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**QUALITY INCENTIVES VERSUS QUALITY OUTCOME IN  
PROCURED PUBLIC TRANSPORT  
CASE STUDY STOCKHOLM\***

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**ABSTRACT**

*Gross contracts appear to be the most common contract form for procured public transport in Sweden and elsewhere. This contract form, it has been argued, gives weak incentives for operators to deliver the desired quality level. Therefore many procuring public transport authorities amend contracts with quality incentives.*

*This paper is probably one of the first studies to examine how such quality incentives influence quality outcomes with focus on cancelled departures and delays. The main findings are that the introduction of quality incentives are correlated with both increases and decreases in measured quality outcomes.*

*We do not think, however, that the incentives in themselves have negative effects but hypothesize that the results are driven by underlying cost changes for achieving desired quality objectives that exceed the possible revenues from the incentives. In interviews with the Stockholm public transport authority (SL) and some operators, two central observations surface. The first is that there are causes for quality failures that are not solely the responsibility of operators and that these are therefore not fully reached by the incentives, and the second is that the operators believe that they have exhausted what they can do under the current contracts.*

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## 1 INTRODUCTION

This paper<sup>1</sup> presents the results and interpretations of analyses of possible relationships between quality incentives and quality outcome for procured public transport services by the Stockholm County Public Transport Authority (SL).

In 1988 a new act in Sweden allowed (but did not mandate) local and regional public transport authorities to procure public transport services under competition. The authorities are therefore, since then, all in charge of planning, i.e. tactical decisions, and can thus procure the operations under competition.

In 1991 SL launched its first competitive tenders. Between 1989 and 1991 the in-house operator of SL was given a couple of years for strengthening of its competitiveness in order to be able to meet the coming competition from private operators. In fact, operating costs went down by some 30 percent before the first tender round, by the mere threat of competition.

Gothenburg in Sweden applied a similar procedure with similar results. In 2006 all local and regional public transport authorities in Sweden has procured services under competition.

More information on how the Swedish policy on (land-based) public transport evolved around 1990 is found in Jansson and Wallin (1991).

In the longer run since 1991 competitive tendering in Sweden has reduced costs by some 5-10 percent on average. The cost outcome of procurement of bus transport in Stockholm, and in Sweden in general, has been the topic in several studies (e.g., Jansson, 1993; Alexandersson et al., 1996; Alexandersson and Pyddoke, 2003).

Research in terms of quality, however, has not been reported very much. This is a certainly a deficiency. Not much seems to be reported in the literature on effects of incentives for quality improvements either. That is at least one conclusion drawn by Jansson and Pyddoke (2007), a literature study on behalf of the Stockholm County Public Transport Authority (SL). This paper makes an effort to provide a contribution in the field: quality incentives – quality outcome.

SL is the public transport authority in Sweden that has experimented with a large number of incentives and has a large number of quality measurements. That is the reason why SL is an interesting candidate for analysis of the link between quality incentives and quality outcomes in Sweden. The reason for these experiments is of course the belief that quality incentives will lead to quality improvements.

In a previous pilot study Jansson and Pyddoke (2005) financed by Vinnova, compared samples of the quality outcome measurements before and after an incentive has been introduced and calculated if the differences in averages were statistically significantly different from naught. If the difference was statistically significant and had the desired sign this could indicate that the incentive had worked well. The statistical tests for three contract areas suggested that four incentives worked well and had the desired effects

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<sup>1</sup> A preliminary report including the first results was presented at Thredbo 10 in Australia 2007.

and that three incentives did not work well, whereas two incentives did not seem to have any significant effect at all. From this we concluded that the full set of incentives for the whole set of bus contracts may not have produced the desired quality improvements and a positive welfare net. A more definite conclusion on the efficacy of the quality incentives would clearly have been premature from this study, since we had not controlled for other circumstances that may have influenced the outcomes. The study did however show that both data and methods allow for meaningful evaluation of the design of individual incentives and that these methods could be applied to the whole set of contracts.

In this study one of the objectives was to expand the data set and further explore how data could be used to further examine quality incentives. However, in an early stage of the project it was agreed with SL to focus on punctuality and delivered departures. We then found that the instances where there was data both before and after a clear change in quality incentives were fewer than we had initially expected. This study therefore presents results only from the cases where we found both data and significant changes in incentives.

