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"The usership model to fasten takeoff of electric cars"

To my parents and my friends, whose support helped me go through this amazing journey.

Management Summary

Usership is a way to acquire the rights to benefit from a product (or a service), and it has become very popular in the last decade. This is due to the fact that end users might find it more convenient not to possess an item, thus avoiding purchase charges, maintenance and depreciation costs, but still have the right to use them paying a monthly or per-use fee.

The purpose of this paper is to study how the usership model (here intended as a long-term rental program) affects the consumer choice of electric vehicles against traditional gasoline ones. Electric vehicles are considered to be the future of the automotive industry, due to their environmental compatibility and their relatively easier maintenance procedure. On the other hand, the diffusion of EVs has struggled from the very beginning, mainly due to high purchase prices, low performance figures, and consumer technological uncertainty, caused by the fast turnaround of the very technology upon which the EVs are built on. We will therefore prove that usership has a positive effect on EV car choice against gasoline ones: usership can therefore be a valuable tool to increase the diffusion of more environmental friendly vehicles.

We therefore outlined a conditional choice logit model, in order to analyze which are the main drivers of consumers' car choice and whether usership can influence their perception from end user. We focused mostly on the car attributes that are considered to be the barriers to consumer choice, which are but not limited to:

- High purchase price
- Low Performance
- Low driving range
- Long time to recharge the batteries

The data, collected on two of the main workforce crowdsourcing platforms, Amazon MTurk and Crowdflower, showed us that among 115 respondents, usership does have a mitigating effect on the attributes that are perceived as reasons why not to buy an EV. Our analysis has also shown that usership has a direct positive effect on EV preference. In other words, when a consumer is given the opportunity to acquire an electric vehicle with the usership option, he will be more likely to do so than when he has to purchase it.

Secondly, we showed which are the main attributes that infuence the choice of a car. These attributes are:

- Purchase price
- Engine Type
- Driving Range
- Operating Costs
- Refuel/Battery Recharge Time
- Performance (Acceleration and Top Speed)

Moreover, we could demonstrate that the presence of usership as an acquisition option has a positive moderating effect on the influence that the car attributes listed as barriers to the purchase of electric vehicles have on consumer EV choice. This means that low driving range, high purchase price and high battery recharge times do matter less when usership is present.

These outcomes imply that automotive manufacturers that are willing to boost the diffusion of their electric vehicles might therefore start to offer usership program to their customers. In this way, car companies might mitigate the negative effects of EVs' technological uncertainty, as the final user will not be the owner of the vehicle. The customer will also avoid the burden of unexpected maintenance costs (especially regarding battery packs' substitution), as they will be included in the usership fee.

The positive effects of usership might be of great interest also for Governments. As reducing pollution is always a great deal of Nations' agenda, Governments could become usership service providers, purchasing EVs from car manufacturers and renting them to citizens.

This research unfortunately is limited in scope. Indeed, it takes into account a small niche of the automotive market that is the one comprising electric vehicles. Future research could focus on the application of the usership model to other products, such as consumer electronics, home appliances, and, more generally, to expensive consumer goods.

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1. Introduction

1.1. Current Market Analysis

The global car industry, due to the spectre of near future fossil fuels scarcity and a consistent change in consumer demand, is facing a considerable shift towards “greener” products. Car companies are investing large amount of capitals to develop more sustainable products that should gradually become less fuel dependent and more eco-friendly. If in the present the flagship of green cars is represented by Hybrid automobiles like the Toyota Prius (i.e. standard fuel engine cars whose emissions and fuel consumptions are reduced with the aid of a small electric motor) or EREVs and Plug-in Hybrids (PHEV), like the Chevrolet Volt (Opel Ampera in the EU) or the Toyota Prius Plug-in (Electric engine cars whose range is extended –and batteries recharged by- a small gasoline motor), in the immediate future we might face a steep increase in the demand of full electric cars – or BEV, Battery Electric Vehicles - , that in no way are tied to the supply of fossil fuels.

Unfortunately, the car industry is facing major issues in increasing the market penetration of greener cars, especially when it comes to convincing potential customers of the benefits that may emerge from a switch to a BEV or a PHEV. Indeed, as of 2012, sales for Electric vehicles accounted only for the 0.4% of the total U.S. market share (Baum & Associates, 2012), while in Western Europe market penetration was as low as 0.2% (Automotive Industry Data and Forbes, 2014).

1.2. Consumer and Society related issues

Today, when choosing to purchase a fully electric car, customers are facing major trade-offs in comparison with gasoline fueled cars. If it is true that on a daily basis an EV might be cheaper to run, as “full tank” of electricity might cost as low as 2 Euro, and governments across the globe incentivize the purchase of these cars through tax rebates, access to no-traffic zones and free parking spots, on the other side a potential buyer will have to come across a substantially higher retail price caused by the still too high cost of lithium batteries (that indeed might make economically unattractive the above mentioned fuel savings) and severe usage limitation. Indeed, current technological capabilities only provide electric cars with modest range autonomy and with extremely long re-charging times (up to 8 hours for a full recharge), thus not making it possible for an average user to undertake long trips, also because electric recharge stations are nowhere nearly diffused as gas ones. More specifically, as of 2013, 5,678 public recharge stations where available in the U.S. territory (U.S. Department of Energy, 2013) versus the 121,446 traditional gas stations (U.S. Census Bureau, 2013). In Europe the situation appears to be similar, with around 15,000 recharging stations available (Renault, 2012), versus 137,000 gas stations (MarketView, 2012). Moreover, EVs could turn out to be more expensive to maintain in the long run, as batteries lose their charging capacity over time (indeed, they have an “expiring date” related to a fixed number of charging cycles), and they may account for as much as 80% of the overall car cost. A report by The Telegraph (2011), has found out that replacing the battery pack on a Nissan Leaf, one of the most popular EV on the market (Daziano, 2013), might cost as much as £19000, when the retail price for the same car, after government rebates, is £26000.

In addition to that, a 2010 study from J.D. Power and associates, a leading marketing research company specialized in the car industry, has indeed analyzed the customer sentiments when evaluating the purchase of an electric car, discovering that the main factors that generate concern are but not limited to:

- Dislike of their look/design
- Worries about the reliability of new technologies
- Dissatisfaction with overall power and performance
- Anxiety about driving range
- Concern about the time needed to recharge battery packs

The same study also gives a lot of importance to the economic factors underlying the purchase of an electric car. According to their findings, “many consumers say they are concerned about the environment, but when they find out how much a green vehicle is going to cost, their altruistic inclination declines considerably”. Moreover it emerges that “the overall cost of ownership of HEVs and BEVs over the life of the vehicle is also not entirely clear to consumers, and there is still much confusion about how long one would have to own such a vehicle to realize cost savings on fuel, compared with a vehicle powered by a conventional internal combustion engine (ICE)”. Finally, it is important to notice that electric car buyers are represented by a precisely defined and narrow demographic segment: typical EV customers are indeed older than average, well educated (in possess of a postgraduate degree), interested in technology, they have an higher-than-average income and are willing to be the early adopters of a new technology.

The study concludes stating that, considering all these factors, it is not clear whether EVs will be likely to appeal the general population.

1.3. The Usership Model

The usership model is an innovative solution for the facilitation of fruition of (durable) consumer goods. Usership implies that a consumer will not be the exclusive owner of an item, but it will rather use it paying a variable periodic fee.

The usership model could turn out to be one of the most suitable ways to increase the diffusion of EVs. With the aid of a correctly developed pricing scheme, it might be extremely useful to overcome the tradeoffs typically associated with the use of electric cars while boosting their popularity. Indeed, consumers would not have to face the price premium that EV charge not worrying about maintenance costs and battery life. Secondly, consumers will not have to face one of the main issues related to the purchase of an EV: performance uncertainty, also known as functional risk. Customers are worried that the innovative product has not been fully or properly tested, therefore creating the doubt that it might not work perfectly (Sam and Sheth, 1989). Consequently, as the model does not imply the ownership of the vehicle, the user will not have to face the threat of buying a product that could potentially become obsolete in a short period of time, thus dramatically decreasing the resale value of the vehicle. Secondly, the risk associated to the potential uprising of a new and more efficient technology would be waived by the fact that the consumer has not invested a notable amount of money in the purchase of the vehicle.

Finally, it is interesting to notice that the automotive market is already shifting to the usership model. The KPMG's Global Automotive Executive Survey states that "the world is moving from car ownership to car usership" and that "customers are becoming less certain of their reasons for purchasing a vehicle". Finally, we must underline that, according to the report, among customers there is "no clear winner among the various electrified technologies", demonstrating once more how the EVs market is characterized by a high degree of technological uncertainty.

1.4 Research questions and motivation

We will therefore investigate how the usership model will influence the consumer preference of electric cars compared to traditional gasoline cars. It is interesting, under a behavioral economics point of view, to analyze how much an individual is willing to trade off when embracing the usership model. Indeed, traditional ownership is still a delicate matter when dealing with consumer goods, as some customers might be reluctant to pay for something they do not own, especially when dealing with cars, always considered a very "personal" and sometime "emotional" good.

Consequently, the research question will be:

How the usership model will influence the consumer preference of electric vehicles compared to traditional internal combustion engine (ICE) vehicles?

The sub-questions that we will answer are:

1) **Which attributes influence the most consumer choice related to electric vehicles preference?**
2) **Does the presence of the usership model alter the importance of the various attributes?**

The issues we are raising might result to have extremely important research and managerial relevance. More specifically:

- ***Scientific relevance:*** car-related consumer choice has been extensively studied in the recent past. Research has analyzed how car attributes drive consumer choice both for traditional (McCarthy and Tay, 1988) and for alternative fuel vehicles[1] (Hackbarth and Madlener, 2012). It will be extremely important to see how these frameworks are influenced with the introduction of the usership model, as it is an eventuality that past research has never considered. Moreover, there is no available research that exclusively focus on the attributes that drives the choice of a full electric car, as previous studies only took into account gasoline Hybrid cars and, more generally, alternative fuel cars.

The following table reviews the main academic papers that are relevant to this study:

[1] We consider alternative fuel the ones that are not (fully) derived from petroleum, such as Liquid Petroleum Gas, Compressed Natural Gas, Hydrogen, Electricity.

Study	*Context*	*Findings*	*Method*	*Contribution*
McCarthy and Tay, 1988	Auto Industry	Cost, performance, space, comfort, and safety characteristics are important determinants of vehicle choices.	Survey (Multinomial logit model)	Analysis of the Willingness To Pay for a Vehicle and its specific attributes.
Ram, 1989	Marketing of Innovation	The existence of a considerable amount of barriers for a consumer to adopt an innovative product.	Theory Paper	What type of barriers consumers need to face when considering the adoption of an innovative product.
Dasgupta, Siddarth and Silva-Risso, 2007	Auto Industry	Consumers are myopic and prefer contracts with lower payment streams even when they have higher total costs, and they are more likely to lease than to finance cars with higher maintenance costs because this provides them with the option to return the car before maintenance costs become too high.	Survey (Discretionary choice model)	Development of a model useful to evaluate the effectiveness of promotional incentives, such as cash rebates, interest rate subsidies, and increased residual values.
He, Chen and Conzelmann, 2012	Auto Industry	Local drivers preference towards HEV is higher when compared to preference of highway drivers.	Survey (Pooled choice model)	Analysis of utility of Hybrid vehicles attributes, Hybrid vehicles usage patterns.
Hackbart and Madlener, 2012	Auto Industry	Alternative fuel vehicles have a lower overall utility when compared to traditional gasoline engines.	Survey (Discrete choice MXL Model)	Analysis of utility of alternative fuel vehicles.
Daziano, 2013	Auto Industry	The price that consumers are willing to pay for an extra mile of range is higher than the marginal cost to produce a battery capable of a range with said extra mile.	Experiments (Conditional-logit Bayes estimators)	Analysis of utility of Hybrid and EV attributes.
Valle Fuin, 2014	Auto Industry	???	Survey (Choice Model)	The effect of the Usership model on the preference of EVs vs. traditional gasoline powered cars

- ***Managerial implications:*** The findings that will arise from this paper will be extremely important to drive future managerial decisions. Car manufacturers are investing large amount of capital into the development of alternative fuel cars (and in particular EVs), while consumers are hesitating to adopt new technologies. The usership model, if proven to be successful, might give car industry managers the right tool to foster the diffusion of electric cars and therefore starting to have a positive return on their investments. Indeed a precisely priced usership model can turn out to be of extreme usefulness for managers struggling to convince customers of the benefits of the usage of EVs.

