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alternative fuel vehicles: are
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SP surveys for electric and alternative fuel vehicles: are we doing the right thing?

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Abstract

This paper analyses the practice of SP surveys for Electric Vehicles and identifies a number of their limitations. Specifically it is found that SP surveys may not represent adequately several dimensions that are relevant in the context of EV purchase such as garage ownership, second versus first car, refuelling conditions, and that they often neglect transitory technologies (Plug in Hybrid) which are instead an important element in the diffusion of EVs. This paper also provides a number of recommendations for practitioners to conceive more realistic SP surveys which could increase the validity of policy recommendations formulated by economists.

Keywords: Stated Preferences surveys, Conjoint Analysis; electric cars, alternative fuel vehicles

JEL Codes: C53, O33

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Introduction

The interest of policy makers and the general public about Electric Vehicles has gained strength in the most recent years. The question of how many of these vehicles can really be sold and which policy design can make the best of their diffusion potential has become very relevant for applied economics and transport policy. In this context, a large part of the research effort has concentrated on the achievement of Stated Preference surveys to provide necessary information about the purchase behavior of car buyers. This success reflects the benefits of SP compared with other methods in use in electric vehicle forecast, namely Bass diffusion models and Total Cost of Ownership (as analyzed in Massiani 2012)

There are however still a number of open research questions and challenges for practitioners relating to how SP surveys are actually performed. In particular, how SP surveys are properly taking into account the specificities of purchase behavior in presence of EV's is questionable. Is there a chance that when defining SP survey, transport modelers, due to firmly established habits or too limited awareness of what makes EV a peculiar alternative, neglect some important features? Are we confident that we correctly deal with the likely larger number of dimensions of car purchase attributes in presence of EV's? How confident are we that we propose to car buyers the most important attributes with the correct trade-offs between completeness and cognitive burden? While these questions are certainly relevant, especially considering that policy recommendations are often based on forecast calibrated on SP data, most of them did not receive a precise answer. On the contrary most of the reflection on SP data use has concentrated on modeling issues referring for instance to the structure of correlation among error terms to be hypothesized for the implementation of the RUM paradigm. While this latest aspects are certainly worthwhile and highly challenging for researcher, there is a risk that other fundamental issues related to the realism and relevance of SP surveys have been too neglected.

The purpose of the present paper is to partly fill in this gap and understand how much currently existing surveys are fit for purpose and to indicate how their relevance could be improved. In order to do so, we proceed through the following steps. First we make a thorough examination of methodological features of existing SP surveys. In a second section, we provide recommendations to improve the relevance of SP surveys and propose some future directions for research.

Are existing SP surveys for Electric Vehicles fit for purpose?

The advantages of Stated Preferences compared with other methods, have motivated researchers and practitioners to perform an increasing number of them. A list of surveys available to the research community and taken into consideration for the present paper is presented in Table 1 . In this table we make a distinction between three categories of works: academic peer reviewed publication, other academic papers and applied forecasting studies.

Table 1 – List of SP surveys considered

Academic (peer reviewed) publications: Other academic papers:

(Beggs & Cardell 1980)	(Golob et al. 1991)
(Train 1980)	(M. J. Knight 2001)
(Beggs et al. 1981)	(Batley & Toner 2003)
(Calfee 1985)	(Adler et al. 2003)
(Bunch et al. 1993)	(Horsky et al. 2004)
(Ewing & Sariloglu 1998)	(Knockaert 2005)
(Tompkins et al. 1998)	(Kuwano et al. 2005)
(Brownstone & Train 1999)	(Högberg 2007)
(Brownstone et al. 2000)	(Achtnicht 2009)
(Dagsvik et al. 2002)	(Ziegler 2010)
(Batley et al. 2004)	(Hess et al. 2009)
(Zito & Salerno 2004)	(Achtnicht 2009)
(Potoglou & Kanaroglou 2007)	(Dagsvik & Liu 2009)
(Ahn et al. 2008)	
(Caulfield et al. 2010)	Applied forecasting:
(Mabit & Fosgerau 2011)	
(Hidru et al. 2011)	(IMUG 2010)
	(Öko-Institut & ISOE 2011)

From a methodological point of view, two types of consideration can be made, the first one relates to the design of the survey (which attributes are present in the profile and how are they presented), the second one to the data processing (how collected data are used in the choice modeling process, this can imply the use of other data items that the ones related to choice, typically socio economics, but other as well as will be better illustrated below).

