The Stockholm Trial report

IEA DSM TASK 24 Subtask 2 report – SWEDEN

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Image 1. Credit: Holger Ellgaard

1. Introduction to this study

This document presents the general observations and lessons learnt from the empirical analysis of the Swedish project Stockholm congestion taxes. This case study is part of Subtask 2 (Case Studies) of Task 24: Closing the Loop – Behaviour Change in DSM: From Theory to Practice[1].

2. A short introduction to the Stockholm trial

The Swedish Stockholm Congestion Taxes Trial was a project for congestion pricing system performed in Stockholm between January 3rd and July 31st, 2006. The main partners in the project were the City Council of Stockholm, the Swedish Road Administration and the Stockholm Public Transport (SL). The project was financed by the Swedish Government. The Swedish Secretariat for Environmental Tax was responsible for project management, execution and evaluation. The City Council of Stockholm was responsible for public information, evaluation and coordination with other actors. The Swedish Road Administration was responsible for building and running the technical system for congestion charging and to inform about payment methods. The Stockholm Public Transport was to expand public transport during the trial and to build new parking areas in the surrounding municipalities.

The system was implemented as a tax levied on most vehicles entering and exiting central Stockholm, Sweden. The trial also involved, apart from the taxing, new parking areas ("park-and-ride") within walking distance to public transportations, and also an enhanced public transportation (bus lines etc.). The primary purpose of the congestion tax was to reduce traffic congestion and improve the environmental situation in central Stockholm. The funds collected were to be used for new road constructions in and around Stockholm. The budget for the project was 3.8 billion Swedish crowns to cover the costs of technical systems, expanded public transport, new bus stations, parking lots et cetera.

Information about the project can be found at http://www.stockholmsforsoket.se including reports about the trial and information documents. The project did also result in a book called Stockholmsförsöket – en osannolik historia (Swedish only).

Goals, behaviors and problems addressed

The purpose with the trial for congestion charges in Stockholm was to evaluate whether environmental taxes/congestion charges and expanded public transport can contribute to a more effective traffic system and an improved environment. The main goals with this project were to reduce the amount of cars, improve accessibility and to improve environmental aspects.

[1] http://www.ieadsm.org/ViewTask.aspx?ID=16&Task=24&Sort=0

The population of Stockholm County is growing at a rate of some 20 000 people a year, which inevitably means more traffic, and an even greater burden on city streets and roads. It also means a lower standard of access and mobility if no new roads are built. During rush hour the Stockholm traffic system comes close to reaching its maximum capacity. The traffic situation in Stockholm was strained, with a lot of cars during rush hours going in and out of the city. The traffic situation also caused environmental problems in the form of more noise and emissions. In many sites in Stockholm, the regulations of air quality and pollution limits were exceeded. The congestions also cost time and money for the inhabitants.

According to the Kyoto protocol, in 2020, emissions should be reduced by 20%. Stockholm is the capital and the largest city of Sweden, and the air pollution due to traffic is the largest environmental problem in Stockholm.

The target for the trial and its evaluation was to act as a basis for:

- The referendum about a congestion pricing system/ Environmental tax in 2006,
- Development and improvement of the tax system,
- Research about environmental tax systems.

The target of the actual system was that the policy would lead to less traffic within the city of Stockholm. The measureable goal was to:

- Reduce traffic to and from the city by 10 - 15 percent during rush hour,
- Creation of a better level of service in Stockholm city traffic,
- Reduction in the emissions of carbon dioxide, nitric oxide and particulate matter,
- City residents experiencing a better city environment.

The trial implementation of a congestion tax was organized as two parallel projects: one for technology and operations and another for communication. Both were equally crucial for the implementation of the full-scale trial. A prerequisite for being able to ensure a reliable collection of the congestion tax was that relevant information had reached vehicle owners prior to putting the system into operation. The overall communication objective was formulated as follows:

> ”Everyone who drives a Swedish registered vehicle in the Stockholm inner city area after the turn of the year 2005/2006 shall know of the existence of the congestion tax and that it must be paid without having been prompted to do so.”

The idea was that vehicle owners and drivers would have received enough information before the trial period began to know if the tax concerned them, and if so, how they should pay it. Ideally they would also have procured an onboard unit for direct debit since the more drivers chose to pay this way the more efficiently it was expected the system would run. If drivers were well informed, the flow of traffic at the control points would not be disrupted and Customer Services would not be overwhelmed by calls.

Focus area

Changing behavior when it comes to exposed parts of your life such as cars and other objects is fundamentally different from the mundane day-to-day things that are kept in the home or even in the basement. Since the car also is a status symbol for people and a way to express themselves, it is a more complex psychological area than for example to install insulation in your house.