We have made an effort to seek ways to control for other factors that may influence the operator's possibilities to achieve the public transport authority's objective. The main finding in this paper is that the correlation between the introduction of incentives for punctuality and cancelled departures are weak, instable and often insignificant. A probable reason for this may then be that the incentives are too weak. This interpretation is probably too simplistic. For this reason we discuss also other factors that are not possible to quantify in a statistical analysis but that affect the performance of the operators.

Even if the study is focused on SL in Stockholm as a case, we believe that the problems we have encountered with respect to monetary incentives and the recommendations we provide can be of interest for many other public transport authorities in urban areas around the world where incentives are used or considered.

Section 2 includes a principal discussion on the economic rationale for various incentives and how SL has dealt with incentives historically. Section 3 describes the methodology employed and structure of analyses. Section 4 presents the quantitative analysis and section 5 the qualitative one. Conclusions and recommendations are presented in section 6. The appendix includes a listing of the type of data that the Stockholm County Public Transport Authority (SL) collects for quality measurement purposes.

## **2 DISCUSSION OF PRINCIPLES**

### **2.1 Incentive forms**

In this paper we adopt conventional microeconomic assumptions about the objectives and behaviour of the public transport authority and the operators. We assume that a public transport authority, as SL, is welfare maximising, while we assume the competing operators to be profit maximising.

The economic rationale for incentives in contracts is to make the operator act so that one achieves the largest possible social net benefit. Incentives are thus often regarded as important tools by public transport authorities, in order to make procurement of public transport services work satisfactorily.

In this paper we analyse gross-cost contracts since these are used by SL. Common incentive schemes when gross-cost contracts are used are related to:

- number of passengers,
- revenue,
- quality in terms of departures carried out,
- quality in terms of punctuality,
- quality in terms of cleanliness,
- quality in terms of staff behaviour,
- quality in terms of information.

Incentives related to number of passengers or revenues are problematic in two senses. A first problem is that it is difficult to know the ultimate causes for the changes in the number of passengers or revenue and to what extent the operator contributed to the outcome. The causes may be for example: changes in the land-use pattern, changes of cost of driving cars, measures taken by the transport authority, measures taken by some operator that affect other operators' demand. The second related problem is that the transport authority may avoid undertaking (valuable) measures in order not to disturb the distribution of demand between operators.

All in all it is difficult, if not even impossible, to derive the exact relationship between possible measures undertaken by the operator and demand changes. The conclusion is that one should be very careful and restrictive with respect to demand or revenue incentives.

From a welfare theoretic point of view the ultimate goal of the public transport authority should be to increase welfare. More passengers may, but do not automatically, contribute to welfare increases. The benefit of more passengers is related to increased consumer surpluses, higher revenues, less car traffic and thus less pollution. These effects should, however, be taken into account in a cost-benefit analysis.

Theoretical arguments and numerical examples of shortcomings of demand and revenue related incentives for public transport are found in for example Jansson (1997).

## **2.2 Quality incentives**

Quality incentives with respect to for example departures carried out, punctuality, cleanliness, staff behaviour, information etc. are easier to deal with. Hereby one needs to rely on controls of staff, technical recordings and complaints from passengers.

SL in Stockholm applies all these sources. Complaints and opinions from passengers are collected by telephone, e-mail and interviews. SL also uses “mystery shoppers”, who are plainly dressed consultants who travel as passengers with the task to examine quality in various respects. A list of the quality measurements used by SL is found in the appendix.

In an earlier work on behalf of the Stockholm County Public Transport Authority (SL), Jansson (2002) and Eriksson and Jansson (2002) concluded that the quality incentives used by SL were too “toothless”. The amount of money for bonus and penalties were very small, implying that one could not expect the driving force in these incentives to be strong.

Another problem more of a matter of principles was that incentives were mainly related to arbitrarily chosen percentage figures. Bonus or penalty was paid if a quality parameter was over and under respectively a certain objective level. A certain bonus is paid if the accepted number of late departures operator is below 95 percent, another, higher, bonus is paid if the accepted number of late departures operator is below 96 percent etc. A certain bonus is paid if, according to interviews, 75 percent of the passengers are satisfied with the service, another, higher, bonus is paid if 80 percent of the passengers are satisfied with the service etc. Similar percentage rules are sometimes used also for penalties.

Of course such percentage rules may work in the right direction. But a problem is that such rules in many cases have no connection to the passengers’ valuations of quality (willingness to pay). The rules also ignore that it is not only the number of late departures that matters, but also *how late* they are.

