frontiers | Frontiers in Sustainability

TYPE Original Research
PUBLISHED 16 February 2023
DOI 10.3389/frsus.2023.1114437

Check for updates

OPEN ACCESS

EDITED BY
Oludunsin Arodudu,
Irish Manufacturing Research, Ireland

REVIEWED BY
Bertha Maya Sopha,
Universitas Gadjah Mada, Indonesia
Dimitrios Nalmpantis,
Aristotle University of Thessaloniki, Greece

*CORRESPONDENCE
Liesbeth De Wilde
✉ liesbeth.de.wilde@vub.be

SPECIALTY SECTION
This article was submitted to Modeling and Optimization for Decision Support,
a section of the journal Frontiers in Sustainability

RECEIVED 02 December 2022
ACCEPTED 19 January 2023
PUBLISHED 16 February 2023

CITATION
De Wilde L, Keserü I, Macharis C and Vanhaverbeke L (2023) Finding alternatives for the traditional diesel-powered company car: A conjoint analysis approach.
Front. Sustain. 4:1114437.
doi: 10.3389/frsus.2023.1114437

Finding alternatives for the traditional diesel-powered company car: A conjoint analysis approach

Liesbeth De Wilde[1]*, Imre Keserü[1], Cathy Macharis[1] and Lieselot Vanhaverbeke[2]

[1]Mobilise Mobility and Logistics Research Group, Department of BUTO, Vrije Universiteit Brussel, Brussels, Belgium, [2]MOBI Research Centre, Department of BUTO, Vrije Universiteit Brussel, Brussels, Belgium

Although the use of company cars is associated with more congestion, pollution and accidents compared to privately owned cars, the Belgian fiscal system provides exceptionally high incentives to company cars. As a result, the proportion of company cars is higher in Belgium than in any other OECD country. With a corporate mobility budget, more sustainable options are being offered as an alternative to large diesel-powered company cars, but little is known about how company car drivers value these alternatives. In this article, we explore how car-dependent employees make their choices in the company mobility system and aim to find options that enable more sustainable commuting. A choice-based conjoint analysis carried out among 422 car dependent company car drivers was used to measure their preference for alternative car-based solutions. The results indicate an overall preference for hybrid cars, but a shift toward fully electric vehicles is necessary to have a significant impact on climate change. Our results suggest that respondents with a higher environmental concern are more eager to make the transition toward smaller and fully electric vehicles, which is in line with previous studies. The study revealed that there is currently no alternative that is both more sustainable and more preferred by the sample, which again stresses the need for more drastic government intervention.

KEYWORDS

choice based conjoint analysis, stated preference, car users, sustainable mobility, travel behavior, company cars, corporate mobility budget

1. Introduction

Commuting by car is globally associated with many externalities, such as traffic congestion during peak hours, long driving hours, sedentary lifestyles and a negative impact on climate and air quality (Wener and Evans, 2011). A beneficial fiscal system, encouraging many employers to provide company cars to their employees, adds on to the unattractiveness of alternative, more sustainable transport modes. In this article, company cars are defined as motorized vehicles that are made available by the employer to the employee, which can be used both for professional and private purposes (May, 2017; Zijlstra and Vanoutrive, 2017). In many European countries, company cars are often seen as a financially beneficial option to attract employees to a company. They can also offer flexibility for work-related tasks to employees and promote the company. However, company cars are also associated with the negative externalities of commuting by car as well as welfare loss: in Europe, deductions and write-offs for company cars are estimated at €32 billion (Dataforce Transport Environment, 2020).

In Belgium, the company car – with an accompanying fuel card – is subject to one of the most generous taxation policies of all OECD countries (Harding, 2014; OECD, 2022), making it a popular subject of political and academic debate over the last decade. The Belgian government has reformed the legislation concerning the taxation of (company) cars and employee mobility several times, but the effects of these reforms on the modal split and the number of company cars are negligible (Vanoutrive et al., 2010). In Belgium, 13.5% of Belgian workers have access to a company car, and company cars account for 11.5% of the current car fleet (May, 2017). However, almost 60% of the newly registered cars are company cars and this number is increasing each year (Febiac, 2021). When it comes to commuting, the car also remains the most popular transport mode in Belgium (65%), followed by the bicycle (11.1%), train (10.6%), metro, tram or bus (6.8%), carpooling (2.5%), walking (2.3%) and motorcycle (1.2%) (Pollijn et al., 2018). While Zijlstra and Vanoutrive (2017) and many car manufacturers claim that company cars are generally newer and therefore more energy efficient than privately owned cars. Dimitropoulos et al. (2016) found that, because of the generous fiscal treatment, the average company car is also more expensive and larger than a privately owned car and has larger engine capacity. This indicates a contradiction in the sustainability aspect, because larger engines typically produce more carbon emissions. According to Laine and Steenbergen (2017), the average company car driver makes longer trips (for both professional and private purposes) than an employee who has no access to a company car. It goes without saying that offering a company car and free fuel to employees are important determinants affecting the modal choice for the daily commute. Furthermore, regulations allowing employees to get reimbursed for their commuting costs, encourage employees to use their car and to find a workplace that is even further away from their residence (Potter et al., 2006).

The phenomenon of providing company cars has become more common since cars became popular in Europe in the 1960's (Pooley and Turnbull, 2000; Dataforce Transport Environment, 2020). Despite recent trends and developments countering the traditional diesel- or petrol- powered company car, such as the increasing role of shared mobility, the introduction of low-traffic zones in cities and the proliferation of zero-and-low-emission vehicles (ZLEVs), company car drivers are still very reluctant to give up their car under the current conditions and they see their company car as an acquired right (Zijlstra and Vanoutrive, 2017). There is a minority of employees that can be convinced to exchange their company car for additional wage, a bicycle or a public transport pass. At the same time, the majority of company car drivers is more dependent on their car. They cannot easily be convinced to get rid of this highly valued fringe benefit, whether or not for practical reasons, mainly because of the high utility it provides. These are generally more habitual car drivers, for example sales representatives driving to all corners of the country, or commuters living and working in remote suburbs with poor public transport services (Macharis and Witte, 2012; Van Eenoo et al., 2022). There is not a large body of literature dedicated to company cars and especially company car drivers, since it transcends the mobility domain to fiscal studies and studies in Human Resource Management. Transportation and policy studies that look into sustainable mobility policies within organizations are often directed toward the avoidance of travel (Jaakson and Kallaste, 2010; Anderson et al., 2015) and measures promoting modal shift (Cairns et al., 2010; Van Malderen et al., 2012). However, the increasing number of company cars in Europe and Belgium gives us reason to believe that measures to reduce work-related travel and promote modal shift are not sufficient to turn the tide. As stated before, employees are reluctant to support policies that infringe on the benefits of their company car. This is confirmed by Securex, an international partner in the field of social administration and HR: 59% of the questioned company car drivers stated that they would change jobs if the company car was no longer offered by their employer (Securex, 2019). Considering this high resistance, we believe that smaller steps are necessary to transition them into a more sustainable mobility pattern. For example, instead of convincing employees to switch toward a bicycle right away, we might be able to more successfully persuade them to opt for a more sustainable car.

Understanding current and future employee mobility is of great importance for shaping a sustainable mobility policy and for orienting future research. In this paper, we explore the acceptance of current alternative solutions to the traditional company car, to better understand the preference of Belgian company car drivers who are not (yet) ready to give up their car. This can help steer policy making in proposing alternatives that might successfully reduce the negative externalities associated with traditional company cars. There are no other studies investigating company car choice in Belgium to date. This paper therefore seeks to address the following research questions: "Which alternative car-based solutions exist that can provide sustainable alternatives to the current traditional company car regime?" And "Which combinations of alternative car-based solutions are preferred by car dependent employees?". We aim to define these combinations of alternative mobility solutions as well as the relationship between socio-demographic variables and the preference for these alternative mobility solutions. In a literature review, we identified existing solutions for the traditional diesel-powered company car (without the need to get rid of a car completely), such as their electric counterpart and the mobility budget. Next, a choice based conjoint (CBC) analysis, based on a discrete choice experiment, was used to measure the preference of company car drivers toward these possible alternatives. We end the paper with a discussion of the results and implications for policy making. Limitations of the study and suggestions for further research are also discussed.

2. Promoting alternatives to the company car

Companies can influence the travel and commuting behavior of their employees in different ways. In this section, we identify relevant scientific literature on alternative solutions for the traditional company car. Since the scope of this article is on company car drivers who are not ready to get rid of their car, we focus on solutions associated with the car as the main transport mode in Belgium. In the next sections, we will elaborate on two alternatives, namely providing ZLEVs as company cars and corporate mobility budgets.

