Outcomes from new contracts with “strong” incentives for increasing patronage in bus transport in Stockholm

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ABSTRACT
The Swedish Public Transport Association (SPTA) has taken initiatives to develop contract recommendations on incentives for increased patronage in tendered contracts. There is, however, currently a small evidence-base for recommendations for how public transport contracts should be designed to provide incentives to achieve the policy goals of the Regional Public Transport Authorities (RPTA). A review of public contracts from the government agency Transport analysis (2015) indicates that the use of patronage incentives so far is modest. The purpose of this study is to take first steps towards creating such a knowledge base by collecting and analyzing the performance in four bus contracts in Stockholm county spanning seven years. The study focuses on a new kind of contract called E20 where 100 percent of the payments to operators are tied to the number of boarding and paying passengers. The study compares the development of the E20-contract areas (formerly independent contracts) with the outcomes in same contract areas before and with two comparison areas covered by gross cost contracts.

The stated goals for the E20 contracts are to increase patronage and customer satisfaction as well as to increase efficiency. With the use of available monthly outcome data, the outcomes in the E20 areas (three years) are compared with the period before (four years) and to how the comparison contracts using gross cost contracts have developed:

- In two of the E20 contract areas (Sollentuna and Norrort) the operator tried to significantly increase the supply, without this leading to substantial increases in boardings. Thereafter, the supply was reduced to a level slightly above the level before the E20 contract started. In the other two E20-contract areas, supply has increased gradually but little.
- In two other E20 contract areas (Bromma and Norrort) the share of canceled departures decreased, while they increased in (Sollentuna, Solna/Sundbyberg). These effects are small.
- Cancelled departures have decreased more in E20 areas than in the comparison areas.
- Punctuality has changed little in the E20 contract areas.
- Perceived quality deteriorates initially but improved steadily to roughly recover to previous levels.
- Costs have declined in two contract areas (Bromma and Sollentuna) but increased in two other (Solna/Sundbyberg and Norrort). On average, they increase slightly, but less

1 This paper is a condensed version of a report in Swedish.
than in the comparison contracts.

Compared to the gross cost contracts in comparison areas, the operator of the E20 contracts performed better regarding in the dimensions of Costs, Customer satisfaction (initially worse but then better), Punctuality, Cancelled departures
..but inferior in Supply of number of departures
... and not better regarding the number of boarding passengers.

Note that this describes the outcome with available data, in this specific case during this specific period. This single observation does not provide sufficient basis for generalization to other contracts or continuing events of the same contract. Neither does it exclude that a similar course of events could occur later or in other contracts.

1 Introduction

Since the beginning of the 1990s when tendering for public transport procurement commenced, gross cost contracts (a fixed payment for running a timetable) have dominated. Such contracts mean that the regional public transport authority (RPTA) plans the traffic, keeps ticket income and pays the operator. Often there are elements of bonuses and fines. However, the payments for these usually constitute a small part of the contract payments. Already in the 1990s, RPTA's tried various forms of incentive contracts in order to incentivize increased patronage. In recent years, the proportion of such incentive contracts has increased. According to Hultén (2015), Sweden uses three types of incentive contracts: (1) Gross cost contracts with some quality incentives, (2) Gross cost contract augmented with a minor proportion per boarding passenger and (3) 100 per cent payment in the form of an incentive per boarding passenger (p.19). The E20 contracts are examples of the latter and were the Stockholm County Council's first contracts where the payments are based entirely on the number of passengers with valid tickets boarding.

The level of incentives and what the incentives are expected to affect vary between the contracts. According to the Transport analysis (Trafikanalys, 2015) contract database for 2013, 52 percent of all regional public transport authorities’ bus service contracts had no incentive at all. An additional 10 percent had only incentives that did not involve travel, for example for customer satisfaction or punctuality. Contracts with less than 25 percent travel incentives accounted for 26 percent of the total number of contracts while 12 percent of the contracts had travel incentives with more than 25 percent of contract payments.

It is not clear that there is a strong link between the goals the public transport authorities want to achieve and how the design the incentive contract is chosen. Transport analysis (2015) state that Swedish public transport issued guidelines which recommended that the variable part of the payment (incentive part) should consist of compensation per registered passenger of at least 25 percent of the total compensation. It was agreed that this proportion of incentives was necessary to have a real impact on increasing travel (Trafikanalys, 2015, p.33). Apart from these recommendations, we do not know any further examples of recommendations or analyzes that underlie the contractual structure.

