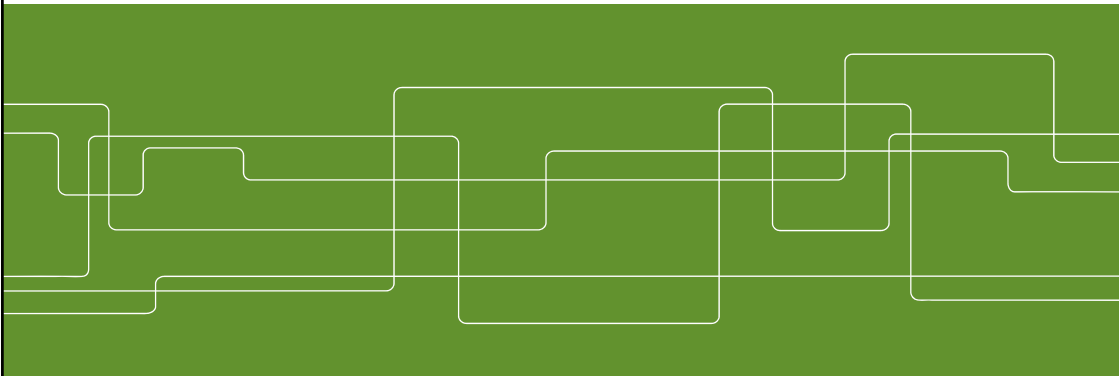




Urban & Regional Policy

2015-05-07



Who is the agent?

Politicians – Local, regional, national
Civil servants
Consultants

Private citizens
Citizen organizations
Labor organizations

Private firms
Industrial organizations
Innovators



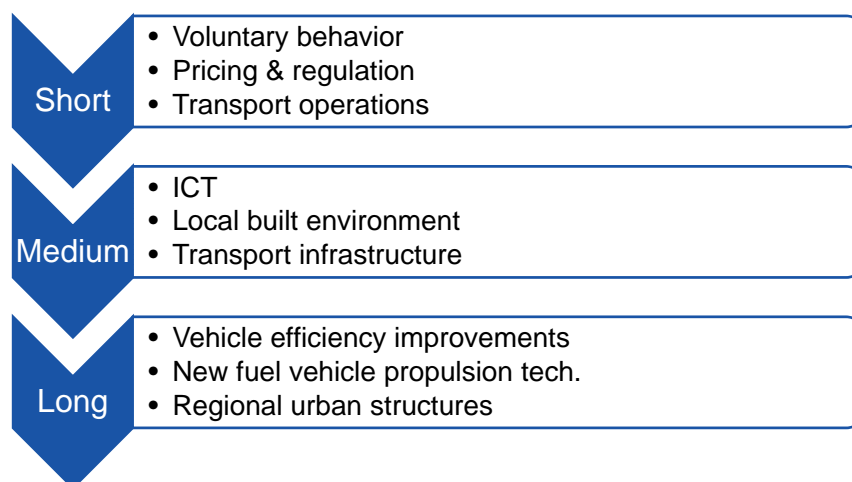


What are the tools?

- Voluntary behavioral changes
- Pricing & regulation
- Transport operations
- ICT
- Local built environment
- Transport infrastructure
- Vehicle efficiency improvements
- New vehicle propulsion tech.
- Regional urban structures



What is the timespan?





Example

Transforming the vehicle fleet:

1. Assessing future policies
2. Assessing past policies



Example 1

TRANSFORMING THE VEHICLE FLEET



Policy measures to change composition of car fleet

Why?

- From a theoretical point of view, why?
- Theory: transport economics and sustainability

Assume we should reduce emissions from cars

- Why should we target policy measures directly towards car fleet?

How?