Do SP surveys design adequately reflect EV purchase situations?

In this section we will illustrate a number of critical issues that are found in numerous implementations of SP surveys, namely: the lack of some fundamental attributes, the ambiguity of some others, the arbitrary restriction of the choice set, the debatable introduction of environmental performance, the ambiguousness of cost in some surveys.

Key attributes like Range are often not introduced

First, existing SP surveys only partially take into account the features that make Electric Vehicles differ from conventional ones. Some attributes that are probably fundamental for Electric Vehicles are not present in many surveys. Range is absent from various surveys (Achtnicht 2009; Achtnicht et al. 2008; Axsen et al. 2009; Ahn et al. 2008) while it is usually perceived as one of the strongest limitations of electric cars. This absence is sometimes supplemented by the introduction of some attributes linked to it, like the density of refueling stations (Achtnicht 2009; Achtnicht et al. 2008), but there is room for discussion on whether this latest variable can suitably represent the effect of range.

Some attributes are ambiguous in EV context

While many attributes would generally be unambiguous for “conventional engine”, they become trap words when considering choices that involve Electric Vehicles. Typically, considering the density of refueling stations, one can raise serious doubts about how interviewees understand this attribute. Is it, for instance, implicit for them that refueling operations will be as quick as for conventional cars?

Environmental performance is introduced with limited confidence in interviewees knowledge

Moving toward other attributes, various surveys introduce environmental performance: often expressed in CO2 emissions (Öko-Institut & ISOE 2011; Caulfield et al. 2010; Achtnicht 2009) or some relative environmental friendliness (“Tailpipe emissions as fraction of comparable 1995 new gas vehicle” in (Brownstone et al. 2000), “fraction of emissions” of existing car in (Batley & Toner 2003)). There are however serious concern about whether interviewees are in position to provide reliable valuation on their preferences for low emission vehicles.

Cost dimension is, surprisingly, often introduced in ambiguous ways

Surprisingly, compared with the dominant SP practice, we find a number of surveys that do not use purchase price as an attribute (Ahn et al. 2008; Caulfield et al. 2010 consider road tax and fuel expenditure as cost attributes). In such cases, cost appears only through other items like maintenance cost (Ahn et al. 2008) or fuel expenditures and Vehicle Road Tax (Caulfield et al. 2010). There are some issues on whether this can be an appropriate approach. It is unsure how interviewees elaborate some implicit assumptions about the value of the price attribute. For instance, is price considered equal among the different alternatives (an assumption expressed by Ahn et al. 2008, pag.2094: “We did not consider purchase price as an attribute. That means we assume that all the vehicles in the survey have the same purchase price”), or is it considered equal to some a priori, possibly uninformed, values?

The set of technologies is arbitrarily reduced

In existing SP studies, available technologies are usually introduced in one of the following ways: focusing on the competition between conventional and electric technologies, mainly Battery Electric Vehicles (BEV) and Hybrid, or through a fairly exhaustive set of competing technologies (CNG, LPG, Biofuels, Hydrogen, etc as in Achtnicht 2009). Here again there is room for discussion. While there is a certain benefit of reducing the choice set in that it reduces the cognitive burden of the interviewees, one should however be careful considering the risks it implies. If SP survey outcome directly result in market share forecasts, these market shares forecasts reflect the set of considered alternatives. Making EV diffusion forecast based on an SP survey including only conventional (fuel and diesel) and EV can just tell us what could happen in a world without NGV, without Hybrid, without fuel cell vehicles, and so on.