In this context Jansson (2002) also discusses the trade-off between valuation and cost. The authority naturally wants to pay the operator the minimum amount for achieving a certain quality level, but two conditions are necessary for a quality improving measure to be undertaken from a welfare point of view:

1. The benefits to the passengers must exceed the cost for the operator,
2. The payment to the operator should not exceed the passengers valuation of (or willingness to pay for) the quality aspect

If condition 1) is satisfied the payment should ideally be just above the cost.

A problem is now that the authority hardly ever knows the cost for the operator to improve quality. This asymmetric information may, however, not be that serious. If bonuses and penalties for improving and worsening quality reflect the willingness to pay, then the operator will make a decision that increases welfare. If the cost for the operator for improvements exceeds the bonus, the improvement measure will not and shall not be undertaken. If the cost for the operator for improvements is below the bonus, the improvement measure will and should be undertaken. Another matter is that one cannot easily know whether a welfare optimum is reached.

So far most of the quality incentives used by SL are of the percentage style, without connection to valuations of the passengers. There is, however, one exception that is discussed in the section below.

### 2.3 Quality incentive with respect to punctuality

A large number of interviews with SL passengers indicate that lack of reliability in terms of departures and punctuality is the most serious problem.

On behalf of SL, Jansson (2004) carried out a work on improvements of incentives related to punctuality. First we describe briefly the recommendation by Jansson and then the new incentive scheme that was actually implemented by Stockholm County Public Transport Authority (SL) in a few areas in 2006.

#### 2.3.1 Recommendation

The same principle for bonus and penalty can in fact be used for:

- late departure,
- early departure,
- cancelled departure.

All of these deficiencies cause delay and may thus be called delay.

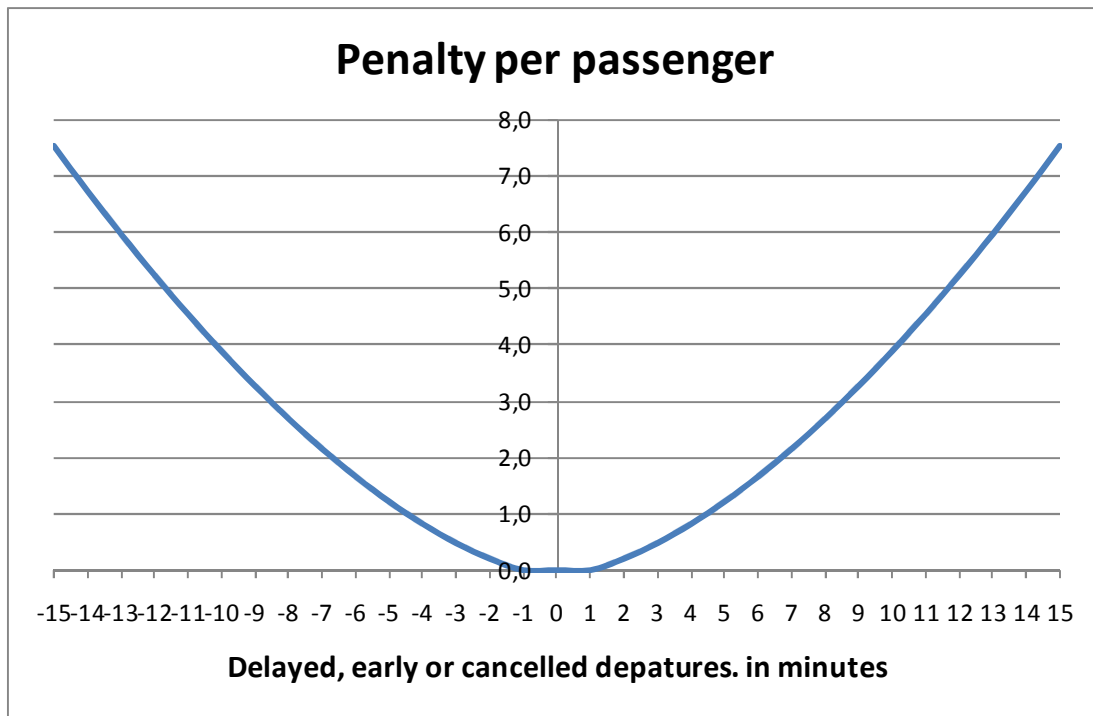
The recommendation is that the operator should be rewarded for improvement based on the passengers valuation of punctuality and if symmetrically penalised for degradation of punctuality.

The passengers perceive waiting time at stops as more uncomfortable than riding time. Waiting time when the bus is late is perceived as normal wait time at the stop. Too early departure means that the passenger has to wait the whole interval till next departure.