The Stockholm congestion charges use a financial incentive to establish a change in behavior, based on a model called the "Homo economicus". The success in the trial shows that money as an incentive can work if the circumstances are the right ones and if the behavior change is facilitated by other factors. Motorists are sensitive to financial incentives and it was therefore a well-founded expectation that car tolls in Stockholm would reduce traffic volumes [2].

The trial evaluated the following points:

- The travel pattern of Stockholm inhabitants,
- Car traffic,
- Public transport traffic,
- Pedestrian and Bike traffic,
- Environmental and health effects,
- Traffic safety,
- Allocation effects,
- Business and regional economy,
- Benefits and costs for the toll system,
- National economy,

[2] Beser Hugosson, Sjöberg & Byström. Facts and Results from the Stockholm Trial – Final version – December 2006. Stockholm: Congestion Charge Secretariat, City of Stockholm.

- Attitudes towards environmental tolls/taxes.

The monitoring and evaluation were performed before and during the trial.

3. Context, methodology and limitations of findings

The trial implementation of a congestion tax received widespread attention both in Sweden and abroad. Stockholm was, after London, the second European city since the turn of the millennium to test a payment system intended to reduce congestion and improve the traffic environment. Many cities throughout the world, particularly in Europe and the USA, exhibited interest in the project, and a large number of international delegations visited Stockholm to study the project first-hand.

Stockholm has very good conditions for implementing congestion charges. In terms of transportation, cities need to have extended and well-structured public transport in order to make the transition as smooth as possible. Stockholm also has a special topology with water and green areas surrounding the city, reducing the number of roads leading in and out of the city and therefore also reducing the number of toll stations implemented.

Sweden has a history of making big reforms across the right and the left wing, perhaps because the opposition politics aren't as divisive as in other countries. The trial was executed and paid for when the left wing ruled in Stockholm County and in the whole nation. In combination with the election 2006, the municipality of Stockholm would also vote for or against the congestion charges. The ruling parties shifted in the election 2006, where the right wing (liberals/conservatives) decided to keep the congestion charges. It is argued that the Swedish citizens have a confidence in the Swedish authorities, allowing the country to implement big changes like switching from left-hand to right-hand traffic overnight. In Stockholm, the habitual car driver is not in majority compared to the ones traveling by public transport. It can be therefore be argued that decreasing an already minor group of travelers is easier than to affect a majority.

All the factors mentioned above could be contributing to why the city of Stockholm demonstrated the right conditions for a congestion tax. The trial itself consisted of three parts listed below:

- Park-and-ride sites in the city and the rest of the county
- Expanded public transport
- Congestion tax/Environmental charges

Some of the surveys before the trial were conducted in the autumn of 2004. The idea was that comparisons could be made with the situation one year later, because the trial was planned to start in autumn 2005. As the trial was not launched until January 2006,

the comparison should have been made with data for the spring period, but by that time it was too late to collect such data. The evaluation group has partly been able to tackle this problem satisfactorily, particularly in terms of traffic counts,

Once upon a time… a city called Stockholm, the capital of a country called Sweden, let their citizens drive their cars as much as they wanted through the city.

Every day… people would get into their cars in the suburbs and drive to work or school in the city, regardless of the emissions their cars produced. One car per individual was also standard, and car pools were rare.

But, one day… the scientists discovered that air pollution due to traffic was the largest environmental problem in Stockholm, and therefore something that needed to be addressed to keep the goal for reduced emissions by 20% in 2020 according to the Kyoto protocol.

Because of that… a trial for congestion charges was implemented to reduce the emissions and to get people to travel more by public transport. The goal was also to reduce the traffic during rush hours and to better the air quality in the city. In order to facilitate the transition, the public transport was reinforced, Park-and-ride facilities were built and a congestion tax was implemented. The money from the tax incomes were earmarked to improve public transport even more.

However… Some parties were lobbying against this, for example the Stockholm Chamber of commerce and the Motoring lobby. The trial was also delayed to early spring in 2006 instead of autumn 2005, leading to problematic evaluation since the pre-measuring was done in autumn 2004. Despite these issues, a difference in pollution was measured and the congestion in the city actually decreased during the trial while the public transport increased.

And, ever since then… the familiarity with the trial made the people more positive to congestion charges since the effects were clear. In the referendum 2006 the majority of Stockholm's citizens decided that congestion charges should be installed permanently in the city. And they all lived happily ever after in a more environmentally friendly city.

where seasonal variations in the inner city are not large and/or we have been able to assess the situation with other data. In other cases the problem would have been difficult, for example regarding the travel-pattern survey for the entire country, in whichseasonal variations are more considerable and less well known.