- Forecasts, models



Policies

CO2-based vehicle circulation tax

Subsidy for privately bought alternatively fuelled cars

- 1 000 EUR
- Ceased 2009

Company car benefit tax reductions

- 20 percent for ethanol fuelled cars
- 40 percent for gas and electric hybrid cars

Congestion charge exempt for alternatively fuelled cars

- 0 – 800 (1 300) EUR
- Ceased 2012

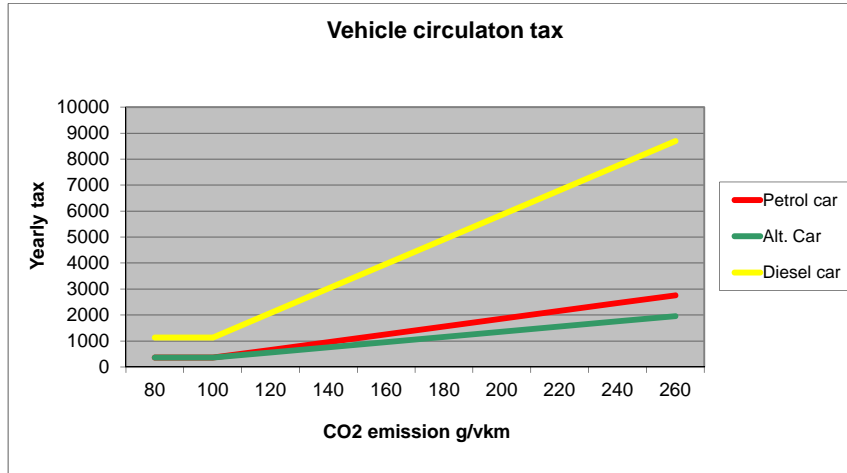
Free city residential parking for alternatively fuelled cars

- 0 – 600 EUR
- Ceased 2009

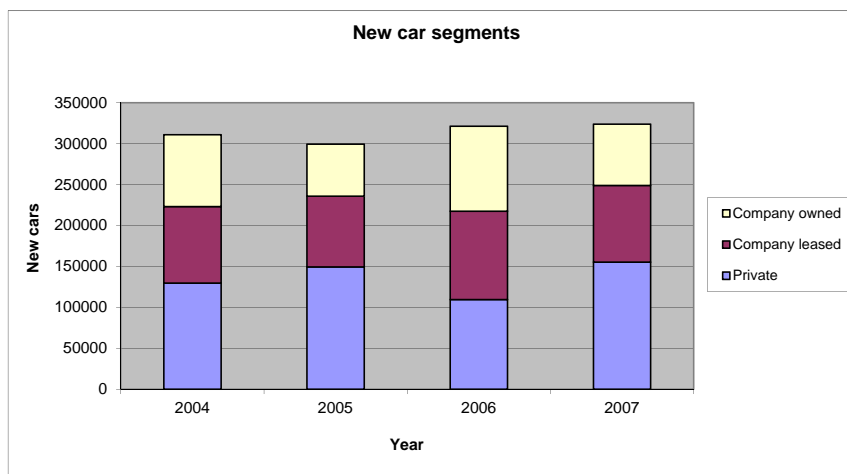
Increased supply of fuelling stations with alternative fuel



Vehicle circulation tax



Who buys a new car?





Company car benefit taxation

13600 (= 0.317 * Base Amount, currently 42 800)
+ 2,17 % of purchase price
+ 9 percent of purchase price up to 321 000 (7,5 BA)
+ 20 percent of purchase price over 321 000

Car price 100 000: 24 770

Car price 250 000: 41 525

Car price 400 000: 66 970



Congestion charges

Alternatively fuelled cars were exempt from congestion charges in Stockholm

The charge is differentiated during the day and varies between EUR 1 to EUR 2

The maximum fee is EUR 6 per day

The exempt may be worth up to EUR 900 per year for regular car commuters



Law on supplying renewable fuel (SFS 2005:1248)