Transition technologies are often not present

Another important feature of alternative technologies relates to the existence of a series of “transition” technologies: mainly Plug-in Hybrids (PHEV) or Range Extender, and, to a certain extent, Hybrid. Interestingly, we find that the existing surveys give usually no room to transitory technologies, especially considering PHEV. This element could be a major concern for the reliability of Electric Vehicle diffusion forecast. Actually, it is found that when these

intermediate technologies are introduced in the survey they achieve a significant market share, usually larger than BEV (Öko-Institut & ISOE 2011).

Market segments (or vehicle size) are often not introduced

We also find that there is usually no room in the preference elicitation process for vehicle segments (for instance: compact car against mini) or any similar attribute that would capture how segment shift can be an alternative to technology shift. Such a shift would replicate the fact that, if conventional fuel is getting more expensive, one may choose to switch to a smaller car rather than opting for an electric car. Such trade-offs are not reflected in the SP surveys when they omit this choice dimension.

To conclude on this point, it emerges from the analysis of existing surveys that there may be some failure to take sufficiently into account certain peculiarities of Alternative Fuel Vehicles, with special concern for range and existence of transition technologies.

Data processing neglects purchase context variables

In this section, we consider data processing issues, that is, the use that can be made of the data once they are collected. These considerations add extra concern to the previous ones; indeed, would the choice experiment be conducted correctly or not, there are other issues that relate to the use of variables other than the choice exercise. Here again, the examination of existing surveys suggests that while most of the ongoing efforts of modellers have concentrated on socioeconomic features of the purchasers, one could argue that they did not completely take into consideration important features of the purchase situation, in particular: garage ownership and second car vs. first car.

Socioeconomics

Insight about the effects of given socio-geographic variables can be found in various SP survey results – although a minority of them. In this case, variations in WTP for different populations are available. Sometimes several models are calibrated based on different socio-economic groups (Dagsvik et al. 2002) while in some other cases, socio economic covariates directly interact with attributes (Achtinicht et al. 2008). Mabit and Fosgerau make an in depth analysis of interactions by testing interaction of individual or household characteristics with attributes, including technology (Mabit & Fosgerau 2011). They found significant negative interactions between “acceleration time” and “male”, “price” and “child in household”, “price” and “single”. Positive interactions were found between “range” and “age<30”, “price” and “high income household”. (Zito & Salerno 2004) measure that female, compared to male, are willing to pay 128,4 € more each year for an electric car. Although these findings are instructive it still appears that most of the survey results available do not exhibit wtp that vary across various populations.

Second car vs. First car is only rarely considered in choice models

Ramjerdi and Rand are among the only authors who investigate how first car/second car purchase can impact choice mechanisms. Unfortunately, the authors provide no couple of comparable models for first and second car with the same explanatory variables (the variables “gasoline car, household income” are only used in first car model, while the variables “electric car, household income” is only applied in models to explain second car purchases (Ramjerdi & Rand 1999, pp.16–18)). Some tentative comparison indicate that the choice mechanisms may

not be so different for the two purchase situations, they are however not sufficient to derive valid general conclusions.

Garage ownership is barely present in models

Garage ownership would generally be a relevant candidate for determining EV purchase behaviour. This relates to the obvious advantage of garage owners who can be sure that they have a place at home to reload car batteries. Strikingly, to our knowledge, only one SP survey makes use of this information (Zito & Salerno 2004): it suggests that garage owners in Palermo are willing to pay 90,2 € extra each year for the electric version of the Fiat 600, a figure that may need to be checked against other results.

Recommendations for future SP surveys

The analysis made in the previous section, leads us to propose a series of recommendations for future SP collections. In principle, such recommendations should recognize a difference between SP surveys that can have two different purposes. Some surveys are exploratory and aim at generally increasing knowledge about consumer preferences, other are dedicated to applied forecast: they aim at producing a relevant forecast in a given market context. While we will not make it explicit each time, it is clear for us that each recommendation should be understood differently for surveys belonging to the one or the other category.

General SP setting

A first series of recommendation relate to making the choice model replicate as much as possible purchase situations.

