To buy or not to buy

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The presentation

Two parts

1. Car demand;
2. EV adoption and urban development.

Car demand

The original plan . . . and the new one

The original plan . . . and the new one

Big focus on implicit subsidies for parking, driving up car demand:

- Supply and Demand for Parking Spaces
- Effects of Parking Charges on Travel Decisions
- Effects of Transport Charges/Taxes on Vehicular Demand.

Data from various sources. Aggregate level, survey data, etc:

- Monthly vehicle registration statistics;
- Swedish National Travel Survey.

The original plan . . . and the new one

But . . . After submitting the application we realised that we could obtain data on:

- Every adult in Sweden over time;
- Vehicle ownership;
- Vehicle mileage;
- Home postcode;
- Work postcode;
- Socioeconomic data.

This opens up many new opportunities.

Then personnel changes . . . Ting :)

We will talk about 3 opportunities we are currently exploring.

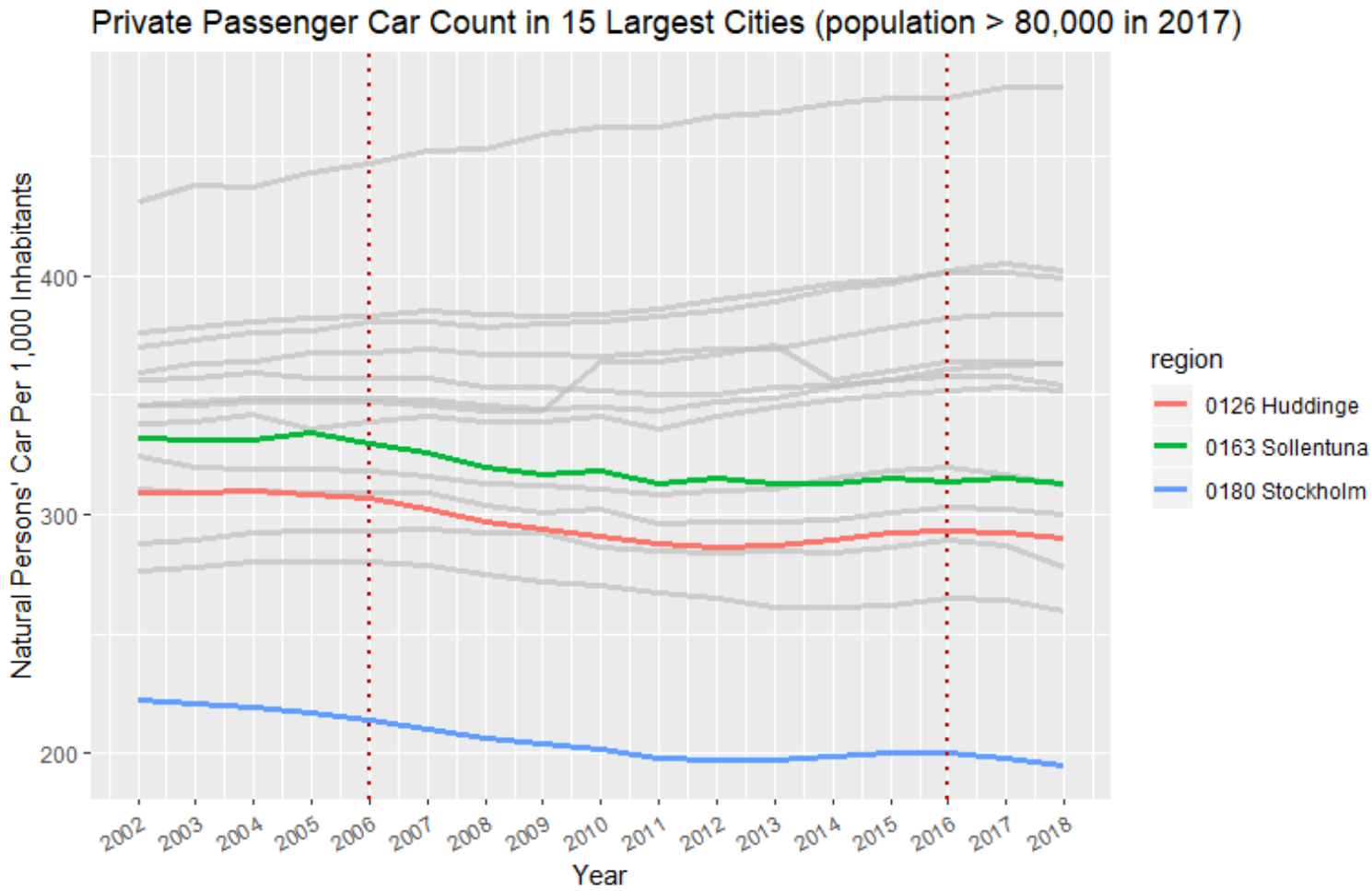
I. Parking charges and vehicle ownership

1.1 The change in car ownership given a change in parking subsidies.

e.g. Q: What is the impact on car demand of increasing the parking charge to its socially optimal level?