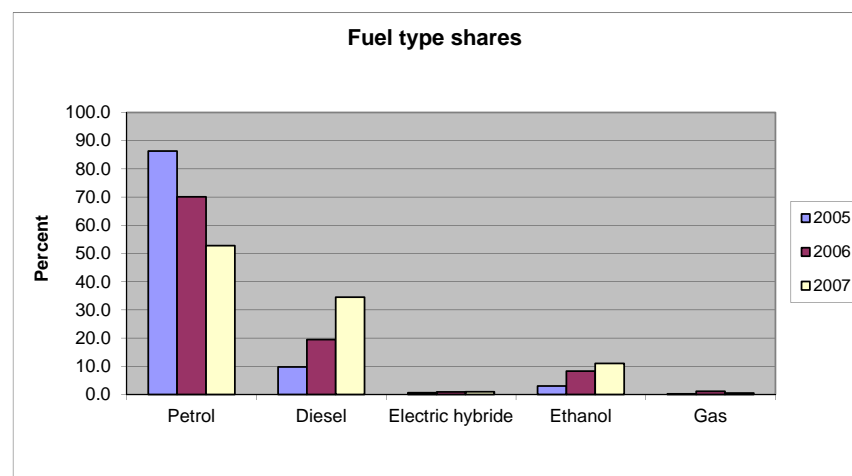
Since 2006

1300 out of 1400 refuelling stations chose ethanol

Only 90 refuelling stations supply biogas or natural gas



And things changed...





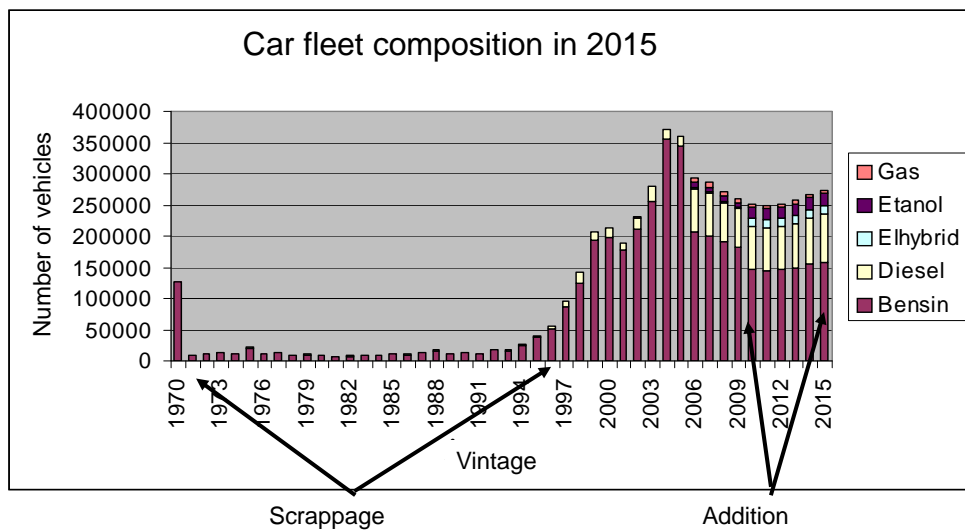
Top five selling models of clean vehicles 2008 and 2010

April 2008		April 2010	
Clean car model	Type	Clean car model	Type
Volvo V70 Flexifuel	Ethanol	Volvo V70 Flexifuel	Ethanol
Saab 9-3 Biopower	Ethanol	KIA CEE'D Eco	Diesel
Volvo V50	Ethanol	Volvo V 50 D	Diesel
Saab 9-5 Biopower	Ethanol	VW Passat Ecofuel	Biogas (CNG)
Ford Focus Flexifuel	Ethanol	Renault Clio flexi fuel	Ethanol

Subsidy of 1 000 EUR when purchasing a new clean vehicle



The vehicle fleet – a slow giant!





Policy effects

CO2 emission factor down

... but what measure had most impact?

What else might have had an impact?

How to optimise the vehicle fleet policy?

Need to model vehicle fleet impact



Three models are needed for a car fleet composition forecast

Scrapping model

- What cars will leave the car fleet?

Car ownership (fleet size) model

- How many new vehicles will be added?

New purchase model

- What cars will be added to the car fleet?