Collect relevant information on car purchase situation

Not having in mind the concept of “car purchase situation” or any equivalent concept when designing an SP survey could lead to a misrepresentation of the purchase behaviour. This applies first to information on whether the purchase relates to “first car” or “second car”, a dimension that is arguably fundamental in choice mechanism but is usually absent of existing models with only very few exceptions (Ramjerdi & Rand 1999). “First car” and “second car” should be properly defined. Several criteria may apply that not necessarily relate to the actual purchase chronology but can also relate to:

- car size
- usage intensity.

The important element is that survey should make available some information on the car endowment of the purchasers' household and some basic features of this endowment (for instance size and usage intensity of the vehicles owned by the household), so that the preferences of the purchasers can be related to this endowment.

Purchase situation also applies to the endowment of purchasers in some assets that are likely to be complementary to EV technology. Think of garage availability that is present in very few SP surveys (Zito & Salerno 2004) but is likely to be as much influential as many other attributes on the choice conditions.

Give sufficient importance to socio economics

A second series of recommendations focuses on socio-economic features. There is a strong case that the modelling of the purchase decision has to consider these features, as the existence of strong heterogeneity among car buyers based on socio-economic data is empirically supported (Dagsvik et al. 2002). SP surveys usually collect some of these socio-economic data. But apart from traditional attributes (income, age), the survey should also dedicate special attention to other attributes that may specifically interact with car choice. Consider for instance the rural/semi-urban/urban dwelling area.

Select interviewees in situations as close as possible to real purchase situations

A third set of recommendations relate to the necessity to place interviewees in conditions that are as close as possible to the one actually prevailing when people purchase a car. For this reason, the process of recruiting interviewees that are actually involved in a car purchase process, as used by some studies (interviews in car showrooms for instance), should probably be used more systematically. For instance, the general public may not be so much informed about the existing car characteristics compared to people actually buying a car will be. The key point is that the information useful for diffusion forecast, is usually not about the general public preferences, but about preferences of people which are in situation to actually buy a car. True: car purchasers are generally more informed than the general public, and are not representative of this latest category: but this is exactly what we want, that is a sample representative of the population of potential car buyers.

Attribute specification

Apart from these general setting issues, some recommendations can also be made about the survey design. In this section, we review the different attributes that can be used in the SP survey.

Including intermediate technologies could be important

The choice of whether (and which) transition technologies should be explicitly included in a SP survey is fundamental. Someone could argue, adhering strictly to the Random Utility Maximisation paradigm, that what counts are attributes, irrespective of how attribute combinations can correspond to a set of “varieties” or “technologies”. This could mean that the focus on the “technology label” we give to some attributes combination is not as important as having the right attributes with the right values in the survey. In this view it would not be strictly necessary to have all competing technologies explicitly present in the model as long as a technology can be adequately defined by the attributes.

An additional reason that could be given to avoid introducing transition technologies is that it may distort the preference elicitation process:

- These technologies may not be known to the general public,
- Presence of such technologies may thus disrupt choice process with the interviewees needing extra information about (unknown) technology.
- Even if these technologies were all known by the interviewee, there is an increased cognitive effort that could impact the quality of the data collection

This position should however be contested. First, about fully describing technologies through attributes, it could be difficult to describe some technologies through the necessarily limited number of attributes present in the survey. Regarding the second reason, the best trade-off has to

be found between cognitive burden and realism of the survey. To conclude on this point, a number of elements appear in favour of explicitly introducing transitory technologies in the survey.

Monetary attributes should possibly cover both purchase costs and running costs

Monetary attributes can consist of purchase and of operating costs. There are strong a priori reasons to consider that both are relevant in the choice mechanisms. Strictly adhering to the homo economicus paradigm, one could argue that marginal disutility of costs should equate among different types of expenses (with an adequate provision for time discounting mechanisms). In other words, the disutility of purchase cost should be the same as the disutility of (time discounted) fuel cost. Using this equality would give rise to more parsimonious choice profiles, where, for instance, only purchase cost attribute would be used. There are however strong reasons to assume that some deviations from homo economicus paradigm may occur and that there are some distortions (additional to time discounting) in the effect of purchase vs. operational costs (D. L. Greene 2010; Massiani 2012). This observation leads to the conclusion that both attributes should be reflected in the choice set.

