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

DCA Workshop 2016

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Outline

Research question

Real research question

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

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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!

Car ownership models

Types of models

- Demand vs. supply

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Static dissagregate car-type choice models [1]

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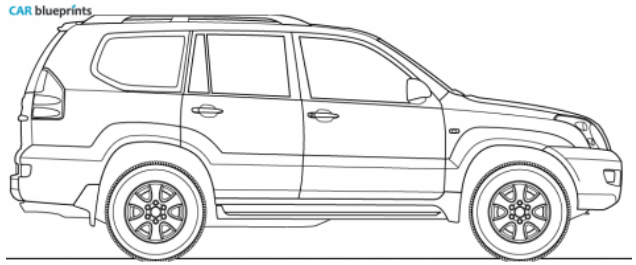
Identifying a vehicle type

Make-model-engine [2]

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

Market and fuel type [3]

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



[2] Birkeland, M. E. & Jordal-Jorgensen, J. (2001) Energy efficiency of passenger cars. Paper presented at the European Transport Conference 2001, PTRC, Cambridge, UK.

[3] Page, M., Whelan, G.,& Daly, A. (2000) Modelling the factors which influence new car purchasing. Paper presented at the European Transport Conference 2000, PTRC, Cambridge, UK.

Data: France 2014

Decision makers

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

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- Reported fuel consumption [l/100km]
- Engine power [bhp]
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- Reported range (EV) [km]

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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

$$\text{Car type} = \text{market segment} + \text{fuel type}$$

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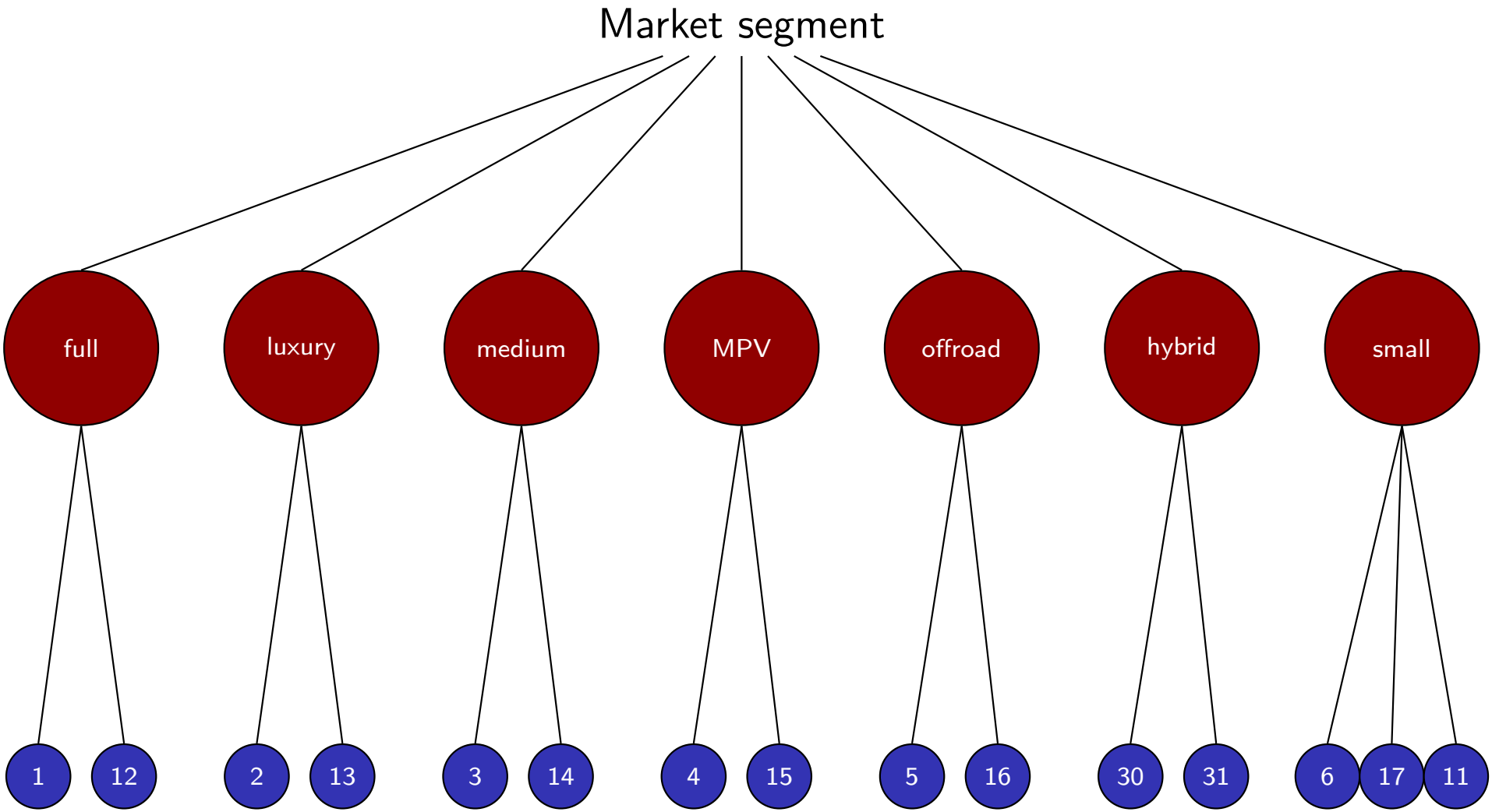
Market segment