The value of delay time was also assumed to increase progressively with the delay time.

A delay smaller than one minute was assumed to cause so little nuisance that it should not give rise to penalty.

The diagram below illustrates the penalty in some monetary unit as a function of delayed, early or cancelled departures.



### 2.3.2 Implementation

Stockholm County Public Transport Authority (SL) applies a principle that is similar to the recommendation since 2006 for a few procured areas. SL thus relates the bonus and the penalty to the passengers' valuation of delay per minute. The difference is that they do not take into account a progressive cost but a linear one, which they thought was easier to understand for the operators.

SL acquires their information about delay minutes from their automatic traffic measurement system (ATR). This system measures the number of boarding passengers and the time at each stop for a sample of departures.

### 2.3.3 Penalty or bonus?

Here we discuss by use of a simple model whether penalty or bonus seems most appropriate for monetary incentives.

For simplicity we assume that both value and cost are quadratic functions of quality, so that marginal costs and marginal values are linear.

The value,  $V$ , as a function of quality  $q$ :

$$(1) \quad V = aq - bq^2$$

The cost,  $K$ , as a function of quality  $q$ :

$$(2) \quad K = cq + dq^2$$

The welfare function,  $W$ , is written as value minus cost:

$$(3) \quad W = aq - bq^2 - (cq + dq^2)$$

Optimal level of quality follows from the first-order condition:

$$(4) \quad \frac{dW}{dq} = a - c - 2q(d + b) = 0$$

$$(5) \quad q^{W*} = \frac{a - c}{2(d + b)}$$

### **Penalty**

The penalty shall equal the willingness to pay for not obtaining the preferred quality.

The penalty is thus the constant value  $V$  minus the valuations according to (1). The operator's cost is then this penalty plus the cost according to (2). The net cost,  $C$ , for the operator is:

$$(6) \quad C = V - (aq - bq^2) + cq + dq^2$$

The operator minimises the net cost according to the marginal condition:

$$(7) \quad MC = \frac{dC}{dq} = c - a + 2q(d + b) = 0$$

The optimal quality from the operator's point of view is then:

$$(8) \quad q^{\pi*} = \frac{a - c}{2(d + b)}$$

The operator's optimum is thus also welfare optimal. The reason is that the authority is assumed to know the true passenger valuations and the operator the true cost.

### **Bonus**

Assume now the authority applies bonus equal to the passengers' valuations. In this case the operator has to pay the authority in advance, say a lump sum  $A$ . The operator maximises profit,  $\pi^B$ , according to:

$$(9) \quad \pi^B = aq - bq^2 - (cq + dq^2) - A$$

The operator chooses optimal quality according to:

$$(10) \quad q^{\pi^B*} = \frac{a - c}{2(d + b)}$$

The chosen quality level is thus the same as for application of penalty. The difference is that with bonus the authority has to pay the bonus minus the lump sum  $A$ . Application of bonus is thus worse than application of penalty from financial point of view, and



which also gives rise to an excess burden through taxation. The conclusion is that penalty normally is preferable.

### **3 METHODOLOGY, MODELS AND DATA**

#### **3.1 Method and models**

As mentioned above the basic theoretical assumption in this paper is that the public transport authority maximizes welfare and that the operators maximise profits. Furthermore we assume that the operators' maximisation will imply that their costs increase with increases in the quality outcomes in terms of punctuality and performed departures. Costs are also assumed to increase with increased number of boarding passengers and precipitation.

Our hypothesis is that the introduction of incentives for improvements in punctuality and performed departures will lead to improvements as measured by SL's outcome measures.

We use a plain ordinary least squares regression technique to estimate the effects of incentives and to control for variables that may influence the outcome measures.

#### **3.2 Data**

Most of our data is monthly data in a first case from 2001 to 2006 (implying 72 observations) and in a second case from 2002 to 2008 (implying 84 observations). We have used the following data received from SL:

- The incentive is described by dummy variables, so that before the incentive is introduced the variable takes the value 0 and after it takes the value 1. This has the disadvantage that all other changes that may coincide with the period designated by a dummy variable will be caught by the dummy.
- Punctuality, measured either as the percentage of timely departures from or arrivals at bus stops.
- The number of cancelled departures.

As complementary, exogenous, explanatory variables we have used:

- The number of boarding passengers.
- The number of days in a month with more than 5 mm of precipitation in Stockholm.
- The average speed during one month, except bus stops, used as a proxy for congestion

The reasons for using these exogenous variables are the following. The passenger variable is used because more passengers boarding will, on average, also delay the service in question.