This said, there are some interrogations relating to how each of these two elements should be included. Regarding purchase price, most of existing results are based on conventional pricing schemes. Considering the interest of electric cars' proponents in more innovative pricing scheme, it would certainly be useful to have some insights about how consumers are affected by such pricing formulas.

Regarding operating costs, the existing results usually make use of one among two attributes: operating costs, maintenance costs, running costs or fuel costs. Operating costs are relevant, but they may be ambiguous for the general public: do some people think that it includes amortizing? And there is a risk that a non-negligible part of the people would not have a clear perception of these costs: apart from definitional issues (how do people understand "maintenance costs") people may lack realistic knowledge about the magnitude of the cost of an alternative they currently use (Turrentine & Kurani 2006). One may object that knowing realistically the cost of currently owned vehicle and being actually in condition to express preferences for fuel cost/economy are two different things.

The next question is whether one of the various labels of operating costs should be preferred to others. Fuel costs are less comprehensive than operating costs, but they are more univocal to customers. Also, it is likely that difference in fuel cost will represent the main source of difference in operating costs between alternative fuel and conventional vehicles in a foreseeable future. One should however consider a limitation in choosing fuel costs: if some incentives impact operating costs other than fuel (for instance ownership annual tax), it will be difficult to integrate its effect in the trade off formulation resulting from the SP survey, if one rejects the discussible assumption of identical marginal disutility of cost across cost items. A provisionary recommendation could be to include purchase cost and fuel costs.

Eventually there is a question on whether fuel costs should be included in physical terms or in monetary terms. In making this choice, the analyst should carefully consider that for many alternative modes l/km or, even more, kwh/km are meaningless to most of car purchasers, it then becomes a natural recommendation to use monetary value to express fuel costs.

As a conclusion, it seems that for applied forecast surveys, concentrating on fuel costs, additional to purchase costs, may be a fair solution as it focuses on a crucial attributes and provides information of the effect of delayed (vs. immediate) cost. This recommendation could

be less strict when the study has to investigate the effect of more specific monetary instruments to respond to a specific envisaged policy.

Non-monetary attributes

We now consider non-monetary attributes. A first set of attributes relates to autonomy (range, refueling network).

Range is fundamental and refueling should be made unambiguous

A first question is whether one of these attribute has more “priority” than the others. Ideally, range and refueling network should both be included as they represent two different (although interlinked) attributes of the technology, but this may make the number of attributes excessive. If this is an issue, one could conjecture that range is more important than refueling network: arguably, most of the concerns expressed by potential consumers are expressed in terms of Range and not in terms of refueling network. This conjecture can be checked against the results of SP surveys looking at the monetary value of the largest reasonably possible variation of each attribute. The intuition behind is that, if the value of raising fuel availability from 0 to 100 % corresponds to limited number of range kilometres, it could be wiser to concentrate on the latter attribute. SP surveys where both refueling stations and range were present provide a mild conclusion on this point. Supposing that an Electric vehicle would typically be in the range of 100 km vs. 800 km for conventional engines, while refueling stations could not represent more than 100% increase. Based on the metaanalysis made by (Massiani 2012) such an increase in range could be valued as much as 9000 €. This is slightly smaller than the amount provided by (Batley et al. 2004) for refueling stations, but slightly higher than the amount provided by (Brownstone et al. 2000).

A second question relates to the fundamental ambiguousness of the notion of refueling network. Refueling network attribute may not be completely clear for consumer because it may relate to highly different refueling durations (fasts, super fast) and because the effects of fast charging on battery life is still unclear and will not be perceived by respondents. As a precautionary recommendation, it could be wise to avoid using refueling station as an attribute if it is not accompanied by a clear indication of refueling modality or by an extra attribute corresponding to refueling time (as in Batley & Toner 2003).