The purpose of this study is to compare the outcomes after the start of the E20 contract in its four contract areas with the outcome before, and the outcome before and after in two comparison contracts, the E13 contracts: Södertälje and Järfälla Upplands-Bro. This comparison is made using data from 2009 to 2015. The E20 contract areas Bromma (Stockholm Västerort), Solna/Sundbyberg and Sollentuna started on August 20 in 2012, and
the contract area Norrort (Täby, Åkersberga and Vaxholm) started January the 7th 2013. The contract covers both bus and rail traffic, but this project only analyzes bus traffic.

The E20 contracts set the following goals: "The overall goal of the contract is to increase the number of passengers and increase public transport's market share in the contract area, drive and develop bus and rail traffic that provides more and more satisfied passengers, plan traffic to make it more efficient. In addition, the traffic operator must ensure the fulfillment of the Stockholm region RPTA requirements regarding traffic safety, that the traffic is performed without interruptions and disturbances, make sure that revenues are generated, and manage and maintain SL's property and infrastructure to ensure that the value and status are maintained during the contract period." (Stockholm region RPTA SLL, 2014a). In addition to the payment to that the E20 contract operator is payed per by boarding passenger with valid ticket, incentives are linked to quality in terms of fines. Fines are paid for:

- Cancelled departures (a sum for each departure that constitutes a "Cancelled departures")
- If the proportion of punctual departures is less than 91 per cent in the first part or 92 per cent in the second part an additional fine is paid on for each additional percentage of failure in punctuality.
- If the Customer Satisfaction Index (CSI) level is less than 65 percent in both parts of the contract (63 percent in the first 24 months in the first part), an additional fine for each additional percentage unit in THE CSI.

In addition to these fines, further fines may be levied for shortcomings in according to the Stockholm region travel guarantee, vehicle-related shortcomings and other quality requirements which are not considered in this study.

In the comparative areas, Södertälje and Järfälla Upplands-Bro, gross cost contracts apply where the operator receives a basic compensation based on a certain number of supply kilometers per year. If the RPTA orders (or cancels) traffic, this increases (decreases) the compensation according to a price per supply kilometer and hour. It is also predetermined what compensation the operator will receive if it needs to acquire new buses.

However, there are elements of incentives also for the comparison areas. Limit levels are set for punctuality (delay minutes / boarding passengers), performed traffic (delay minutes / boarding passengers for missed departures), vehicle condition and securing of revenue (ticket control). If the operator reaches a better level than the limit, bonus will be awarded, and if a lower level, the fine is demanded.

2 Data

For this study data from the Stockholm region RPTA were received. The variables used in the study are the number of departures, punctuality, the number of completed and canceled departures, an index for customer satisfaction, the contract payments and an estimate of the number of boarding passengers on weekdays based on a sample of boarding counts. The observations are monthly and refer to a total of six contract areas for seven years. There are thus 504 observations of contract outcomes.

For the number of boarding passengers there are data for weekdays. We asked for the total number of boarding passengers, the number of boarding per route and frequencies, new route outlines, vehicle requirements and which vehicle classes are actually used, but such data was not available. There are some notations on route changes and there have been few such changes of significance during the contract period. Changes in supply have mainly taken place in terms of changing frequency. Both change of route outlines and speed are briefly described in the Traffic Committee’s (Trafiknämnden) reports on traffic changes. However, we do not have any information about any changes that occur during the year.
The supply data is in the form of number of departures. The main categories can be divided into scheduled traffic and cancellations. Actual traffic is calculated by subtracting removing the canceled departures from planned departures.

For demand (Table 1), the data used is the number of boardings on weekdays. Such data are available on a monthly basis throughout the period studied. This data is measured by means of automatic passenger counts (ATR) which is a measure of the number of boarding on a sample (tenth) of the departures. Data are processed by a consultancy firm and delivered to the RPTA. The figures are given in thousands and are thus estimates. When the E20 contracts started, the intention was to base the compensation to the operator on actual verifications by each passenger verifying the Access Card on the bus. The system, however, had some teething problems, which is why ATR data are used.