Abbreviations: OECD, Organization for Economic Co-operation and Development; CBC, choice based conjoint; EV, electric vehicle; BEV, battery electric vehicle (full electric vehicle); PHEV, plug-in hybrid electric vehicle; HEV, hybrid electric vehicle; SD, standard deviation; SE, standard error; ZLEV: Zero-to-low-emission vehicle.

2.1. Electric vehicles

Currently, the majority of the company cars in Europe and Belgium are powered by diesel and petrol (de Borger and Proost, 2017; Departement Omgeving, 2020). Therefore, ZLEVs have a high potential to act as an environmentally friendly alternative. When it comes to the environmental impacts of the available options in electric vehicles, we distinguish between zero- and low-emission vehicles. Zero-emission vehicles are full electric, battery operated vehicles (BEV). Low emission vehicles are plug-in electric vehicles (PHEV) which have both a combustion engine and an electric engine. The Belgian regulation stipulated that the average CO_2-emissions for PHEV's cannot exceed 50 g/km (Federale Overheidsdienst Financiën, 2020), meeting the regulations of the European Union. Hybrid electric vehicles (HEV) are regular diesel or petrol powered cars that are supported by an electric motor which uses the energy stored in batteries. They cannot be charged. Although the average emissions of HEVs are generally lower than traditional diesel- and petrol powered cars, they are not considered as low emission vehicles.

Gutiérrez-i-Puigarnau and Ommeren (2011) describe the company car market as the main driving force of changes in European car fleets. This means that ZLEVs penetrate mainly through the company car market. Governmental intervention through fiscal reductions for company cars can stimulate the demand for BEVs and PHEVs. Dimitropoulos et al. (2016) found that potential early adopters of company EVs travel short annual distances and are less likely to have higher incomes. With the help of a discrete choice experiment approach, the authors pointed out that especially PHEVs and extended-range electric vehicles (EVs) are preferred by early EV adopters. However, in reality, PHEVs are claimed to exhaust even more CO_2 than the average European car, as they generally have larger engines and small batteries, and are charged less than once a week. Additionally, the pollution of these cars is higher than claimed by the manufacturer (Bannon, 2020; De Wolf, 2020). The Belgian government has taken active steps to electrify the company car fleet. First, only zero-emission company cars will remain 100% deductible from company tax in 2026, as opposed to cars with combustion engines. This means that cars with combustion engines, including those in PHEVs, will become unattractive as newly purchased or leased company cars. Simultaneously, the Belgian government will provide tax incentives for the installation of charging stations at home and at public charging points (Winckelmans, 2020). Mainly because of past and upcoming regulations concerning the electrification of company cars and the fast rotation on the company car market, the average CO_2 emissions of new car registrations in Belgium have decreased with 20% in 10 years time, going from 135g/km in 2010 until 108 g/km in 2020, and are forecasted to decrease further in the coming years (Febiac, 2020). In 2021, the new registrations in Belgium were still dominated by petrol cars (52%), followed by Diesel (23.7%, decreased by 9% compared to 2020), PHEV (12.5%, increased by 5% compared to 2020), BEV (5.9%) and HEV (5%) (Febiac, 2021).

However, there are currently also issues associated with EVs: limited charging infrastructure, limited driving range, and higher price points. Additionally, new technologies allowing for a more sustainable battery production are still in an early stage and nickel, lithium and cobalt stocks are currently insufficient for large-scale breakthrough of EVs (Daems, 2018). Partly because of the difficulties entailing a complete electrification of the company car fleet, it might still be too early to convince company car drivers to go fully electric.

2.2. Corporate mobility budget

The increasing demand for flexibility and individualization in modern society also trickles down to the mobility domain (Barreto et al., 2019) and employee management (Busse and Mitteldorf, 2021). Corporate mobility budgets provide flexible solutions to the traditional company car scheme and have been gaining importance over the last decade (Schlegel and Stopka, 2022). Schlegel and Stopka (2022) describe the corporate mobility budget, in this article further referred to as "mobility budget", as an amount of money, made available by the employer, that the employee can spend on a portfolio of different transport options. Mobility budgets therefore do not necessarily imply replacing a company car, but they can supplement it. This is because one can include the lease price of a cheaper, smaller, and/or more fuel-efficient (e.g., electric) car in a mobility budget, where the price difference is rewarded to the employee. In short, a mobility budget offers more options than merely providing a car and its main objective is for the employee's work-related travel to become more multimodal. Mobility budgets provide additional benefits to the employer as they might enhance their environmental certification (ISO 14001) and increase their attractiveness in the war for talent (Schlegel and Stopka, 2022). In addition, a mobility budget allows employees to regain autonomy and freedom of choice and, at the same time, employers can generate higher productivity levels because of increased employee satisfaction (Zijlstra and Vanoutrive, 2017). Similarly to company cars (as per definition in this article), a mobility budget is mainly a European concept, and no similar model currently exists outside of Europe to date (Schlegel and Stopka, 2022). Some examples of international mobility budget providers on the European market are Skipr (FR), XXlmo GmbH (Germany), OD Mobility UK Ltd. (UK), Alphabet International (Netherlands) and MaaS Global Ltd. (Finland). Many of these providers are also active in Belgium.

In Germany, the implementation of a mobility budget has increased from 10% in 2019 to 31% in 2020 and the majority of the employers offering a mobility budget has a disproportionally higher company car to employee ratio (Arval Deutschland GmbH 2021, p. 55 in Schlegel and Stopka, 2022). Also in Belgium this model is gaining popularity: in 2017, 29% of the Belgian company car drivers already had access to a mobility budget and 12% of the (total) questioned company car drivers actually made use of this budget. Of the respondents that did not have access to a mobility budget, 20% indicated that they would opt for a smaller company car if they were given the opportunity (Fleet Profile, 2017).

In response to both the pressure of the European Union to drastically change the current company car policy (Harding, 2014; De Vliegher, 2022) and the increasing demand for more flexibility, the Belgian government developed a legal framework in 2019, which provided specific tax benefits to employers offering and employees using a mobility budget (De Craecker, 2020). The framework is as follows: it is up to the employer to decide to offer a mobility budget, but when a number of conditions are met, employees can request to trade their company car for a budget that can be spent on three pillars: an environmentally friendly company car (max. 95g CO_2/km), sustainable means of transport, which are completely tax-free for the employee, and cash, i.e., a tax-privileged payment of the surplus. This means that employees could voluntarily opt for a smaller car with a smaller engine and drive fewer kilometers in order to have a bonus left at the end of the year. A stated preference experiment by Zijlstra (2016) revealed the challenges of the early mobility budget and its components (i.e., company bicycles, public transport passes, extra leave days and financial bonuses), and showed that Belgian company car drivers were not (yet) ready for these types of alternative solutions, preferring the traditional company car scheme. However, Zijlstra's research was as well focused on the concept of modal shift and did not consider the preference for LZEVs. Nevertheless, 2 years after its implementation, in 2021, it seems that the recently introduced legal framework for the mobility budget has indeed not been convincing to employers nor employees. Few employers offer it and only 0.15% of the employees with a company car uses this form of the mobility budget (De Craecker, 2020).

To understand why the mobility budget has been unsuccessful so far, even though it can be fiscally beneficial (e.g., following the Belgian legislation), we need to understand the preferences of company car drivers. Most research on company cars in Europe has been focused on solutions that, from an employer or governmental point of view, can be implemented to reduce the use of company cars. Little research has been done on the preference of company car drivers themselves and their reactions to these solutions. Research on the preferences of these more car dependent company car drivers is non-existing. Dimitropoulos et al. (2016) studied the preference of Dutch company car drivers toward different types of EVs, but did not take the size of the car into account, nor the amount of (free) fuel or electricity that goes with providing a company car. These are essential questions in today's policy making.

3. Method

In this article we aim to find (combinations of) alternative car-based solutions, reducing the negative externalities of the traditional company cars, that are preferred by car dependent employees. Employees that are already willing to exchange their company car for other transport modes or cash do not fall within the scope of this study. To find these combinations, the attributes that make up the benefits of a company car were defined by using the concept of the mobility budget as a starting point. We answer our research questions by conducting a choice based conjoint (CBC) analysis obtained through an online questionnaire. The first part of this research is mainly confirmatory, since literature shows that the interest in exchanging the company car for alternative mobility solutions and the mobility budget is still limited. We expand existing research by testing the association of the utilities and importance scores (dependent variables) of the attributes with socio-demographic, attitudinal and mobility related variables (independent variables).