4. And so it started[3]

[3] For a description of the use of storytelling as a methodology see Mourik, R.M. and Rotmann, S. (2013) Most of the time what we do is what we do most of the time. And sometimes we do something new. Analysis of case studies IEA DSM Task 24 Closing the Loop -Behaviour Change in DSM: From Theory to Practice. Deliverable 2 for IEA Implementing Agreement DSM Task 24

5. Key lessons learnt

This chapter goes through the main lessons learnt from the Stockholm Trial, regarding behavior, methodology, replication and conditions.

Monitoring and evaluation

The success of the intervention has been measured mostly through the number of cars passing the charge cordon during rush hour. To more deeply investigate individual behavior and their adaptation, studies have been made focusing on knowledge and attitudes through travel diaries and interviews. The evaluation battery also contained emission calculations, socioeconomic calculations and investigations how trade and businesses were affected.

Table 1.1 Number of journeys passing the charging zone at least once during a 24-hour weekday period by various means of transport.

Number of journeys with different means of transport passing the charging zone at least once during a 24-hour weekday period.						
	On foot	By bicycle	Car	Public transport	Others	Total
RVU 2004	20,000	40,000	377,000	70,000	40,000	1,184,000
RVU 2006	22,000	9,000	284,000	727,000	26,000	1,068,000
Percentage change	(+8 %)	-78 %	-25 %	(+3 %)	-33 %	-10 %
Statistically significant difference	No	-31,000	-93,000	No	-14,000	-116,000
Seasonal variation in county according to RES	*8 %*	*-41 %*	*-14 %*	*-2 %*	*-47 %*	*-10 %*
Seasonal variation across charging zone			*-5 %*	*-2 %*		*-5 %*

Table 1. Journeys with different means of transport from the report on change in travel habits.

The congestion charging trial has meant that residents of Stockholm County have reduced the number of their car journeys across the charging zone by approximately 20%.

Congestion charges implemented permanently will lead to both short-term and long-term adaptations. Since the Stockholm trial is by definition a trial, and a short one, only short-term adaptations can be expected. The measurements and evaluation methods are also developed for short-term changes. How this was considered when the trial was implemented permanently in 2007 is unclear, including the long-term effects of the charges implemented.

The importance of improved public transport

It has been proven earlier that car drivers are sensitive to financial incentives. This trial adds to that assumption, showing a decrease in car trips during the trial. The

Stockholm trial is however unique in the execution of the trial and the circumstances. Enhanced public transport in addition to congestion charges are considered as one of the biggest reasons to why the trial was a success. Below are two citations from an interview with ethnologist Greger Henriksson about the Stockholm Trial:

> And it was actually half a year before the congestion charging started there was something called a reinforcement of public transport (…) So it was actually like this time of the year, there was this reinforcement with new direct bus lines from the suburbs, this started in the fall. And then came the congestion charging scheme in January. And in May, I think, the fares on the public transport were evened out so it cost just as much to go 7 kilometers as to go 70 kilometers so there were no progressive fares. It was 25 crowns and you could travel a hundred kilometers for 25 crowns.

The reinforcement of public transport is perceived as one of the facilitating reasons to why the process of switching from your car to public transport was relatively easy for the Stockholm county inhabitants. There are however individual examples from interviews where people fear the transition to public transport because of the prolonged travel time.

People are more positive after experiencing the effects

Both the public opinion and corporate ones have become more positive towards the congestion charges with own experiences and advantages becoming clear. Before having any kind of own experience, the obstacles and the costs make the biggest impression. But when facing the trial in practice, one discovers the advantages and the benefits for the individual[4].

During autumn 2005, 51% of all the county inhabitants considered the decision to execute the trial a ”rather bad/very bad decision”. This part has decreased since the implementation of the trial in January 2006, and in May 2006, 54% considered the trial a ”rather good/very good decision”, while 42 % considered it a ”rather bad/very bad decision”. The individuals that traveled by car to or from the inner city during the past two days were more negative towards the trial than county inhabitants overall, but this group has also turned more positive during the trial. These changes have been observed in repeated surveys with different samples of the county inhabitants.

The companies are however coherent in their critique towards the trouble and the administrative costs that the trial system meant to them. There are also implications that the companies still think that the system inhibits the growth, although opinions before the trial about both the own and other companies that would experience

[4] Beser Hugosson, Sjöberg & Byström. Facts and Results from the Stockholm Trial –Second version – August 2006. Stockholm: Congestion Charge Secretariat, City of Stockholm.

negative development are not that certain about their own negative development anymore.