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

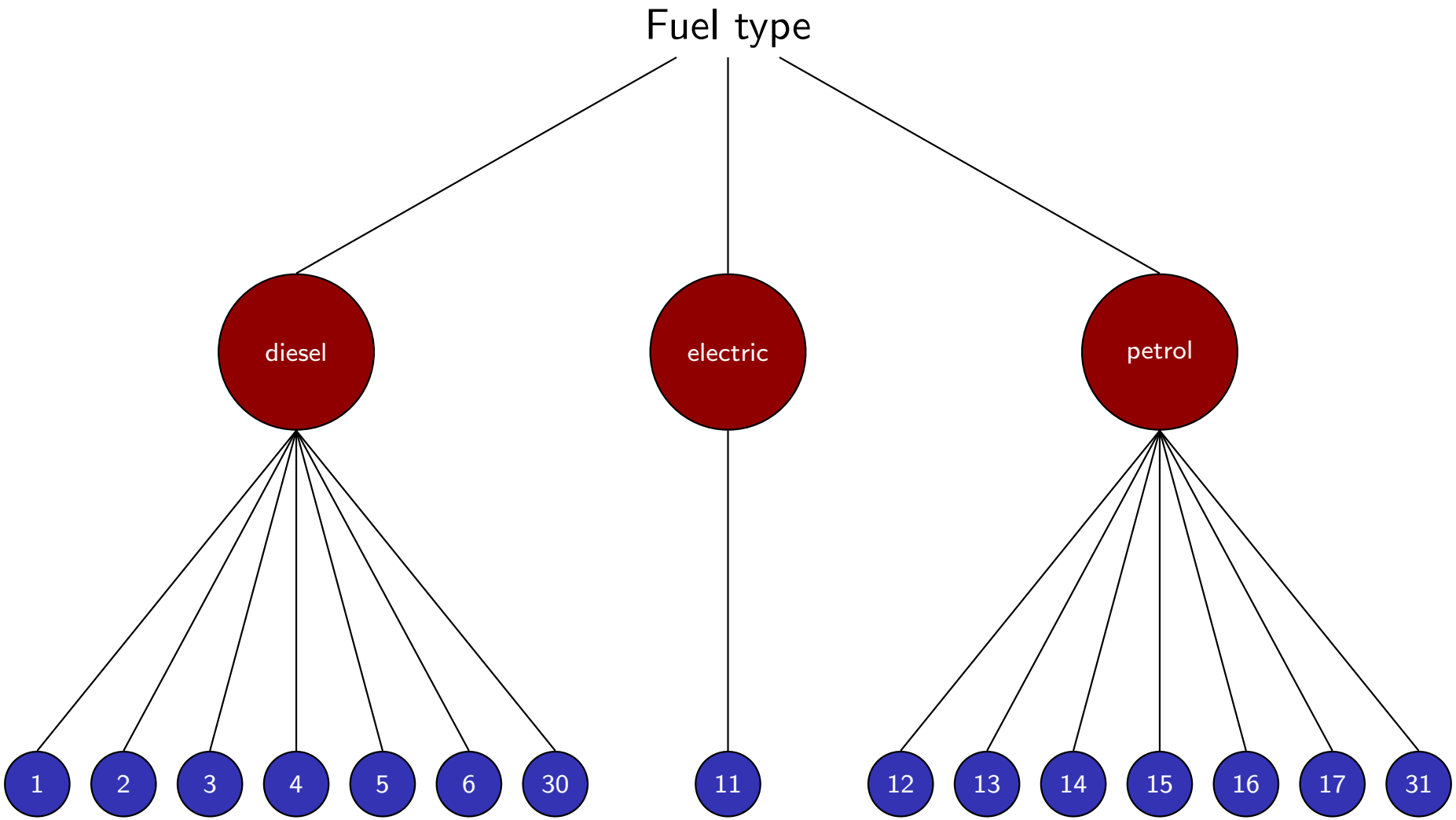
Fuel type

- Hybrid
- Diesel
- Petrol
- Electric

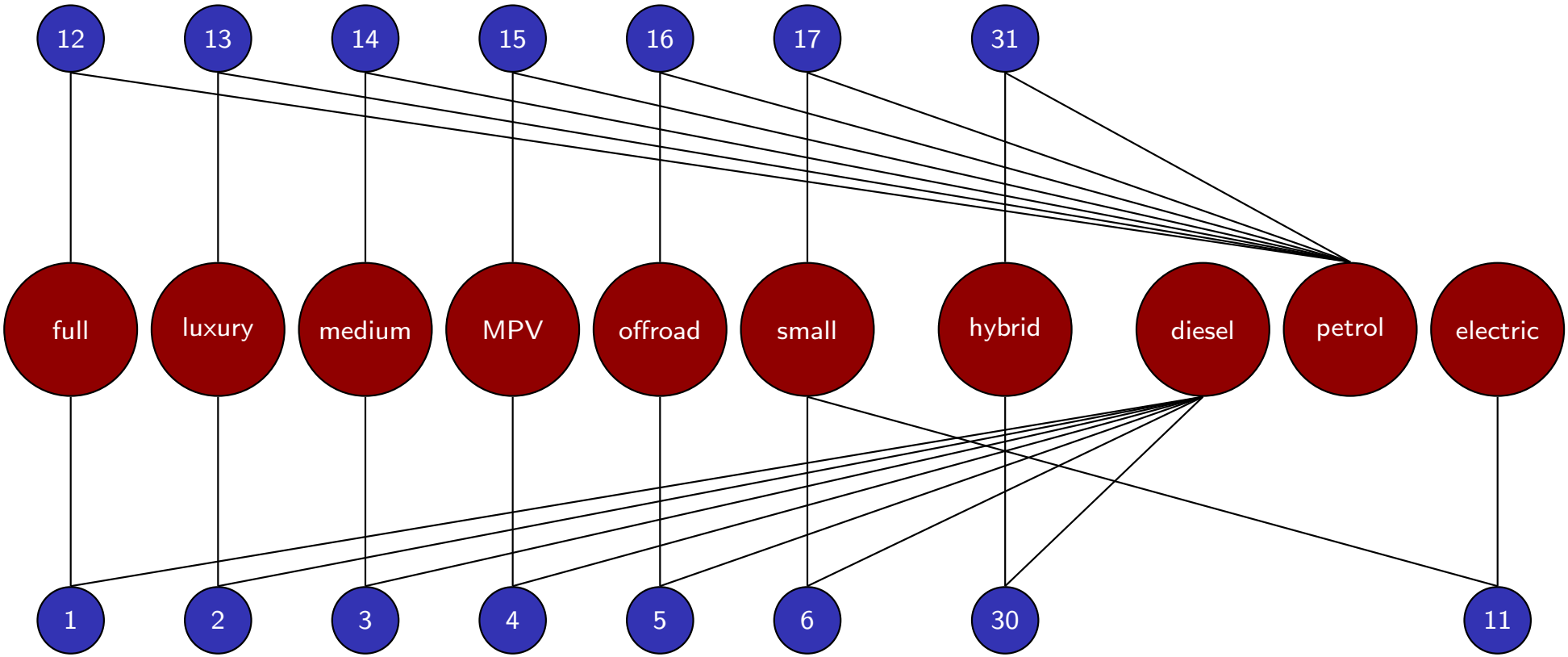
Nesting structure 1



