's consequences for the public-sector budget may therefore be the best proxy for cost efficiency that could be made available.

4.2 Financial aspects of the airport shuttle

A-Train's financial result is poor. For year 2004 (2003), revenues were SEK 402 (359), and operating costs SEK 314 (310) million. The gross 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 (see further A-Train 2005). A-Train has consistently been showing red figures and although travelling and ticket revenue is going up, there is still a way to go to break-even.

One reason for poor performance is that operating costs are said to be 60 percent higher than expected (Andersson 2005). The big problem compared to expectations however seems to be on the revenue side. Total income from an airport shuttle service is the number of

public-sector commercial firms in commercial deals could be considered to be just like any commercial financial construction.

passengers times unit price. The number of airport employees and, in particular, of airline passengers is therefore a crucial variable. Table 2 presents an official 1990 forecast together with the actual number of passengers, indicating that the forecast for year 2000 overestimated the turnout with close to 20 percent. Another forecast was made by the government's task force 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. Official 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	

Table 3 summarises market shares for different modes of transport to and from the airport for all destinations. Numbers should be treated with great care, since data have been collected using different methods during different years. It is, however, obvious that the train shuttle has had little effect for the market share for car and taxi, meaning that the original objective to reduce road traffic has not been realized. Instead, the train has taken about half of the patronage of airport coaches. On the sub-market for trips between downtown Stockholm and the airport only – i.e. the core market – the market share is between 25 and 30 percent each for coach and train.

Table 4 summarises the actual patronage of the Arlanda shuttle. It is obvious that travelling during the first years of service is well below the official forecast, the actual

number of passengers on the train being about fifty percent of the (official) projection made for 2005. A-Train's own projection for 2005 was for 4 million passengers (SOU 1995:25, p. 40; cf. further section 3.4 below), lower than the official but still about 25 percent higher than actual patronage.

Table 3: Market share (percent) for different modes of transport to and from Arlanda. Based on interviews with departing passengers made by the airports agency.

	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 forecast* in the 1994 Bill.

	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*

Events outside the control of the operator have had obvious consequences for patronage. The combined effects of an economic downturn in year 2000, the terrorist attack on September 11 2001, the Sars epidemic etc. has hit subsequent total travelling hard, in Sweden as in most countries, with consequences for the train shuttle's market. At the same time, competition from low-fare operators, such as Ryan air and EasyJet, has substantially reduced prices and attracted new passengers, also at Arlanda. Low-cost passengers do however not provide the core business of A-Train.

Changes in the domestic transport market after that the contract was signed in 1994 have also had consequences for the shuttle. There are now three other airports in the greater Stockholm area that, taken together, compete both for domestic and international air traffic; in the early 1990ties there was one domestic competitor. The motorway between Arlanda and downtown Stockholm has been upgraded, including a much higher capacity at the airport approaches. The airport agency has also expanded affordable parking capacity at the airport, further promoting the competitive edge of private cars.

One component of A-Train's business strategy is the priority given to short travel time. The train does therefore not make any stops between Stockholm and Arlanda. Furthermore, it has chosen not to extend the shuttle service to the southern suburbs. Both features restrict the scope of the market and the potential for attracting more passengers.

An additional reason for the discrepancy between projections and actual patronage is A-Train's high-price policy, meaning that the service in particular attracts business passengers. *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 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. The price also seems to be higher than at similar services at other airports.

A-Train's competitive strategy should also be considered from a strategic perspective. Coaches are today operated as a profitable commercial enterprise.¹⁰ Their policy seems to be to charge half the price for using the train; during spring, 2006, it costs SEK 90 and 200 for a travel time of about 40 and 20 minutes for bus and train respectively. At the same time, taxi

¹⁰ Coaches to Arlanda are today part of a national enterprise providing coach services to all major airports except for its wider supply of chartered services.

charges SEK 475 for a travel time of somewhat about 30 minutes.¹¹ It is obvious that we see an oligopolistic market situation with strong interaction between the different modes and their pricing and supply strategies.

The contract between A-Track and A-Train leaves all revenue risk with the operator. 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 market segments in order to design profit-maximising multi-part tariffs. A-Train's current policy may moreover be based on elasticity information not in the public domain. Irrespective of this, it is not obvious that the current pricing policy maximises revenue. 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.¹²

Irrespective of which, A-Train was well aware of the market risk when it submitted its original bid and signed the subsequent contracts. 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.