- Work in progress: collecting data on variations of parking charges.

II. Vehicle ownership and usage



2.1 The impact of regional policies on vehicle ownership/usage:

e.g. Does the expansion of Stockholm congestion charge in 2016 lead to a further decrease in vehicle holding?

Work in progress: identifying regional policy changes.

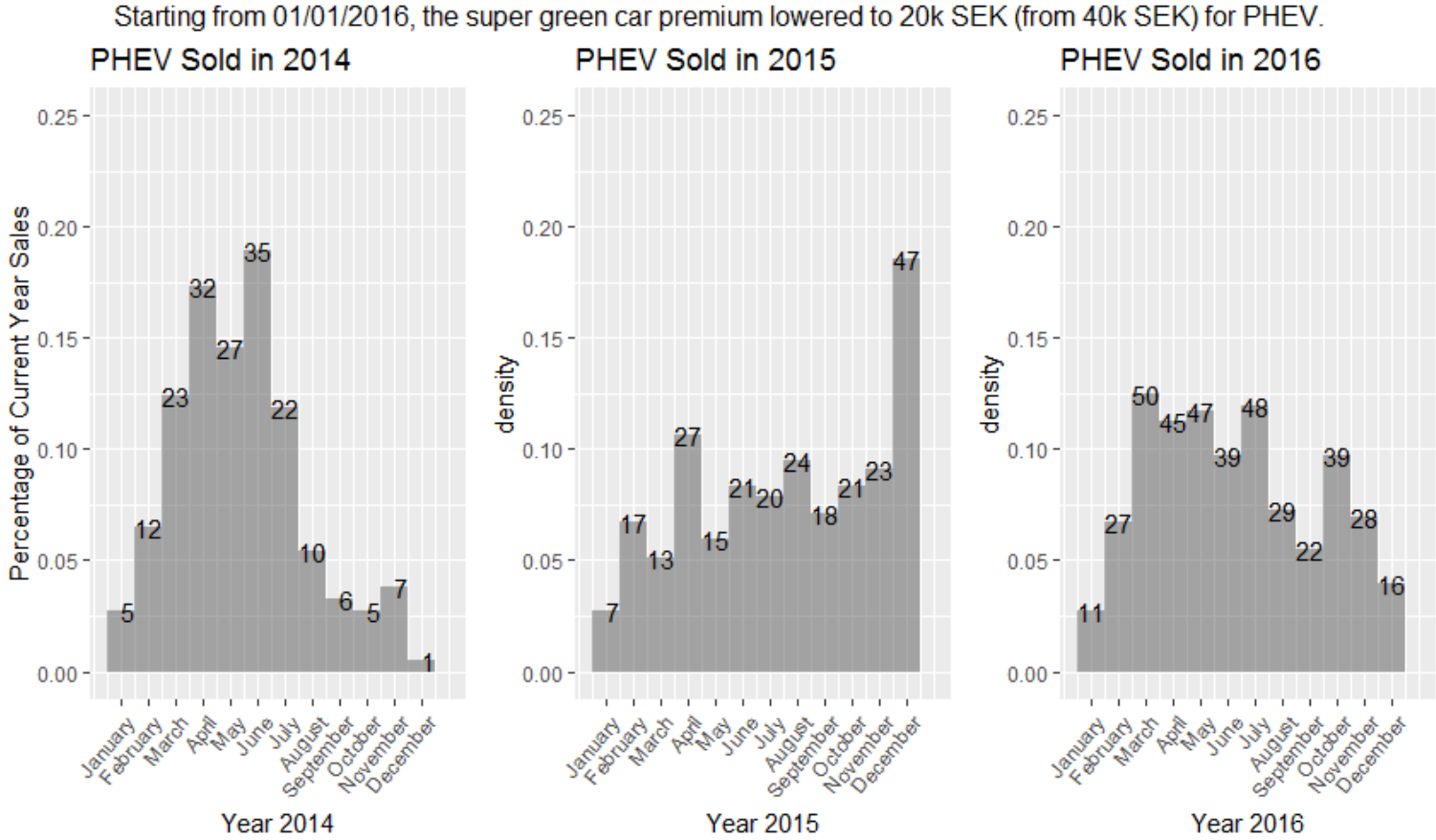
II. Vehicle ownership and usage

2.2 The long-run elasticity in urban travel demand (private automobiles vs. public transportation):

e.g. Q: How large is the share of urban travelers switching to public transportation from private automobiles if the cost of driving increases by 1%? (think in terms of market share, could be a dynamic model with forward looking travelers)