Nesting structure 2



Cross-nesting structure



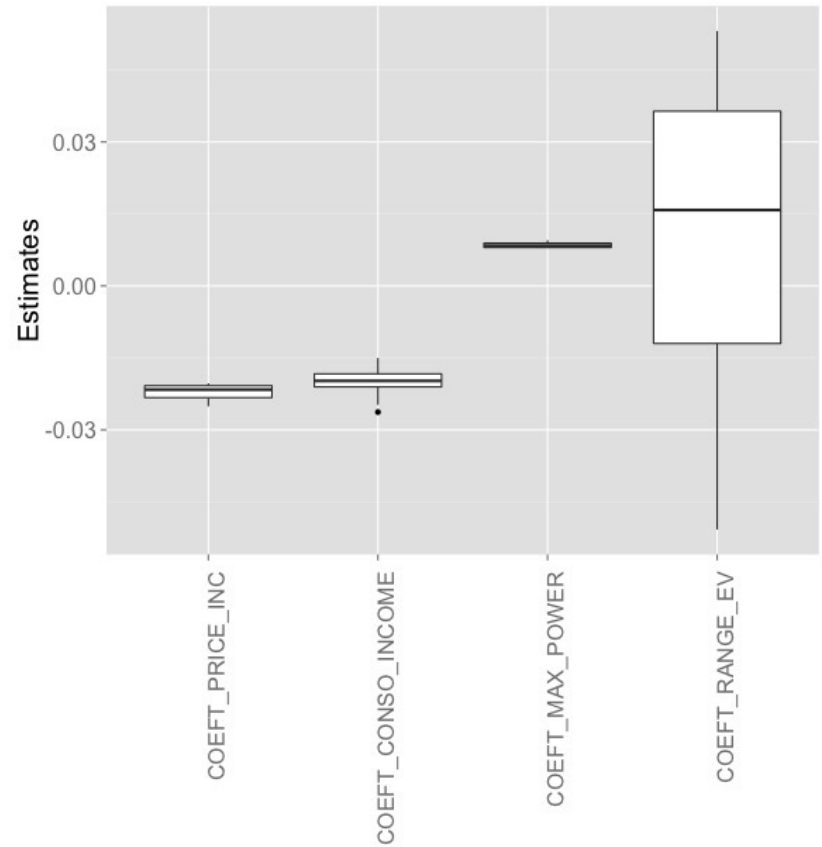
Attributes of non-chosen alternatives

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

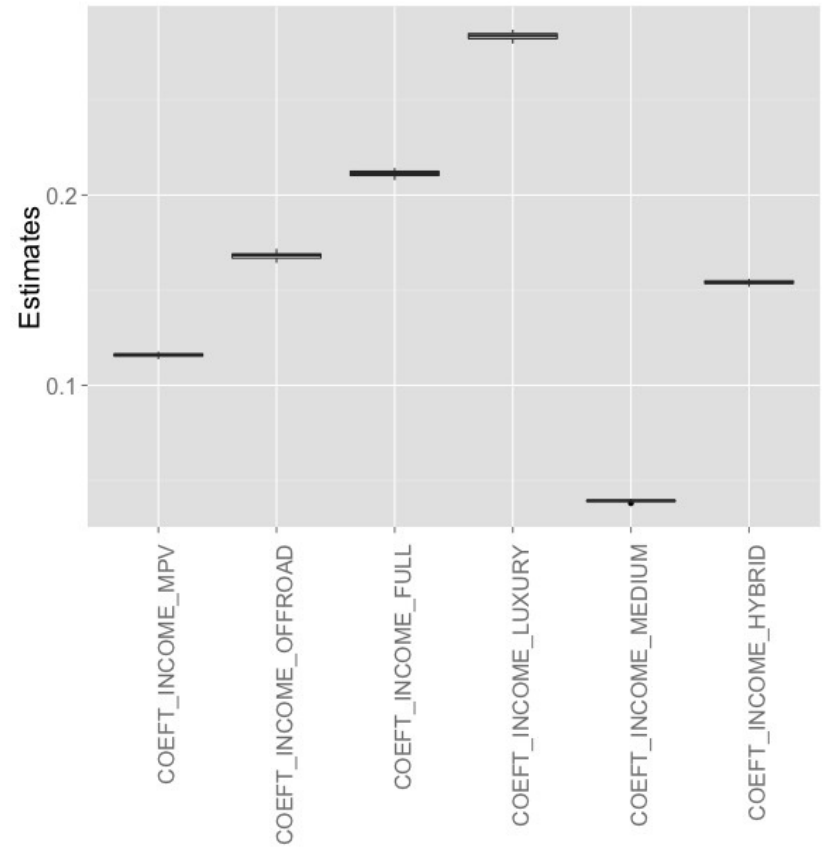
1. Draw vectors of attributes from the empirical distribution.
2. Define the unchosen alternatives for each respondent.
3. Estimate the parameters of the model with this dataset.
4. Iterate.