3.1. Data collection and sampling

In April 2018, we conducted a quantitative survey among 621 Belgian company car drivers. A non-probability sampling method, namely uncontrolled quota sampling, was chosen for this survey, which allows us to freely choose sample group members. This resembles convenience sampling, but can guarantee a certain representativeness by dividing the population into specific groups and predetermining a quota for each group. Quota for region, age and gender have been calculated based on similar studies (Vandenbroucke et al., 2020). We did not weigh the result, since little is known about the true population of Belgian company car drivers (Vandenbroucke et al., 2020). This is because the available data does not distinguish consequently between leased and bought company vehicles, regular employees and company directors, or utility vehicles and salary cars.

Respondents were found through an online panel, made available by research company Survey Sampling Europe B.V. The research company uses a point-based reward system to pay respondents for filling in questionnaires that apply to them. Because of this reward system, respondents might be less punctual when filling in the questionnaire, resulting in more corrupt or inaccurate records than when using no reward system. Therefore, we applied an extensive data cleaning process to remove 92 observations. Starting from 621 responses, 529 respondents remained. We used nine criteria to clean our data, being, in chronological order, the removal of speeders (24), IP doubles (1), flatliners (15), respondents indicating to live near a non-existent metro station (12), cross-validation by removing inconsistent replies to open questions (22) and inconsistent (14) or unrealistic (4) mobility budget indications. After cleaning the data, we eliminated the respondents who indicated that they would like to exchange their company car for alternative transport modes or other fringe benefits, which is an exclusion criteria as they do not fall within the scope of this study.

The first component of the survey consisted of a traditional questionnaire where socio-demographic information was asked, followed by questions that provide insight into job characteristics, mobility characteristics and the attitudes of the respondent toward the environment. To measure this last variable, four questions on a five-point Likert scale, validated by Petschnig et al. (2014) were used to calculate an average score for "environmental concern", personal norm regarding fuel/engine types (internal Cronbach's $\alpha = 0.92$). In the second component, a discrete choice experiment (explained in the next section) was carried out in order to reveal a more detailed preference for alternatives targeted to car users. The questionnaire was created in Dutch (Vandenbroucke et al., 2020) and translated into French using forward-backward translation. The reliability and validity were checked by conducting a pilot survey among academic experts and users in the field. There were three test rounds. The first test round was conducted among nine academic experts, who checked whether all topics, questions and response options were covered. In the second test round, the survey was tested live with 12 users in the field. The objective of this second test round was to observe whether the questionnaire was easy to understand and intuitive enough to fill in, as well as to estimate the average response time. Adjustments were made to the survey and the process of live testing was repeated, until the average response time approximated 15 min and all questions were clear. A third test round was conducted by the research company Survey Sampling Europe B.V., who executed the survey. In this last test round, the general flow of the questionnaires and technical aspects were checked. On average, it took 17 min (SE = 13 min) to complete the final questionnaire.

3.2. Survey design: Discrete choice experiment

In the second part of the questionnaire, CBC or discrete choice modeling is applied: a technique for data collection and analysis, considering several characteristics (attributes) and mimicking the real life decision-making process of individuals (Hair et al., 2010). CBC stems from marketing research (Green and Hall, 2001) and has recently been widely applied in mobility and transportation research to measure consumers' preferences (e.g., Lebeau et al., 2016; Aryal and Ichihashi, 2020; Nickkar et al., 2020). Choice modeling allows us to model the decision making process through stated preferences of the respondents, when faced with multiple alternatives. Other popular choice modeling techniques, which can help to understand how individuals make decisions, include logit model or latent class analysis. However, choice based conjoint analysis based on discrete choice experiments is unique in the sense that it can help to understand how individuals trade off between different product attributes. It is a technique used to determine how respondents value different features that make up an individual product, in this case a company car. In the context of this study, CBC analysis allowed us to understand the relative importance of different car attributes (e.g., cost, size, and engine type) to company car drivers, and ultimately to identify any opportunities in the market for alternative car-based solutions.

To ensure an efficient survey design, the number of attributes and levels for a discrete choice experiment should be limited (no higher than six) and the attribute (levels) should be realistic (Hair et al., 2010). Therefore, the attributes and levels in our experiments were selected with the aim of presenting realistic scenarios, based on literature review, interviews with mobility managers and leasing companies, and deliberations with academic experts. The attributes reflect possible mobility solutions for companies, linked to recent policy measures such as the mobility budget and the electrification of the company car fleet. In the experiments, the various mobility packages (attributes) were first explained in an introduction. After the introduction, a fictitious mobility budget of 700 EUR was offered to the respondents. A mobility budget resembles individual transport related costs, and therefore 700 EUR is an estimation of the average total cost of ownership. The purpose of offering a fixed budget is to imitate the mobility budget policy and to make the experiment as realistic as possible.

CBC analysis allows us to measure the utility of the different attributes of a company car. For an efficient survey design, four attributes with four levels each were chosen: PRICE, car segment (SEGM), engine type (TYPE) and fuel- or charging card (FUEL). By selecting these four attributes, based on similar studies (Dimitropoulos et al., 2016; Lebeau et al., 2016; Zijlstra, 2016) and deliberations with academic experts, we attempt to present a wide variety of realistic car options, again mimicking the first (car) and third (cash) pillar of the Belgian mobility budget framework. PRICE is often used in CBC analysis and can be used to measure willingness-to-pay (WTP) and price sensitivity (Sawtooth, 2017; Buldeo et al., 2019). The brand, size and segment of the car were combined into one attribute (SEGM), since they are closely related. TYPE represents the engine type of the car, and is introduced for measuring the preference for new technologies such as (plug-in) EVs. Lastly, FUEL is chosen to distinguish between the numbers of kilometers that one is allowed to drive. In conjoint experiments, the number of attribute levels influences the importance given to them, e.g., three-level attributes are generally considered more important than two-level attributes. Therefore, we decided to keep the numbers of levels (four) constant across attributes. The attributes with corresponding levels are shown in Table 1. The levels for the attribute PRICE are selected based on an online simulator for (professional) lease cars (Leaseplan, 2018) as well as the prices defined in the study of Zijlstra (2016). Unequal price increments are chosen, following the theory of price elasticity: the gaps in price are smaller toward the left side of the range and larger toward the right side. The levels of the SEGM attribute are as well based on the discrete choice experiment of Zijlstra (2016) and are matched with current lease prices (Leaseplan, 2018) to ensure a realistic range. The different FUEL options represent common realistic company car scenarios; however, the charging pole is added to offer an alternative for BEVs and PHEVs. For the attribute TYPE, we have selected the most common engine types that are currently on the market. However, BEVs were selected over HEVs, following the objective of electrifying the entire company car fleet on the path to climate neutrality (Winckelmans, 2020).

The design of the CBC experiment is set up in a way that some combinations are excluded: a charging infrastructure for EVs and conventional engine type cars (petrol and diesel) cannot be shown in the same choice task. Because prohibitions (exclusions) in the design can cause efficiency loss in the analysis, these are kept to a minimum. The CBC design in the survey consists of 12 choice sets with three randomized choice tasks each, in which the respondent needs to choose the most attractive combination of attribute levels. Ten choice sets are randomized using the analysis software and two choice sets are fixed across all respondents (see Figure 1). Using fixed choice sets allows to control for inconsistent responses. The combinations of attribute levels in the fixed choice tasks are set up in a way that they represent a scenario that is as realistic as possible (Sawtooth, 2017).

3.3. Data analysis

For each of the attribute levels, individual preferences (i.e., part-worth utilities, numerical values used in CBC designs) were derived from the responses, using the Sawtooth software Lighthouse Studio 9.6.0 (Sawtooth, 2017). The hierarchical Bayesian algorithm made an estimation of the average utility for the complete sample size and then used the individual data of the respondent to determine how each respondent differed from the mean. Afterwards, the algorithm adjusted the utilities of each respondent to determine the optimal mix of individual choices and sample averages (Jervis et al., 2012). The goodness-of-fit of the individual-level choices could be assessed with the root-likelihood statistic, however, the objective of the hierarchical Bayesian algorithm is not to maximize the individual-fit, but to find an appropriate compromise between the lower-level model (individual choices) and the upper-level model (population choices). The prior variance is set at the recommended default of 1.0, which informs the algorithm regarding the optimal balance (Orme, 2018). For each attribute, relative importance scores are obtained at the individual level by calculating the range of the zero-centered utilities (i.e., the highest level minus the lowest level of the point estimates), and percenting them (by dividing the range per attribute by the total range and multiplying by 100). After calculating individual importance scores, we calculated the averages and standard deviations.

To find out whether the importance of the attributes (dependent variables) vary with the proposed independent variables, we used linear regression analysis with the Ordinary Least Squares (OLS) method. All *post-hoc* analyses are calculated in the R software (R Core Team, 2019).

TABLE 1 Attributes and levels of the CBC design.