Similarly increased precipitation, will on average, decrease the timeliness of public transport, for buses all year round and for rail in wintertime (snow). The speed variable is used as a proxy for congestion reflecting the idea that more congested streets may lead to increased difficulties in producing timely departures for buses.

We have analysed possible relationships quality incentives – quality outcome for the following contract areas, but not in the same way for all of them:

- Commuter train services
- Bus services
  - Södertälje
  - Söderort
  - Järfälla

In some cases we have also used the following reasons for cancellations that the operator itself is obliged to report to the authority SL:

- Actions by the operator (OPERATOR)
- Actions by the Swedish National Rail Administration (Banverket, BV),
- Actions by the authority (AUTHORITY)
- Lack of staff (STAFF),
- Lack of vehicles (VEHICLES)
- Track problems (TRACK)
- Other factors (OTHER).

#### **4 QUANTITATIVE ANALYSIS**

This section presents the results from two groups of analyses. In the first group a first generation of incentives involving payments that were not necessarily connected to the willingness to pay for the improvements are analysed, and in the second group a later generation of incentives are analysed where the payments were designed to reflect more closely the willingness to pay for the improvements.

For the first group we have results both for commuter trains and bus transport. In the second group we have only results for bus transport. In both groups we first present the results for punctuality and then the results for cancelled departures

## **4.1 Results for incentives without regard for willingness to pay for commuter trains during 2001-2006**

### **4.1.1 Punctuality**

In this estimation the measure of punctuality outcome is regressed on the incentive dummy and the precipitation variable.

*Table 4.1: Commuter train punctuality*

	Coefficients	t-value
Constant	91,6	24,3
Incentive	-0,14	-2,23
Precipitation	0,41	1,54

In this equation the incentive reduces punctuality and an increased number of days with large amounts of precipitation increase it. Therefore both the coefficients for the incentive variable and the precipitation variable have the wrong sign.

### **4.1.2 Cancelled departures**

In this estimation the measure of cancelled departures caused by the operator is regressed on the incentive dummy and the precipitation variable.

*Table 4.2: Cancelled commuter train departures*

	Coefficients	t-value
Constant	140,3	3,41
Incentive	-0,20	-0,29
Precipitation	-7,82	-2,60

In this equation the incentive decreases the number of cancelled departures which is the right sign but the coefficient is statistically insignificant. Increased precipitation decreases cancellations which is the wrong sign.

## 4.2 Results for bus transport in two contracts with incentives without regard for willingness to pay during 2001-2006

### 4.2.1 Punctuality

#### *A Contract Södertälje*

Table 4.3: Punctuality in Södertälje

	Coefficients	t-value
Constant	87,7	8,89
Incentive	-2,99	-4,74
Passengers	-0,09	-2,23
Speed	0,35	1,38
Precipitation	-0,18	-2,34

In this model the incentive decreases punctuality which is the wrong sign, whereas the number of boarding passengers and precipitation both decrease punctuality which is the right signs. Increased speed which is considered as a proxy for less congestion also increases punctuality which is also the right sign. Both the coefficients for boarding passengers and precipitation are significantly different from naught but not the coefficient for speed.

#### *B Contract Söderort*

Table 4.4: Punctuality in Söderort

	Coefficients	t-value
Constant	108,7	20,5
Incentive	-2,62	-7,74
Precipitation	-0,03	-0,56
Passengers	-0,04	-2,47
Speed	-0,36	-2,23

In this equation the incentive and increased speed (less congestion) decrease punctuality. These coefficients are therefore clearly wrong. The other effects and coefficients are right. More days of large amounts of precipitation, and more boarding passengers are correlated with decreased punctuality.

#### 4.2.2 Cancelled departures

##### *A Contract Södertälje*

Table 4.5: Cancelled bus departures in Södertälje

	Coefficients	t-value
Constant	40,9	4,88
Incentive	-3,30	-0,13
Precipitation	0,51	0,23

In this equation the incentive decreases the number of cancelled departures which is the right sign. An increased number of days with large amounts of precipitation increases the number of cancellations which is also the right sign. Neither of the coefficients is statistically significantly different from naught.

##### *B Contract Söderort*

Table 4.6: Cancelled bus departures in Söderort

	Coefficients	t-value
Constant	291,90	5,80
Incentive	16,6	0,35
Precipitation	-18,9	-2,12

In the equation for Söderort the results from Södertälje are turned upside down. The incentive increases the number of cancelled departures which is the wrong sign. An increased number of days with large amounts of precipitation decreases the number of cancellations which is also the wrong sign.