Work in progress: collecting information about public transportation ridership and pricing in major cities.

III. The design of incentives for green cars



3.1 The effect of green car subsidies:

e.g. Q: How many extra PHEV will be purchased if the subsidy for PHEV increases by 1%?

Work in progress: in contact with transportstyrelsen for information about model-specific premium applied.

III. The design of incentives for green cars

3.2 Consumer responses to the new bonus/malus system starting 1 July 2018: "...to reward vehicles that emit relatively small amounts (up to 60 grams per kilometre) of carbon dioxide (CO2), with a maximum bonus of 60,000 SEK, while burdening vehicles that emit relatively large amounts of CO2 with higher vehicle tax for the first three years..."

e.g. Q: How do market shares of different vehicles change with the implementation of a new bonus/malus system? What is the distributional effect of this new policy design? What is the long-run effect on CO2 emissions?

Work in progress: applying for new car registration microdata for the most recent years.

EV adoption and urban development

Motivation

- 2030 Agenda for Sustainable Development: Successful management of the anticipated, rapid, urban growth.
- Urban population: 55% today $\longrightarrow$ 68% by 2050.

Region	2010	2015	2020	2030	2040	2050	% increase 2020-2050
World	51.7	53.9	56.2	60.4	64.5	68.4	21.7%
More developed regions[a]	77.2	78.1	79.1	81.4	84.0	86.6	9.5%
Less developed regions[b]	46.1	49.0	51.7	56.7	61.3	65.6	26.9%
High-income countries[c]	80.0	80.9	81.9	83.9	86.2	88.4	7.9%
Middle-income countries[c]	47.9	50.8	53.7	59.0	63.9	68.3	27.2%
Low-income countries[c]	28.9	30.9	33.2	38.3	44.2	50.2	51.2%

Source: United Nations (2018)

[a]Europe, Northern America, Australia/New Zealand and Japan

[b]Africa, Asia (except Japan), L. America & the Caribbean plus Melanesia, Micronesia & Polynesia,

[c]Based on 2016 GNI per capita from the World Bank

Motivation

- This rapid urban development offers a unique opportunity to focus on sustainable urban planning.
- Environmental challenges in cities: water, sanitation, energy and air quality.
- Traffic is the important contributor of local air pollution in cities (Karagulian et al., 2015).
- Current urban development induces higher car dependence and longer commuting (OECD, 2018) $\longrightarrow$ higher levels of traffic jam and air pollution.
- Increasing number of people moving from rural to urban areas worldwide $\longrightarrow$ *urban air pollution calls for action!*

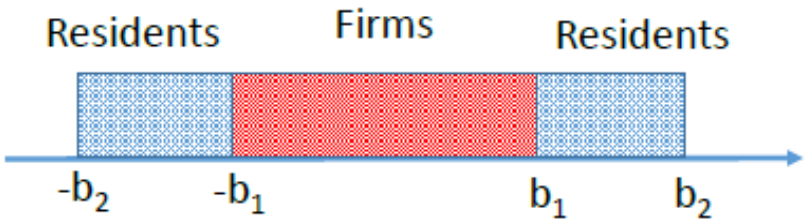
Motivation

- Traffic-induced pollution is likely to change
  - through policies: bike lanes, metro investments, parking-transit, urban tolls,...
  - through technlologies: car efficiency, low-sulfur gasoline, electric cars, car pooling, autodriven shared cars, teleworking

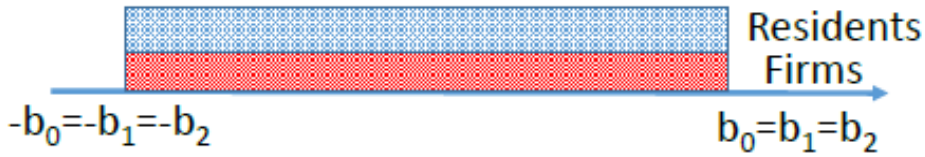
Our analysis

- Research question:
  - How does local traffic-induced pollution affect the internal structure of a city in a fully endogenous set-up? (What are the potential equilibrium urban structures?)
- Objective:
  - Study the internal structure of a city when both firms and households take their location decisions.
  - Compare the equilibrium and the optimal city configurations.
  - Design environmental policies that will fully internalize the damage from pollution.
- Contribution:
  - This is the first paper that studies how local traffic-induced pollution affects the land market for business and residential space and how it changes the internal structure of a city.