2. Theoretical model

2.1 New Business Models: From product ownership to product usership

Product ownership has been radicated in our culture since the concept of “product” itself existed. This is why it might be difficult for consumers to understand a product fruition system that diverges from traditional ownership. This arguably is due to several socioeconomic reasons. First of all, past research as argued that product possession might be used as a symbol of control. It is said that most of individuals showing a tendency to materialistic attitudes, do prefer the ownership of possessions (Hunt, 1990). Moreover, objects can be seen as a tool to control an individual’s external environment (Furby, 1978). Finally, products can be considered as material extensions of an individual’s self. In this case products and possession can exercise control over the persona itself (Belk, 1988).

According to Griskevicius (2013), evolutionary underpinning made the human species inherit a set of defined psychological and behavioral mechanism that are activated, both by internal and external cues, in order to increase the chance of survival and reproduction. These mechanisms are called *“fundamental motives”* and are:

1. Self-protection
2. Disease Avoidance
3. Affiliation
4. Status seeking
5. Mate Acquisition
6. Mate Retention
7. Kin Care

All of these seven *“fundamental motives”* have respectively strong different relationships with our purchase and consumption behavior. Especially in the case of the status seeking motive, product ownership is considered to be a way to signal an individual’s status and its role in the societal hierarchical system. Products are seen as trophies that hopefully “will successfully yield social honor” (Solomon, 1999)

With the introduction of the concept of usership, it is evident how consumers will lose control over their possessions, and, considering the evolutionary motives that we mentioned above, it is easy to say why individuals might be reluctant to embrace it.

It is nevertheless clear that, on the other hand, usership is a fundamental and necessary step that has to be taken to lead our world towards a more sustainable economic system.

Some companies have indeed already proven that the application of a usership based business model can be profitable. We will therefore show examples of successful startups that base their revenues on service usership.

- **Netflix:** Netflix is a California based company founded in 1997. Its core business, at least at the beginning of the operations, was door-to-door DVD rental. The main breakthrough is considered to be the introduction of a “monthly flat subscription fee”, which gave customers the possibility to rent (therefore applying an usership model) an unlimited number of DVDs. Ten years after the beginning of the operations, and five after its Initial Public Offering on the NYSE, Netflix delivered its billionth DVD. At the same time, the company started offering an internet movie-on-demand service, therefore shifting its focus from DVD rentals to digital media online distribution.
- **Airbnb:** Airbnb is a San Francisco based company founded in 2008, with the purpose of connecting people looking for lodging accommodation and sharing. Unlike other traditional booking sites, Airbnb doesn’t own any physical property, but indeed it matches up users and makes them find the perfect accommodation and guest/host combination according to their profile, in a sort of “house-sharing” system platform. As of 2013, Airbnb served 9 million customers and raised half a billion dollars in venture capital funds, after a company value estimation of $10 billion.
- **Car2go:** Car2go is a car usership/car-sharing service offered by Daimler AG, the group that owns Mercedes-Benz and Smart car companies. The service premiered in Germany in 2008, and since then it extended geographically throughout Northern Europe and the United States. Users are provided with a fleet of electric or gasoline powered Smart minicars, and sometimes they are charged a fixed annual subscription fee. Subscribers can search for available cars nearby through a smartphone app, showing the remaining fuel/battery charge on the specific charge, and they will pay an hourly or per/KM fixed fee; daily or weekly discount rates are applied automatically. The service has been remarkably successful in terms of a shift toward a sustainable consumption and usage of cars. Indeed, according to an internal survey conducted by Car2go itself, it emerges that:

- More than 40% of the owners of 1 vehicle likely to become members of a car sharing service, consider the possibility of selling/getting rid of the current car
- More than 60% of the non-car owners interested in becoming a car sharing member would NOT consider purchasing a new car in addition to the membership

We might finally list the major advantages and disadvantages of ownership vs. usership and their respective marketing strategy in the following table.

	Ownership	**Usership**
Advantages	• Total control over the possessed good • Possibility to use the product without time and situational constraints • Psychological implications (achievements, status signaling)	• Leading to a sustainable consumption and economic system • Usually more convenient that owning the product in the long run • Environmentally sustainable • Hedging against technological uncertainty
Disadvantages	• Upfront investment required to purchase the product • Implies taking care (maintenance) of the good at extra cost • Consumers' goods devaluate over time	• Time and situational usage constraints • The product might not be available and ready to use when we need it
Marketing Strategy	Market centric strategy: Companies usually try to "push" a product towards the market and sell it as much as possible	Customer centric strategy: In this case companies listen carefully to consumers need, "pulling" the and developing the product from the customer base

2.2 Consumer resistance to new products

The approach that consumers adopt when facing the potential purchase of an innovative product has been extensively studied. We have insights about the types of risks associated to the purchase of the product (Sam and Sheth, 1989), the consumers' knowledge structure in response to new products (Moreau, Lehmann and Markman, 2001), and possible strategies to avoid innovation resistance (Ram, 1989).

More specifically, as we are analyzing a possible tool to decrease the negative externalities deriving from the purchase of an EV, we want to focus on why consumers resist adopting an innovative product. Past research shows us that consumers have to face to types of barriers: Functional and Psychological barriers (Sam and Sheth, 1989).

Functional barriers relate to three main components of the product:

- **Usage Patterns (Usage Barrier):** This barrier arises when the new product involves a dramatic change in the consumers' existing workflows, practices or habits. In this case, customer acceptance requires a long developmental change and effort. In our case, the use of an EV might change consumers' habits in term of "freedom to roam", as usually EV have lower mileage range and longer time to recharge batteries opposed to the short time required to refill a fuel tank.
- **Product Value (Value Barriers):** In this case, if the product has no strong price-to-performance value compared to product substitutes (in our case EVs versus traditional gasoline cars), consumers are not incentivized enough to change. In the case of EV, that is one of the main barriers that consumers are facing. Indeed, the added value of an electric car is still not offset by the higher purchase price. The usership model can be a viable way of making EVs' value more attractive by making negligible the purchase price of the car.
- **Product usage (Risk Barriers):** Here, risks are associated to possible and unpredictable side-effects that might arise from the use of the innovative product. More specifically, we can distinguish among four types of Risk Barriers:
    - **Physical Risk:** it relates to possible physical damage related to the use of the product. In our situation this type of risk is unlikely to be relevant, as EVs offer safety standards that are comparable –if not higher- to traditional gasoline cars.
    - **Economic Risk:** In this case, the higher the cost of the innovation, the higher the perceived economic risk is. This is indeed the issue that we want to tackle with our model. A consumer, as he is facing the potential purchase of an innovative product, thinks that if he waits enough, a better product with a lower price tag will go into the market. With the usership model we expect this risk to be negligible, as the potential EV customer will not have to face a high price tag for the product.
    - **Performance Uncertainty (Functional Risk):** Here, the consumer thinks that the product might not have been fully tested and it not might work as expected. This is another issue that should be moderated by the introduction of the usership model, as making EVs more economically accessible should increase the diffusion of the former, while building a sound performance record to be used by consumers considering the purchase of an EV,

eventually triggering a virtuous cycle that would lead to a larger diffusion of electric cars.

    - **Social Risk:** In this case, consumers are afraid that adopting the innovation they would encounter social shunning or, more generally, unacceptance by their peers. This is indeed a delicate matter, as it is very difficult to control the type of "personas" associated to a particular type of product.

On the other hand, Psychological Barriers are explained mainly by to factors:

- **Tradition Barriers:** Here the barrier is created by the cultural change needed to adopt the innovation. Indeed, it might difficult for consumers to drop a traditional habit as filling the car with fuel from a gas station.
- **Image Barrier:** This issue is related to the (unfavorable) association that a consumer might develop about an innovative product, especially regarding the product class, the industry or the country in which the innovation is manufactured. In case of unfavorable associations, the innovation might find it difficult to penetrate the market.

The following table summarizes the main barriers that might threaten the diffusion of Electric Vehicles.

Type of Barrier (and Risks)	*Motivation*
Economic Risk	Higher investment required to purchase an EV compared to a traditional gasoline car, high technological uncertainty (still developing) and therefore high risk of future product devaluation.
Performance Uncertainty (Functional Risk)	Despite the fact that EVs have been developed in the last century, their diffusion has been relatively limited, making therefore impossible to build a consistent reliability record which consumers might consult when choosing to purchase an electric car.
Usage Barrier and Tradition Barriers	The purchase of an electric vehicle nowadays implies a steep change in daily habits from the customer that is going to use it. For example, fast refueling and home-made maintenance are not possible with current available technology.
Value Barriers	Nowadays, the higher purchase price of an EV does not offset the benefits brought by fuel savings, tax rebates and road incentives (e.g. free parking spots, dedicated highway lanes, etc.)

It is therefore interesting to our purposes to individuate possible strategies that might fight consumer resistance to innovative products. In his work, Ram (1989) distinguishes between *Communication Strategies* and *Innovation Modification.* More specifically:

- **Communication Strategies:** In this case, the importance of such strategy relies in the fact that "while the ways in which individual consumers perceive a new product determine whether or not it is an innovation, there is still a great difference between consumer perception of an innovation and its market success.
  Even if consumers perceive differences, they do not develop preferences. This is where communication enters into the picture." (Scheuing et al., 1974, 40). In other words, effective communication strategies might still convince a reluctant customer to make use of the innovative product in question.
  Moreover, it is suggested that communication strategies can be classified along two dimensions: the extent to which the marketer can control communication, and the type of influence on the customers.
  - **Non-controllable Communication Strategies:** In this category, we find word-of-mouth and opinion leadership, that have been proven successful in shaping the opinion of consumers towards an innovative product. Word-of-mouth implicates that a consumer's opinion is shaped through social interactions with its peers, which in turn share their beliefs about a product.

- It is clear that the marketer in this situation has little or no control, and that this type of communication is strictly related to later stages of the product lifecycle, as, in order for WOM to exist, as the product must have gained some acceptance among a conspicuous number of consumers (Robertson, 1971).
- **Controllable Communication Strategies:** In this category, we find change agents and mass media communication. The change agent is an individual in charge of providing positive product information in order to convince potential customers to adopt it. In this case, the role is directly taken by marketers or their representatives and, as it involves face-to-face interaction, it is a communication strategy of a very persuasive nature (Rogers, 1983).
  The second type of controllable communication strategy is Mass Media. This is a valuable tool, at early stage of product deployment, to increase adoption of innovative products (i.e. to persuade consumers that they should switch to the new product). Indeed, previous research has found a positive correlation between mass media expenditures and product adoption rates (Horsky et al., 1983).

The following table shows communications methods to fight product resistance along the two dimensions: extent of control and type of influence on the customers.

		Extent of Marketer control	
Type of Influence on Customer		*High To Limited*	*Low To None*
	Personal	• Change Agents	• Word of Mouth • Opinion Leadership
	Impersonal	• Mass Media • Publicity Releases • Testimonials/Endorsements	• Government Agencies • Consumer agency Reports

- **Innovation Modification:** The second strategy that might be useful to fight innovative product adoption resistance is the product modification. Innovation modification implies that a product should be modified in order to be more acceptable by customers. This translates into the fact that discovery push (i.e. innovating just because a new technology is made available) should be avoided, en lieu of a market pull oriented strategy (Madique et al, 1984, and Day, 1971).