#### 4.3 Results for bus transport in two contracts where willingness to pay compensation was introduced in 2006 with data from 2002-2008

##### *4.3.1 Punctuality*

##### *A Contract Södertälje*

Table 4.7: Punctuality in Södertälje with willingness to pay incentives

	Coefficients	t-value
Constant	77,5	27,7
Incentive	1,9	2,1
Passengers	-0,1	-1,5
Precipitation	-0,2	-1,1

In this equation the incentives increase punctuality. Furthermore more passengers and more days with much precipitation decrease punctuality. All these signs are right.

### **B Contract Järfälla**

*Table 4.8 Punctuality in Järfälla with willingness to pay incentives*

	Coefficients	t-value
Constant	78,9	24,3
Incentive	-5,24	-5,00
Passengers	-0,14	-1,65
Precipitation	-0,25	-1,03

In this equation the incentive reduces punctuality. This is the wrong sign. But both more passengers and more days with much precipitation decrease punctuality. These signs are right.

### **4.3.2 Cancelled departures**

#### **A Contract Södertälje**

*Table 4.9 Cancelled departures caused by the operator in Södertälje with willingness to pay incentives*

	Coefficients	t-value
Constant	101,4	3,16
Incentive	-14,9	-1,43
Passengers	-1,53	-1,92
Precipitation	-0,90	-0,47

In this equation the incentive decreases the number of cancelled departures which is the right sign. Both more passengers and increased precipitation decrease the number of cancelled departures which are the wrong signs.

#### **B Contract Järfälla**

*Table 4.10: Cancelled departures caused by the operator in Järfälla with willingness to pay incentives*

	Coefficients	t-value
Constant	-30,9	-0,81
Incentive	40,9	3,31
Passengers	1,56	1,56
Precipitation	2,28	0,80

In this equation the incentive increases the number of cancelled departures which is the wrong sign. Both more passengers and increased precipitation increase the number of cancelled departures which are the right signs.

#### 4.4 Summary and conclusion from the quantitative analyses

We are now in a position to summarize the quantitative analyses and to conclude. For the commuter trains the results are summarized in Table 4.11.

*Table 4.11: Results from quantitative analyses of incentives for commuter train operations*

Commuter trains		
2001-2006 Introduction of incentives		
	Punctuality	Cancelled departures
Caused by	All causes	The operator
Incentive	- (w) *	- (r)
Precipitation	+ (w)	- (w) *

In the tables + means a positive coefficient, - a negative coefficient, \* a coefficient which is significantly different from naught, (r) right sign, (w) wrong sign, n.a. an estimate has not been made and n.r. where an estimate would not be relevant.

We conclude the following:

- The introduction of an incentive for punctuality is not correlated with improved outcomes.
- The introduction for cancelled departures on the other hand is correlated with improved outcomes.
- More days with much precipitation are not correlated with less punctuality or more cancellations. This may possibly be due to that train transport is less sensitive to variations in precipitation than bus transport.

For bus transport the results are summarized in Table 4.12. Note that the results are estimated for two different contract reforms and for two different time periods. Note also that three of four incentives are correlated with the desired outcomes for the analyses of the reform analysed for the period 2001-2006. In 2006 the new willingness to pay based incentives were introduced. These appear to be correlated with the desired outcomes in Södertälje but obviously not in Järfälla. We have not been able to identify the grounds for this difference. Therefore we may not conclude that the new incentives work better than the old.

Table 4.12: Results from quantitative analyses of two incentive reforms for bus transport operation

Bus transport								
2001-2006 Introduction of incentives					2002-2008 Introduction of incentives based on willingness to pay			
	Punctuality		Cancelled departures		Punctuality		Cancelled departures	
	Södertälje	Söderort	Södertälje	Söderort	Södertälje	Järfälla	Södertälje	Järfälla
Caused by			The operator	The operator			The operator	The operator
Incentive	-(w) *	-(w) *	-(r)	+(w)	+(r) *	-(w)	-(r)	+(w) *
Passengers	-(r) *	-(r) *	n.a.	n.a.	-(r)	-(r)	-(w)	+(r)
Speed	+(r)	-(w) *	n.r.	n.r.	n.a.	n.a.	n.a.	n.a.
Precipitation	-(r) *	-(r)	+(r)	-(w)	-(r)	-(r)	-(w)	+(r)

In addition we conclude the following:

- The data on average speed during a month was costly to produce and did not provide an obvious improvement of the estimates. We therefore chose not to produce them for the later series.
- The precipitation data does yield the theoretically expected signs in most of the estimated equations.