Urban structures



Monocentric city



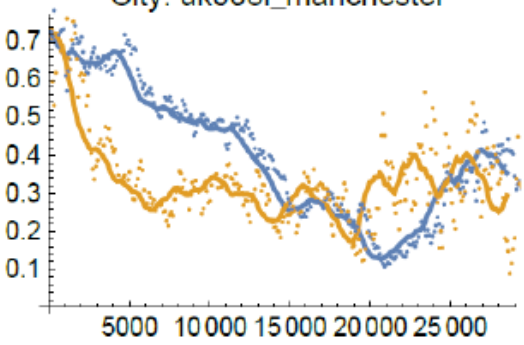
Integrated city

Partially integrated city

Real urban structures

Monocentric

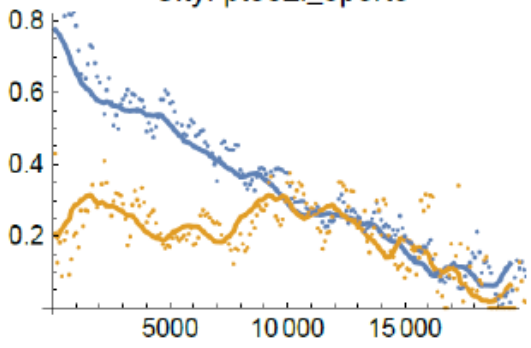
City: uk008l_manchester



- (Hous+Ind)/Area
- Ind/(Hous+Ind)

Fully Integrated

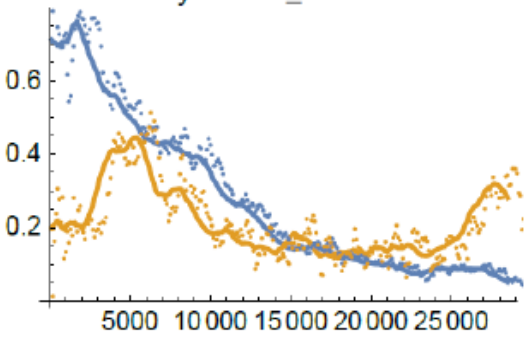
City: pt002l_oporto



- (Hous+Ind)/Area
- Ind/(Hous+Ind)

Partially Integrated

City: fr004l_toulouse



- (Hous+Ind)/Area
- Ind/(Hous+Ind)

Results overview

1. Monocentric cities: lower per-vehicle pollution benefits the owners of residential properties at the expense of their occupiers.
2. Partially integrated cities: lower per vehicle pollution enlarges the residential districts and shifts business districts closer to the city geographical center.
3. The first-best policies that fully internalize the externalities lead to a stimulation of the agglomeration externalities.

Spatial equilibria

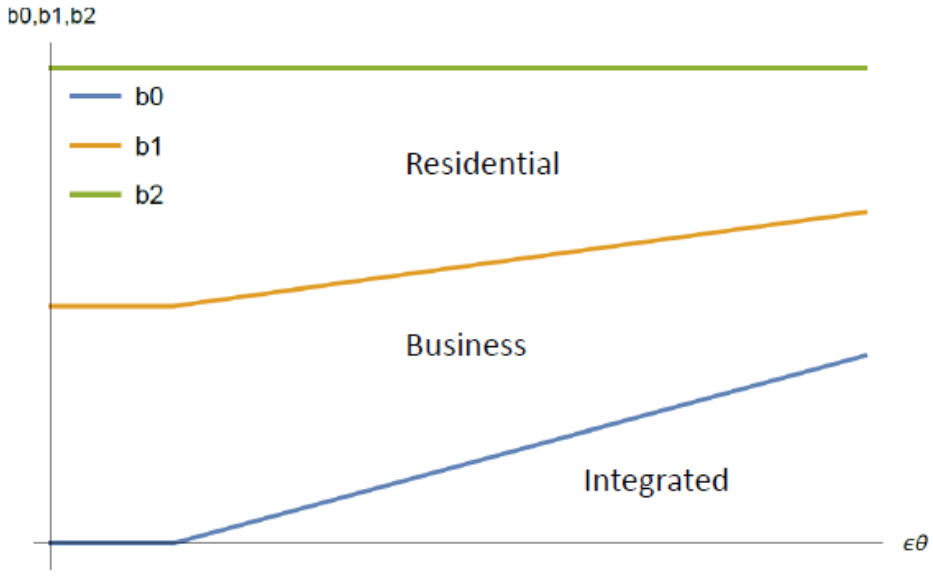


Figure 2: Equilibrium urban structure as impact and effect traffic induced pollution