Parameter estimation: CNL

Attributes of the car

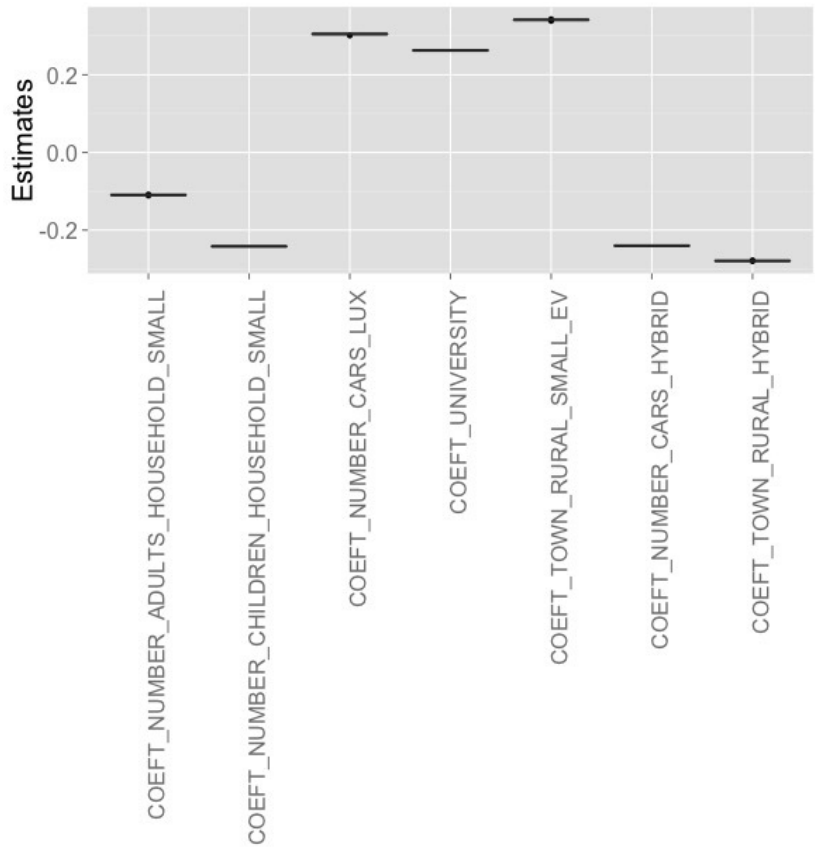


Income

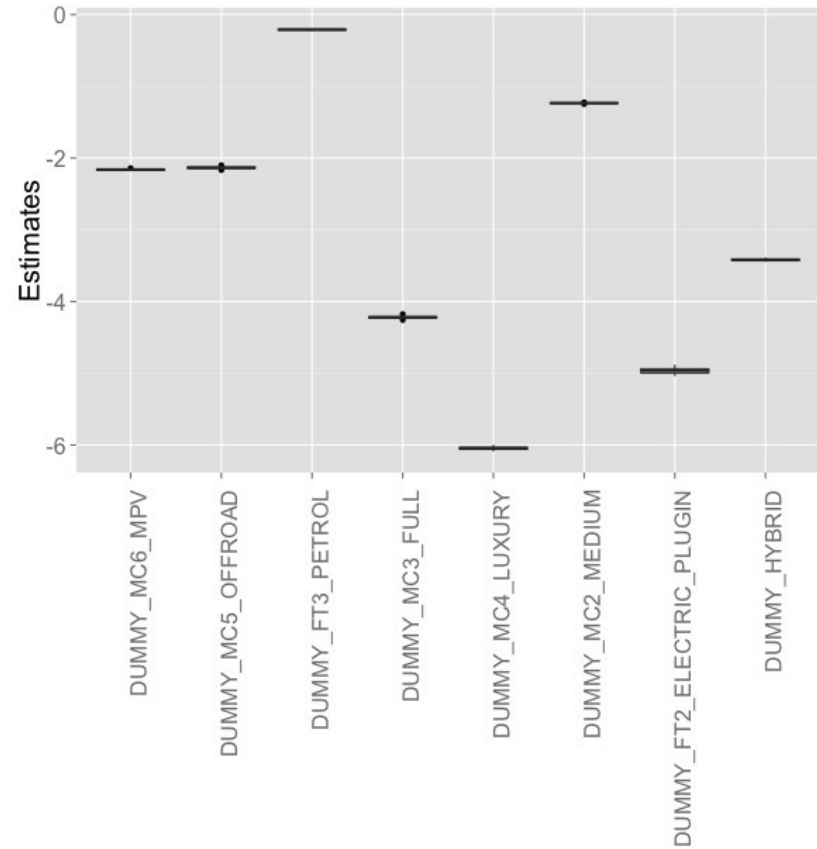


Parameter estimation: CNL

Socioeconomics