It is somewhat problematic for the analysis that we only have work day daily travel and not the total number of passengers per month as the compensation is based on the total number of boardings. With total boardings a comparison could have been made between total boardings and the billed amount. For the E20 contract areas there are thus number of boardings per month; for the first part available from August 2012 and for the second part available from January 2013. We have no information about how these have been estimated from the ATR numbers. For the E13 bus areas, this variable is not available.

Table 1 Data on demand. All data is per bus area.

<table>
<thead>
<tr>
<th>Boardings</th>
<th>Key ratios that provide a monthly average for the number of boarding per day, is measured by ATR. Available for the entire period studied.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boardings average per weekday</td>
<td>Monthly averages for the number of boardings per workday, are measured by validations provided by the validation system. Available for the period September 2014-December 2015.</td>
</tr>
<tr>
<td>Boardings average per month</td>
<td>Estimated total number of passengers per month.</td>
</tr>
</tbody>
</table>

To measure quality, we have access to data on the timeliness, cancelled departures and the Customer Satisfaction Index (CSI) presented in Table 2. For punctuality, we have the percentage of timely departures and arrivals. For cancelled departures, these data are available as mentioned above. Customer satisfaction comes from the Quality Survey conducted on board the vehicles to approximately 5,000 people each month. For the CSI, we have three variables: overall satisfaction, driving style and driver behavior. Passengers have answered questions as to how satisfied they are (Are you dissatisfied, neither dissatisfied nor satisfied or satisfied) regarding the three categories. We have chosen to focus on the proportion of satisfied passengers.
Table 2 Quality data. All data is per bus area.

<table>
<thead>
<tr>
<th>Punctuality</th>
<th>Departures on time</th>
<th>Percentage of punctual departures. Punctual departure is defined as a departure within the interval of 1 minute to +3 minutes compared with the timetable.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arrivals on time</td>
<td></td>
<td>Percentage of punctual arrivals. Punctual arrival is defined as an arrival within the interval of 1 minute to +3 minutes compared with the timetable.</td>
</tr>
<tr>
<td>Customer Satisfaction Index</td>
<td>Summary ratings</td>
<td>The proportion of passengers who indicate that they are overall satisfied with the trip.</td>
</tr>
<tr>
<td>Rating driving style</td>
<td></td>
<td>The proportion of passengers who are satisfied with the driving style.</td>
</tr>
<tr>
<td>Rating response</td>
<td></td>
<td>The proportion of passengers who are satisfied with the response.</td>
</tr>
</tbody>
</table>

In addition to supply, demand and quality data, we also have access to the RPTA’s contractual payments. These are made on a monthly basis and should, according to the principle of paying per passenger with a valid ticket, follow the number of boarding passengers. It should be mentioned that this is not the case, due to the fact that the monthly invoicing is based on a forecasted number of passengers with valid tickets. This amount is later adjusted according to the outcome of the number of boardings. Thus, there is a lag in the billing. Other variations may occur as contract payments and may also be influenced by fines, which are regulated monthly.

Finally, we want to make a qualification about the reliability of the data regarding Solna/Sundbyberg and Sollentuna. According to information provided by officials at the Stockholm region RPTA at our first presentation, it is not certain that all departures reported to Solna/Sundbyberg and Sollentuna pertain to these areas. Departures may sometimes have been attributed to a false contract because both contract areas are based at the same depot (Lunda).

3 Theory and method

A point of reference for the assessment of developments may be the supply of services at a certain time, such as the supply of routes, departures, prices, passengers, etc. Another point of reference could be an estimated potential for socially optimal supply given social costs, for increasing passengers and community benefit. The latter approach requires information on bus traffic's potential to attract new passengers through improvements in supply as well as the value of the improvements that can be achieved through, for example, frequencies or short-term travel times (for example, public transport lanes and signal prioritization).

However, the latter approach would require some operationalization of optimality. For this purpose, we define three kinds of optimality with increasing ambitions to cover different consequences.