New purchase model variables

- Price/benefit tax,
- Size class,
- Fuel type,
- Tank volume,
- Rust protection guarantee,
- Running cost (fuel and vehicle tax),
- Safety (NCAP / Folksam classification)
- Engine power (hp) from SP study
- Share of fuel station with alternative fuel
- Brand



Policy analysis

Effects of different economic policies:

- Fuel tax
- Benefit tax
- Vehicle tax

Effects of exogenous factors:

- Fuel price
- Economic growth
- Population change

Effects of new car types



Supply assumptions

Car model development assumption

Introduction year	Petrol	Bifuel	Diesel	Petrol hybrid	Ethanol	Diesel hybrid	E85 hybrid	Total
2004	328	2	49	1				380
2005	2		16		4			22
2006	2	6	4	1				13
2007	11	8	16	4	33			72
2008					12			12
2010			23	8	10	2	1	44
2012				2	1	1	2	6
2015	57		26	3	23	2	1	112
2016				1		1	3	5
2018				2		5	4	11
2019				1			1	2
2020				7		5	3	15
Total	400	16	134	30	83	16	15	694

Continuous technological development of conventional and other techniques 1 % / year



Vehicle fleet composition

Determines

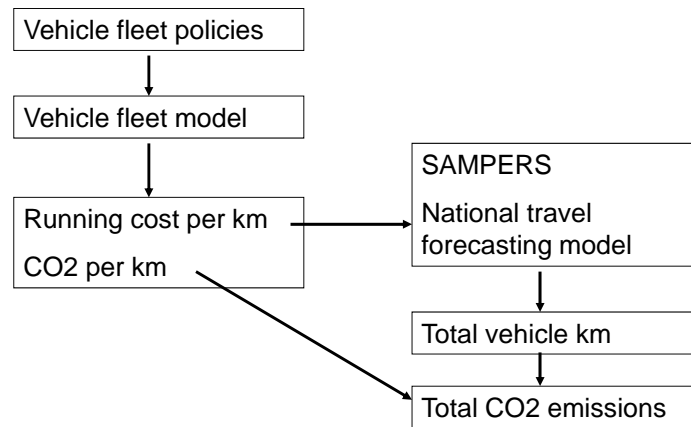
- Emissions
- Running costs

Running costs -> car use

- Rebound effect
 - More efficient cars, lower costs, increased use



Rebound effects



Recent application

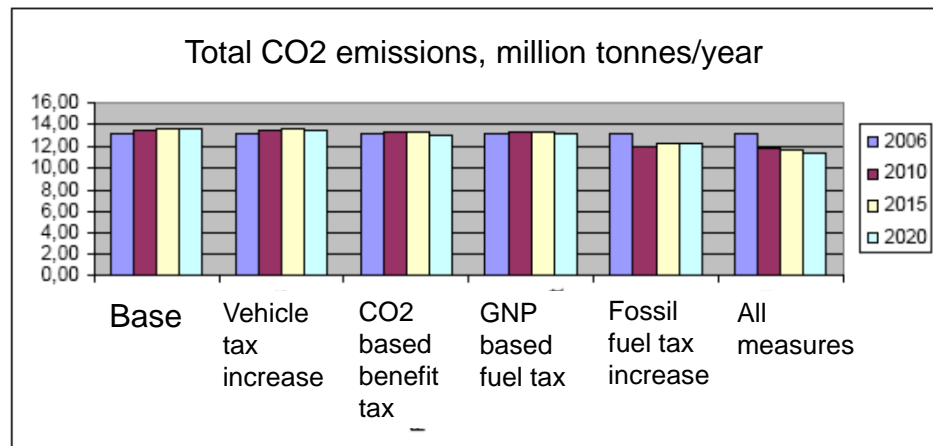
Swedish Environmental Protection Agency

Scenarios:

- Vehicle circulation tax: stronger CO₂ dependence, no reduction for alternatively fuelled cars
- Benefit taxation rules: CO₂ based, no reduction for alternatively fuelled cars
- Fuel tax: strong immediate increase of tax for fossil fuels
- Fuel tax: GDP and inflation adjustment
- Combined policy: *all of the above*



