Effects of congestion charges in Stockholm

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The Stockholm congestion charges

- 10-20 SEK (1-2 €) per cordon crossing, depending on time of day
- No charge evenings or weekends
- Alternative-fuel cars exempt
- Max 60 SEK/day

- Trial period during spring 2006
- Referendum Sept 2006 – close "yes"
- Reintroduced Aug 2007
- Large positive majority now (~70%)
Designing a congestion charging system

- Formulate the aim and the goals for the system
- Constructing a good design is difficult – may create new problems instead!
- "Common sense" is in general not enough
- Use traffic forecasting models
- Don’t make political commitments to design details (at least not too early)
- Start working on the design early
- Keep it flexible – be free to change details after implementation
Stable traffic decrease ≈ 20% across cordon
Parts of the traffic decrease remained after charges were abolished!

*dashed line – 2006-2007 ”between” charging*
Significant change in traffic trend
Why is traffic increasing?

Average charge is decreasing in real terms:
- Inflation
- More green cars (2% → 11%)

General traffic increase driven by:
- Incr. population
- Incr. employment
- Incr. car ownership
... which used to be held in check by capacity problems!
30-50% less time in queues
April 2005/2006

Delay time, PM peak

- Inner main roads, inbound
- Inner main roads, outbound
- Inner streets
- Inner main roads, northbound
- Inner main roads, southbound

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Same magnitude of congestion reduction after reintroduction

As during the trial – but less cong. to begin with than in April

Small effects now and during the trial
What happened to disappearing traffic?

- Work/school
- Professional, business
- Discretionary
- Other travel patterns
- To transit

No measurable effect on retail
The Essinge bypass

- The major connection between northern and southern Stockholm
- Congested even before – but was still made free of charge
- Much less increase than anticipated!
- 4% more traffic 2006 than 2005…
- … but yearly traffic increase virtually unchanged by the congestion charges!
Less emissions

- 10-14% less emissions in the inner city
  - positive long-term health effects
  - significant reduction of exposure
- 2-3% less CO2 emissions in the county
Forecasts worked

Yellow square - forecast
Bars - Outcome

-25%  -20%  -15%  -10%  -5%  0%  5%

-25%  -13%  -18%  -6%

City streets
Large city streets
Through arterials
Vehicle km’s, city
Cordon
Inner arterial
Outer arterial
Circumferential roads
Public opinion

- "U-curve" typical:
- Support for the charge lowest right before the start…
- … but rapidly increased once effects became visible
- Inner city residents most positive – inner periphery most negative
- Women and young more positive

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![Graph showing public opinion over time and across different regions and demographics.](image-url)
How many are affected?

- May pay sometimes – few pay often
  - During two weeks, half of the car owners pay the charge sometimes…
  - … but less than 5 percent of car owners pay more than 100 kr/week
- A small group pays a substantial part of the charges
  - 5 percent of the car owners pay a third of the charges

Almost half of the cars in the county

5% of the cars – 1/3 of revenues
Who pay the most?

- Inner city residents pay twice as much as the rest in the county
- "Rich" households pay three times as much as "poor" households
- Employed pay three times as much as the rest
- Men pay twice as much as women
- Households with children or two adults pay 50% more than the rest (per person)
High income segments pay more…

- High: 29%
- Mid high: 27%
- Middle: 19%
- Mid low: 17%
- Low: 8%
...middle income segments change more

- Low: -6%
- Mid low: -25%
- Middle: -30%
- Mid high: -9%
- High: -15%
Rich lose more than poor – before revenue recycling

Direct effects

Net effect after revenue recycling

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Inner city residents supposedly the biggest losers – but are the most positive!

- Inner city residents lose twice as much as the rest
- Why are they the most positive?
- We neglect self-selection effect on values of time
- … and effects on perceived urban environment
Media turned almost overnight

"Stockholmers – where did you go?"