In Pyddoke and Wretstrand (2016) research on social optimization of urban and public transport is surveyed. These papers analyze the optimization of instruments for handling city traffic, road congestion and public transport. If a socially optimal supply (routes, frequencies, prices, passengers) can be calculated, the optimal supply could be approached by optimal incentive contracts. An optimal incentive contract could be defined as an contract that generates prices and travel as close to any of the optima as defined above under the restriction that the operator chooses that which is a profit maximizing supply. This means that
the contract should be such that the operator chooses the welfare-optimizing offer as a profit-maximizing offer.

Without defining what the goal is and what optimality is, it is not possible, from a welfare economic perspective, to comment on the direction in which the number of boardings, etc., should develop. Initially, the number of boardings can be both too large or too small. However, it is important to remember that traffic in urban areas is associated with welfare gains that are not realized if the operator strives to cover costs with revenue. Too much focus on ticket revenue is therefore likely to lead to too below socially optimal supply.

Previous studies of incentives (Bekken and Norheim, 2006; Pyddoke and Andersson, 2010) indicate that the socially optimal payments per boarding passengers may have to be at least exceed the double of the ticket price to give the operator incentives to increase supply. However, at the time of writing this paper, there are no recent calculations of incentives to achieve optimal public transport.

Another type of result can say something about the form of incentives. In Nilsson et al. (2016), a theoretical incentive is studied to give an operator incentives to maximize the social welfare. This incentive weights the benefits from ticket revenues, the number of trips and the benefits of higher frequencies in terms of less waiting time. This means that a subsidy is linked to both the number of boradings and the number of departures or bus kilometers.

The present follow-up study is thus done without knowledge of whether an optimal supply would mean an increase or decrease in supply or a change in tariffs. Instead, we have chosen to use the stated objectives of the E20 contract and for Stockholm’s ”Traffic supply program” (Trafikförsörjningsprogram) in 2012 (Trafiknämnden, 2012) as the political goal. The contract points to the goals of increased travel, increasing the proportion of satisfied passengers and increased efficiency. In the Traffic supply program, the target image is more composite, but all the above purposes are included.

We have therefore chosen to follow up the results in mainly the dimensions of the boarding passengers, quality in terms of few canceled trips, high percentage of punctual trips as well as perceived quality and costs. There are two main questions for this follow-up.

- How are the outcomes in the E20 areas evolving compared with the period before?
- How are the outcomes in the E20 areas evolving compared to the comparison areas?

We do not decide if it the observed changes improve on social welfare or not and we only lock to if the contract generates increased travel, better quality or lower costs (a first step towards calculating cost per trip or production efficiency, not to be confused with socio-economic efficiency).

4 Supply
4.1 Number of departures
4.1.1 Before and after

The development of the number of departures differs between the areas. In some contract areas, like Bromma no dramatic changes to the monthly average for the number of departures are observed after the E20 contract starts. The number of departures increases slightly during the first two years after the start of the contract and then decreases somewhat year three. In another area, Sollentuna, a more dramatic change occurs. Here, the monthly average of the number of departures increased by 92 percent between the year before and the year after the contract started. However, this big increase diminished during the two following years and returned to previous levels.

In one of the comparison areas, Södertälje, the increases in supply has been quite even over the years, except for 2012, which has a higher monthly average than any other year (the
temporary increase was due to bus replacing commuter trains starting in the autumn term of 2011 and continuing through 2012). Järfälla Upplands-Bro has a similar development.

4.1.2 E20 contracts compared to comparison areas

Comparing the E20 and the comparison contracts through average increases in departures would be misleading as this would not capture developments that have taken place during the three years. One can assume that it will take a few years before the entrepreneur learns the market and consequently to adjust its supply to demand by either increasing or decreasing the number of departures and routes depending on the response of passengers. We therefore compare the percentage change between 2011 and 2015 in the whole E20 area to the same change in both E13 areas. What we can see is that the number of departures has increased by 0.3 percent to 2015 compared with 2011 in the E20 area, while the same increase in the E13 area is 16.5 per cent.

4.2 Redistribution of departures

To get an idea of route changes and changes in frequency, we have read Stockholm region RPTA’s documentation on traffic change 2012/2013, 2013/2014, 2014/2015 and 2015/2016 (Traffic Management, 2012; 2013; 2014b; 2015). The information is relatively well in line with the changes in supply. Traffic year 2012/2013 is characterized by increased frequencies, no major changes during the 2013/2014 traffic year and then reduced frequencies the traffic year 2014/2015. For Norrort there is no information on traffic change 2012/2013, when "Discussions between SL and Arriva take place regarding change of supply to be implemented at the start of the contract" (Stockholm region RPTA 2012, p.78).