Recent application



Related research issues

Modelling car fleet evolution

- Scrapping
- New cars
- Car ownership
- Discrete choice approach

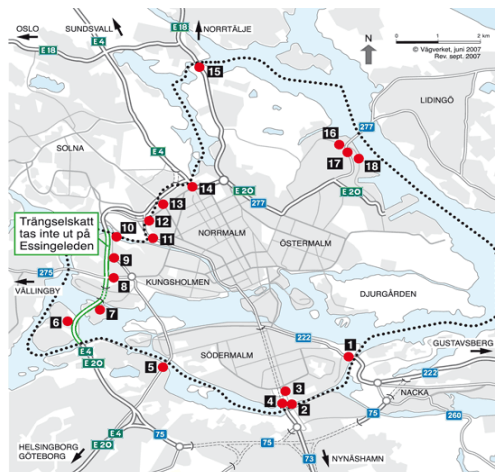
Modelling concerns

- Choice set formation
- Brand loyalty
- Unobserved random utility term correlation
- Heterogeneous preferences

REBOUND EFFECTS

Stockholm's Congestion Pricing

- 6.30am - 6.30pm
- 10 – 20 SEK per crossing (0.87 – 1.74 GBP)
- Max 60 SEK per day (5.24 GBP)





Stockholm's Mix of "Green" Transport Policies

2005:

- Free Residential Parking in Central Stockholm for LEVs

2006:

- Congestion Charging Trial
- **Low-Emission Vehicle (LEV) Exemption Starts**

2007:

- Started National Purchase Rebate
- Congestion Charges Return, Permanently (with LEV exemption)

2008:

- **LEVs are 28% of new vehicle purchases**

2009:

- **Stopped LEV Exemption for New LEVs**
- Stopped Free Residential Parking for LEVs
- Stopped National Purchase Rebate

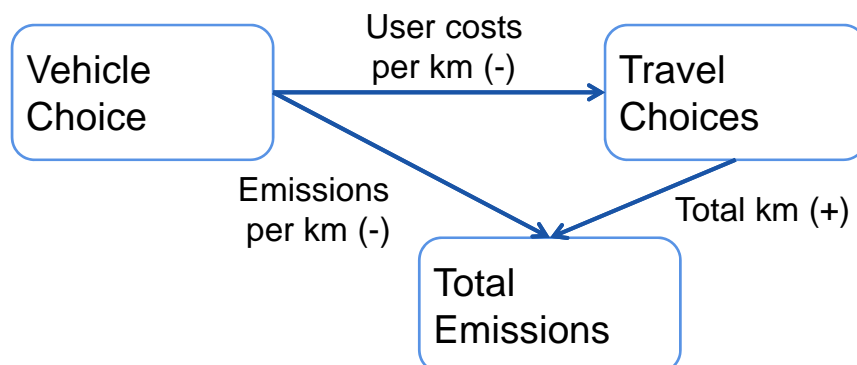
2012:

- **Stopped LEV Exemption for Old LEVs**

29



Greening Urban Transport



30



Research Questions

How much did LEV-owners use their vehicles compared with demographically similar conventional vehicle owners in Stockholm during 2008?

How did the exemption from congestion pricing affect the use of LEVs in Stockholm during 2008?

What was the overall effect on emissions in Stockholm during 2008 due to the transition to LEVs within the fleet?

To what extent were these emissions reductions offset by rebound effects?