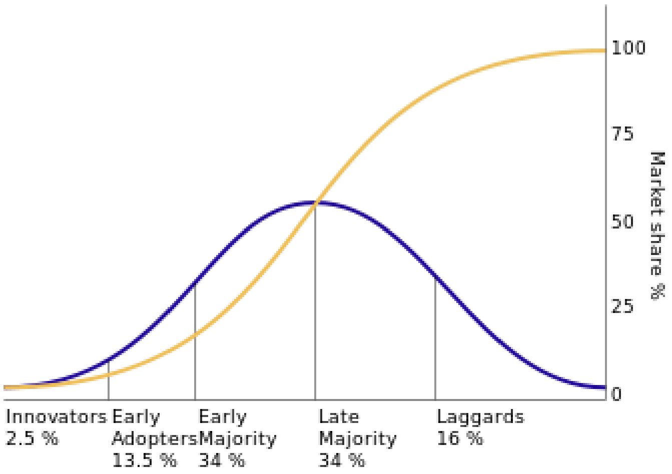
2.3 Electric Vehicles: radical and innovative products

The first fully electric car was built by Thomas Parker, a London Underground engineer, in 1884. Due to a great evolution in the technology underlying internal combustion engines, the electric car model was put aside, resulting in the diffusion of gasoline powered engines. The 1970s energy crisis revamped the interest in alternative fuel technology, also thank to a sensible technological evolution. The introduction by General Motors of their electric model EV1 in 1996 probably determined the beginning of the “modern era” of electric cars technology. Indeed, the EV1 had performance that could compare to a traditional car, a decent mileage range (80 to 100 miles on a single charge) and high security standards. More interestingly, the car was available only with a usership model type of purchase (long-term rental) and was an immediate success. Unfortunately, the project was considered anti-economical by GM and was therefore canceled 3 years later.

Deciding the exact date of launch of an innovative product is important when we want to study the diffusion pattern and the time to take off of such an innovative product. With his 1962 study, Roger claims that consumer follow a typical pattern when deciding to adopt an innovative product. Consumers are divided among different tiers in relation to the adoption of the product at a specific time of the product life-cycle:

- Innovators → 2.5% of the relevant market
- Early Adopters → 13.5% of the relevant market
- Early Majority → 34% of the relevant market
- Late Majority →. 34% of the relevant market
- Laggards → 16% of the relevant market

This pattern will translate into a typical bell-shaped distribution curve showed in the next figure:



Moreover, previous research has shown a typical pattern in the "takeoff" of innovative products. It emerges that, in the post World War II era, the takeoff is "an elbow shaped discontinuity in the sales curve showing an average sales increase of over 400%". Research also shows that the typical time to takeoff is 6 years from the introduction of the product, while market penetration is 1.7% (Golder and Tellis, 1997).

Bringing the two above mentioned studies together and taking into account that the market penetration of electric cars is 0.4% in the U.S. and 0.2% in Europe, we might conclude that consumers are extremely hesitant to adopt electric cars. Indeed, the takeoff, considering the 1996 EV1 to be the pioneer of electric cars, is extremely late and has not happened yet.

2.4 Main drivers of car consumer choice

One of the most important questions that might arise from the issue presented in the previous section is: **why consumers hesitate to adopt electric vehicles?** As we stated before there are many factors that disincentivize the purchase of an EV, among which certainly emerges uncertainty about the new technology. When approaching this matter, is important to take into account previous research about the attributes of a car that drive consumer choice. Regarding traditional gasoline cars (McCarthy and Tay, 1988) the main drivers were:

- Performance related attributes (Acceleration, Reliability)
- Space Related Attributes (Trunk Space, Interior Space)
- Comfort related attributes (Door Sill Height, Dashboard Accessibility, Interior Noise Level)
- Safety related attributes (Safety, Vehicle Size)
- Brand loyalty

On the other hand, a similar study has been done but taking into account attributes that drive the choice of a hybrid electric vehicle (He, Chen and Conzelmann, 2012). The attributes that resulted to drive choice were:

- Price
- Vehicle Origin
- Vehicle Size
- Vehicle Type
- Vehicle Quality Standards Ratings (on safety, interior, etc.)

Our intention is to perform a similar investigation, focusing exclusively on the attributes that drive the choice of an EV.

As we stated before, according to a 2012 J.D. Power survey, the main concerns about the potential purchase of an EV come from:

- Dislike of their look/design
- Worries about the reliability of new technologies
- Dissatisfaction with overall power and performance
- Anxiety about driving range
- Concern about the time needed to recharge battery packs
- High retail price
- Uncertain resale value (technological uncertainty)

We can therefore formulate the first Hypothesis:

H1: The attributes listed as barriers to purchase an EV have a negative impact on the consumer preference of EVs against a traditional gasoline car.

Taking into account the above mentioned consumers' concerns towards the purchase of an EV, we might formulate the following sub-hypothesis:

Past research shows that price has a negative effect on consumer choice towards Hybrid cars (He, Chen and Conzelmann, 2012, Daziano, 2013) and alternative fuel cars (Hackbarth and Madlener, 2011).Most of consumers might assume electric cars as expensive, since they might think that electric cars are higher technology products. They might perceive higher economic risk to buy an electric car, since they are new and not guaranteed perform accordingly given their high price. A higher perceived economic risk might also be due to the evolving nature of technology itself: indeed, being EV technology relatively new, it might be probable to buy an expensive product that will become obsolete in a very short amount of time. As price is listed as one of the main issues raised by customers approaching the purchase of an EV, we expect price to have a negative effect on choice. Therefore:

H1a: A higher purchase price has a negative effect on the consumer preference of an EV against a traditional gasoline car.

Current technology provides electric cars with batteries that have only a limited range. Together with a still in-development recharging infrastructure and extremely long recharging times, it might become very difficult, if not impossible, for an electric car user to undergo a long trip or, more generally, to use its car without the constant fear of remaining without “fuel” (i.e. “range anxiety”) (J.D. Power and Associates Reports, 2012). Past research has quantified how much more a typical car user is willing to pay for an extra mile of “electric” range. Indeed, an individual is willing to pay $100 more per mile of range, while it is interesting to notice that the marginal cost to produce a battery pack capable of providing an extra mile is $160 (Daziano, 2013).

Therefore we expect that:

H1b: A higher driving range has a positive effect on the consumer preference of an EV against a traditional gasoline car.

Past research about consumer preference towards alternative fuel (Hackbarth and Madlener, 2011) and Hybrid Electric cars (He, Chen and Conzelmann, 2012), has already shown that time to recharge batteries has a negative effect on consumer choice. As we are focusing on pure electric cars and one of the main “customer pains” about this type of vehicles is indeed time to recharge batteries, we expect time to recharge to have a negative effect on consumer preference. Interestingly, “time to recharge” might be a common parameter with traditional gasoline car. Indeed, ICE vehicles require some time to be refueled (e.g.: find a gas station, stop, fill the tank, pay for the gas), even though if compared to the time required to fully recharge an EV battery the effort to refuel a gasoline car can be considered negligible. Accordingly, we hypothesize that:

H1c: A long time to recharge batteries has a negative effect on the consumer preference of an EV against a traditional gasoline car.

The importance of performance as a consumer choice driver has been studied both in relations to traditional gasoline cars (McCarthy and Tay, 1988) and Hybrid electric cars (He, Chen and Conzelmann, 2012). Despite the market has witnessed a convergence between EVs and traditional gasoline vehciles, current EVs performance does not match up to traditional gasoline cars: lack of performance is indeed one of the main downsides that customers take into account when considering the purchase of an EV (J.D. Power, 2012). Consequently, we can hypothesize that the better the performance of an EV, the higher the utility for the consumer will be. We state therefore that:

H1d: Higher performance has a positive effect on the consumer preference of an EV against a traditional gasoline car.

In order to operate a car, a consumer will incur in monthly expenditures. These costs are usually related to insurance, taxes, maintenance and fuel purchase. As we noted earlier, in case of purchase of an EV, these costs will be dramatically lower, as:

- Refueling with electricity is considerably cheaper than with gasoline
- Governments offers tax breaks and rebates for purchases of EVs (Hackbarth et al., 2012)
- Ordinary maintenance is less demanding and, therefore, less expensive[2]

Previous research has shown that monthly operating costs have a negative effect on the utility of a vehicle (Daziano, 2013, and McCarthy et al., 1988). In our case, we might expect this effect to be moderately mitigated by the presence of an EV, as monthly operating costs will be lower. Therefore we hypothesize that:

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[2] Ordinary maintenance includes periodic interval servicing/checkup and the substitution of all consumable car components, such as: motor oil, filters, brake pads, tires, etc. Due to its simplicity, an electric engine requires very little maintenance and does not need the change of the majority of said components, including oil and filters, belts, clutch.
On the other hand, extraordinary maintenance regards the substitution or repair of components due to a sudden and unexpected breakdown of the car. In this case EVs might turn out to be more expensive to repair, mainly due to the high replacement costs of batteries.

H1e: Lower monthly operating costs have a positive effect on the consumer preference of an EV against a traditional gasoline car.

2.5 The usership model in the automotive industry

We are interested in studying how the usership model will influence the consumer preference of electric cars compared to gasoline and Hybrid vehicles. Firstly, we must answer a compelling question: **"What is usership?"**

As we mentioned earlier the usership model is an innovative solution for the facilitation of fruition of (durable) consumer goods.

Usership implies that a consumer will not be the exclusive owner of an item, but it will rather gain usage rights paying a variable periodic fee. Currently there are two main kind of usership available in the automotive industry:

- ***Pay-as-you-go (also known as Car Sharing or Carpooling):*** the user, paying an annual subscription fee, will gain the access to a fleet of (electric) vehicles located in public areas of major urban agglomerates. The user will have to book in advance the car he wants to use, pick it up at a pre-determined parking spot, and pay a fee which is related to how much he used the vehicle (e.g. time and distance). Benefits for the end user are clear: there will be no worries about maintenance and insurance costs, and the risk associated to resale value and technological uncertainty, as he will not be the owner of the car. A notable example of this type of usership is represented by the car2go program, which offers Smart electric drive cars in major European and North American cities. (Picture: car2go in Amsterdam)

- ***Long-term rental:*** In this case, the user will pay a monthly usage fee, which usually includes insurance, maintenance, road assistance and taxes. As in this case the benefits are even larger than in the case of car-sharing (the consumer will be able to use the car without having to book it and without any time, place or mileage constraints), **we will focus on this type of usership for our research**. Indeed, consumers will get all the benefit of possessing an EV (lower running costs, more environmentally friendly, access to limited traffic zones, free parking spots), without having to face the major risks related to the purchase of one of them.

  At the moment, long term rental is offered by a large number of third party companies (such as financial institutions, long-term rental companies and fleet management firms) but not by car manufacturers.

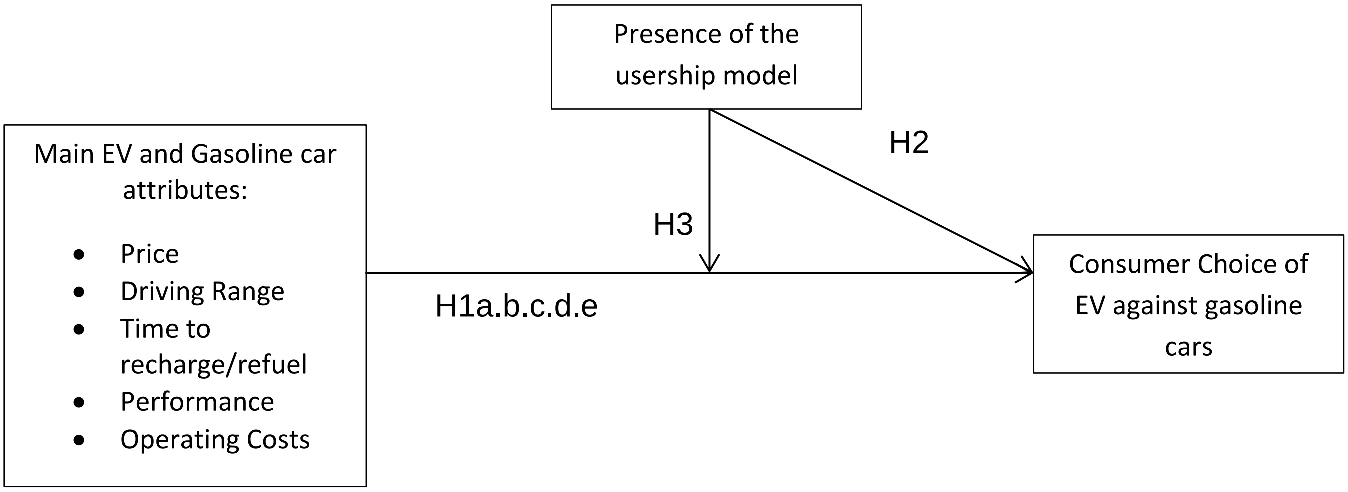
It is immediately clear that the application of the usership model will tackle the main downsides related to EV ownership. Firstly, consumers will not have to face the retail price premium associated with the purchase of an electric car (indeed, they will have to face no up-front payment at all). Secondly, as the user will not be the actual owner of the vehicle, he will not have to worry about technological uncertainty and therefore resale value. Finally, the user of the vehicle will not be concerned by eventual mechanical or battery failures, as maintenance services are included in the monthly price. We can assume therefore that the presence of a usership model will increase the likelihood of a consumer to choose an EV over a traditional gasoline car. Finally, it is important to mention that according to previous research operating costs, which might include but are not limited to maintenance, insurance and tax expenditures, resulted to have a negative drive on consumer choice (Daziano, 2013). Accordingly, we state our second hypothesis:

H2: The usership model has a positive effect on the consumer preference of electric vehicles versus traditional gasoline vehicles.