There are some route changes, mainly extensions or shortenings of routes, as well as adaptation to new residential areas, workplaces or commercial areas (eg, Friends Arena). Construction sites are also a reason for temporary redeployment. Our assessment is that the changes in route outline are insufficient to affect demand at the aggregated level.

5 Cancelled departures

The number of cancelled departures also vary among the E20 areas, even though the differences are small.

![Figure 1](https://example.com/figure1.png)

Figure 1 The change in the number of canceled departures for the E20 and E13 areas, expressed in percentage points, in 2015 compared with 2011.
For E20 contracts there is a greater reduction in the number of cancellations noted than for the comparison contracts (Figure 1). The change is from 0.7 percent to 0.1 percent. For the E13 contracts, the outcome changes from 0.4 percent to 0.2 percent.

6 Punctuality
Punctuality, or timeliness, is measured using the computers in the buses that record departures and arrivals. The small change in averages in the E20-areas (Figure 2), with a small reduction of punctual departures and a small increase of punctual arrivals. Bromma is the only contract area where punctuality improved in both departures and arrivals, while punctuality in Solna/Sundbyberg and Norrort deteriorated.

Figure 2 Punctuality of departures and arrivals for all E20, before and after the start of the contract.

The mean changes in proportion punctual departures (Figure 3) or punctual arrivals (Figure 4) between 2011 and 2015 is an increase in E20 zones while punctuality decreases in the area E13. It is difficult to draw any general conclusions regarding punctuality in the E20 areas. If anything, it has stabilized, that is that the variation in punctuality decreased. However, for the E13 area, it appears that there has been a deterioration over the last couple of years.
Figure 3 The percentage change of punctual departures for the E20 and E13 areas, in 2015 compared to 2011.

Figure 4 The percentage change of punctual arrivals for the E20 and E13 areas, in 2015 compared with 2011.

7 Experienced quality

Experienced quality is measured via surveys to passengers aboard every month. The figures below show the share of satisfied customers as a percentage. The development in E20 contract areas deteriorates on average when comparing the years before and the years after the start of the contract. This is largely due to the low grades at the beginning of the contract period. As seen in Figure 5 the perceived quality recovers at the end of the period and in the fall of 2015, the percentage of satisfied customers even rises above any number during the period before the contract start.

Figure 5 Solna/Sundbyberg. Customer Satisfaction Index (CSI) per term. The figure shows the proportion of respondents who answered "satisfied".
In a comparison of the CSI “overall grades” between 2011 and 2015 for both the E13- and the E20-areas the CSI the results for E13 increases more, by 5.6 percent than the E20’s 2.8 percent. This is most influenced by a large improvement in Södertälje.

![Change in overall satisfaction](image)

*Figure 6 The percentage change in the proportion of customers who have stated “satisfied” as aggregating grades for the E20 and E13 areas, in 2015 compared with 2011.*

8 The number of boarding passengers

The supply increases more in the E13- than in the E20 areas and the difference is relatively large. What has happened to the demand, ie the number of boarding? On average, the total number of boardings increased during the contract period by 6 percent in the E20 areas compared with the period before. In the comparison areas, the number of boardings during the contract period increased by 4 percent.

However, the variation between the E20 areas and over time in the areas is high. The number of passengers boarding increase in all areas, except in Sollentuna where the number of passengers boarding decreases slightly. Bromma has the largest increase; the mean value increased by 10.5 percent. The corresponding figure for Södertälje is 2 percent.

Counting the average for the E20 area, the number of boardings per day increased by almost 3000 period after compared to before (Figure 7), i.e. 6.3 percent. The corresponding change for the E13 is 4.2 percent.
Figure 7 The entire E20 area. The average number of work day boardings increases for four years before and three years after the start of the contract.

Above we showed the difference in mean before and after the start of the contract. Comparing the number of passengers in 2011 to 2015, the difference is larger for E13 than for E20, 5.4 percent and 4.8 percent respectively. The reason that these changes differ from above are that in all E20 bus areas, the number of boardings between 2014 and 2015 decreases. In Järfälla Upplands-Bro and Södertälje, travel continues to increase between 2014 and 2015.