Car segments should be included when long term projections are needed

A part from range and refueling, another important element relates to the introduction of car segments in the choice exercise. With the wording “car segment” we refer to the different categories of car (for instance, Compact, Mini, ecc) that the industry places on the market. The main question is whether segments should be present in the SP survey? On the one hand, one should recognize that the primary focus of the SP survey usually relate to car technologies. On the other hand, it is arguable that a correct representation of segment choice is necessary to realistically represent the diffusion of a given technology:

- 1 - There is probably a strong interaction, in consumer preferences, between technology and car segments (an electric car may be a good alternative for small cars but not for large cars).
- 2 - Many of the mechanisms that will influence the diffusion of electric vehicles will also influence the share of the different car segments (for instance Corporate Average Fuel Efficiency standards may generate a shift from "large" cars to "small cars" as well as a switch from one technology to another). If the model does not allow for such a shift, there is a risk that it will overestimate other adapting mechanisms (including shift to electric vehicles).

While being aware that such a recommendation raises some concern (correlation among attributes, endogeneity in case one introduces segment attributes that are tailored to each

respondent choice set), we find that there is a strong case for introducing these elements in the survey. This is certainly the case for exploratory surveys, and can as well be recommended for applied forecast surveys in market conditions where segment shift can be significant.

Environmental features should be introduced with care

Another set of attributes relate to environmental features, most often harmful emissions and, more and more, CO2 emissions. The accumulated knowledge of preference elicitation would however recommend caution about the introduction of such variables. This relates both to the well-known warm glow effect and to the limited knowledge of the general public about the actual meaning of environmental characteristics (with the exception of countries where emissions are an important determinant of car taxation).

Thus the fact that CO2 appears significant in some studies is not in itself a proof of the adequacy of its introduction (Achnicht 2009). Additionally even when introduced; the impact of these attributes on the choice probabilities is very low for a realistic range of variation. Other studies (Öko-Institut & ISOE 2011) also indicate that the effect of CO2 emissions on market diffusion forecast is low compared with other attributes. There is a chance that, in the absence of carefully assessed motivations, emissions would be introduced at the cost of a high uncertainty and with little effect on the results. This would not be a problem if it would not come at some cost and specifically dispersing cognitive resources of the interviewees from other, more relevant, tasks.

Eventually, one could add that there appears a real risk of confusion between what the realm of policy is and what the realm of consumer choice is. True, CO2 emission reduction is an increasingly important policy target, but most of the levers that will be used to reach this target will be indirect (taxation, regulation, incentives). Thus, the increasing policy focus is not in itself a justification in increasing the focus on CO2 in SP surveys.

As a conclusion, on this point, there is a chance that the introduction of emissions comes at the cost of excluding other variables whose effect could be more relevant.

Data collection should be conceived to make calibration possible

In this last section, we consider calibration issues for future SP surveys and argue that while calibration against market shares are misleading in EV context, the surveys should still collect information to be able to check for forecasting capability of the estimated models.

Calibration against existing market shares is unfeasible or misleading

In a first instance, we consider calibration against market shares. A standard procedure in use in SP surveys (Hensher et al. 2005) is that, once the model is estimated, the reasonableness of the results is checked against real market data. In case there is too much discrepancy between computed market shares and observed market shares, one should proceed with a calibration of extra parameters: Alternative Specific Constants, that are intended to correct for possible distortions that can occur within SP surveys. This procedure is however problematic for several reasons in the EV's.

The first obvious objection is that, when a technology is not present in the market, no valid observed market shares are available. But this objection may rarely apply strictly to car technologies (maybe Hydrogen would be the only one). In many situations, some cars of these technologies are sold on the market.