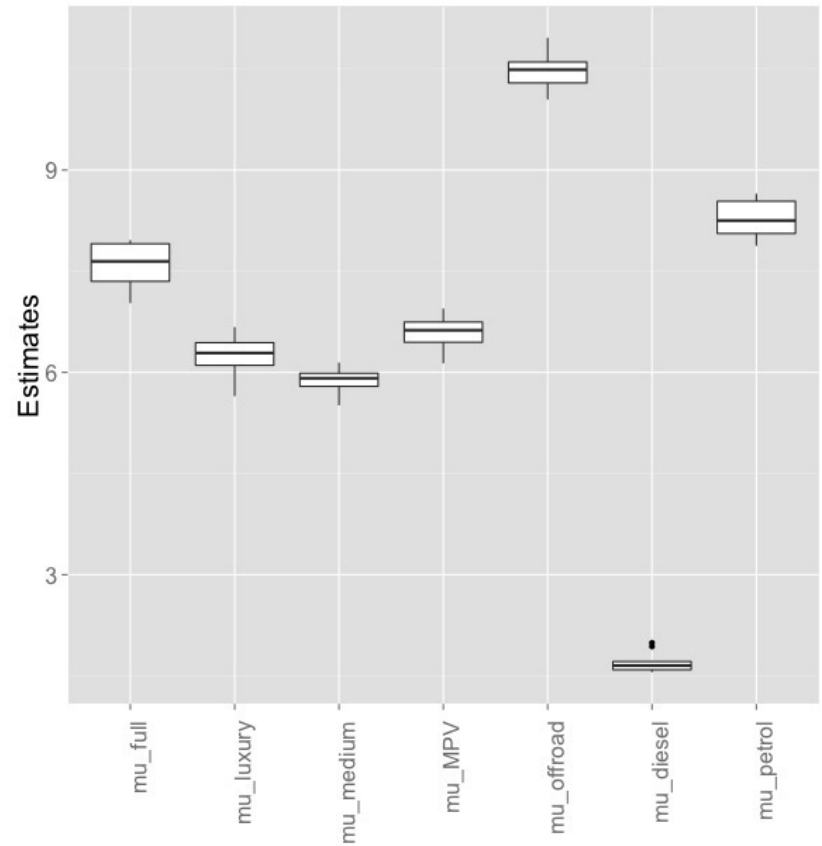


Dummy variables

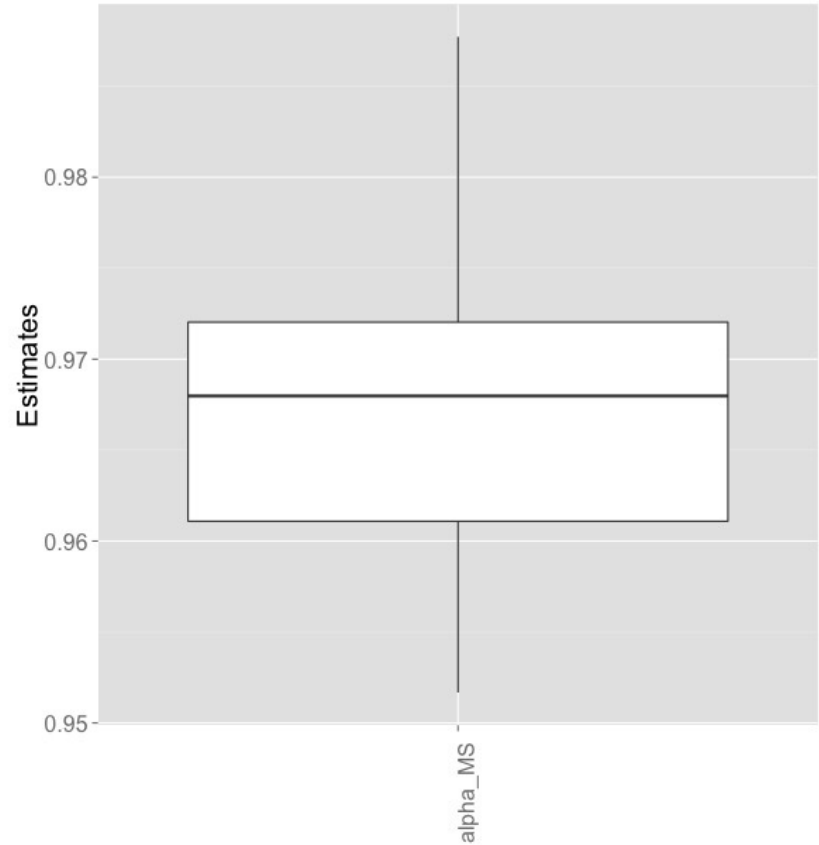


Parameter estimation: CNL

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