Who paid the fee?

In the discussion about adaptation strategies, it is important to remember that only a small part of all the county inhabitants' trips were affected by the congestion charges. The analysis shows that almost everybody paid the fee at least once, but a few of the motorists paid the majority of the congestion charges. The groups that paid most of the taxes per individual were men, persons with high income, married or cohabitants with children and people living in the inner city or on Lidingö. About 4 % of the cars in the county, corresponding to 1,2% of the county inhabitants, paid a third of the total income from congestion charges from civil cars. Why these people went on driving as before and what incentive that would make them change are interesting questions that the reports don't answer.

Two adaptations

There are two adaptations going in opposite directions from each other. Either you changed in order not to pay the fees in one way or another, which reduces traffic, or you changed to benefit from the space resulting from less congestion, which counteracts the reduced traffic. Another adaptation in order to avoid the congestion charges was to use a green car, which, at least marginally, reduces the environmental impact. Increased use of a green car does not however reduce congestion. Since green cars also contribute to negative environmental impacts, the positive effect from the congestion charges could be reduced if people with access to a green car take advantage of reduced congestion to increase their travelling. No such effect has however been shown in the investigation of travelling habits.

Some trips just went into thin air?

About half of the 80 000 toll transactions (?) that disappeared as a result of the Stockholm trial are trips to and from school/work. Since working from home and carpooling has not increased, the assumption is that these work-related trips have been replaced with the public transport. A few have also changed their route from driving through the inner city to taking the "Essingeleden". Below is a citation from the interview with Greger Henriksson once more:

> But now you must remember that it was not only the effect a change of mode, it was also a reduction in the overall travel. So there was also a reduction in... that travel, in general, decreased. And that was kind of a mystery to the transport economists because they didn't really know which travel hat disappeared. Because it was not the commuting or the more visible travel that you have good statistics on. It was like some travel on the margin that was cancelled by people.

The reduction of car trips outnumbers the increase of trips done by public transport during the trial. Since the amount of trips done by public transport doesn't add up to the decreased amount in car trips, some trips have changed route, chosen other travel destinations or just not occur as a result of the trial. The number of trips is therefore not a static number that needs substitution, but contains room for adaptation meaning that people plan their travelling different so that the number of trips decreases.

Change in travel habits

Since interviews were conducted during different stages of the trial, it is possible to follow processes of behavioural change for individuals and households. The early interviews tell us about planning a change in behavior, a change that did not necessarily occur. Despite several examples of individuals planning to change their habits but didn't go through with it[5], 25% in the evaluation reported a change in their behavior afterwards compared to 17% that before the implementation thought they would change their habits. Three types of habits have been observed during the study of knowledge and attitudes towards the trial; travel by car, travel by public transport and mixed use. The last group is especially interesting since they change ways of travelling in different ways and for different reasons.

All geographical and socio-economic groups reduced their car journeys across the charging zone between September/October 2004 and March 2006, irrespective of whether one is looking at charging periods or periods free of charge. We cannot know how much of the effect on the individual groups has been caused by the trial. The reduction varies in different groups. Job seekers, students and pensioners are those who have reduced the number of their car journeys the most between the periods. Even during the charging period all groups have reduced their car journeys across the charging zone in March 2006 compared with September/October 2004.

To what extent was the trial successful?

The three primary goals of the trial were reduced traffic, a better environment and perceived improvements to the city environment. The goal of traffic reduction has been achieved, and thereby also the environmental goal. The degree of achievement of the city environment goal is more difficult to interpret.

When the trial ended after six months, the traffic did not go all the way up again, probably because people had changed their behaviour during these six months and established a new habit of commuting by public transport or other methods. People became more positive towards the trial after it was implemented.

The Stockholm Trial reduced emissions of both carbon dioxide and particles. This reduction is substantial to have been achieved through one single measure. Seen across the county as a whole however, it can only be regarded as one of several

[5] Henriksson, G. (2008). Vad betydde försöket för Stockholmarna? in K. Isaksson, Stockholmsförsöket – en osannolik historia (ss. 230–288). Värnamo: Fälth & Hässler.

measures required to achieve national climate objectives, for example. As the reduction in traffic took place in densely populated areas, the reduction – mainly of particles – brought a major health benefit to the county as a whole. The health benefit is about three times higher than the benefit that would have been gained had the reduction occurred through an increase in fuel prices. As expected and in general terms, the Stockholm Trial only had a marginal impact on noise levels. [6]

People have expressed their worries concerning distributional effects of the trial. In an interview with Greger Henriksson[7], the people benefitting from the congestion charges appeared to be the ones provided with a professional or leased car which they could exchange for a green car and then go on driving as before but with less congestion.