Attributes			
SEGM car segment	TYPE engine type	FUEL fuel card/charging infrastructure	PRICE monthly cost
Levels			
City car (e.g., VW Polo/Audi A1)	Diesel	None	€ 575
Mid segment (e.g., VW Golf/Audi A3)	Petrol	Belgium (<20.000 km/yr)	€ 650
Luxury segment (e.g., Audi A4)	PHEV	Europe (unlimited #km)	€ 750
Executive (e.g., Audi A6/BMW 5-series)	BEV	Charging pole + charging pass	€ 875

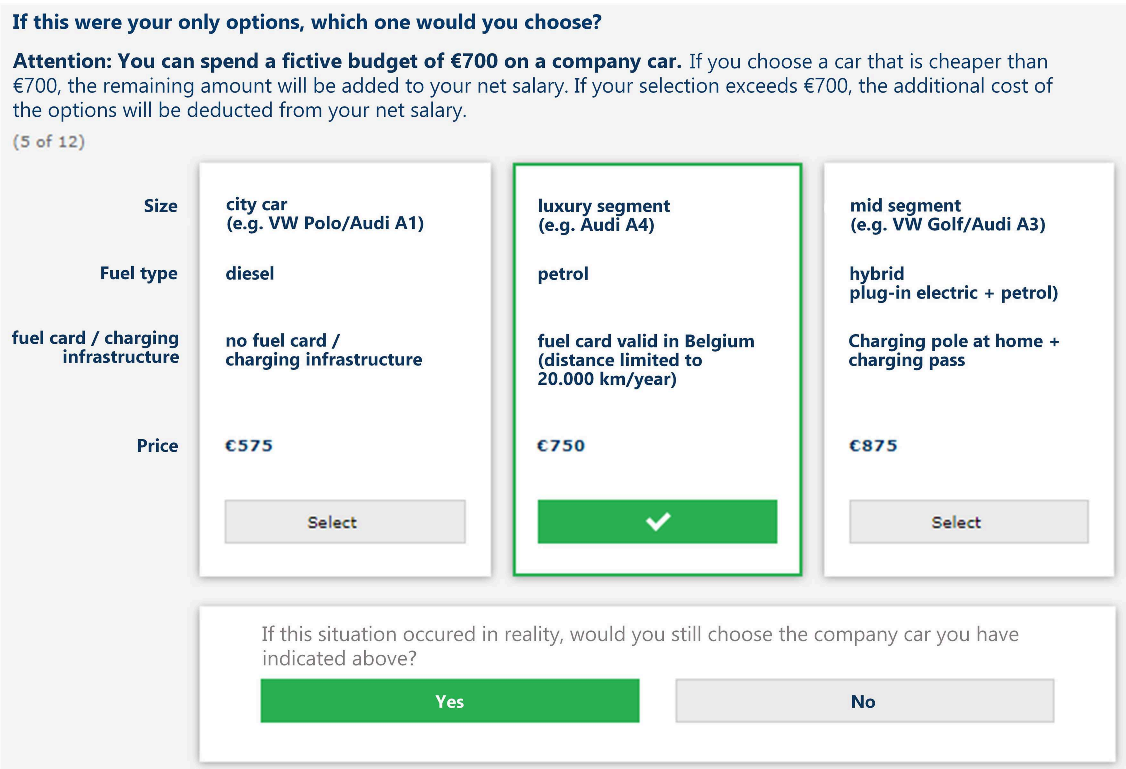

FIGURE 1
Example of a choice task (translated from Dutch).

4. Results

4.1. Sample description

Eliminating the respondents that are willing to exchange their company car for other fringe benefits, caused 20% of the cleaned data sample to be excluded, leaving us with a sample of n = 422 respondents. These represent the car dependent company car drivers. It might also be noticed that this sample (80% car dependent respondents) differs significantly in environmental concern from the excluded sample (20% non-car dependent respondents; independent t-test, $p < 0.001$). The sample characteristics shown in Table 2 reveal that the majority of our sample is male and has a net income of 2001 EUR or higher (66%). The large majority uses their car as the main transport mode to make professional trips. There is no population data available and therefore we cannot assess the representativeness of our sample. However, there are some studies available on Belgian company car drivers in general. First of all, they are mostly male [70–75% according to Vandenbroucke et al. (2020)]. In terms of age, another sample of Belgian company car drivers (Zijlstra, 2016) consisted of 40% of respondents between 40 and 49 years old. Company car drivers are also estimated to have a higher income, seeing that 51% of company cars are given to the proportion of the population situated in the highest decile of tax revenues (Vandenbroucke et al., 2020).

4.2. Stated preference: Company car

Individual utilities are estimated using Hierarchical Bayes method. In Figure 2, one can see a summary of the results of the

TABLE 2 Sample characteristics ($n = 422$).

Variable	Value	Estimate
Age	in years	43.25 (SD = 12.53)
Gender	male	65.7 %
	female	34.3 %
Net income	0–1500 EUR	8.4 %
	1501–2000 EUR	16.8 %
	2001–2500 EUR	29.0 %
	2501–3000 EUR	20.6 %
	>3000 EUR	15.9 %
	No response	9.35 %
Environmental concern	5-point Likert scale	2.82 (SD = 1.22)
Urbanization level of workplace	urban	18.7 %
	suburban	51.7 %
	No fixed workplace	29.6 %
Perceived accessibility of work-place with public transport	7-point Likert scale	3.78 (SD = 2.08)
Own public transport pass	Yes	21.1 %
	No	78.9 %
Alternative mode use (other than driving a car), both private and professional	< 1 x/ month	76.3 %
	1–3 x/ month	13.7 %
	1–4 x/ week	6.4 %
	> 4 x/ week	3.6 %
Main mode for professional trips	Car (as driver)	89.1 %
	Alternative transport modes	10.9 %

CBC analysis. It shows an overview of the attribute levels and their corresponding utilities. In Table 3, sample characteristics (socio-demographic, attitudinal and mobility related variables) are fitted in a linear regression model as predictors of the relative importance scores for all four attributes. The goodness-of-fit of the four analyses were very low (adjusted $R^2 < 0.1$). However, we could derive some statistically significant associations from the models.

4.2.1. Price

The attribute PRICE is designated as the most important attribute, with a relative importance score of 30.52% (SE = 15.48). While the median utilities of 575 EUR and 650 EUR are very similar, there is a pronounced negative preference for 875 EUR, which appears to be too expensive. The utility of this price point is the lowest of all measured utilities. A possible explanation for this is the endowment effect; an anomaly to rational economic behavior that is in place when people are given an object. The endowment effect states that people require more money to give up a given good than they would pay to acquire the same good (Kahneman et al., 1991). A budget restriction of € 700 was indicated throughout the experiment. If the endowment effect is in place, respondents might not want to exceed this budget because it could mean that they have to hand in a part of their salary. Respondents with lower incomes tend to be more sensitive to the price; as they show lower utilities for high price points and higher average utilities for lower price points. This is as well illustrated in Table 3, where income is a significant predictor of the importance of the attribute PRICE. Age, having a workplace located in an urban area (ref. no fixed workplace) and having access to a public transport subscription are as well significant predictors of the relative importance of the price attribute. This means that younger respondents, respondents with a workplace located in an urban area, and respondents without a public transport subscription, chose the more expensive options less.

4.2.2. Fuel

The type of fuel/charging card, possibly indicating the number of kilometers one is allowed to drive, appears to be the second most important attribute (24.1%, SE = 10.61), although the importance score is similar to the attributes SEGM (23.62%, SE = 12.76) and TYPE (21.15%, SE = 12.01). This shows that in addition to the price, respondents value the privilege of driving an unlimited number of kilometers. The relative importance of the FUEL attribute is significantly associated with age, environmental concern, having a workplace located in an urban area (ref. no fixed workplace), having a public transport subscription and the perceived accessibility of the workplace.

4.2.3. Segment

The individual utilities of the attribute describing the car segment and size show a linear trend, with negative utilities for smaller cars, and positive utilities for larger and more luxurious cars. The regression analysis shown in Table 3 reveals that environmental concern is a significant predictor for the importance of the attribute SEGM ($p < 0.001$): when respondents are more concerned with the environment, the segment (including the size) of the company car might become less important than the other factors. Income is also a significant predictor in the regression analysis. When performing two sample t-tests comparing the importance for SEGM, we found that respondents with a higher income are more sensitive to the segment/size (average of 25% importance score, it is the second important attribute for them), compared to respondents with a lower income (average of 21% importance score, it is the least importance attribute for them).