The private consortium that built the infrastructure and owned A-Train comprised NCC and SIAB, Swedish construction companies undertaking all construction works and *Vattenfall*, Sweden's leading electricity utility. A fourth owner was GEC Alstom, an European railway equipment supplier building the trains that operate on the line, while John Mowlem is a British construction company with experience in railway construction,

¹¹ It has some cursory relevance that the current trial with congestion charges in Stockholm may save up to 10 minutes for a bus trip between downtown Stockholm and Arlanda and perhaps 5 minutes for an average taxi journey, further undermining the competitive position of the bus service.

¹² International comparisons indicate that price elasticities are well below minus unity for these types of services (Preston & Dargay 2005), which would indicate that there is scope for even higher prices. Non-marginal price cuts into a range of the demand curve that would be more price sensitive would, on the other hand, point to that a low-price policy could have commercial benefits.

supplying tracks and switches as well as signalling and telecom systems. Neither owner seems to have had any experiences from operating railway services.

In January, 2004, the Macquarie Group acquired all shares in A-Train plus its outstanding debt at a cost of SEK 400 million.¹³ 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.¹⁴

3.3 Economic aspects on the service

One point of departure for the political ambition to raise private money for an infrastructure investment was the project's economic rationale. *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 new CBA. This is noteworthy in view of that the project that came to be built differs from the original design considered by *Banverket*. Any deal of this nature should be based on an economic analysis that identifies the pro's and con's of the project after that all deliberations during the negotiation process have been transformed into its final version.

In particular, the initial intent was to construct a single 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,

¹³ In May, 2006, the annual report for 2005 will be made public. These numbers will be double checked before finalising the paper.

¹⁴ There are reasons to make the same firm control both construction and maintenance of infrastructure in order to optimise life-cycle costs (Martimort & Pouyet 2005). This link is not broken by a sale since the value of the facilities at the sale is obviously related to that appropriate tradeoffs are made during the construction phase. See also Dewatripont and Legros (2005) for an analysis of the pros and cons of participation in PPP projects by third party expert creditors.

stopping at one station. A second, cul-de-sac tunnel, bends off from the main track just before getting submerged and has two stops built exclusively 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 charges other operators for using the facilities. 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.¹⁵ In this way, A-Train gets additional revenue and in particular, it blocks the risk for that long-distance operators charge a lower price than A-Train for Arlanda-Stockholm trips, thus undermining its demand.

The 1994 Bill acknowledged that this construction is harmful for competition. To the extent that passengers and/or operators are scared off by charges 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 the project.

A-Train's monopoly franchise may be particularly harmful for potential passengers living within say 100 km from the airport. For this market segment, a rail service for trips to and from the airport today requires a change of trains at Stockholm central station. The extra inconvenience and the non-existence of inter ticketing in combination with the high price for the shuttle 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 might on the other hand attract many of today's car users.

¹⁵ 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 high price for using the shuttle, the charges for other operators that want to use the Arlanda station and the poor interest in promoting complementary commuter-train services, have meant that the airport 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. This provides a background for the inability of the new service to take market share from cars and taxi.

The new line has also had consequences for long-distance domestic travelling. Trains to and from regional hubs north of Stockholm can now stop at Arlanda on their way to and from the capital. The consequence is that passengers on domestic flights between Stockholm and these hubs have been diverted to interregional trains with several regional airports losing 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 15).

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 standard 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 200 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 indeed be that it was cheaper to build two separate tunnels and three stations rather than one tunnel and 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 choose to organise its operations is that its trains 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.

3.4 Nationalisation?

The socialist government that resumed power about one month after that the contract between the government and A-Train was signed in 1994, had made the PPP project an election issue. Except for protesting against privatisation of a vital part of the nation's infrastructure, a major concern was that A-Train would not have commercial reason to promote local and regional traffic. Social democrats promised to do its best to rip up the agreement, should it get majority. It therefore appointed a representative to try to renegotiate the deal, recommendations subsequently published in February 1995 (SOU 1995:25).

In the complementary protocol, A-Train accepted to give Sweden's government the right to terminate the Arlanda agreement anytime after year 2010 (i.e. 15 years after that the original contract was signed). Nationalisation would be an option if the airport had not been "appropriately integrated" with the national railway grid at that time, the government retaining the right to interpret this concept. The quo for this quid was to ascertain that A-Train shall be fully compensated for the consequences of premature contract termination. The government is then 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, it shall pay compensation for foregone return on the private consortium's risk capital as well as other costs inflicted on A-Train.

The protocol also sought to induce A-Train to open up for local and regional services. At the same time, talks with potential operators of these services had indicated their interest to start operations. A-Train declared that it was willing to admit these additional services on the infrastructure that it controls but retained its right to be "appropriately compensated" for doing so.

Six years after that the airport shuttle started operations, no traffic of this nature is under way. There are some complementary investments in infrastructure that have to precede traffic start, and an obvious issue is who would have to foot the bill for that. Another qualification is that much of this potential traffic is today being operated on non-commercial terms.

