I would like a new car, which one do I choose?

DCA Workshop 2016

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Outline

1. Motivation
2. State of the art
3. Case study
4. Results
5. Conclusions and future work
Motivation

State of the art

Case study

Results

Conclusions and future work
Research question

Real research question

Can we model more flexible substitution patterns using Choice Probability Generation Functions (CPGF) based models?
Real research question

Can we model more flexible substitution patterns using Choice Probability Generation Functions (CPGF) based models?

But before...

- Start by a Cross-Nested Logit
- What can we add on the car-type ownership literature?
Car-type models

Why are they interesting?

- For car manufacturers: valuation of car attributes
- For governments, forecasts of:
  - Tax revenues
  - Energy consumption
  - Emission levels
- Can be used for policy measures

This is preliminary work. Comments and suggestions are more than welcome!
1. Motivation

2. State of the art

3. Case study

4. Results

5. Conclusions and future work
Car ownership models

Types of models

- Demand vs. supply
Car ownership models

Types of models

- Demand vs. supply
- Aggregate vs. disaggregate

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Car ownership models

Types of models

- Demand vs. supply
- Aggregate vs. disaggregate
- Static vs. dynamic

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Car ownership models

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- **Demand** vs. supply
- Aggregate vs. disaggregate
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Car ownership models

Types of models

- **Demand** vs. **supply**
- **Aggregate** vs. **disaggregate**
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Static disaggregate car-type choice models

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State of the art

Identifying a vehicle type

Make-model-engine

- An alternative: Volvo XC90 2.4
- Over 1000 alternatives
- Sampling of alternatives needed

Market and fuel type

- An alternative: Small petrol car
- Between 15 and 30 alternatives
- No sampling of alternatives needed

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1 Motivation

2 State of the art

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Data: France 2014

Decision makers
- 40,000 observations
- 20,000 contain no NAs
Data: France 2014

Decision makers

- 40,000 observations
- 20,000 contain no NAs

Attributes

- Reported fuel consumption [l/100km]
- Engine power [bhp]
- Price after discounts and government schemes [€]
- Reported range (EV) [km]
Case study

Data: France 2014

Decision makers
- 40,000 observations
- 20,000 contain no NAs

Attributes
- Reported fuel consumption \([l/100km]\)
- Engine power \([bhp]\)
- Price after discounts and government schemes \([\epsilon]\)
- Reported range (EV) \([km]\)

Socioeconomic variables
- Income
- Number of adults/children in the household
- Residential location (agglomerations vs. rural areas)
- Education level (university vs. no university)
Choice-set definition

Choice set

Car type = market segment + fuel type
Choice-set definition

Choice set

Car type = market segment + fuel type

Market segment
- Full
- Luxury
- Medium
- Multi-purpose vehicle (MPV)
- Off-road
- Small

Fuel type
- Hybrid
- Diesel
- Petrol
- Electric
Nesting structure 2

Fuel type

diesel

electric

petrol

1 2 3 4 5 6 30
11
12 13 14 15 16 17 31
Attributes of non-chosen alternatives

What are the attributes of an off-road diesel car that I didn’t choose?

1. Draw vectors of attributes from the empirical distribution.
2. Define the unchosen alternatives for each respondent.
3. Estimate the parameters of the model with this dataset.
4. Iterate.
1 Motivation

2 State of the art

3 Case study

4 Results

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Parameter estimation: CNL

Attributes of the car

Income

![Box plots of parameter estimates for car attributes and income categories.](image-url)
Parameter estimation: CNL

Socioeconomics

Dummy variables
Parameter estimation: CNL

Scale parameters ($\mu_{\text{small}} = \mu_{\text{hybrid}} = \mu_{\text{electric}} = 1$)

Alpha market segment
Conclusions and future work

1 Motivation

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Conclusions and Future work

Conclusions

- Most results are in line with our expectations and the literature.
- Results seem stable with only 10 draws.

Future work

- Compute trade-offs.
- Endogeneity of price and fuel consumption
- CPGF-based models
- Question: do I need to correct for the number of real cars within each alternative?
Thank you for your attention!
Questions?

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Parameter estimation: Logit

Attributes of the car

![Box plot of car attributes estimates](image)

Income

![Box plot of income estimates](image)
Parameter estimation: Logit

Socioeconomics

Dummy variables