Replication of this study

Stockholm is a special city, geographically and topographically with few roads leading to few toll stations in the trial. The improvement of public transport in combination with congestion charges has without a doubt contributed to the effects. Stockholm is also a kind of optimum for this intervention since the habitual car driver is not in majority during rush hour. As Greger Henriksson puts it when asked about the air pollution:

> Yeah, but people perceived it as improved environmental quality in the city centre and around the exit and entrance main roads... And that's very particular to Stockholm. Because of the geography, we only have twelve roads. There are no small roads that go into the city so it was so easy to put up this... There is no way to sneak about... Then you have to drive in the woods or something.

The quote above shows that Stockholm was under the right circumstances for this trial, compared to the replication in Gothenburg that was introduced the 1st of January 2013 where car drivers could dodge the congestion cords by choosing smaller roads. On these particular roads the traffic actually increased by as much as 30% when congestion tax was introduced.

The congestion tax in Stockholm was permanently implemented in August 2007, after the referendum in September 2006. The trial has been replicated in Gothenburg with varying results. Despite the reduction in traffic, the congestion charge has remained controversial with reports of some motorists seeking to avoid the charge by diverting to smaller roads. Over 10% of the local electorate asked for a referendum for the congestion tax to become a reality in Gothenburg. In the referendum 2014, the inhabitants of Gothenburg decided that congestion charges would not be a permanent installation.

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6 Beser Hugosson, Sjöberg & Byström. Facts and Results from the Stockholm Trial – Final version – December 2006. Stockholm: Congestion Charge Secretariat, City of Stockholm.

7 Henriksson, G. (May 2013). Congestion charges. (S. Rotmann, Interviewer)

Delay in execution leading to incoherent measures

It is difficult to perform a comprehensive follow-up and evaluation of the Stockholm Trial due to the large scope of the trial. The task has not been made easier by the short time that the expert group had to conduct the follow-ups before the publication of the final report. A more fundamental problem is that some of the surveys before the trial were conducted in the autumn of 2004. The idea was that comparisons could be made with the situation one year later, because the trial was planned to start in autumn 2005. As the trial was not launched until January 2006, the comparison should have been made with data for the spring period, but by that time it was too late to collect such data. The expert group has partly been able to tackle this problem satisfactorily, particularly in terms of traffic counts, where seasonal variations in the inner city are not large and/or they have been able to assess the situation with other data. In other cases the problem is difficult, for example regarding the travel-pattern survey for the entire county, in which seasonal variations are more

Once upon a time… the politicians in Stockholm, Sweden, decided that congestion charges should be tested in the city. They called it the Stockholm trial.

Every day… preparations were made for the study, data was collected about the traffic and surveys about the congestions charges were conducted with county inhabitants. The trial was implemented and working full speed for six months

But, one day… the trial ended and it was time to evaluate the success of it and the main methodological learnings coming from it; how a short-term trial equals short-term measurements and effects, the monitoring and evaluation of the trial, the possibilities for replication and how the delay in implementation led to incoherent measurements. The behavioral effects and the overall change in travel habits were also of course interesting; but many lessons were learnt about the importance of improved public transport, how people became more positive after experiencing the effects, who really paid the fee, adaptations individuals made to deal with the trial, and the mystery that some trips just went into thin air….

Because of that… a lot of documents and reports about the trial were written. A book about the trial has also been written from the views of among others an ethnologist and a transport economist.

However… the trial was overall regarded a success and it received a lot of international attention. The trial acts as a good example of how congestion charges can be implemented and what the necessary conditions are for a success. There was also a referendum in autumn 2006 when the inhabitants of Stockholm city voted that the congestion charges should be implemented permanently.

And, ever since then… The Stockholm congestion charges lives as an example of a successful trial implemented in a city with the right conditions while the inhabitants of Stockholm city go on breathing cleaner air.

considerable and less well known. Furthermore, several other significant changes took place over the 18 months between the measurement periods, such as the increases in fuel prices.

6. A quick summary

The Stockholm Trial was a delicate subject and invoked a lot of reactions when implemented in 2006. Despite delays in the implementation and protests from the public, the project seemed to work from the first day since there was an immediate decrease in traffic. The inhabitants of Stockholm County became a lot more positive towards the trial after it was implemented, and they voted for a permanent implementation of the congestion charges in the referendum 2006. One important aspect of the project was Stockholm as a city was under the right circumstances to implement congestion charges regarding geography, topography and infrastructure. This needs to be addressed in replications of this study.

7. To conclude