Finally, we are interested in how the usership will influence the weight of the attributes driving consumer choice. Previous research on alternative fuel vehicles (Hackbarth and Madlener, 2011) shows that some variables, such as demographics, car price and energy source, might have a moderating effect on the drivers of consumer choice of a vehicle. With usership the customer will not have to face the major downturn of owning an EV (such as high retail price, maintenance costs and worries about reliability). Moreover, it is proven that financing or leasing options affect consumer choice towards the preference of a certain vehicle (Dasgupta, Siddarth and Silva-Risso, 2007). We assume that the presence of the usership model will have a similar effect on the attributes of an EV. Therefore, we formulate our third and final hypothesis:

H3: The usership model has a moderating positive effect on the listed attributes (H1a-H1e) that drive consumer choice of an electric vehicle versus traditional gasoline vehicles.

2.4 Conceptual model



In order to conduct this research, we will develop a choice model that will be very similar to the one developed by Daziano in 2013, as our hypothesis are very alike to the ones that he studied. The next table approximately represents the choice that respondents will be presented with:

	Vehicle A	**Vehicle B**	**Vehicle C**
Vehicle Type	**Large SUV**	**Mini Car**	**Compact PU**
Engine Type	**Gasoline**	**Electric**	**Hybrid**
Performance	**Top Speed 80MPH**	**Top Speed 80MPH**	**Top Speed 80MPH**
	0-60: 16 Seconds	**0-60: 16 Seconds**	**0-60: 16 Seconds**
Total Purchase Price*	**$36,298**	**$16,594**	**$33,025**
Operating Cost *(less routine maintenance)*	**$56.70/mo**	**$7.85/mo**	**$29.10/mo**
Range (in miles)	**300 - 500**	**140 - 150**	**400 - 700**

*Total Purchase Price is the amount customers can expect to pay for the vehicle new at the dealership

3. Methodology

The main goal of this research is to investigate how the usership model might influence the customer choice of an Electric Vehicle versus a traditional gasoline one. As we noted earlier in the literature review, the characteristics of a specific car (whether it is its performance spec or its size), deeply influence consumer choice. Moreover, we noted that there are specific car features (like driving range) that represents substantial barriers for the diffusion of electric cars.

Our research will therefore be of Causal nature, as we are targeting a specific variable (the presence of the usership model) and we want to analyze its effect on consumer car choice. We must also remind that we want to analyze the influence that a car feature has on consumer choice; therefore the best option to pursue is to develop a discrete choice model including all the parameters or specifications that differentiate a vehicle from another.

3.1 The alternative specific conjoint analysis

As our main research goal is to analyze how the usership affects choice, we needed to generate "cards" that followed our predetermined rules. More specifically, we wanted to have a vehicle acquirable with usership in every choice set. We also had to make sure that EV specific features (such as battery recharge time – which is not present on gasoline or hybrid cars), were indeed only present in electric cars cards. Finally, as we intend usership as a mean of long-term renting a vehicle, we had to generate cards were in the presence of a Usership acquisition option, the purchase price was equal to zero.

In order to generate such a model, we used Sawtooth SSI Web software, as it is the only commercially available program which permits the generation of attribute specific cards (as opposed to IBM SPSS). The downside is that the output does not represent an orthogonal design: the possibility of generating a model with attribute specific cards (or "prohibitions") with an orthogonal design will be implemented by Sawtooth in the near future[3].

3.2 Choice of attributes

As we showed earlier, a consumer who is facing the purchase of a vehicle takes into account both performance and the cost of the vehicle. Our goal is to calculate the utility of

[3] http://www.sawtoothsoftware.com/about-us/news-and-events/news/1045-design-efficiency-for-next-version-of-acbc-and-other-improvements

each attributes, and see how the presence of usership acquisition option influence said utility.

We therefore decided to generate a model with the following list of attributes and levels:

- **Engine Type**: the type of engine built in the car, depending on the fuel it runs on. Can be Gasoline, Electric or Hybrid (Gasoline + electric)
- **Top Speed**: maximum speed the vehicle can reach, expressed in miles per hour. Can be 99, 110 or 126 miles per hour.
- **Acceleration**: time needed to the vehicle to reach 60 mph from a standstill, expressed in seconds. Can be 6.6, 8.8 or 10 seconds to reach 60 miles per hour from 0 miles per hour.
- **Acquisition Option**: whether the car will be acquired with a traditional purchase or with a long-term rental/usership option. The usership option includes the long-term car rental fee and the operating costs. It also implies a 5 year/60,000 miles usership period
- **Purchase Price**: the manufacturer suggested retail price (or MSRP), expressed in US dollars. The car can cost $15150, $21955, $26400, $29990 or $0 in case of usership.
- **Operating Costs**: cost needed to run the vehicle, including insurance, taxes, ordinary and extraordinary maintenance and depreciation. The figure is expressed in US dollars and it is based on a 5 years, 60,000 miles ownership period. The costs can be $620, $800, $950 per month.
- **Driving range**: maximum range achievable by the vehicle with a full tank (full battery recharge in case of Electric vehicles). Expressed in miles. Driving range can be 75 miles, 338 miles, 518 miles and 705 miles.
- **Recharge time**: time needed to recharge the vehicle batteries. Expressed in hours and always zero (0) for gasoline and hybrid vehicles. Time to recharge can be 7, 8 or 9 hours. This recharge time refers to charging the car from a standard house power outlet and for a 100% recharge from 0.

We must remind that Vehicle Type will not be taken into account in our analysis. Indeed, the size of a vehicle might represent a choice bias, therefore we did not include it as parameter in our card choice task.

All the attribute levels were taken from real life car models available in the U.S. market. More specifically, the top 5 selling models for each body type were taken into account. Finally, we might explain that the United States Customary unit system has been used, as the research questionnaire will be undertaken mostly by U.S. residents. This choice is due to the fact that the U.S. car market (and therefore its customers) is historically more familiar with electric vehicles, and as of today, is the biggest market for alternative fuel vehicles.

A model comprising 12 choice sets and a total of 36 products has been therefore generated through Sawtooth SSI Web. Every card included 3 randomly generated products. The task implied the choice of one of the three cards, as opposed to the rating or the ranking of them. In table 4 of the Appendix, it is possible to see the whole set of output cards.

Secondly, here it is possible to see an example of a car model that the respondents will be presented with:

- **Engine Type**: Electric
- **Top Speed**: 99 Mph
- **Acceleration**: 8.8 s
- **Acquisition Option**: Purchase
- **Purchase Price**: $29990
- **Operating Costs**: $950
- **Driving range**: 705 mi.
- **Recharge time**: 7 hrs

3.3 Choice model and Hypothesis Testing

In order to test our hypotheses, we must analyze of the importance that every attribute has on the utility of a vehicle. Therefore our model equation will be:

$$U_i = \beta_0 + \beta_1 EngineType_i + \beta_2 TopSpeed_i + \beta_3 Acceleration_i + \beta_4 PurchasePrice_i + \beta_5 OperatingCosts_i + \beta_6 DrivingRange_i + \beta_7 RechargeTime_i + \varepsilon_i$$

It is fundamental to notice that as we are dealing with a conditional logit model (en lieu of a standard binary choice one), we will not be able to use a logit based binomial regression model.

A conditional logit model is a variation of the general choice model where the expected utility of choice is based on the characteristics of the alternatives (therefore the vehicles'' attributes and their levels) rather than attributes of the individuals (McFadden, 1972 and Guadagni et al., 1983).

Instead, we will use the SPSS Cox regression (Coxreg) command[4], which indeed can be used to analyze a categorical dependent variable representing a multinomial (i.e. with more than 2 choices per card) choice model. Most of the independent variables therefore will be categorical, as the majority of the attributes are explained by levels within the same category (e.g. price, acceleration, etc.).

Since the conjoint design obtained with Sawtooth SSI Web software created some collinearity between acquisition type and price (i.e. price is always 0 when the acquisition option is Usership), SPSS automatically dropped one of these attributes when running the conjoint analysis. Therefore, we decided not to include attribute 'acquisition' and 'price' in same conjoint model.

Our first hypothesis H1 (and all its sub-hypotheses) stated that "***the attributes listed as barriers to purchase an EV have a negative impact on the consumer preference of EVs against a traditional gasoline car".*** In order to demonstrate that, after running our conjoint analysis, we will analyze all the coefficients of the variables present in the model, which in this case are the car attributes. Therefore, if a coefficient will be negative, it will mean that the variable will have a negative impact on the overall utility of the car.

On the other hand, our second hypothesis H2 states that ***"the usership model has a positive effect on the consumer preference of electric vehicles versus traditional gasoline vehicles"***. Respondents of the questionnaire will be sometimes presented with the possibility to choose an electric vehicle without the usership option, e.g. with a normal purchase acquisition process. By doing so, we can analyze if there is a statistically significant difference in choice between Electric Vehicles with usership and normal purchase option, determining therefore if the usership might make consumer more willing to acquire an EV.

[4] http://www-01.ibm.com/support/docview.wss?uid=swg21477360

Finally, our last hypothesis H3 states that "***the usership model has a moderating positive effect on the listed attributes that drive consumer choice of an electric vehicle versus traditional gasoline vehicles."*** In order to prove this hypothesis, we will treat the Acquisition Option attribute as a dummy variable. By studying interactions with said variable and the car attributes, we will be able to see whether the usership model dampens the negative effect of the EV attributes listed as a barrier to purchase.

Moreover, we wanted to get a taste of the consumer's familiarity and willingness to adopt EVs and the usership model in general. This is why we added extra (outside of the choice model) questions that will hopefully tell us what consumers think of the subject we are studying. Such questions are but not limited to:

- When you will buy a new car, will you consider a usership/long-term rental solution for an Electric Vehicle?
- How likely are you to consider buying a Gasoline car versus an Electric car?

Finally, we wanted also to investigate what is the willingness to pay for an EV with the usership model. This is why we presented respondents with a card (with the same attributes used earlier) showing the features of the best-selling EV in the U.S: the Nissan Leaf. The respondent will then have to choose whether to purchase it in cash, at $21480 after U.S. tax rebates, or acquire it with usership. The usership fee will be randomized for each unique respondent. The possible levels are:

- $620
- $800
- $950
- $1500

These are estimates calculated taking into consideration the real cost of ownership of the car (i.e. operating costs and depreciation), plus a rental fee, taken from real life long-term rental companies' price lists.

4. Data Analysis

The survey has been distributed in two phases, with a total of 115 responses gathered. In the first phase, the survey has been distributed to the researcher's personal acquaintances, via e-mail and Social Networking sites (Facebook Groups, Twitter, etc.). This choice was made in order to get feedback about the quality of the survey, its easiness to complete and to have a better idea of whether the instructions were easy to follow or not. We must note that a choice model based survey can get repetitive, as the respondent is presented multiple times with the same choice task. It is also worth to mention that the majority of respondents in the first phase are academicals, and therefore are familiar with surveys and in general with statistical research methods: this made their feedback an extremely valuable tool for the outcome of the data gathering process. In this phase, a total of 35 responses were gathered.