We find that the effects of the introduction of incentives for punctuality and cancelled departures are unpredictable and in many cases not statistically significantly different from naught.

If the bonuses and penalties are less than the operators' costs for improving the quality outcomes we should expect that the introduction of these incentives has small effects on the outcomes. If at the same time some other factor which influences on punctuality or cancellations changes we should expect the results observed. If for example a shortage of drivers develops, this may make it costly for the operator to keep find substitutes for sick leaves and backup drivers. If these costs are not covered by bonuses or if they exceed penalties operators will be reluctant to keep up quality outcomes.



## **5 QUALITATIVE ANALYSIS**

The vague relationships between quality incentives and quality outcome may be interpreted so that the incentives have been too weak to motivate the operators to undertake improvement measures. This interpretation may be true to some extent, but inevitably there must also be other reasons for the vague relationships. In order to get some basis for a discussion on other reasons we have conducted interviews with representatives of both the authority SL and some of its operators. Here we discuss other possible reasons, which to some extent may also explain why we find only instable quantitative relationships between incentives and quality outcome.

### **5.1 Unclear responsibility and costs**

There are clearly exogenous factors that the operator cannot cope with, such as malfunctioning new buses, disturbances caused by passengers, extreme weather conditions, road congestion etc.

The contracts are not always clear on where the responsibility limits are for such exogenous factors. It may be that the operator has wrong perception of the actual costs when the bid is put in. If the costs turn out to be higher than expected and higher than the remedies to improve the quality, it is not possible to quantify statistical relationships between incentives and quality outcome. Such exogenous factors changing, also provides the operators with excuses for not delivering and for bargaining for adjustments in the contract conditions. This brings us to the next point which is.

### **5.2 Contract sliding**

There may be situations where the operators try to achieve more generous conditions than originally meant in contracts. One example is that the operator claims that the run times are too short. The authority may then extend the run times by modifying the timetable, which costs more. In such cases the operator gains twice. They are paid more for the production and they reduce the risk for being penalised. If this occurs it means that statistical relationships between incentive and quality outcome will be skewed.

### **5.3 Too high costs**

In interviews with operators some of them say that they have improved quality as much as possible. This may be interpreted so that the cost for further improvement is higher than the penalties they get if they do not improve. In this case one cannot find statistical relationships between incentives and quality outcome.

If now the penalties actually reflect the passengers' true willingness to pay for quality, then the operator's decision would also be welfare optimal. In this case it is correct not to find any statistical relationship between incentive and quality outcome.

## 5.4 Further problems and questions

Below we list a number of further problems and questions.

- Many incentives seem too complex and too much related to fulfilment of certain percentages. We were even given examples of cases when the operator staff obviously was conducting operations unaware of particular quality clauses.
- The number of incentives is large and varying and it is not always clear why a particular incentive or design of incentive has been chosen. The connection to the overall objectives and the relative importance of the different quality dimensions is not clear.
- The introduction of quality incentives and quality measurements by SL seems to have proceeded in a somewhat *ad hoc* fashion. There does not seem to have been any conscious plan to evaluate incentives.
- The money value of bonuses and penalties may be too low compared to the cost of actually implementing improving measures.
- Some incentives, mainly the new punctuality incentive, is calculated based on estimates of passengers willingness to pay for waiting and delay time, may need more time till it works satisfactorily.
- Can some of the quality problems depend on other actors than the operators, e.g., municipalities and the owner of infrastructure?
- Can responsibilities be more clearly defined?

## 5.5 Ideas on improvements

### 5.5.1 *Incentives for whom?*

Typically bonus or penalties accrues to the operator as a firm. But could it be wise that the operator distributes bonus to the operational staff that is closest to the passengers? The authority should not demand such distribution, it is a matter for the executives of the operator, but the matter could be discussed between the operator and the authority.

### 5.5.2 *Double bids*

Could it be worthwhile to discuss the possibility that operators have to give two bids?

- One should include a fixed payment without any monetary incentives, but the contract clearly says that control and sanctions will be implemented.
- The other should include a fixed payment with monetary incentives.

This would give the authority the opportunity to see how much the incentives affect the bids. The operator can then choose operator depending on own forecasts on incentive

payments, quality and the authorities revenues and its lower costs for handling of incentives.

The authority may also get some grasp of the operators' costs for a specific quality, which is of importance when incentive functions are specified.