Alpha market segment



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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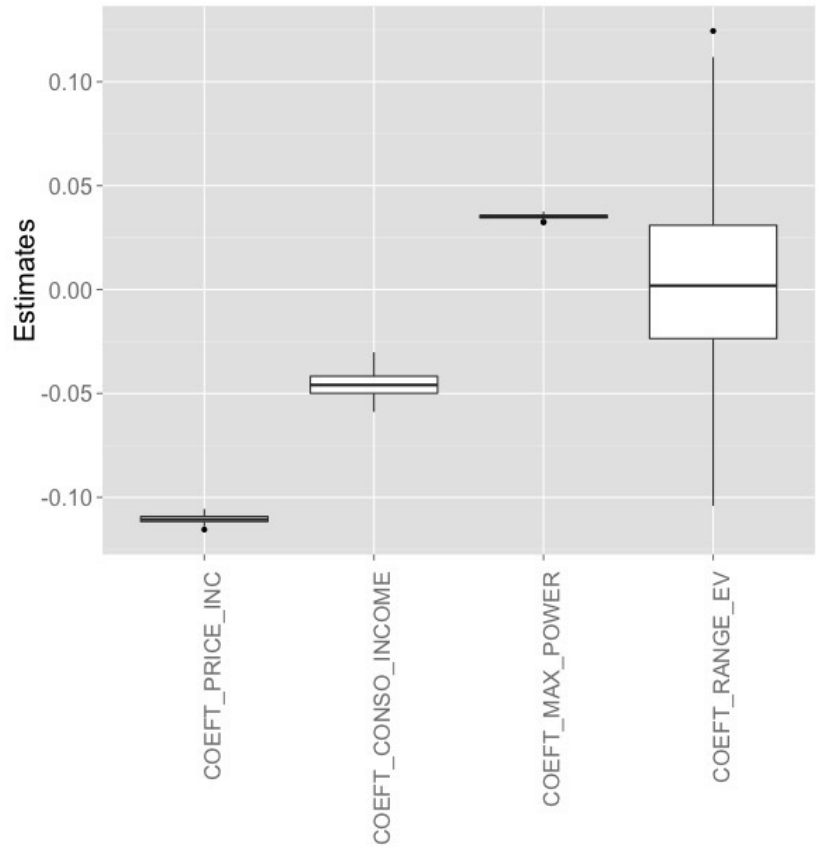
Parameter estimation: Logit