Having received an overall positive feedback about the quality and the ease of use of the survey, the distribution process entered its second phase. The survey has been therefore published on two major Workforce Crowding websites: Amazon's MechanicalTurk, and Crowdflower.

Workforce Crowding platforms work in a very simple way and are becoming a very useful tools for academicals that are looking for reliable, inexpensive and fast responses for their researches. After signing-up on the website, the researcher will publish its survey and/or experiment on the platform, where it will be immediately visualized by thousands of workers. The researcher will then independently set a salary that the worker will receive for completing the survey. Usually, the hourly wage for crowdsourced workforces is around $4/hr (That translates in a per-task-pay of around $0.30/0.40 for a 10 minutes long survey). Workers will then evaluate the time needed to undertake the survey and the salary for completing it. Depending on the wage that has been set, it is possible to receive a hundred reliable responses in a couple of days. Moreover, recent studies demonstrated that available samples are quite heterogeneous, consisting of medium-upper income individuals with a good education level.

Another factor that makes these platforms very useful is that they make it extremely easy to control and filter demographics of the respondents. Indeed, in a few steps it is possible to decide if survey-takers have to meet certain criteria to undertake the task. These criteria include but are not limited to:

- Age
- Gender
- Nationality
- Country of residence
- User/Worker Reliability (calculation based on feedback from past completed tasks)

As we mentioned earlier in the methodology chapter, we wanted to focus (i.e. the majority of our respondents) our research on the North American automotive market, as it is historically more familiar with alternative fuel vehicles, especially hybrids and electrics. It comes natural that the best choice was to get the support of a workforce crowdsourcing platform, as in this way we could get responses from American citizens in a reliable and relatively painless way.

Indeed, the second phase of the survey distribution resulted in 80 respondents, all of which, thanks to the filters provided by MechanicalTurk and Crowdflower, were all of U.S. Nationality. For reliability purposes, a filter which made the task available only to workers with at least 98% of positive feedback and 5000 completed task had been also added.

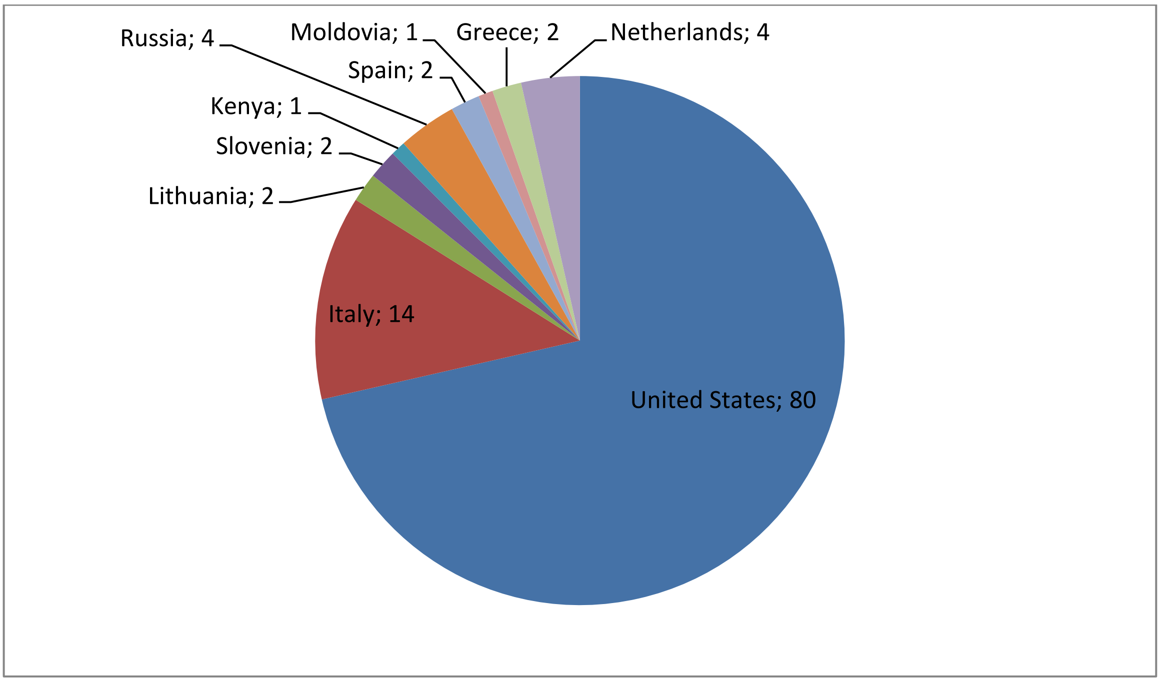
Finally, it is worth to mention that previous studies (Berinski et al., 2013) consider Amazon Mturk and, more generally workforce crowding websites, as a perfect tool for random probability sampling surveys. This is due to the fact that the crowdsourced working force represents quite precisely the overall population.

4.1 Descriptive statistics

The overall sample (*n=115)* resulted to have the following demographics:

- *Gender:* 59 males (51.3%) and 56 females (48.7%). *SD=0.503*
- *Age:* Min. 18, Max. 73. *Mean=36.99*. *SD=13.81*
- *Nationality:* As we mentioned earlier, we wanted to focus on North American respondents. Therefore, 80 respondents are of U.S. nationality (69.56%), while the remaining 35 respondents (30.44%) are from the rest of the World. The following graph explains the distribution of the various nationalities.

Graph: Respondents' nationalities



4.2 Hypothesis Testing

4.2.1 Barrier attributes to EV choice

In the theoretical chapter of this paper we mentioned what the main drivers of consumer car choice were and, more specifically, which of them could be considered as a barrier for the diffusion of Electric Vehicles. The fundamental attributes that we individuated as possible obstacle to EV consumer choice are:

- Price
- Driving Range
- Time to recharge/refuel
- Performance
- Operating Costs

We therefore formulated our first hypothesis ***H1,*** stating that ***"the attributes listed as barriers to purchase an EV have a negative impact on the consumer preference of EVs against a traditional gasoline car".***

We might then recall our first sub-hypothesis ***H1a***:

"A higher purchase price has a negative effect on the consumer preference of an EV against a traditional gasoline car"

After running the conditional logit analysis, we can notice that the variable PRICE (referring to the attribute level $0) is statistically significant with $p<0.05$ (Significance level = 0.000). We can therefore analyze and interpret the relationship between the base attribute level and the other different parameters that can be found in Table 1 of the Appendix.

- PRICE (1), Attribute level $15150. Exp(Beta)= 1.424, p-value=0.001, Beta= 0.354
- PRICE (2), Attribute level $21955. Exp(Beta)= 0.903, p-value=0.903, Beta= -0.102
- PRICE (3), Attribute level $26400. Exp(Beta)= 0.640, p-value=0.000, Beta= -0.446
- PRICE (4), Attribute level $29990. Exp(Beta)= 0.650, p-value 0.000, Beta= -0.430

As we can see from the parameters, it appears that the level referring to the purchase price $21955 is not statistically significant, therefore we will not take it into account for the purpose of our analysis. As we are running a conditional logit analysis, we must on the other hand give a great importance to the value of the exp(Beta). Indeed, this value represents the ratio of the hazards between two individuals whose values differ by one unit when all other covariates are held constant. In other words, exp(beta) explains by how much the odds of choosing one car increase(decrease) when a specific attribute level is present, ceteris paribus.

In this specific case, we can notice that when the purchase price is $15150 (PRICE(2)), there is a 42.4% increase in the possibility that that vehicle is chosen. On the other hand, when the purchase price is $26400 and $29990 (levels PRICE(3) and PRICE(4)), there is a decrease in choice possibility of 46% and 45% respectively. These conclusions are always in relation of the base level PRICE, which represent a purchase price of $0. We can conclude that a consumer is more willing to choose a vehicle when it is priced $15150, but is less likely to do so when prices are $26400 and $29990, always respective of the base price. More specifically, we can deduct that higher price tags yield a lower possibility of choice from the consumer, even because the magnitude of the effects of the presence of the larger prices is indeed greater than the one yielded by the $15150 price. The fact that some users are more willing to pay a vehicle $15150 instead of $0 might rely in the fact that the reference category (price $0), according to our design, appears only in conjunction with Usership as an acquisition option. Therefore it might be possible that some consumers are willing to pay a certain amount of money to purchase the car instead of paying nothing and acquire a vehicle with usership.

As we mentioned earlier, being the magnitude of the effect of the presence of the categories PRICE(3) and PRICE(4) higher than the effect yielded by the presence of PRICE(1), we might conclude that higher price levels decrease the overall utility of a vehicle. We can therefor accept our sub-hypothesis ***H1a***.

Our second sub-hypothesis ***H1b*** stated that:

"***A higher driving range has a positive effect on the consumer preference of an EV against a traditional gasoline car"***

The variable RANGE (referring to the driving range level of 75 miles and explaining the driving range of a certain vehicle) present in the model appears to be statistically significant with $p<0.05$ (Sig. level at 0.000)(Reference at Table 1 of the Appendix).

The output regarding the other attribute levels is as follows:

- RANGE (1), Attribute level 338 miles. Exp(Beta)= 1.148, p-value=0.208, Beta= 0.138
- RANGE (2), Attribute level 518 miles. Exp(Beta)= 1.942, p-value=0.000, Beta= 0.664
- RANGE (3), Attribute level 705 miles. Exp(Beta)= 1.771, p-value=0.000, Beta= 0.572

We straightforwardly notice that the attribute RANGE(1) is not statistically significant, therefore we cannot state whether the presence of such attribute level does have an influence on consumer choice: in other words, we might say that the difference between a driving range of 75 and 338 miles is not perceived as significantly different by consumers. On the other hand, the attributes referring to the two higher range levels are indeed statistically significant for $p<0.05$. We also notice that, according to their exp(Beta) values, the presence of a range of 518 and 705 miles, increase the likelihood of choice by 94.2% and 77.1% respectively, always taking into account of the base value of 75 miles (RANGE). In other words, we can conclude that higher range levels do have a positive effect on consumer car choice.

We can therefore accept the sub-hypothesis ***H1b***.

Our third sub-hypothesis ***H1c*** states that:

"A higher time to recharge batteries has a negative effect on the consumer preference of an EV against a traditional gasoline car"

The variable RECHARGETIME present in the model explains the importance that consumers give to the time needed to fully recharge the batteries of an electric vehicle for their car choice. In this case the base level is 0 hours to recharge. We must underline that, as the time needed to refuel a gasoline or a hybrid car is negligible; all the cards with these engine types had a recharge time level of 0 hours.

The variable is statistically significant with $p<0.05$ (Sig. Level of 0.002). We can therefore proceed to analyze the other categorical variables relating to recharge times. The variables present in the model are as follows:

- RECHARGETIME (1), Attribute level 7 hours. Exp(Beta)= 0.452, p-value=0.008, Beta= -0.794
- RECHARGETIME (2), Attribute level 8 hours. Exp(Beta)= 0.948, p-value=0.749, Beta= -0.054
- RECHARGETIME (3), Attribute level 9 hours. Exp(Beta)= 1.200, p-value=0.268, Beta= 0.182

We immediately notice that the only attribute level appearing to be statistically significant is the one explaining a recharge time of 7 hours, RECHARGETIME (1). This means that, when the time to refill the batteries is 7 hours, the probability of choosing the vehicle including that option decreases by 44.8%. That is, when the recharge time of a certain vehicle shifts from 0 to 7 hours, the overall utility of the vehicle itself decreases. In other words, a higher recharge time yields a lower overall utility, ceteris paribus.

We can therefore accept our sub-hypothesis ***H1c***.

Our fourth sub-hypothesis ***H1d*** states as follows:

"Performance has a positive effect on the consumer preference of an EV against a traditional gasoline car."

In order to test this hypothesis, we want to analyze two specific variables in the models, which are TOPSPEED (referring to the base attribute level of 99 miles per hour) and ACCELERATION (relative to the base attribute level of 6,6 seconds). As we can notice from the output of our model, the two variables unfortunately are not statistically significant (Sig. Levels respectively of 0.118 and 0.424). This implies that we cannot state with an acceptable degree of certainty whether performance has a positive or negative effect on consumer car choice, that his we cannot accept our hypothesis but neither accept the null hypothesis.