Commuter train ticket revenue for instance pays about 50 percent of its costs, the rest subsidised on a regional basis. But at the same time, the tracks under A-Train's control have an abundance of capacity, and the types of services that could be initiated would probably not attract today's shuttle passengers, in particular if their quality level (number of stops and thereby travel time) would be inferior. Each *krona* extra revenue should therefore be a direct addition to A-Train's profits. It is therefore difficult to understand why the parties have not been able to negotiate a deal opening up for this complementary traffic.

An alternative to nationalisation is that A-Train defaults on its loans. The private investor's 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 use its loan to provide some leverage in order to change operations in ways that would attract more usage. Importantly, bankruptcy would not mean any destruction of physical capital, only an adaptation of the deal to the reality of the situation, in particular to the below-target patronage.

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 over Arlanda which may force it to take action within a near future. But for

the time being, A-Train seems to hold a strong position if the government considers a takeover of the service.

4. The search for an efficient industry structure

Sweden's 1988 vertical separation of the railway sector split the state-owned 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 have 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. 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 been too fast to accept the separation of “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 (reduced costs for operating services) at the expense of service quality. These difficulties have not always been possible to overcome by contractual arrangements (Yvrande 2000, Yvrande-Billon and Menard 2005). Substantial transaction costs have also arisen as a result of the vertical split.

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 some subsidised 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 possibly 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 option to have vertically integrated firms operating their own regional or national infrastructure in parallel with 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.

It is not obvious that the Arlanda link project is a good candidate for a public-private partnership: The costs were too high for the private consortium to foot the bill for it all, making it necessary for the government to provide risk capital. Moreover, the alternatives to the railway services are highly competitive which means that it is difficult to recover costs with user revenue without scaring off demand. In addition, the charges levied for other services to get access to the airport are high, adding to the sub-capacity use of the infrastructure.

On the other hand, one obvious benefit of the deal is that taxpayers have not had to pay 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.¹⁶ Even though the monopoly franchise that the Arlanda consortium is operating under has had substantial efficiency losses, the alternative – i.e. tax financing – may have generated even higher efficiency losses. From this second best perspective, there may be reason to implement even an efficiency distorting solution.

It may, moreover, be possible to put the deal on a better track. 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

¹⁶ 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 $(0,3 \cdot 1,7 =)$ SEK 510 million.

between A-Train and the operator of commuter services, for instance in order to secure 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. The possibility to introduce a complementary shuttle service from Stockholm's southern suburbs, possibly in combination with a stop somewhere between Arlanda and Stockholm C in order to attract travellers in the northern suburbs, might also be viable and/or economically beneficial.¹⁷

It is always going to be difficult to organise 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.

5. 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 many optimal contract design problems. These include the mode for selecting the winning bidder, the wish to optimise costs over a long period of time, the allocation of risk between the parties and – not least – the safeguarding of allocative efficiency, i.e. the efficient use of the facilities that are built.

¹⁷ An alternative project that could be eligible for vertical integration, would be to put Malmaban 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

The contract between Sweden's government and the private agent selected for the Arlanda Private Public relationship is basically of a fixed price nature, providing proper incentives for cost pressure and income generation. It also left all risk in the hands of the private contractor. The slump in air travel the years after that services commenced has revealed the high price that the owners of A-Train has had to pay for accepting revenue risk. In view of the low revenue from passengers, it is also obvious that mistakes may have been made by the winning consortium with respect to travel forecasts and choice of pricing and market strategy.

Irrespective of how diligent that the operator has been in its choice of competitive strategy, it is obvious that the original contract established a clear distinction of the parties' respective responsibilities. There is no way for the private partner to come back to the government and claim that it has been dealt with in an unfair way. And in case of default, the government does not have to chip in more money, except if it wants to reorganise operations along new lines. It is, however, not clear what the complementary 1995 protocol really means in a situation where the government would want to renegotiate its contract with A-Train in order to improve services. An further benefit of the deal is that taxpayers did not have to pay some SEK 1,7 billion for building the infrastructure.

These upside aspects should be related to the distortionary consequences from letting a private contractor exercise monopoly rights. The most important is that an abundance of track capacity is not used at the same time at the alternative mode, roads, is over used and moreover has severe environmental consequences. The inability of the new facility to dent the market share of cars and taxis provides an indication of the magnitude of the economic problem. It is therefore an open question if the extra funds and the innovativeness introduced by Arlanda's consortium, was worth this price. It has, however, also been demonstrated that the changes of

mill (Luleå to the east). It uses much of the line's capacity, and the links to other railway operations that might be crowded out from using the line are therefore poor.

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 might boost both economic and financial results.

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