9 Contract expenditures

For the four areas E20 costs have decreased in Bromma and Sollentuna, but increased in Solna/Sundbyberg and Norrort. The largest change occurred in Sollentuna, where the costs for the RPTA were almost halved. For E13 areas, costs have increased about 17-19 percent.

The contract expenditures increased between 2011 and 2015 with a total of 0.7 percent in the E20 areas, while it increased by 15.9 percent in the E13 area (Figure 8). E20 contracts seem to have held back the Stockholm region RPTA costs.
10 Concluding observations and explanations

10.1 Summary of findings

If the incentive is large enough to cover the cost of expanded traffic and if demand is sufficiently sensitive to supply increases the E20 contracts may lead to increased supply and thus an increase in demand. The contracts can also be expected to lead to a reallocation of both supply and demand, by moving capacity from routes with low demand to routes with higher demand. If the number of passengers increases, so does the costs for the RPTA.

Overall, the number of departures, calculated as an average number of departures during the entire contract period, increased by 16 percent in E20 areas. The variation between E20-areas and over time in the contract areas, however, is large. In the comparison areas the departures, on average, increased by 15 percent.

If we compare the number of departures only during 2015 to 2011 (as the number of departures fell sharply in the period just before the new contracts became effective and the number of departures decreased between 2014 and 2015 in E20 areas), we get a different picture. Then frequencies only increase slightly in the E20 areas while they increase in the comparison areas with 16 percent. In 2015 the incentives do not seem to have been strong enough to sustainably stimulate a larger supply increase than would come about with the gross cost contracts.

The documentation we received from the Stockholm region RPTA indicates only small reallocation of departures occurs.

If demand is sufficiently sensitive with respect to the quality and the costs for increasing the quality are low, the incentives "should" lead to higher quality. The results suggest that the incentives, on average, have a small but positive effect on punctuality and cancellations, and over time, a positive effect on perceived quality. During the three years with the E20 contract the perceived quality increases and in the last year it is on level with or even above previous levels. The effects are small. Effects on punctuality are also small. Our overall assessment is that the quality development is positively affected by the E20 contracts. One explanation may be that some measures to achieve improved quality have low costs and are therefore carried out in the hope that they can affect travel positively.
Overall, the number of passengers increased during the contract period by 6 percent in the E20 areas compared with the previous period. The variation between the E20 areas and over time in the contract areas, however, is large. In the comparison areas the number of boardings during the contract period calculated in the same way increased by 4 percent.

If we compare the number of passengers only in 2015 in 2011, the picture is different. The E20 areas, the number of boardings increased by 4 percent, while it increased by 5 percent in the comparison areas.

Compared with the comparison areas cost increases in the sense of the client's contract spending are on average less in E20 areas. However, we know nothing about the operator's costs, and we therefore do not know if the incentives are sufficient to cover costs at the margin to produce more boardings.

The stated objectives are to increase travel and customer satisfaction and increase efficiency. With the use of the chosen indicators the E20 contracts performed better than the comparison area gross cost contracts regarding

- Costs
- Customer satisfaction, but Initially worse
- Canceled departures
- Punctuality

...but worse in

- Departures

... and not better regarding

- Boardings

This comparison is not necessarily representative of the gross cost or incentive contracts in general, but concerns the compared contracts. The E20 contracts are not better at increasing the number of passengers boarding than the comparison contracts. A troublesome observation may be that the number of boardings decrease in several contract areas in 2015. It seems as if the strength of the incentives in the E20 contract to increase demand are weaker than those that arise in the management of gross cost contracts. However, this is only a problem if the goal of the RPTA really is to increase travel. If e.g. supply and travel in these areas, are oversized in the starting position, it is not a problem. In this case, it is difficult to understand why a contract with the declared aim to increase travel is needed.

The increase in demand can be compared what the population increase would have generated using a Swedish average elasticity of demand with respect to population growth for Swedish cities. This is 0.5, which means that an increase in population in cities at 10 percent everything else being equal, on average, would lead to an increase in the number of boardings on buses by 5 percent. The corresponding elasticity of demand with respect to supply is 0.7 and with respect to the price -0.4 (in Nilsson et al. 2013).