The output regarding the variables explaining Performance, relative to Table 1 of the Appendix, is as follows:

- TOPSPEED (1), Attribute level 110 miles per hour. Exp(Beta)= 0.753, p-value=0.039, Beta= -0.283
- TOPSPEED (2), Attribute level 126 miles per hour. Exp(Beta)= 0.873, p-value=0.045, Beta= -0.135
- ACCELERATION (1), Attribute level 8,8 seconds. Exp(Beta)= 1.105, p-value=0.208, Beta= 0.100
- ACCELERATION (2), Attribute level 10 seconds. Exp(Beta)= 1.037, p-value=0.696, Beta= 0.037

Subsequently, we cannot accept our hypothesis ***H1d.***

The fifth and final sub-hypothesis we formulated states that ***"Lower monthly operating costs have a positive effect on the consumer preference of an EV against a traditional gasoline car".***

In our model the independent variable that explains this effect is OPERATINGCOSTS (referring to the base level of $620 per month). As we can see from the output the variable appears to be statistically significant in a 90% confidence interval, with $p<0.10$ (Sig. Level at 0.097). The output for the other category variables, referring from Table 1 of the appendix, appears to be as follows:

- OPERATINGCOSTS (1), Attribute level $800 per month. Exp(Beta)= 0.919, p-value=0.326, Beta= -0.084
- OPERATINGCOSTS (2), Attribute level $950 per month. Exp(Beta)= 0.818, p-value=0.035, Beta= -0.200

As we can see from the output, the variable OPERATINGCOSTS (2), referring to the attribute level of a $950 per month operating costs, is statistically significant for *p<0.05.* Being the exp(Beta) value 0.818, we can infer that when the operating costs shift from $620 to $950 per month, the likelihood of car choice decreases by 12.8%. In other words, higher operating costs do have a moderate (as OPERATINGCOSTS is statistically significant for *p<0.10)* negative impact on the overall utility of a vehicle. We must notice nonetheless that the variable OPERATINGCOSTS (1) is not statistically significant. This might mean that consumers do not consider determining a shift in operating costs from $620 per month to $950 per month. Nevertheless, we can conclude that higher operating costs do decrease the utility of a vehicle in a statistically moderate way.

This outcome is in line with what we predicted earlier, therefore we can state that sub-hypothesis ***H1e*** is accepted.

Overall, we can conclude that our first hypothesis ***H1,*** stating that ***"the attributes listed as barriers to purchase an EV have a negative impact on the consumer preference of EVs against a traditional gasoline car",*** is partially accepted. The only effects that we could not measure, being not statistically significant, were the ones relative to performance. Our main reasoning behind this outcome is that in the near past performance levels for electric cars have converged towards the ones of traditional gasoline ones, and the performance levels that were chosen for the cards were not distant enough from each other.

4.2.2 The effect of Usership on EV versus gasoline car choice

With the formulation of our second hypothesis ***H2***, we want to prove the existence of a positive moderating effect that the presence of usership as an acquisition option has on consumer EV choice versus traditional gasoline vehicles. In order to do so, we computed an interaction variable, between a dummy variable explaining the presence/absence of the usership and the "Electric Engine" dummy variable, explaining the presence/absence of the electric engine in the chosen card option. We must specify that in this case we removed the variable PRICE from our model. This is due to the very specific design of our choice cards. Indeed, whenever the Usership option is present, the price of the vehicle presented is always $0. This means that entering both variables in the model, we would incur in linear covariates. The model for testing ***H2*** will therefore be as follows:

$$U_i = \beta_0 + \beta_1 EngineType_i + \beta_2 TopSpeed_i + \beta_3 Acceleration_i + \beta_4 OperatingCosts_i + \beta_5 DrivingRange_i + \beta_6 RechargeTime_i + \beta_7 AcquisitionOption_i + \beta_8 UsershipXElectric_i + \varepsilon_i$$

According to the output of our model, present in Table 2 of the Appendix, the variable UsershipXElectric appears to be statistically significant for *p<0.05* (Sig. Level of 0.000). The exp(Beta) of the variable is, on the other hand, 2.282. More specifically, the SPSS output of the variable is:

UsershipXElectric: exp(beta) = 2.282. p-value = 0.000. Beta = 0.825

This means that in the presence of usership, there is an increase in EV consumer choice of 128.2%. We can conclude indeed that the presence of usership as an acquisition option has a positive effect on consumer EV choice versus traditional gasoline ones. In other words, this implies that a consumer is more willing to purchase an electric vehicle when he is presented with the usership option than when he is not. This outcome might have large implication on the auto industry and, overall, on the diffusion of Electric Vehicles. Indeed, we could demonstrate that usership can be a viable tool to foster the diffusion of electric vehicles.

In conclusion, we can state that our Hypothesis ***H2***, stating that ***"the usership model has a positive effect on the consumer preference of electric vehicles versus traditional gasoline vehicles",*** is accepted.

4.2.3 The moderating effect of Usership on the car attributes

In the third and final part of our paper, we wanted to prove that the presence of Usership as an acquisition option can moderate (and therefore mitigate) the negative effects of the car attributes that we listed as barriers of a consumer's choice towards an electric vehicle. To do so, we generated interaction variables between a dummy variable explaining the presence/absence of the usership and the various attribute variables. We proceeded then introducing the aforementioned interactions in the models, and therefore run the Cox Regression analysis. It is important to notice that, as in the presence of usership the purchase price is always zero, we will not be able to analyze the interaction between usership and price, as the interaction itself will result in constantly linear covariates. In this case, the model for hypothesis ***H3*** testing will be:

$$U_i = \beta_0 + \beta_1 EngineType_i + \beta_2 Price_i + \beta_3 TopSpeed_i + \beta_4 Acceleration_i + \beta_5 OperatingCosts_i + \beta_6 DrivingRange_i + \beta_7 RechargeTime_i + \beta_8 AcquisitionOption_i + \beta_9 UsershipXRange_i + \beta_{10} UsershipXRechargeTime_i + \beta_{11} UsershipXSpeed_i + \beta_{12} UsershipXAcceleration_i + \beta_{13} UsershipXOperatingCosts_i + \varepsilon_i$$

The first interaction that we will analyze is the one between the presence of Usership as an acquisition option and the effect that Driving Range has on consumer car choice. As we can see from the regression output, we can notice that the variable UsershipXRange is statistically significant for $p<0.05$ (Sig. Level 0.001). On the other hand, the exp(Beta) coefficient is 2.376. This means that indeed usership has a positive moderating effect on the effect that the parameter RANGE has on car choice. In other words, in the presence of usership, consumers tend to be less influenced by the low driving range of an electric car. More specifically, it means that for any driving range that a given vehicle is capable of, in the presence of usership there is a 137.6% increase in the possibility of car choice. This has important implications, has poor range has always been one of the main reasons why EVs haven’t been successful in the market so far, as a traditional gasoline car can drive up to six time further distance than an electric one.

The second interaction that we want to study is the one between the presence of Usership and the variable explain that the time to recharge the batteries of an EV has on consumer car choice. The interaction variable UsershipXRechargetime is statistically significant for $p<0.05$ (Sig. Level of 0.001). We can interpret the coefficient of the variable exp(Beta) = 1.619 by saying that the presence of usership has indeed a positive moderating effect on the effect that time to recharge batteries has on EV car choice. In other words, in the presence of usership as an acquisition option, a consumer will give less importance to the usually long times required to “fill the electricity tank” of an EV. More specifically, we can infer that for any give recharge time a vehicle has to undergo to refill its batteries, the presence of usership increases the utility of said parameter by 61.9%, therefore compensating for the negative effect that long recharge hours have on EV choice. Once again we consider this outcome to have major implication in the auto industry, as the huge difference of time needed to refuel a traditional gasoline car versus the time necessary to recharge the batteries of an EV, has indeed been one of the major barriers for EV diffusion.

Furthermore, we want to test the effect that the presence of usership has on car performance. As we noted earlier, we could not state that performance has any statistically significant effect on consumer car choice. On the other hand, it appears that the interaction variable UsershipXTopspeed is indeed statistically significant for $p<0.05$ (Sig. Level 0.005). Being the coefficient of exp(Beta) = 1.892, we can conclude that usership does indeed have a positive moderating effect on the influence that the TOPSPEED variable has on car choice. Unfortunately, it appears that the interaction between Usership and Acceleration is not statistically significant (Sig. Level 0.102). We cannot conclude therefore whether the presence of usership has a moderating effect on the overall performance of a car. This might seem logic, as we realized that according to our analysis performance has not any statistically significant effect on consumer car choice.

Finally, we will look into the effect that Usership has on operating costs. We must remember that in the case of usership Operating Costs must be considered Usership fees, including the very operating costs and the long-term rental fee. The variable UsershipXOperatingcosts is statistically significant for $p<0.05$ (Sig. Level of 0.017). Being the coefficient of the variable exp(Beta) = 2.177 we can conclude that the presence of usership has positive moderating effect on operating costs. This means that the presence of usership will mitigate the negative effect that higher operating costs have on consumer EV choice. In other words, for any given operating costs level, the presence of usership will increase the likelihood of a given vehicle choice by 117.7%.

Overall, we demonstrated that the presence of usership has a positive moderating effect on the attributes listed as barriers to purchase EVs. We therefore state that our second hypothesis ***H3***, stating that ***"the usership model has a moderating positive effect on the listed attributes that drive consumer choice of an electric vehicle versus traditional gasoline vehicles"***, can be partially accepted. We indeed could not state whether the presence of usership mitigates the negative effect of low performance levels towards the choice of an EV. This outcome might be explained by the very same reasons why we could not prove the effect on performance on car choice. More specifically, we might say that usership has no effect due the recent convergence of EVs performance levels towards the ones of traditional gasoline cars.

4.3 Additional Data analysis

As we mentioned earlier, together with the hypothesis testing, we had the intention to get an impression of the consumers' thoughts and attitude towards the EV market. This is why in the second part of the survey we presented the respondents with questions not related to our choice model analysis, but indeed regarding their opinion on electric vehicles and their car usage habits.

It emerges that on average the respondent or its family owns between 2 and 3 cars (*M=2.82, Std.D= 1.045),* that are driven mostly between 2 and 5 days per week. On average, the respondents would consider themselves not very familiar with electric vehicles, based on ratings on a 7-point familiarity likert scale (*Mean=3.58, Std.D 1.60*). It also emerges that respondents, when considering to buy a new car (27.8% of respondents were at the moment considering the purchase), will still prefer a gasoline vehicle against an electric one (*Mean=5.17, Std.D=1.743)* but, interestingly enough, they will be more likely to consider Usership as an acquisition option more for EVs (41.7% of respondents) than for gasoline cars (30.4% of respondents).

Moreover, we presented the survey takers with a series of statements about EVs that they had to rank on a 7-Point Likert Scale of agreement (Cronbach Alpha= 0.646). The following table resumes the main descriptive statistics about the results.

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Electric cars are currently quite expensive.	115	1	7	5,33	1,160
Electric cars have no tailpipe emissions.	115	1	7	5,01	1,430
The charging time is never less than 30 minutes.	115	1	7	4,50	1,602
100 mi cost less than 2 dollars.	115	1	7	4,35	1,109
Electric cars increase the pleasure of driving.	115	1	7	3,88	1,352
Electric cars have high maintenance costs.	115	1	7	4,30	1,299
Electric cars are noisy.	115	1	7	2,61	1,349
Road transport is a major source of emissions which harm the environment.	115	1	7	5,40	1,491

Electric cars are safe.	115	1	7	5,13	1,274
Driving an electric car is like driving a conventional car with automatic gears.	115	1	7	4,49	1,429
Electric cars can run for a maximum of 150 mi between two charges.	115	1	7	4,04	1,259
Valid N (listwise)	115				

The results show that the respondents have an overall positive view of electric cars:

- Agreement about being environmentally friendly (*Mean=5.01 Std.D.=1.430)*
- Disagreement on the fact that EVs are noisy (*Mean= 2.61 Std.D =1.349*)
- Agreement about EVs safety levels (*Mean=5.13 Std.D=1.274)*
- Moderate agreement on easiness to drive (*Mean=4.49 Std.D=1.429)*

Respondents on average agree on the fact that driving an EVs is like driving a traditional gasoline car, that they are very environmental friendly but, on the other hand, are not very driving pleasure oriented (*Mean=3.88 Std.D=1.352*).

