

Do Consumers Value Qualitatively Identical Improvements in Fuel Consumption and CO₂ Emissions of Cars Equally?

The Metric and Unit Effects on Consumer Decisions and Choices

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Description

The goal of this research project is to study whether and how consumers differ in both their preferences toward and willingness to pay (WTP) for qualitatively identical improvements in fuel consumption (thereon, FC) and CO₂ emissions of cars. From a technical view, these two metrics are linearly connected by a specific factor and thus, both can be used to assess an environmental impact of a specific car specification. For example, one litre of diesel and petrol fuel used per a kilometre driven produces approximately 26.5 and 23.2 gram of CO₂, respectively. However, the question is whether consumers do understand this relationship and thus, can correctly use the information on fuel consumption and/or CO₂ emissions while making their choice decision. In addition to the metric effect, it is of interest to investigate how various types of units CO₂ emission values are presented in (e.g. 100 g/km; 0.100 kg/km; 10000 g/L) influence this understanding.

The current research is motivated by two streams of previous studies. First, previous studies have shown a discrepancy in willingness-to-pay values for fuel savings in cases whether fuel consumption of a car is presented in km/L or L/100 km (e.g. Larrick and Soll, 2008; Schouten et al., 2014; Tversky and Kahneman, 1981). The second stream of research on framing of numerical quantities has demonstrated that bigger numbers of units in the attribute information lead to a greater perceived difference between products described by this attribute (e.g. Pandelaere et al., 2011; Cadario et al., 2016)

Overall, the current study aims at investigating how metric and scale design as choice architecture tools can be manipulated to "nudge" consumers to make better decisions. This task is relevant from both policy-making and managerial perspectives. First, environmental costs of "wrong" consumers' perceptions of information provided in various metrics (FC or CO₂) and scales (g/km or kg/km) can be accessed. Second, firms can use the study's insights to guide their decisions regarding a design of both the best product options and advertisement text. The study's contribution also lies in a direct comparison of the investigated metric and scale effects between consumers who prefer diesel or petrol vehicles.

The research is planned to be conducted as follows:

Method	Choice-based conjoint analysis (CBC)
Product category	Car rental
Fielding the survey	Computer-based questionnaire (Internet survey)
Framework	Mixed experiment design with a variation in metrics (FC or CO ₂) within subjects, and a variation in scales (CO ₂ in g/km or kg/km) between subjects
Experiment design	Full factorial with 3 attributes with levels $2 \times 4 \times 4$
Stimuli design	2 alternatives + "None" option
Utility scores	Engine type (diesel, petrol); price per day (€); FC (L/100 km); CO₂ (g/km or kg/km); engine type \times FC ; engine type \times CO₂
Estimation I	Individual-level part-worth utility scores using hierarchical Bayes (HB)
Estimation II	WTP distribution using mixed (random coefficient) logit model (in WTP-space)

Because it is impossible to separately identify preferences for FC and CO₂ with revealed preference data, the research goals command a usage of stated preference data. Thereby, a **choice-based conjoint experiment** creates a choice situation close to a realistic one, by asking respondents to choose one of several product concepts or leave the market ("none" option). Additionally, within the choice-based conjoint analysis with full factorial design it is possible to include and test an existence of **interaction terms of interest**. CBC is selected as being a good alternative to estimate how levels from different attributes combine to affect overall preference for a product. Through estimating the utility scores for the selected attributes and their levels, the following outcomes of interest will be analysed: differences in the **predicted product choices**, **relative importances** of and **WTP** for improvement in FC versus CO₂ values depending on framing of the attribute information and on engine type.