### **5.5.3 Number of incentives**

There may be several reasons for applying fewer incentives:

- It is costly both for the authority and operator to manage the incentives.
- It may be costly for the operator to fully comprehend a large number of incentives, something that may raise the bid prices,
- Some quality factors may be valued less by the passengers than the cost of them,
- For certain quality factors it may suffice that the operators know that they will be supervised, and that the outcome may affect its good-will for the next tender.

Maybe the following incentives could be enough:

- Cancelled departures and punctuality. These incentives could be based on technical devices in the vehicles,
- Cleanliness of vehicles, staff behaviour and information. These incentives could be based on surveys on passenger satisfaction.

In addition the authority can use mystery shoppers, complaints by telephone or e-mail, development meetings with the operators etc.

## **6 CONCLUSIONS AND RECOMMENDATIONS**

### **6.1 Conclusions of analyses**

The quantitative analyses have shown that:

- There are vague and often non-significant relationships between on the one hand incentives for punctuality and cancellations and on the other quality outcomes,
- The evidence from the new willingness to pay based incentives in bus contracts is clearly mixed. The results indicate that optimal incentives may not always yield substantial quality improvements.
- There are probably positive effects of the incentives, but these are weak, and in addition, the incentives probably anyway have small effects compared to other factors.

The qualitative analyses indicate reasons for vague quantitative effects may be that:

- There are a number of factors beyond control of the operators, such as road congestion, weather and business cycles.
- Changes in these exogenous factors may provide the operators with incentives for bargaining for adjustments in the contract conditions.
- Such bargaining may in turn lead to agreements on changed contract conditions, eg., that run times increase, which gives the operators increased payment,
- The complicated incentive clauses may prevent operators from clearly seeing through the consequences when preparing their bids.
- The main explanation why the operators do not increase quality may be that it would cost too much. If, however, the penalties are based on the passengers' willingness to pay for quality, the decision by the operators will also be welfare optimal.

## **6.2 Preliminary recommendations**

- If incentives do not work as well as they are supposed to, one may have to consider the costs of administrating the incentives in relation to the effects of the incentives. A preliminary recommendation is that number of incentives should be fewer and the conditions less complex. This would save costs both for the authority and the operators.
- The new punctuality incentive based on willingness to pay that has been introduced in a few areas may be a way forward.
- One could consider two bids, one with incentives and one without,
- One may consider own in-house operation in a few areas in order to achieve knowledge on the relationships between costs and quality and maybe also achieve enhanced competition.

An open question is if we have ignored some important factors that would be possible to include in an analysis of this kind, and whether such factors have been discussed in other studies that we are not aware of.

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## **APPENDIX: DATA COLLECTED BY SL**

SL has several different datasets relevant for our purpose. SL has also by itself and by commissioning various consultants conducted a number of studies of quality in bus transport. Therefore data is scattered in several sources. For this project we have also hired the consultant ÅF-Infraplan for collection and generation of input data. The type of measured quality data that SL collects is presented below.

### ***A.1 Cancelled departures***

The operator in charge of a particular bus line records cancellations. For each cancellation the operator pays a fine. If SL detects that an operator fails to report a cancelled departure and SL the fine charged is significantly higher.

### ***A.2 Quality monitoring***

Since 2003 SL procures a consultant firm to monitor a set of quality dimensions by so called “mystery shoppers” who travel in the bus system and record the following dimensions.

- cleanliness of the vehicles,
- presence of litter,
- presence of graffiti,
- cleanliness of bus stops,
- graffiti at bus stops,
- the service attitude of personnel,
- if the bus driver calls out bus stop names

### ***A.3 Passenger complaints***

Passengers can complain by telephone or e-mail. The complaints are categorized as follows

- the state of a bus stop or terminal,
- the state of the vehicle,
- the conduct of personnel,
- the quality of traffic in terms of for example cancelled or delayed trips.

#### ***A.4 Technical punctuality***

For this quality dimension automatic equipment is mounted on the vehicles. This equipment is circulated systematically among vehicles and different lines during a year. The equipment registers deviations in arrival and departure times compared to schedule as well as if the bus arrives at the terminal stop before departure time, as it should.

#### ***A.5 Interviews with passengers***

A total of 20 000 passenger interviews are conducted during spring and autumn each year. Passengers rate the services in the following dimensions:

- punctuality,
- conduct of personnel,
- driving performance,
- cleanliness of vehicle
- cleanliness of bus stop
- quality of information about delays and cancellations