Moreover, we wanted to analyze the willingness to pay of respondents when presented with the choice to purchase a vehicle (a Nissan Leaf) or acquire it with a 5yrs/60,000 miles period usership. The following table resumes the results:

Now imagine that you choose to buy the following electric vehicle, a Nissan Leaf. The Leaf has the following specifications: Vehicle Type: Sedan Engine Type: Electric Top Speed: 87...

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Purchase: $21480	91	79,1	79,1	79,1
	Usership/Long-term Rental: $620 per month	11	9,6	9,6	88,7
	Usership/Long-term Rental: $800 per month	3	2,6	2,6	91,3
	Usership/Long-term Rental: $950 per month	6	5,2	5,2	96,5
	Usership/Long-term Rental: $1500 per month	4	3,5	3,5	100,0
	Total	115	100,0	100,0	

Even though the price of the car after car breaks can be considered low, we can notice that some respondents actually opted for the usership option. We can finally notice that the most successful usership rate is the one at $620 per month. This outcome sounds very logical, as it is the price level which actually implies money savings for the consumer. Indeed, $620 per month commonly represents monthly operating costs for a medium sized vehicle. A usership fee costing that much, would imply that the consumer will not incur in the acquisition costs at all.

Finally, as in our survey was present a yes/no question about willingness to acquire an electric car with usership, we divided our sample in respondents who said yes (indeed willing to acquire an EV with usership) and subjects who said no. We then proceeded to run two separate analysis in order to study the differences among the two groups. The next two tables represent the outputs of our model.

Table 1: Conditional logit regression output. Group: yes to usership

Variables in the Equation

	B	SE	Wald	df	Sig.	Exp(B)
TOPSPEED			15,566	2	,000	
TOPSPEED(1)	-,560	,142	15,462	1	,000	,571
TOPSPEED(2)	-,230	,119	3,745	1	,053	,795
ACCELERATION			3,335	2	,189	
ACCELERATION(1)	,167	,115	2,111	1	,146	1,182
ACCELERATION(2)	,216	,128	2,857	1	,091	1,242
PRICE			35,846	4	,000	
PRICE(1)	-,185	,160	1,333	1	,248	,831
PRICE(2)	-,374	,172	4,756	1	,029	,688
PRICE(3)	-,789	,183	18,673	1	,000	,454
PRICE(4)	-,693	,160	18,774	1	,000	,500
OPERATINGCOSTS			4,873	2	,087	
OPERATINGCOSTS(1)	,185	,121	2,356	1	,125	1,203
OPERATINGCOSTS(2)	-,066	,131	,254	1	,614	,936
RANGE			29,188	3	,000	
RANGE(1)	,314	,155	4,099	1	,043	1,368
RANGE(2)	,864	,161	28,704	1	,000	2,372
RANGE(3)	,377	,148	6,509	1	,011	1,458
RECHARGETIME			,253	3	,969	
RECHARGETIME(1)	-,028	,143	,040	1	,842	,972
RECHARGETIME(2)	-,070	,162	,187	1	,666	,932
RECHARGETIME(3)	-,053	,167	,101	1	,750	,948

Table 2: Conditional logit regression output. Group: no to usership

Variables in the Equation

	B	SE	Wald	df	Sig.	Exp(B)
TOPSPEED			3,802	2	,149	
TOPSPEED(1)	-,156	,114	1,849	1	,174	,856
TOPSPEED(2)	-,201	,105	3,675	1	,055	,818
ACCELERATION			3,646	2	,162	
ACCELERATION(1)	-,040	,095	,183	1	,669	,960
ACCELERATION(2)	-,203	,109	3,469	1	,063	,817
PRICE			20,121	4	,000	
PRICE(1)	,598	,141	17,927	1	,000	1,819
PRICE(2)	,256	,146	3,065	1	,080	1,291
PRICE(3)	-,049	,152	,103	1	,749	,953
PRICE(4)	-,012	,134	,008	1	,927	,988
OPERATINGCOSTS			7,241	2	,027	
OPERATINGCOSTS(1)	-,215	,105	4,173	1	,041	,807
OPERATINGCOSTS(2)	-,307	,117	6,851	1	,009	,736
RANGE			38,363	3	,000	
RANGE(1)	,173	,138	1,578	1	,209	1,189
RANGE(2)	,697	,141	24,362	1	,000	2,008
RANGE(3)	,607	,130	21,806	1	,000	1,835
RECHARGETIME			25,845	3	,000	
RECHARGETIME(1)	-,571	,134	18,140	1	,000	,565
RECHARGETIME(2)	-,302	,137	4,857	1	,028	,739
RECHARGETIME(3)	-,448	,139	10,411	1	,001	,639

As we can see from the two previous tables, respondents in the group “yes to usership” appear to be definitely more sensitive to price increases. This outcome is quite logical, as usership does not imply any upfront purchase costs. We can also notice that the attributes relative to car performance are only statistically significant (Top Speed) for the group “yes”. On the other hand, increasing operating costs are significant only for the respondents of group “no”. This outcome might explain a lot about the structure of the usership model. Indeed, people who are not willing to acquire a vehicle with usership, will have to face an upfront purchase price. They will therefore become sensitive to increases in operating costs, as they already paid a large amount of money to acquire the vehicle. While the effect that driving range has on choice is quite similar among the two groups (their exp(Beta) are close to each other), we interestingly notice that, for the group willing to acquire an EV with usership, higher battery recharge times are almost non influent to choice, while for the group “no”, they can decrease the likelihood of choice up to 43.5% (exp(Beta) of 0.565.

5. Conclusions

In this paper, we demonstrated three main factors that influence consumer car choice, especially regarding Electric Vehicles. First of all, we showed that most of the car attributes that previous research (Daziano, 2013, McCarthy et al., 1988) considered to be barriers to EV choice and, more generally, to the diffusion of electric cars, do have a main driving role in the decision making process of consumers willing to purchase a car (Hackbarth and Madlener, 2011, and He, Chen and Conzelmann, 2012). These factors and their effect are:

- Price (negative effect on EV choice)
- Driving Range (Positive effect on EV choice)
- Time to recharge/refuel (Negative effect on EV choice)
- Performance (Positive effect, Hypothesis not accepted)

The only effect that we could not measure is the one that performance should have had on choice. This may be due to several reasons. First of all, we can try to see the problem under the cards design point of view. In order to create the product cards, we tried to select attribute levels that reflected the real market as much as possible. We choose therefore the most common levels in the automotive market, picking them from the best-selling vehicles in the last two years. As the levels resulted to be quite similar to each other, this might have made the survey takers insensitive to the change in performance. On the other hand, it might be possible that parameters such as acceleration and top speed are too specific for the average customer. A parameter indicating the overall level of performance (high, low, medium) of the car, might have beet more significant to the survey takers.

Moreover, we must notice that in the last two years the performance of electric vehicles has increased dramatically, and an acceleration figure that in the past might have been impossible to obtain for an EV (e.g. a 0-60 time in 10 seconds), is now quite standard for good-selling models as the Nissan Leaf.

Secondly, we demonstrated that the presence of Usership has an acquisition options has a positive moderating (and mitigating) effect on the negative influence that the aforementioned attributes have on EV car choice. This means that, as predicted, parameters as low driving range and long time to recharge batteries, become less important when Usership is present. Again, we could not prove that usership has said effect on the importance of performance as a choice determinant. The reason why might be the same as the one we used to explain the not significant of performance in ***H1***. Indeed, respondants might not have found the performance levels presented to be distant (and therefore determinant for choice) to them. Moreover, it is possible that, being the actual performance levels of EVs quite decent for the average car, acceleration and top speed are not to be considered a barrier to EV choice anymore.

Finally, we demonstrated that the Usership model as an alternative to a traditional purchase scheme does indeed have a positive moderating effect on consumer EV choice. In other words, being an electric car equal in its entirety, a consumer will be more willing to acquire it if it were presented with a Usership acquisition option. This might have enormous implications for the automotive industry that is struggling to foster the diffusion of alternative fuel vehicles. The following table resumes all the findings of this paper:

Hypothesis H1	***Reject or do not reject H0***
H1a: A higher purchase price has a negative effect on the consumer preference of an EV against a traditional gasoline car	Reject H0
H1b: A higher driving range has a positive effect on the consumer preference of an EV against a traditional gasoline car	Reject H0
H1c: A higher time to recharge batteries has a negative effect on the consumer preference of an EV against a traditional gasoline car	Reject H0
H1d: Performance has a positive effect on the consumer preference of an EV against a traditional gasoline car	Do not reject H0
H1e: Lower monthly operating costs have a positive effect on the consumer preference of an EV against a traditional gasoline car	Reject H0
H2: The usership model has a positive effect on the consumer preference of electric vehicles versus traditional gasoline vehicles	Reject H0
H3: The usership model has a moderating positive effect on the listed attributes that drive consumer choice of an electric vehicle versus traditional gasoline vehicles	Partially reject H0

5.1 Managerial Implications

Knowing that a long term rental solution could help car manufacturers sell more EVs might ignite a virtuous cycle of unprecedented magnitude. Indeed, a greater diffusion of EVs will result in greater investments from car companies to improve powertrain technology (e.g. performance, driving range, time to recharge batteries), creating a convergence in quality and pleasure of driving towards the traditional and well established gasoline vehicles. In turn the society and the green environment as a whole would benefit from greater air quality and a more sustainable production system.

The development (and future commercialization) of the Google's self-driving car might indeed represent another step that will take us from ownership to usership/service model. In a near future consumers (that will become users), will just tap a button on their smartphone and call a car just when they need it. This could be defined as an improved version of the business and technological model used by today's car sharing companies

The findings of this paper might have implication on the consumer market as a whole. Expensive items such as home appliances, furniture, and consumer electronics could benefit from the introduction of the Usership model. First of all, this would make these items accessible to a large chunk of market share that could not afford them. Secondly, it would decrease useless consumption, as at the end of the usership contract the items could face a second and a third life with other owners, instead of being thrown away for a newer model.

In conclusion, Usership might represent the face of a future sustainable economy, not only for the automotive market but for the consumer goods industry as a whole, in order to safeguard the environment and reduce waste.

5.2 Scientific Relevance

Choice modelling has been a practice that is been extensively used by marketers for a long time. Our economy, on the other hand, is shifting towards a new way of benefiting from the usage of products that is usership. Indeed, we are in a time when not only is important to determine the effect that the price of a product has on choice, but it becomes fundamental to take into account how the product will be acquired.

Moreover, car-related consumer choice has been extensively studied in the recent past. Research has analyzed how car attributes drive consumer choice both for traditional

(McCarthy and Tay, 1988) and for alternative fuel vehicles (Hackbarth and Madlener, 2012). For the first time, this paper has added to a well-established framework the presence of usership as a determining factor for electric and gasoline vehicles. Furthermore, there is no available research that exclusively focus on the attribute s that drives the choice of a full electric car, as previous studies only took into account gasoline Hybrid cars and, more generally, alternative fuel cars. Finally, it is important to notice that this study analyzes how the acquisition option influences the effect that the car (or product) attributes have on choice, and not the product as a whole.

5.3 Limitations and future research

One of the main issues regarding this research was about the cards design. Indeed, we were forced to make attribute specific card options, and this might have limited the control and the analysis of interaction between variables. The problem regarding the number of choice cards is twofold. On the one hand, we can hypothesize that a larger pool of product cards and therefore a larger number of attribute combinations could have led to more precise results. On the other hand, it is true that a more complex and longer questionnaire could have instilled confusion in our respondents, therefore diminishing the significance of the data collected. It is to be said that it was in the intentions of the researcher to keep the survey as simple (and short) as possible, in order to comply with time and budget constraints. This is also why the scope of this research is relatively narrow. Indeed it regards a quite small sub-category (Electric Vehicles) of the automotive market. It would be interesting to see future research trying to study the application of the usership model to other consumer goods category. After all, according to our data some respondents were willing to acquire even a gasoline car with a usership/long term rental solution. It is therefore of great interest to analyze the effect of usership on the consumer goods market as a whole, even for items that are not as much as expensive as an electric vehicle.