31



Data

Sweden's Central Bureau of Statistics' (SCB) vehicle registry data for Stockholm County, 2008

Vehicles

Make

Model

Year

Propulsion

Fuel Consumption

Emissions

Owners

Age

Gender

Income

Home Post Code

Work Post Code

No. Children

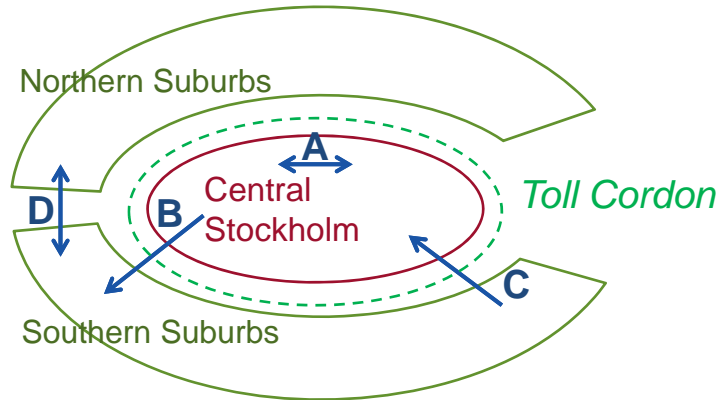
Travel

Annual
Kilometers
Traveled (AKT)

32



Abstracted Geography of Stockholm



33



Frequencies

	Living inside Cordon		Living outside Cordon		All Owners
	Working inside Cordon	Working outside Cordon*	Working inside Cordon*	Working outside Cordon	
Conventional	1 144 (64.5%)	700 (49.0%)	4 974 (71.0%)	13 827 (75.6%)	20 645 (72.43%)
Low CO ₂ Petrol	101 (5.7%)	99 (6.9%)	343 (4.9%)	985 (5.4%)	1 528 (5.36%)
Low CO ₂ Diesel	67 (3.8%)	63 (4.4%)	206 (2.9%)	638 (3.5%)	974 (3.42%)
Electric	47 (2.7%)	41 (2.9%)	94 (1.3%)	149 (0.8%)	331 (1.16%)
Ethanol	415 (23.4%)	526 (36.8%)	1 386 (19.8%)	2 697 (14.7%)	5 024 (17.63%)
Total	1 774	1 429	7 003	18 296	28 502

Annotations: Rebate (points to Ethanol), Free Parking (points to Electric), Toll Exemp. (points to Low CO₂ Diesel).

34



Approach: Difference-in-Differences

Four Commuter Groups:

- A. Inner-City Worker/Residents
- B. Reverse (Outbound) Commuters
- C. Standard (Inbound) Commuters
- D. Outer-City Worker/Residents

For each Commuter Group:

- Measure Annual KM Travelled (AKT) in 2008 for LEVs
- Measure Annual KM Travelled (AKT) in 2008 for Non-LEVs
- Compute Difference between LEVs and Non-LEVs
- Compare Difference-in-Differences between:
 - A and B
 - C and D

35



Differences in Annual KM Travelled (AKT)

Commuter Groups		Number of Observations		Average Annual Kilometers travelled (AKT)			
Group	Commute Pattern	LEV (Treated)	Conventional (Control)	LEV (Treated) [km/year]	Conventional (Control) [km/year]	Difference [km/year]	% Difference
A	Live/Work in Centre	102	4,605	11,844	11,707	137	1.17%
B	Outbound Commute	87	2,661	14,692	13,447	1,245	9.26%
C	Inbound Commute	216	18,859	13,950	13,324	626	4.70%
D	Live/Work in Suburbs	514	62,621	15,094	14,590	504	3.46%

36



Differences-in-Differences

Owner Group 1	Owner Group 2	Group 1 ATT [km/year]	Group 2 ATT [km/year]	Difference in ATT [km/year]	Average Control Group AKT [km/year]	% Difference in AKT
B: Outbound Commute	A: Live/Work in Centre	+1,576	+184	+1,391	13,447	+10.4%
C: Inbound Commute	D: Live/Work Outside Centre	+620	+503	+118	13,324	+0.9%

37



Key Findings

- LEV owners travelled further than Conventional Vehicle owners of similar characteristics (between 1.6 and 11.2%)
- A large difference is associated with the congestion charging exemption:
 - For inner-city residents: +10.4%
 - For suburban residents: +0.9%
- Difference is due to non-work trips?