Proposition: Given the population size, increasing environmental damages from commuting $\varepsilon\theta$ can turn a monocentric city to a partially integrated city.

First best

First best:

1. internalizes the effect of location on agglomeration economies (higher concentration of firms)
2. internalizes pollution exposure (commute less)

First best

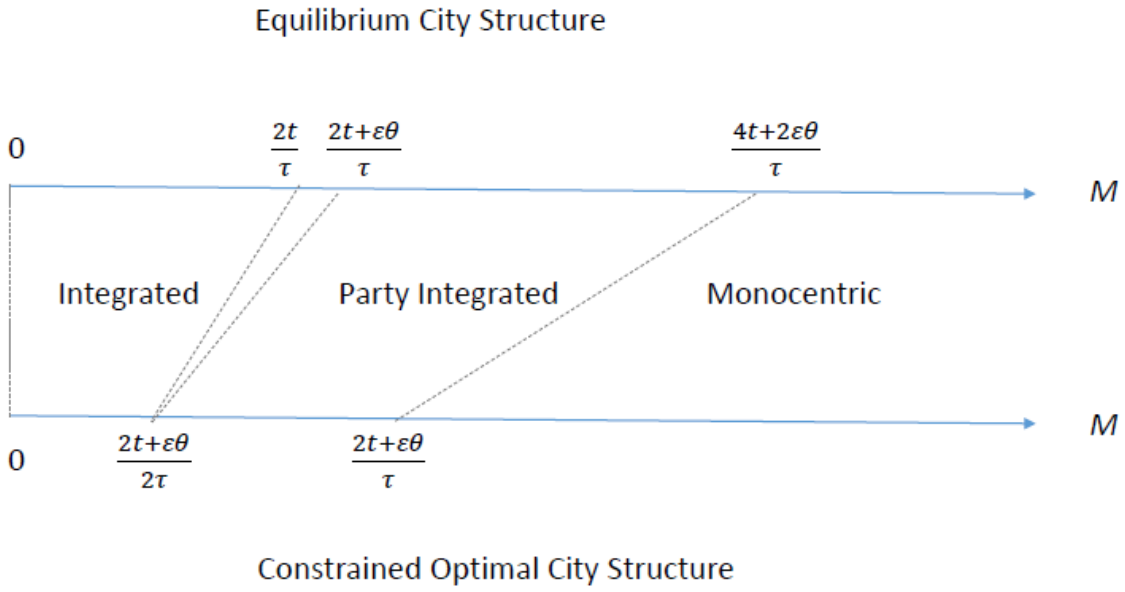


Figure 4: Equilibrium & Optimal City Structures

Two forces:

- More monocentric to enhance agglomeration
- Less monocentric to reduce pollution exposure
- Result: the implementation of the first-best policy stimulates the agglomeration externalities

First-best policy

- The optimal environmental policy is a **site-specific tax** that will be imposed on the worker living at x and increases with the distance to the city center (working location).
- This implies that workers who live far away pay a higher tax when commuting to work by their private vehicles.
- This policy design is in line with the new transport policy that was introduced in June 2019 in Olso (European Green Capital 2019): **additional toll stations** $\longrightarrow$ 83 toll stations in three **different toll rings**.
    - Lower prices on each toll but more toll crossings per trip
    - Congestion charge and **environmentally differentiated rates** in all toll rings.
    - Long-distance drivers will cross more rings and pay a higher price.

Activity plan

- According to the plan, we have:
  - built a spatial general equilibrium model that is suitable to deal with policy issues associated with traffic-induced pollution
  - Paper: "On the design of sustainable cities: local traffic pollution and urban structure": presented in conferences and workshops (& will be submitted soon).
- We are currently working on:
  - the policy simulations
  - the extension of the present model to a two-vehicle model (electric and conventional vehicles). We have built the theoretical model and we are running the simulations.