Overall, the population increased during the period (2009-2015) in all areas by about 11 percent. It "should" lead to a trend increase of boardings by about 6 percent. The average increase of boardings in the E20 areas was about 12 per cent. But between 2011 and 2015, the change in the number of passengers boarding was 5 percent.

During the periods when the number of departures increases, the number of boardings "should" increase if demand is sensitive to the supply increases. Balcombe et al. (2004) gives an average short-term demand elasticity with respect to bus supply at 0.38 (page 73). They also refer to Dargay and Hanly (1999) and Preston (1998), who find wide variations in estimated elasticities. The latter state that the elasticity is often higher in off-peak than in peak traffic, which often coincides with the longer the time interval between departures than
in the peak hours. If the frequency in the starting mode is 10 minutes or less, this will lead to an improvement effects less than if the frequency is 20 minutes. Balcombe et al. (2004) also references studies showing that demand responds with a lag, which means that we do not know exactly how long the operator (or RPTA) should wait to be sure that the adjustment should have time to take place.

To the extent that the contract leads to an increased number of boarding passengers, this would also lead to increased costs. Overall, the Stockholm region RPTA contract expenses for E20 increases by 5 percent compared to the previous period. Given an increase in the number of boardings by 6 percent this seems reasonable. This proportionality is, however not present for all the individual contracts. In the comparison contracts costs increase by 18 percent. According to the contract officers in the Stockholm region RPTA part of this cost increase could be explained by the fact that the Stockholm region RPTA ordered more traffic. This difference in cost increases raises several questions. One question is whether the E20-operator really breaks even? If not, are the incentives strong enough to maintain a service compatible with the goals of the Traffic supply program?

10.2 Possible explanations

A first question is whether the incentive payments may are too low to generate supply and thus the demand. As the E20-contracts was a new type of contract, it may have tempted bidders to speculate on the potential to attract new passengers and on the costs of doing so. If the winning bidder was the provider of the most "optimistic" tender, there is thus the possibility that the firm submitting the winning tender underestimated costs and overestimated its future income. If so, this would explain the reduction in costs.

It is also interesting to compare the magnitude of the incentives with optimal incentives calculated in previous studies (eg Bekken and Norheim, 2006; Pyddoke and Andersson, 2010). In these studies - albeit for other areas - we find that the optimal incentives in the order of twice the ticket revenue per passenger. This estimate can only be interpreted as a rough indication. New estimates of with for example the Urbanet Analyse method (such as in Norheim and Kjerstad, 2009) can provide both higher and lower values. In Stockholm, it could possibly correspond to an incentive equivalent to around the average cost of a traveler.

It may be noted that the first tenders of bus services in the early 1990s led to substantial cost reductions, but that these cost reductions were later followed by large cost increases. It is of course difficult say something about what the counterfactual development could have been without a good model. A likely scenario is that continued in house operation of the services would also have led to cost increases. General cost increases for wages, vehicles, fuels and depots should affect all operators equally.

One possible explanation for the moderate increase in the supply and number of boarding passengers may be that the incentive became too low. The incentive in the second part of the contract (Norrott) is higher than in the first part E20 areas. The reason is that it is based on a longer average travel length in the second part than in the first part. The outcome of Norrott does not differ clearly from other areas.

A second question is about the freedom of the operator to change the route network. What freedom does the operator have, for example, to implement measures to speed up traffic by public transport lanes, signal priority, new stops or fewer stops. All these decisions are owned by the municipality. The operator can under the contract reallocate capacity between the routes by reducing the frequency of one and by increasing it in another. The samples of analyses we have made of schedules indicate only small changes in the timetables. No quantitative analysis has been made of the schedule changes. Insofar as the old schedules stored by the Samtrafiken (an agency responsible for national timetabling) such analysis could be made based on these schedules.
A third question is whether the contracts inadvertently led to the later desired deceleration of the cost.

A fourth issue is whether it is good or bad that the costs of the E20 contracts increase slower than the costs for gross cost contracts. If the slower growth was due to increased efficiency, it is good, but if it is caused by slower expansion of supply than desired by the RPTA, then it is not good.

References