"Every fourth car disappeared"
"Charges heading for the ditch"
"Bypass threatened by chaos"
"Charging chaos continues"

"Stockholm loves the charges"
"Charges a success"
"Thumbs up for the charges"
Why a "success"?

- The technical system worked
- Information had worked – people knew what to do
- Visible congestion reductions
- Extensive scientific evaluation
- Clear objectives – that were reached
- "Fair and efficient" design that was consistent with the stated objective

- Humble, matter-of-fact political "marketing" (?)
  - "let’s try it; if it doesn’t work, we’ll scrap it"
What do you think about the charges (after the reintroduction)?

- Very positive: 27%
- Fairly positive: 48%
- Neither: 27%
- Fairly negative: 0%
- Very negative: 0%
- Don’t know: 0%
To what extent do you think that the charges contribute to…

- Less queues to/from city
- Less queues within city
- Better air q. within city
- Less noise within city
- Better walk/bicycle safety
- Better transit services
- More choosing transit
Did you change your opinion during the trial?
Regular car drivers more negative

**Attitude towards Congestion Charges**

How often do you travel to work/school by car

- **Never**
- **Rarely**
- **Sometimes**
- **In most cases**
- **Always**

![Bar chart showing attitude towards congestion charges by travel frequency]

- **Very positive**
- **Fairly positive**
- **Neither pos/neg**
- **Don't know**
- **Fairly negative**
- **Very negative**
Environmentally concerned more positive
More positive groups (*all else equal*)

- Men
- Highly educated
- Inner suburbs
- Seldom car to work
- Environmental concerns
- Fairly content with transit services in residential area
Conclusions

- Car drivers are cost sensitive
- Extremely cost-efficient congestion reduction compared to transport investments
- There are many ways to adapt - not just route and mode changes
- Simple design worked well
  - but coming up with it wasn’t easy
- Keep an eye on technology and administration costs
- Evaluate effects early, and (later) comprehensively
- Keep it flexible – revise if necessary
There’s nothing more practical than good theory.
Effects on public transit

- High transit share to the inner city => moderate impact on PT crowding (5% increased ridership)
- New users very satisfied – but most used PT even before
- New buses did not affect car traffic
- Made perhaps transition easier?
- Psychologically/politically important
Business & retail

• No identifiable effects on retail at aggregate level

• Commercial traffic:
  – Time gains valuable, but administration cumbersome
  – Administrative procedures changed at re-introduction

• Very small predicted influence on land use, real estate prices and regional economy
Social and financial net surplus after four years of operation

- The congestion charge gives a **financial** surplus of around 550 mSEK/year (net of running costs)
- Investment+ first year running costs were 1900 mSEK
- The congestion charge gives a **social** surplus of around 800 mSEK per year
## Cost-benefit analysis of the congestion

<table>
<thead>
<tr>
<th>Benefit/Expenses</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shorter, more reliable travel times</td>
<td>590 mkr/year</td>
</tr>
<tr>
<td>Paid congestion charges</td>
<td>-760 mkr/year</td>
</tr>
<tr>
<td>Health and environment</td>
<td>90 mkr/year</td>
</tr>
<tr>
<td>Traffic safety</td>
<td>120 mkr/year</td>
</tr>
<tr>
<td>Revenues from congestion charges</td>
<td>760 mkr/year</td>
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<tr>
<td>Other revenues/costs</td>
<td>190 mkr/year</td>
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<tr>
<td>Maintenance and running costs</td>
<td>-220 mkr/year</td>
</tr>
<tr>
<td><strong>Net benefit</strong></td>
<td>760 mkr/year</td>
</tr>
</tbody>
</table>

### Additional Costs

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investment and running costs 2006</td>
<td>-2000 mkr</td>
</tr>
<tr>
<td>Shadow prices etc.</td>
<td>-1100 mkr</td>
</tr>
<tr>
<td><strong>Total initial cost</strong></td>
<td>-3100 mkr</td>
</tr>
</tbody>
</table>

**Payback time: 4 years.**