4.2.4. Engine type

Diesel and petrol vehicles are preferred equally by the respondents, and the analysis shows a strong overall preference for hybrid cars. The preference (Figure 3) for engine type (TYPE) tends to vary significantly with the degree of environmental concern. Respondents who are more environmentally concerned prefer BEVs to cars with conventional fuel, whereas respondents who are less environmentally concerned show the least preference for BEVs. Pearson's-moment correlation between the individual utilities and diesel (−0.23), petrol (−0.32), PHEV (0.28), and BEV (0.26) company cars are significant ($p < 0.001$) for all of the four attribute levels. However, when it comes to the importance of this attribute, it is not significantly associated with the environmental concern. This

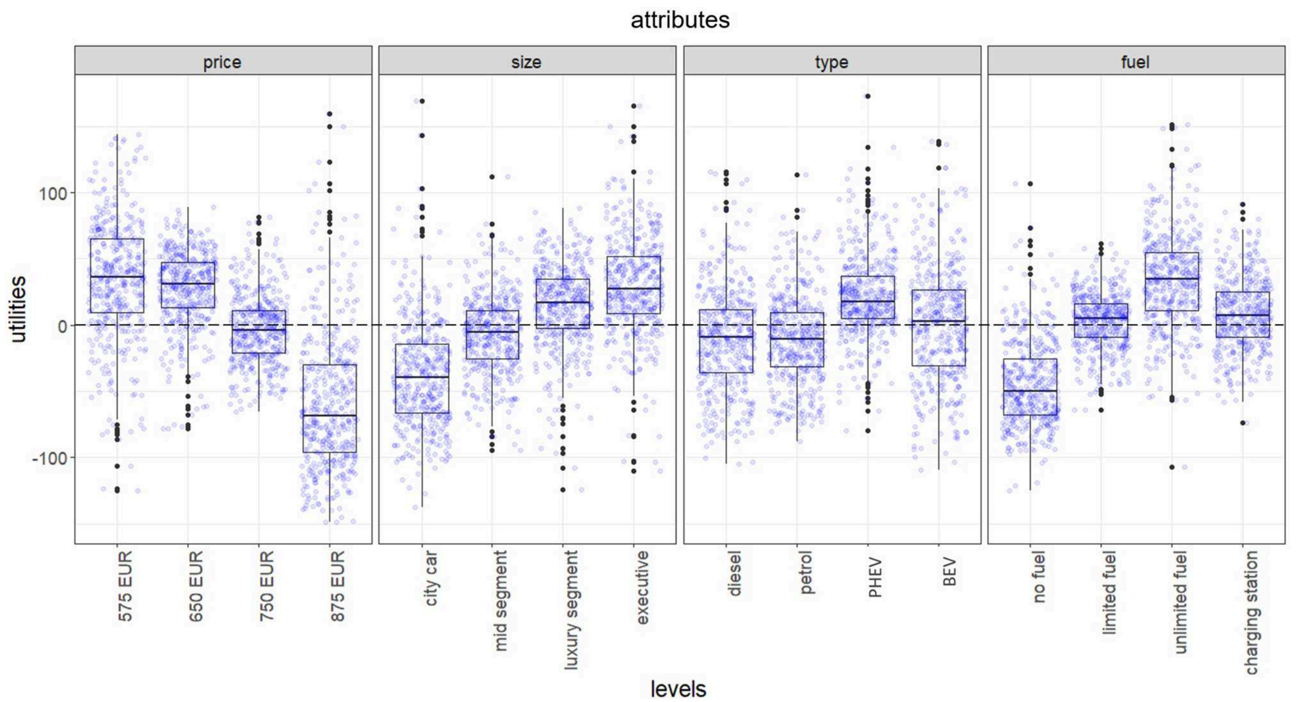

FIGURE 2
Visual representation of zero-centered utilities for each attribute level (price, segment, engine type, and fuel card) of the company car.

TABLE 3 Socio-demographic variables and mobility related factors as predictors of the relative importance scores for the attributes price, segment, fuel card, and engine type of company cars, using linear regression.

Coefficients	Estimate (SE) ***			
	PRICE	SEGM	TYPE	FUEL
(Constant)	37.82 (4.52)***	21.01 (3.81)***	30.12 (3.24)***	11.06 (3.61)**
Age	−0.12 (0.06) +	0.02 (0.05)	−0.03 (0.05)	0.13 (0.05)*
Gender (male)	−0.41 (1.58)	3.22 (1.33)*	−2.00 (1.13) +	−0.81 (1.26)
Income	−1.19 (0.53)*	1.07 (0.45)*	0.56 (0.38)	−0.44 (0.42)
Enviornmental concern	0.46 (0.64)	−1.93 (0.54)***	−0.68 (0.46)	2.14 (0.51)***
Suburban workplace (ref. no fix workplace)	2.60 (1.71)	−1.37 (1.44)	−0.59 (1.22)	−0.64 (1.36)
Urban workplace (ref. no fixed workplace)	5.50 (2.23)*	−1.09 (1.91)	−1.23 (1.62)	−3.17 (1.81) +
Alternative mode use for professional trips (ref. car driver)	1.18 (2.61)	3.05 (2.21)	−2.04 (1.88)	−2.19 (20.9)
Own public transport pass (yes)	−5.31 (2.23)*	0.64 (1.88)	1.49 (1.60)	3.19 (1.78) +
Perceived accessibility of workplace	0.00 (0.38)	0.22 (0.32)	−0.72 (0.27)**	0.50 (0.30) +
Goodness-of-fit (R^2)	0.054	0.090	0.044	0.086

$^{+}p < 0.10$, $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$.

means that although a different degree of environmental concern is associated with a different preferred engine type, it does not differ in how importance this attribute is in the choice for a company car.

4.2.5. Trade-offs and market simulations

To estimate the average utility of more sustainable company car types compared to the current standard, we use the average utilities presented in the previous sections and sum them for four specific choice sets, as illustrated in Figure 4. All attributes but price are considered, in order to illustrate the individual choice behavior for similar price points. The standard company car, a large luxury diesel car that comes with unlimited fuel (average utility = 36.93), is compared to three alternatives that are considered more sustainable: the first alternative (average utility = −62.50) is slightly smaller (mid segment), powered by petrol and comes without fuel card. The second alternative (average utility = −7.57) is a smaller, hybrid company car and comes with a charging card. The last alternative (average utility = −28.48) is the electric (BEV) variant of the second alternative. We observe that all three of the alternatives

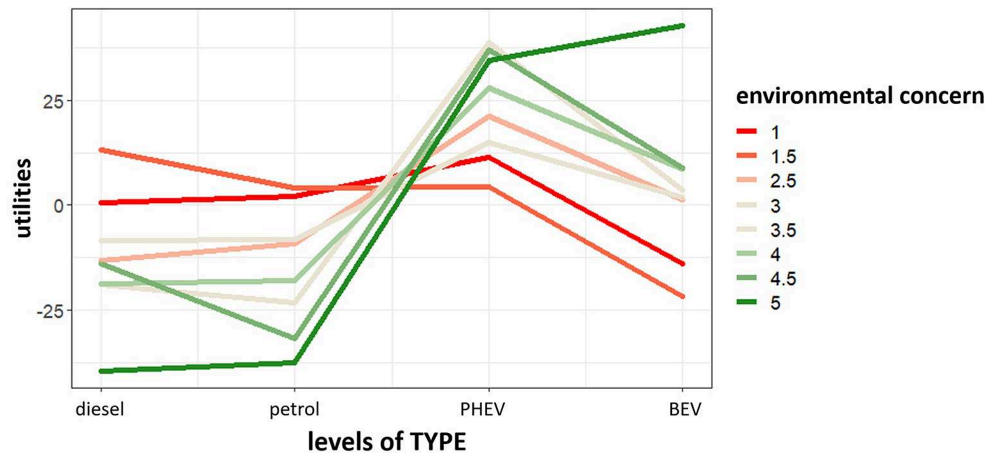

FIGURE 3
Utility scores of the attribute engine type, among respondents with a lower and a higher environmental concern.

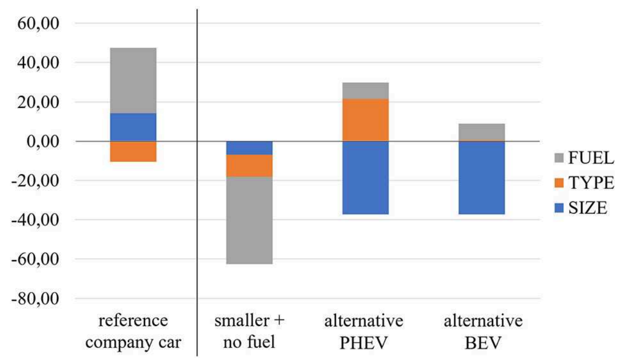

FIGURE 4
Summed utilities for the current company car standard, compared with three more sustainable alternatives.

show negative summed utilities. Smaller cars without fuel card are considered the least preferred, which is largely influenced by the negative utilities associated with the "no fuel" level. Although PHEVs have a higher utility than petrol and diesel, this increase in utility cannot compensate for the lower utilities associated with a smaller segment and the charging card that comes with it.