Then, a successive question is what can be done when some technologies are present with very low numbers in observed sales. Consider for instance EV's that sold less than 1000 units in France in 2011. Then the problem becomes one of distribution tails. In most of the practical situations, users of Normal (or Extreme Value 1 or other distribution) are concerned with what happens at the tail of population. Saying that, for instance, German population size has a Normal distribution, amounts to say that there are people 4 meters tall, and, even more embarrassing, that there are people with a negative size. This is however a statistical strangeness that has no practical implication for many of the uses analysts would generally make of a distribution. In the case of EV's, it becomes a serious concern. The value of the ASC you would need in order to replicate existing market shares are fully determined by the density of probability at the tail of the distribution. It is however hardly defensible that Extreme Value or Normal distribution has been selected for the stochastic component of Utility based on how accurately they represent low probability events. Thus Alternative Specific Constant calibrated based on the standard procedure would just tell how the assumed distribution is inappropriate to be used for low diffusion vehicles, and not what is the specific Utility associated with a given technology.

Third, there is an issue that relates to the number of "varieties" of each technology present in the market. The observed market share of each technology will crucially depend on the number of different models (or varieties) existing in each technologies. New technologies will usually exhibit a reduced variety, but until this is not taken into account in the model, the simulated market shares will, by construction, overestimate new alternatives market shares. Simulations based on existing models (for instance in Achtnicht 2010) actually confirm that alternative technologies have a forecasted market share that is significantly higher than observed market share. Part of this distortion may be due to the fact that the SP exercise does not capture the difference in the number of varieties available for each technology. The number of varieties is difficult to introduce in the survey exercise (Brownstone et al. 2000 introduced the number of models but it came from RP data to be used conjointly with SP data). One reason is that people don't consider variety in itself, but rather whether they find the product suitable for them. Having more variety makes this matching more likely, but is not directly part of preferences.

As a conclusion on this point, we suggest that standard approach to ASC calibration based on observed market share is probably inappropriate for electric vehicle purchase due to low diffusion number and limited variety.

Calibration could instead be based on reported car purchase

This however does not mean that calibration should not help to provide robust models. On the contrary, we posit there is a possibility to collect information about actual choice behaviour of interviewees. The survey should adequately contain some information on the latest car purchase situation to which the household took part. Did the John's buy a gasoline mini 2 years ago, in addition to their Citroen C4 Coupé 1.4? Did interviewees buy 4 % of GPL cars in the last two years? That, together with other adequate details is a useful information, and even more useful is the computation of single purchasers probability (do the John's only have a limited probability, in our model, to buy a gasoline mini) to be checked against actual choice, or real market shares of the sampled population to be checked against market shares (does model forecast 10 % market share for GPL).

Eventually, one could suggest another type of calibration related to the hypothetical distortion that may affect SP surveys in general and EV surveys in particular, due to the limited experience that users have of that technology. A promising area of application of SP surveys is the replication of similar survey on a panel of car users before and after they have used an EV for a significant period. While some results are available on before and after assessment by users (Gaerling & Johansson 2000), there is still too few research to better understand how the

lack of experience of car purchasers may impact the preferences elicited in surveys. While the purpose of developing correction factors, to convert “uninformed” preferences into “informed one” may still seem far away, it seems however that the use of repeated surveys could shed light on the quality of data collected on people with no significant experience of EV’s.

Conclusions

The current interest of policy makers and the general public on Electric Vehicles have urged economist to provide quantification of the likely diffusions of these technologies. Economists have relied on the consolidated Stochastic Utility Function paradigm and fed it with data from SP surveys. While SP certainly present a number of valuable features compared with competing methods, it is likely that the highest benefit has not been achieved.

We found a number of issues that should be carefully considered in the design of surveys and that can be found particularly critical if SP results are used to derive policy recommendations. Especially, we found that the tendency of numerous surveys to restrict the view of competing technologies to Battery Electric Vehicles against Internal Combustion Engine is restrictive and may be misleading as it does not consider that probably most of the potential of electric car lies into transition technology (PHEV and Hybrid especially). Moreover, when a limited set of technology is used to derive market diffusion forecasts, there are serious concerns about the illegitimate truncated view of the choice process that can result into inflated market share forecasts for studied technologies.

We also propose a number of recommendations for the future data collection which respond to the identified limitations (have and large set of technologies that include intermediate technologies, consider car segment as an attribute, and collect data on real purchase to corroborate the model).

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