Attributes of the car



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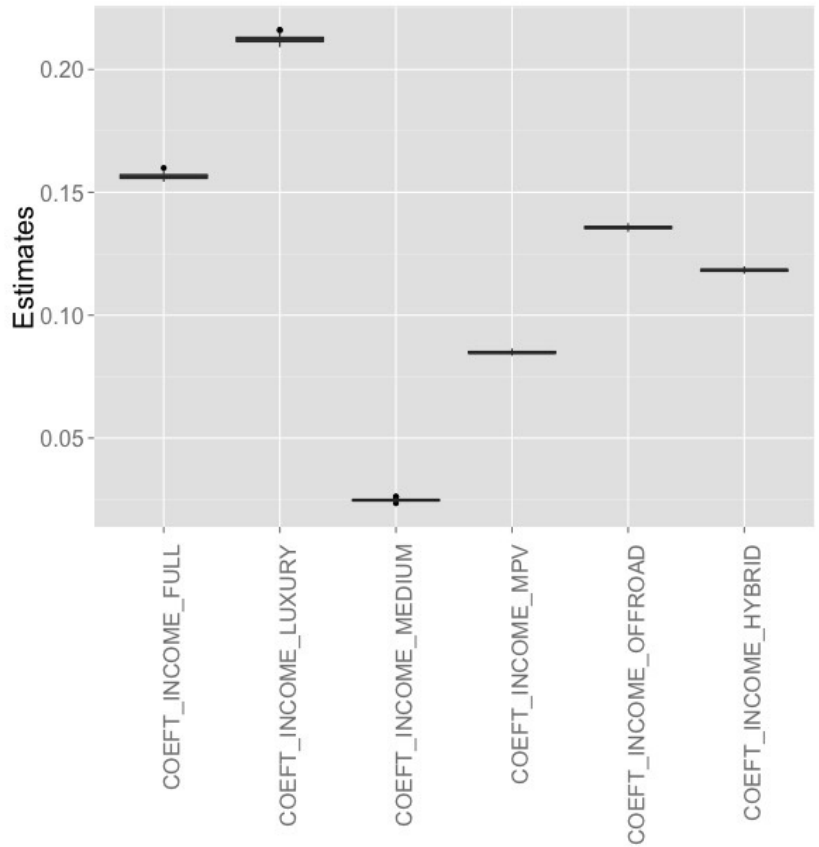

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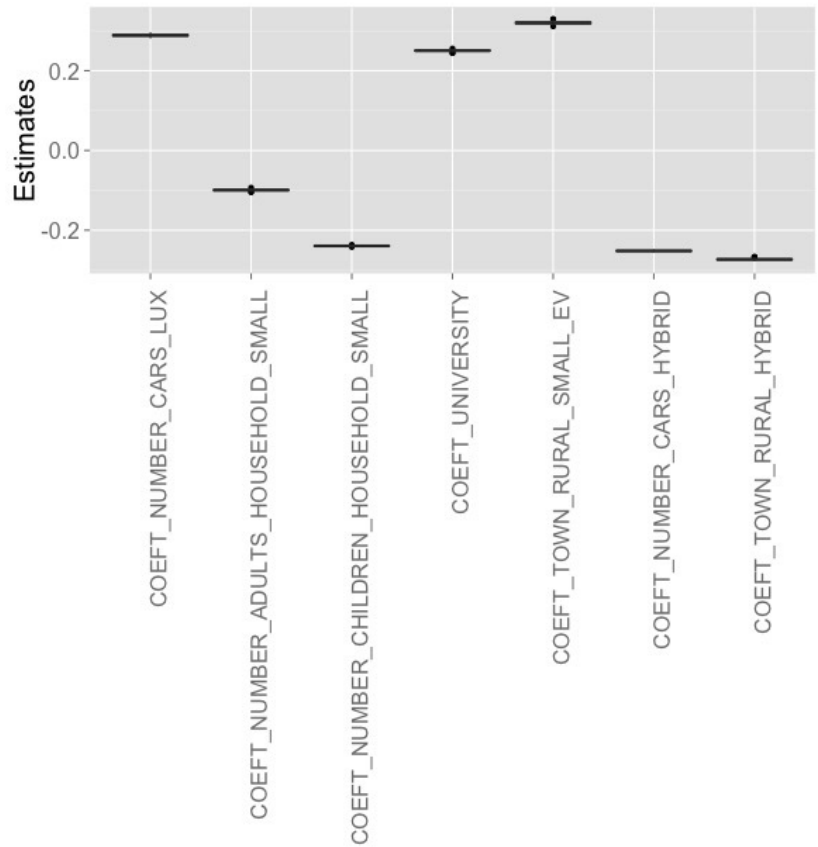

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