The attributes show the highest utilities for 575 EUR, executive, PHEV and unlimited fuel (see Figure 1). This means that the general sample preferred the largest possible PHEV with unlimited fuel at the lowest price point, as expected. A market simulation, performed with the help of the Sawtooth software, allows us to study these preferences in more detail. The different market simulations and preference shares are shown in Figure 5. When we look at the more sustainable options, the first two market simulation shows the most preferred options in ZLEVs, both for PHEV and BEV, among the general sample. The first market simulation reveals the preferences for the most popular BEV options. Only large cars (luxury and executive) with the cheapest price (575 EUR) are preferred above the none-option (20.4%). The second market simulation among the most popular PHEV options shows the highest preference for an executive PHEV with unlimited fuel card at 575 EUR (26.7%), followed by the same version at a price of 650 EUR (22.4%). When comparing realistic BEV options for each price point, the highest share of preference is assigned to the none-option (25.0%), meaning that more respondents chose to opt out of the choice task, than to choose a BEV option with a realistic price point. The last market simulation shows the most popular options with the price held constant at 575 EUR, revealing the executive PHEV with unlimited fuel card as the most preferred option (25.3%).

5. Discussion and conclusion

More sustainable alternatives such as ZLEVs and a mobility budget could be offered to the traditional petrol and diesel powered company car, but little is known about how company car drivers value these alternatives. Our research shows that the majority of company car drivers still prefer the traditional company car. 80% of the total respondents in our initial survey indicated that they are not interested in trading their company car for alternative transport modes or any other fringe benefit, which is in line with the study of Zijlstra (2016) and illustrates the resistance of company car drivers to get rid of their highly valued fringe benefit. This group of respondents (n = 422) is the scope of our study. By analyzing the behavior of these car-dependent company drivers, we explored their stated preference for (the combination of) several company car-related attributes.

Through a discrete choice experiment, we have found that the price or cost of the company car is considered a more important attribute than the segment, the amount of fuel and the (fuel) type of the car. This means that although company car drivers might prefer to have unlimited fuel and larger cars, this is outweighed by the cost. Other studies using conjoint analysis to measure preferences for innovative transport modes (e.g., BEVs in logistics, driverless buses and flexible transport services) show similar results, i.e., the highest importance is given to the price attribute (Lebeau et al., 2016; Tsoukanelis et al., 2019; Papadima et al., 2020). A possible implication for policy making is that financial measures (i.e., fuel tax) could be effective to make company cars smaller and more sustainable. The current mobility budget meets this criterion because it offers an

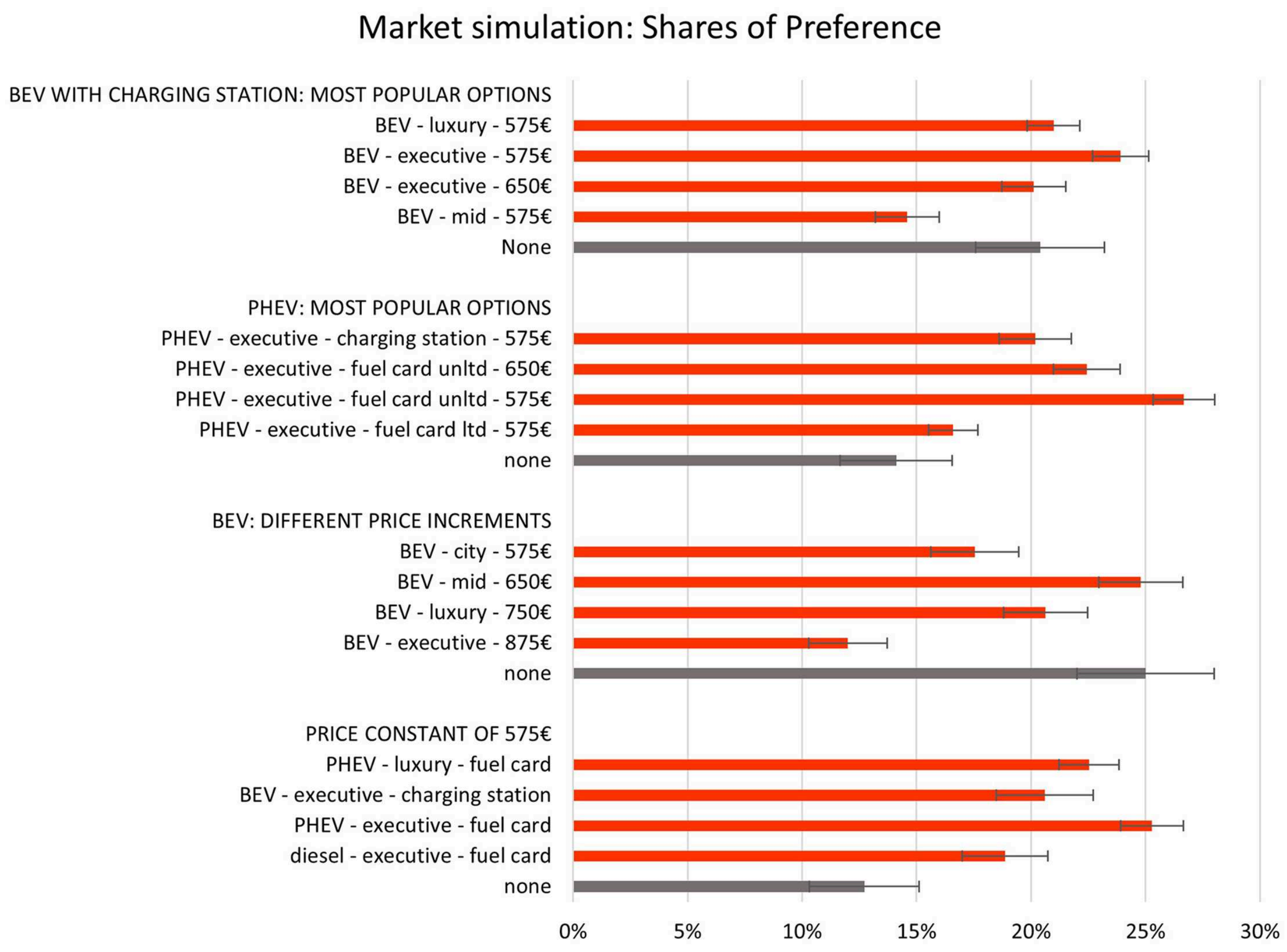

FIGURE 5
Market simulations showing preference shares among four categories, including the none-option.

additional fiscal advantage on the budget that has not been spent, which was simulated in our experiment as well.

When it comes to engine type, a high preference for PHEVs was revealed. However, the utilities for this attribute level are still too low for company car drivers to intentionally shift toward cleaner company cars. This is because the preference for hybrid technology does not outweigh the additional cost or smaller segment that is currently associated with PHEVs. These findings also confirm previous research by Dimitropoulos et al. (2016), who explained that the overall preference for PHEVs among Dutch company car drivers is caused by their longer range and their similarities to conventional cars. Even though PHEVs are not necessarily more expensive than BEVs, the respondents show a clear preference for the first category. Out of the more sustainable attribute levels in the experiment, the average utilities for PHEV (TYPE) (21.39) are the highest. The utilities of BEV (TYPE) are higher (0.49) compared to no fuel card (−44.32) (FUEL) or small (−37.29) and mid (−6.80495) sized vehicles (SEGM). However, the attribute engine type (TYPE) also shows the least relative importance among the attributes studied: the price, the size (segment) and the amount of fuel are more important than the type of energy the car consumes.

Literature has shown that PHEVs are often not a sustainable option, unless they are used in electric mode for a significant distance (Bannon, 2020). Because owning a fuel card is the second most important attribute, we know that most company car drivers highly value their unlimited number of kilometers. Having access to an unlimited fuel card further explains the low incentive to charge the PHEV, causing the hybrid company car to be less sustainable. Considering these results, the plan of the Belgian government to fully electrify the company car fleet by 2026 might be a sensible choice. BEVs make good company cars, because employers often provide charging infrastructures and this new technology can penetrate faster to the (secondhand) private market through the company car market (Dataforce Transport Environment, 2020). The utilities for the BEV engine type are higher than for diesel and petrol, and they are also higher than the utilities for smaller sized cars and no free fuel. However, fuel card, price and segment (size) are more important. This is potentially problematic for the adoption of ZLEVs in today's situation, where the purchase price and lease price of ZLEVs are more expensive than the price of their non-electric counterparts. This means that, for the same budget, company car owners would be forced to opt for a smaller car if they were to have an electric variant. This might be even more opposed by respondents with higher incomes and respondents who are less concerned with the environment. Contrary to the study by Dimitropoulos et al. (2016), a relationship between the preference for EVs (engine type) and income has not been found in our study. And although age is significant in predicting whether respondents are more dependent on their company car, it does not seem to be a significant factor in predicting the importance and utilities of different attributes. Additionally, in order to have a truly lower overall environmental impact than conventional cars, more investment in renewable energy will have to be made and the sale of large electric cars will have to be discouraged (Miotti et al., 2016; Lamberts, 2018).