38



Key Findings (cont.)

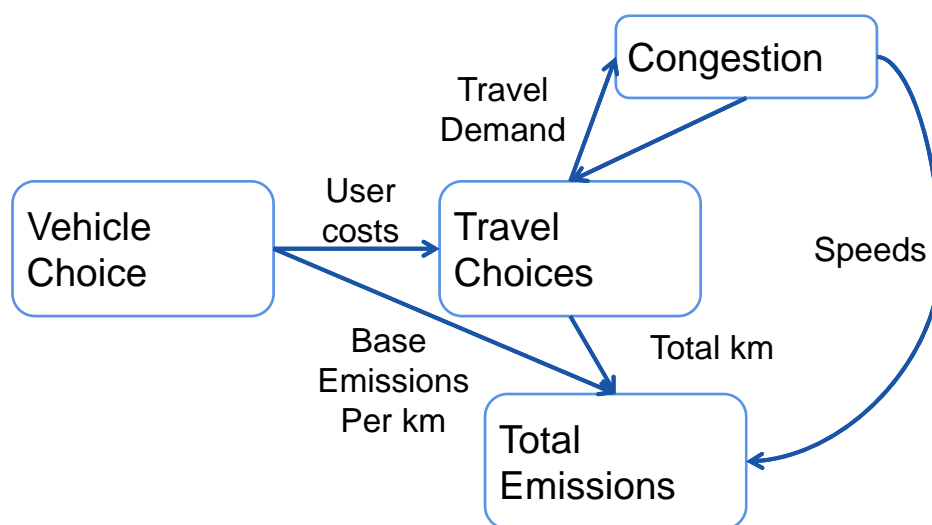
- Simulated effects on emissions:
 - Assumed Flexi-Fuel used 75% E85, 25% petrol
 - Reduction due to vehicle technology: **- 49.5%**
 - Increase due to rebound effects: **+ 2.5%pt**



39



Outlook for Research



40



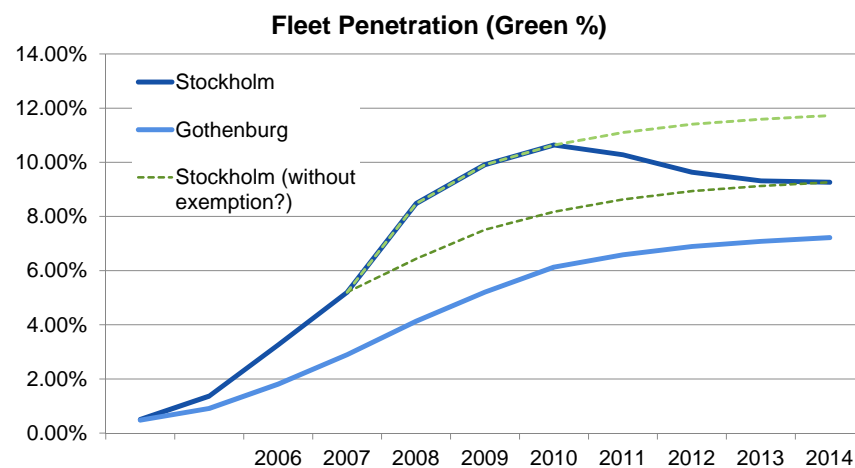
Outlook for Policy

- LEV incentives today:
 - 2012: Super-Clean Vehicle Premium: mostly EVs & Plug-in HEVs – 40,000 SEK (R\$ 14,000) for private persons
 - 2013: Exemption from annual tax for 5 years
 - 2013: Reduced tax for a company car benefit
- On Congestion Charges:
 - Expanded to Gothenburg
 - Likely revision of Stockholm
 - Other Cities? Ought exemptions be considered?

41



Temporary Effect?





Discussion

How can local and regional actors improve the effectiveness of their policies?

- Prediction?
- Cooperation amongst themselves?
- Coordination with industry?

What lessons here can be applied to other policy areas, e.g. land use/transport planning?