The electrification of the company car fleet will not in itself contribute to solving the congestion problem or reducing accidents, but location-based solutions and solutions related to modal shift could. These types of alternatives are out of the scope of this study, which forms a first limitation of this study, as these alternative can have an even stronger impact on sustainability. After all, company cars are also provided to make the workplace accessible to employees. If one day the government decides to stop fiscally stimulating company cars altogether, many companies might move closer to mobility hubs.

This study mainly confirms existing research, although new knowledge is generated by analyzing the impact of several variables on the respondent's attitude, utilities and relative importance. The degree of environmental concern has been a significant variable in the *post-hoc* analyses. Firstly, environmentally concerned respondents were more willing to exchange a company car for other fringe benefits. Secondly, they attached significantly more importance to the engine type and less importance to the size of the vehicle. Thirdly, BEVs are most preferred by respondents with a high score of environmental concern, and least preferred by respondents with a low score of environmental concern. Even though the goodness-of-fit of our models is rather low, which forms a second limitation of this study, given the explorative nature of this survey, interesting insights are found that can be explored further. To measure the environmental concern of the respondents, more questions could as well be added in future research. In this study, we have only asked four questions concerning personal norms toward different engine types. Since this variable turns out to be significant in the *post-hoc* analyses, more questions to map the overall environmental concern could be asked to obtain a more diversified image of this variable, which may increase the reliability of the study. Dimitropoulos et al. (2016) and Cusack (2021) have also proven that the degree of environmental concern can have a positive impact on modal shift, and addressing the environmental concern in future analyses can be a pathway to the mobility budget and mobility management within companies. However, significant associations only mean that there are relationships between two variables that are statistically significant and warrant further investigation. Another suggestion for further research might therefore be to study the causality between environmental concern and this indication for modal shift. Could we move toward a more sustainable employee mobility by making employees more concerned with the environment?

Nevertheless, important managerial implications of this study are that companies, similar to policy makers, should consider the resistance of company car drivers to give up their current cost-efficient benefits of owning a combustion engine company car. Considering the large discrepancy between employees interested in a mobility budget (20%) and the actual uptake (0.15%), we have reason to think that not enough employers offer the mobility budget to their employees yet, and that more efforts should be made by mobility managers to offer a corporate mobility budget. In light of this study and the upcoming regulations concerning the electrification of company cars, companies should already be making conscious efforts in familiarizing employees with using ZLEVs e.g., by setting up sensibilization campaigns and trial periods (i.e., testing out a BEV for 1 month with the ability to return back to the traditional company car after this period).

The paper concludes with the findings that even though environmentally friendly options compared to traditional powered company cars do exist, the preference for these alternatives cannot outweigh the traditional company car for the majority of company car drivers, and the interest in a mobility budget among company car drivers is still too limited. Therefore, we stress again that both managerial and government intervention is necessary to make a significant shift toward alternative transport modes. Reducing the fiscal benefits associated with the company car is hereby an option, but electrifying the company car fleet, leaving aside HEVs and PHEVs, is a prudent intermediate step. In any case, the policy needs to be based on nudging to raise employees' preference for BEVs as company cars, and more importantly to raise their preference for alternative transport modes such as public transport and cycling.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. Written informed consent from the participants was not required to participate in this study in accordance with the national legislation and the institutional requirements.

Author contributions

LD: conceptualization of research objectives, data collection, and analysis. LD and LV: survey design. LV: methodological support. LD, IK, and CM: verification of results and review of the article. All authors contributed to the article and approved the submitted version.

Funding

This research was part of an academic, independent research chair coordinated by the Brussels Studies Institute (BSI), called "Companies and Sustainable Mobility: The Company Car Debate and Beyond". The research chair was funded by eleven different institutions and organizations (Renta, Febiac, Traxio, Solvay School Alumni, VAB, Touring, Acerta, BLVABM, FEGARBEL, BFFMM, and FOD Mobiliteit en Vervoer). The funding parties were present in quarterly steering committees and had a strictly advisory role. The advice was never binding nor compromising our research.

Acknowledgments

We would like to thank all partners of the research chair for their advisory part in the research design, as well as our colleagues for proofreading this article, more in particular: Philippe Lebeau, Sara Tori and Lara Stas.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

References

Anderson, A. J., Kaplan, S. A., and Vega, R. P. (2015). The impact of telework on emotional experience: when, and for whom, does telework improve daily affective well-being? *Eur. J. Work Org. Psychol.* 24, 882–897.

Aryal, T. R., and Ichihashi, M. (2020). A choice-based conjoint experiment on commuters' preferences for public transport services: a case study of Kathmandu. *IDEC DP2 Series* 10, 1–22.

Bannon, E. (2020). *Plug-in Hybrids in New Emissions Scandal as Tests Show Higher Pollution than Claimed. Transport and Environment.* Available online at: https://www.transportenvironment.org/press/plug-hybrids-new-emissions-scandal-tests-show-higher-pollution-claimed (accessed November 23, 2020).

Barreto, L., Amaral, A., and Baltazar, S. (2019). "Flexible on demand transport services (FDTS): the future of mobility systems," *2019 IEEE International Conference on Engineering, Technology and Innovation (ICE/ITMC)*, 1–9, Piscataway, NJ.

Buldeo, R. H., Mommens, K., Verlinde, S., and Macharis, C. (2019). How does consumers' omnichannel shopping behaviour translate into travel and transport impacts? Case-study of a footwear retailer in Belgium. *Sustainability* 11, 2534.

Busse, R., and Mitteldorf, S. (2021). Time is the most valuable thing–revisiting the impact of flexible working arrangements on employee satisfaction and perceived productivity. *Adv. Manage.* 14, 1–14.

Cairns, S., Newson, C., and Davis, A. (2010). Understanding successful workplace travel initiatives in the UK. *Trans. Res. Policy Prac.* 44, 473–494.

Cusack, M. (2021). Individual, social, and environmental factors associated with active transportation commuting during the COVID-19 pandemic. *J. Trans. Health* 22, 101089.

Daems, E. (2018). *Wie betaalt de 'groene' rekening van de elektrische auto? MO.* Available online at: https://www.mo.be/analyse/wie-betaalt-de-groene-rekening-van-de-elektrische-auto (accessed June 21, 2018).

Dataforce and Transport and Environment (2020). *Dataforce Study on Company Cars. Transportand Environment.* Available online at: https://www.transportenvironment.org/sites/te/files/publications/2020_10. (accessed September 09, 2022). _Dataforce_company_car_report.eps

de Borger, B., and Proost, S. (2017). What can European experience teach us for Belgian transport policy? Reflets et perspectives de la vie économique. *LVI* 2, 33.

De Craecker, S. (2020). *Slechts 0,011% Van De Medewerkers Koos Voor Mobiliteitsbudget. Acerta.* Available online at: https://www.acerta.be/nl/over-acerta/in-de-pers/slechts-0-011-van-de-medewerkers-koos-voor-mobiliteitsbudget (accessed January 10, 2020).

De Vliegher, S. (2022). *Vlaanderen Verstevigt Positie als Regio Met de Meeste Bedrijfswagens.* Available online at: https://press.securex.be/vlaanderen-verstevigt-positie-als-regio-met-de-meeste-bedrijfswagens (accessed September 7, 2022).

De Wolf, L. (2020). *Plug-in-Hybrideauto's Stoten in Realiteit Gemiddeld Meer CO_2 Uit Dan Auto's Met Verbrandingsmotor. Vrtnws.be.* Available online at: https://www.vrt.be/vrtnws/nl/2020/11/26/plug-in-hybride-auto-s-stoten-in-realiteit-meer-co2-uit-dan-gemi/ (accessed November 26, 2020).

Departement Omgeving (2020). *Aantal Wegvoertuigen. Indicator. Milieurapport Vlaanderen (MIRA).* Available online at: https://www.milieurapport.be/sectoren/transport/sectorkenmerken/aantal-wegvoertuigen (accessed August 02, 2021).

Dimitropoulos, A., Ommeren, J. N. V., Koster, P., and Rietveld, P. (2016). Not fully charged: welfare effects of tax incentives for employer-provided electric cars. *J. Environ. Econ. Manage.* 78, 1–19.

Febiac (2020). *Automotive Pocket Guide*. Belgium: Febiac.

Febiac (2021). *Analyse van de Belgische Automarkt in 2021*. Belgium: Febiac.

Federale Overheidsdienst Financiën (2020). *Valse hybrides. FOD Financiën*. Available online at: https://financien.belgium.be/nl/faq/valse-hybrides (accessed February 6, 2020).

Fleet Profile (2017). *Company Cars Report 2017.* Available online at: https://www.fleetprofile.com/solutions/company-car-report/. (accessed April 05, 2018).

Green, P. E., and Hall, S. H. D. (2001). Thirty Years of Conjoint Analysis: Reflections and Prospects. Boston, MA: Springer.

Gutiérrez-i-Puigarnau, E., and Ommeren, J. N. V. (2011). Welfare effects of distortionary fringe benefits taxation: the case of employer-provided cars: distortionary company car taxation. *Int. Econ. Rev.* 52, 1105–1122.

Hair, J. F., Anderson, R. E., Babin, B. J., and Black, W. C. (2010). *Multivariate Data Analysis: A Global Perspective. 7th Edn.* Upper Saddle River, NJ: Pearson.

Harding, M. (2014). Personal Tax Treatment of Company Cars and Commuting Expenses. OECD Taxation Working Paper*s* 20. doi: 10.1787/5jz14cg1s7vl-en

Jaakson, K., and Kallaste, E. (2010). Beyond flexibility: reallocation of responsibilities in the case of telework: telework and change of responsibilities. *New Technol. Work Empl.* 25, 196–209.

Jervis, S. M., Ennis, J. M., and Drake, M. A. (2012). A comparison of adaptive choice-based conjoint and choice-based conjoint to determine key choice attributes of sour cream with limited sample size: CBC versus ACBC analysis of sour cream drivers. *J. Sen. Studies* 27, 451–462.

Kahneman, D., Knetsch, J. L., and Thaler, R. H. (1991). Anomalies: the endowment effect, loss aversion, and status quo bias. *J. Econ. Persp.* 5, 193–206.

Laine, B., and Steenbergen, A. V. (2017). Commuting subsidies in Belgium. Reflets et perspectives de la vie économique. *LVI* 2, 101.

Lamberts, A. (2018). *Grote Elektrische Auto Stoot Meer CO_2 Uit Dan Kleine Benzinewagen. Apache*. (2018). Available online at: https://www.apache.be/gastbijdragen/2018/01/23/grote-elektrische-auto-stoot. https://www.apache.be/gastbijdragen/2018/01/23/grote-elektrische-auto-stoot-meer-co2-uit-dan-kleine-benzinewagen/-meer-co2-uit-dan-kleine-benzinewagen/ (accessed October 26, 2018).

Leaseplan (2018). *Business Lease? Zakelijk Leasen Vanaf €228,- Per Maand. LeasePlan*. Available online at: https://www.leaseplan.com/nl-be/business/. (accessed October 26, 2018).

Lebeau, P., Macharis, C., and Mierlo, J. V. (2016). Exploring the choice of battery electric vehicles in city logistics: a conjoint-based choice analysis. *Trans. Res. Log. Rev.* 91, 245–58.

Macharis, C., and Witte, A. D. (2012). The typical company car user does not exist: the case of flemish company car drivers. *Trans. Policy* 24, 91–98.

May, X. (2017). The debate regarding the number of company cars in belgium. brussels studies factsheet. brussels studies. la revue scientifique électronique pour les recherches sur bruxelles/het elektronisch wetenschappelijk tijdschrift voor onderzoek over brussel. *J. Acad. Res.* doi: 10.4000/brussels.1540

Miotti, M., Supran, G. J., Kim, E. J., and Trancik, J. E. (2016). Personal vehicles evaluated against climate change mitigation targets. *Environ. Sci. Technol.* 50, 10795–10804.

Nickkar, A., Khadem, N. K., and Shin, H. S. (2020). *Willingness to Pay for Autonomous Vehicles: An Adaptive Choice-Based Conjoint Analysis Approach*. Reston, VA: American Society of Civil Engineers.

OECD (2022). *Taxing Wages 2022: Impact of COVID-19 on the Tax Wedge in OECD Countries*. Paris: OECD Publishing.

Orme, B. (2018). *With HB, the Goal Is NOT to Maximize Individual-Level Fit (RLH). Sawtoothsoftware.Com*. Available online at: https://sawtoothsoftware.com/resources/blog/posts/with-hb-the-goal-is-not-to-maximize-individual-level-fit-rlh (accessed December 18, 2018).

Papadima, G., Genitsaris, E., Karagiotas, I., Naniopoulos, A., and Nalmpantis, D. (2020). Investigation of acceptance of driverless buses in the city of trikala and optimization of the service using conjoint analysis. *Utilities Policy* 62, 100994.

Petschnig, M., Heidenreich, S., and Spieth, P. (2014). Innovative alternatives take action – investigating determinants of alternative fuel vehicle adoption. *Trans. Res. Policy Prac.* 61, 68–83.

Pollijn, L., Herman, P., and Kwanten, M. (2018). *Kerncijfers van de Mobiliteit 2017. Federale Overheidsdienst Mobiliteit en Vervoer*. Available online at: https://mobilit.belgium.be/sites/default/files/kerncijfers_mobiliteit_2017.eps. (accessed January 07, 2019).

Pooley, C. G., and Turnbull, J. (2000). Modal choice and modal change: the journey to work in britain since 1890. *J. Trans. Geography* 8, 11–24.

Potter, S., Enoch, M., Rye, T., Black, C., and Ubbels, B. (2006). Tax treatment of employer commuting support: an international review. *Trans. Rev.* 26, 221–37.

R Core Team (2019). *R: A Language and Environment for Statistical Computing. Vienna, Austria: R Foundation for Statistical Computing.*

Sawtooth (2017). *Survey Software and Conjoint Analysis - CBC. 2017*. Available online at: https://www.sawtoothsoftware.com/products/conjoint-choice-analysis/cbc#methodology. (accessed September 09, 2022).

Schlegel, M., and Stopka, U. (2022). *Corporate Mobility Budgets as a Contribution to the Enforcement of Sustainable Mobility. In HCI in Mobility, Transport, and Automotive Systems, edited by Heidi Krömker, 600–617. Lecture Notes in Computer Science*. Cham: Springer International Publishing.

Securex (2019). *6 op 10 Belgen verlaat job bij afschaffing bedrijfswagen*. Available online at: https://press.securex.be/6-op-10-belgen-verlaat-job-bij-afschaffing-bedrijfswagen. (accessed September 21, 2022).

Tsoukanelis, A., Genitsaris, E., Nalmpantis, D., and Naniopoulos, A. (2019). *Conjoint Analysis for the Optimization of a Potential Flexible Transport Service (FTS) in the Region of Zagori, Greece. In Data Analytics: Paving the Way to Sustainable Urban Mobility, Advances in Intelligent Systems and Computing*. Cham: Springer International Publishing.

Van Eenoo, E., Fransen, K., and Boussauw, K. (2022). Perceived car dependence and multimodality in urban areas in flanders (Belgium). *Eur. J. Trans. Inf. Res.* 22, 42–62.

Van Malderen, L., Jourquin, B., Thomas, I., Vanoutrive, T., Verhetsel, A., Witlox, F., et al. (2012). On the mobility policies of companies: what are the good practices? The belgian case. *Trans. Policy* 21, 10–19.

Vandenbroucke, A., Mezoued, A. M., and Vaesen, J. (2020). *Bedrijfswagens en Duurzame Mobiliteit. Analyse en Uitdagingen*. Brussel: ASP Academic and Scientific Publications.

Vanoutrive, T., Malderen, L. V., Jourquin, B., Thomas, I., Verhetsel, A., Witlox, F., et al. (2010). Mobility management measures by employers: overview and exploratory analysis for Belgium. *Eur. J. Trans. Inf. Res.* 10, 121–141.

Wener, R. E., and Evans, G. W. (2011). *Transportation and Health: The Impact of Commuting. Encyclopedia of Environmental Health, 400–407*. Amsterdam: Elsevier Inc.

Winckelmans, W. (2020). *2026 Voor Elektrische Bedrijfswagens is Niet Onhaalbaar. De Standaard*. Available online at: https://www.standaard.be/cnt/dmf20200918_94881456 (accessed September 18, 2020).

Zijlstra, T. (2016). *On the Mobility Budget for Company Car Users in Flanders Proefschrift.* Antwerpen: University of Antwerp.

Zijlstra, T., and Vanoutrive, T. (2017). *The Employee Mobility Budget: Aligning Sustainable Transportation with Human Resource Management? Transportation Research Part D: Transport and Environment*. doi: 10.1016/j.trd.2017.10.005