Appendix

Table 1: Conditional logit regression output for hypothesis H1 testing

Variables in the Equation

	B	SE	Wald	df	Sig.	Exp(B)
ETYPE			31,793	2	,000	
ETYPE(1)	,894	,255	12,335	1	,000	2,446
ETYPE(2)	1,255	,232	29,212	1	,000	3,507
PRICE			44,794	4	,000	
PRICE(1)	,354	,103	11,739	1	,001	1,424
PRICE(2)	-,102	,111	,840	1	,359	,903
PRICE(3)	-,446	,115	14,937	1	,000	,640
PRICE(4)	-,430	,106	16,435	1	,000	,650
TOPSPEED			4,281	2	,118	
TOPSPEED(1)	-,283	,137	4,278	1	,039	,753
TOPSPEED(2)	-,135	,093	2,121	1	,145	,873
ACCELERATION			1,718	2	,424	
ACCELERATION(1)	,100	,079	1,582	1	,208	1,105
ACCELERATION(2)	,037	,094	,153	1	,696	1,037
OPERATINGCOSTS			4,672	2	,097	
OPERATINGCOSTS(1)	-,084	,086	,964	1	,326	,919
OPERATINGCOSTS(2)	-,200	,095	4,450	1	,035	,818
RANGE			60,569	3	,000	
RANGE(1)	,138	,110	1,586	1	,208	1,148
RANGE(2)	,664	,119	31,191	1	,000	1,942
RANGE(3)	,572	,106	28,933	1	,000	1,771
RECHARGETIME			15,144	3	,002	
RECHARGETIME(1)	-,794	,298	7,094	1	,008	,452
RECHARGETIME(2)	-,054	,167	,103	1	,749	,948
RECHARGETIME(3)	,182	,165	1,226	1	,268	1,200

Table 2: Conditional logit output with interaction between Usership and Electric engine attribute level, for hypothesis H2 testing.

Variables in the Equation

	B	SE	Wald	df	Sig.	Exp(B)
ETYPE			24,996	2	,000	
ETYPE(1)	-,240	,156	2,361	1	,124	,787
ETYPE(2)	-1,431	,301	22,543	1	,000	,239
TOPSPEED			16,927	2	,000	
TOPSPEED(1)	-,683	,166	16,834	1	,000	,505
TOPSPEED(2)	-,329	,098	11,296	1	,001	,719
ACCELERATION			1,489	2	,475	
ACCELERATION(1)	,074	,075	,976	1	,323	1,077
ACCELERATION(2)	-,009	,087	,010	1	,922	,992
OPERATINGCOSTS			8,229	2	,016	
OPERATINGCOSTS(1)	,213	,103	4,284	1	,038	1,237
OPERATINGCOSTS(2)	-,013	,094	,020	1	,887	,987
RANGE			67,606	3	,000	
RANGE(1)	,409	,104	15,363	1	,000	1,506
RANGE(2)	,957	,135	50,053	1	,000	2,604
RANGE(3)	,459	,105	19,283	1	,000	1,583
RECHARGETIME			11,837	3	,008	
RECHARGETIME(1)	-1,082	,315	11,825	1	,001	,339
RECHARGETIME(2)	-,394	,174	5,119	1	,024	,674
RECHARGETIME(3)	-,305	,154	3,900	1	,048	,737
ACQUISITIONOPTION	-,263	,127	4,303	1	,038	,769
UsershipXElectric	,825	,225	13,461	1	,000	2,282

Table 3: Conditional logit output with usership interactions, for hypothesis H3 testing

Variables in the Equation

	B	SE	Wald	df	Sig.	Exp(B)
ETYPE			17,776	2	,000	
ETYPE(1)	-,067	,224	,090	1	,765	,935
ETYPE(2)	-1,145	,313	13,387	1	,000	,318
PRICE	-,401	,082	24,014	1	,000	,670
TOPSPEED			9,131	2	,010	
TOPSPEED(1)	-,270	,223	1,465	1	,226	,764
TOPSPEED(2)	,096	,130	,544	1	,461	1,101
ACCELERATION			3,025	2	,220	
ACCELERATION(1)	,271	,157	2,992	1	,084	1,312
ACCELERATION(2)	,097	,107	,824	1	,364	1,102
OPERATINGCOSTS			,908	2	,635	
OPERATINGCOSTS(1)	,030	,143	,045	1	,833	1,031
OPERATINGCOSTS(2)	-,093	,189	,239	1	,625	,912
RANGE			28,072	3	,000	
RANGE(1)	,468	,173	7,350	1	,007	1,597
RANGE(2)	,915	,195	21,983	1	,000	2,496
RANGE(3)	-,066	,234	,079	1	,779	,936
RECHARGETIME			15,046	3	,002	
RECHARGETIME(1)	-,957	,337	8,063	1	,005	,384
RECHARGETIME(2)	-,776	,272	8,167	1	,004	,460
RECHARGETIME(3)	,153	,171	,801	1	,371	1,165
ACQUISITIONOPTION	-7,319	1,884	15,096	1	,000	,001
UsershipXSpeed	,638	,226	7,971	1	,005	1,892
UsershipXAcceleration	,318	,195	2,671	1	,102	1,375
UsershipXRange	,865	,249	12,116	1	,001	2,376
UsershipXRechargeTime	,482	,141	11,615	1	,001	1,619
UsershipXOperatingCosts	,778	,325	5,744	1	,017	2,177

Table 4: Choice card set

CARD #	ETYPE_GASOLINE	ETYPE_HYBRID	ETYPE_ELECTRIC	TSPEED_99	TSPEED_110	TSPEED_126
1	1	0	0	1	0	0
2	0	0	1	0	1	0
3	0	1	0	0	0	1
4	0	0	1	1	0	0
5	0	0	1	0	0	1
6	1	0	0	0	1	0
7	0	0	1	0	0	1
8	0	1	0	0	1	0
9	0	0	1	1	0	0
10	1	0	0	1	0	0
11	0	1	0	0	0	1
12	0	0	1	0	1	0
13	0	0	1	0	0	1
14	0	0	1	1	0	0
15	1	0	0	0	1	0
16	0	1	0	0	0	1
17	0	0	1	0	1	0
18	0	0	1	1	0	0
19	1	0	0	0	0	0
20	0	1	0	0	0	1
21	0	0	1	0	1	0
22	0	0	1	0	0	1
23	0	0	1	1	0	0
24	0	1	0	0	1	0
25	0	1	0	1	0	0
26	0	0	1	0	1	0
27	1	0	0	0	0	1
28	0	0	1	0	1	0
29	1	0	0	1	0	0
30	0	0	1	0	0	1
31	0	0	1	1	0	0
32	0	0	1	0	0	1
33	1	0	0	0	1	0
34	0	1	0	0	1	0
35	0	0	1	0	0	1
36	1	0	0	1	0	0

ACC_6,6	ACC_8,8	ACC_10	ACQU_PURCH	ACQU_USER	PRICE_15150	PRICE_21955	PRICE_26400
1	0	0	1	0	1	0	0
0	0	1	1	0	0	1	0
0	1	0	0	1	0	0	0
0	1	0	1	0	0	0	0
1	0	0	1	0	0	0	1
0	0	1	0	1	0	0	0
0	0	1	1	0	1	0	0
0	1	0	1	0	0	0	0
1	0	0	0	1	0	0	0
0	0	1	1	0	0	1	0
1	0	0	1	0	0	0	1
0	1	0	0	1	0	0	0
0	0	1	1	0	0	0	0
1	0	0	0	1	0	0	0
0	1	0	1	0	0	0	1
0	0	1	0	1	0	0	0
1	0	0	1	0	0	1	0
0	1	0	1	0	1	0	0
0	1	0	0	1	0	0	0
0	0	1	1	0	0	1	0
1	0	0	1	0	0	0	0
0	0	1	0	1	0	0	0
0	1	0	1	0	0	0	1
1	0	0	1	0	1	0	0
0	1	0	1	0	0	0	0
0	0	1	1	0	1	0	0
1	0	0	0	1	0	0	0
0	1	0	0	1	0	0	0
0	0	1	1	0	0	1	0
1	0	0	1	0	0	1	0
0	0	1	1	0	0	0	1
0	1	0	0	1	0	0	0
1	0	0	1	0	0	0	0
1	0	0	0	1	0	0	0
0	1	0	1	0	0	1	0
0	0	1	1	0	1	0	0

PRICE_29990	PRICE_0	OPCO_620	OPCO_800	OPCO_950	RANGE_75	RANGE_338
0	0	0	0	1	0	1
0	0	1	0	0	0	0
0	1	0	1	0	0	0
1	0	0	0	1	0	0
0	0	0	1	0	1	0
0	1	1	0	0	0	1
0	0	0	1	0	0	0
1	0	1	0	0	0	0
0	1	0	0	1	1	0
0	0	0	1	0	1	0
0	0	1	0	0	0	0
0	1	0	0	1	0	1
1	0	0	1	0	0	1
0	1	1	0	0	0	0
0	0	0	0	1	0	0
0	1	0	0	1	1	0
0	0	0	1	0	0	0
0	0	1	0	0	0	1
0	1	0	1	0	0	0
0	0	0	0	1	0	1
1	0	1	0	0	1	0
0	1	1	0	0	0	0
0	0	0	0	1	0	0
0	0	0	1	0	1	0
1	0	0	1	0	0	1
0	0	0	0	1	0	0
0	1	1	0	0	0	0
0	1	0	1	0	1	0
0	0	0	0	1	0	0
0	0	0	0	1	0	0
0	0	0	1	0	0	0
0	1	1	0	0	0	1
1	0	0	0	1	1	0
0	1	0	1	0	0	1
0	0	1	0	0	1	0
0	0	0	0	1	0	0

RANGE_518	RANGE_705	RECTIME_0	RECTIME_7	RECTIME_8	RECTIME_9
0	0	1	0	0	0
1	0	0	0	1	0
0	1	1	0	0	0
0	1	0	0	0	1
0	0	0	1	0	0
0	0	1	0	0	0
0	1	0	0	0	1
1	0	1	0	0	0
0	0	0	0	1	0
0	0	1	0	0	0
1	0	1	0	0	0
0	0	0	1	0	0
0	0	0	0	1	0
1	0	0	0	0	1
0	1	1	0	0	0
0	0	1	0	0	0
0	1	0	0	1	0
0	0	0	1	0	0
1	0	1	0	0	0
0	0	1	0	0	0
0	0	0	0	0	1
0	1	0	1	0	0
1	0	0	0	1	0
0	0	1	0	0	0
0	0	1	0	0	0
1	0	0	1	0	0
0	1	1	0	0	0
0	0	0	0	0	1
1	0	0	1	0	0
1	0	0	1	0	0
1	0	0	0	0	1
0	0	0	0	1	0
0	0	1	0	0	0
0	0	1	0	0	0
0	0	0	1	0	0
0	1	1	0	0	0

Tables referring to additional data analysis

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
How many cars do you/does your family own?	115	1	5	2,85	1,045
How many days a week you drive your car?	115	1	8	5,82	2,238
At the moment, are you considering the purchase of a new car?	115	1	2	1,72	,450
When you will buy a new car, will you consider a usership/long-term rental solution for a Gasoline car?	115	1	2	1,70	,462
When you will buy a new car, will you consider a usership/long-term rental solution for an Electric Vehicle?	115	1	2	1,58	,495
How likely are you to consider buying a Gasoline car versus an Electric car?-Gasoline Vehicle	115	1	7	5,17	1,743
How likely are you to consider buying a Gasoline car versus an Electric car?-Electric Vehicle	115	1	7	3,92	1,943
Do you or does your family own an electric car at the moment?	114	1	2	1,96	,185
Valid N (listwise)	114				

Do you or does your family own an electric car at the moment?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	4	3,5	3,5	3,5
	No	110	95,7	96,5	100,0
	Total	114	99,1	100,0	
Missing	System	1	,9		
Total		115	100,0		

Do you or does your family own an electric car at the moment?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	4	3,5	3,5	3,5
	No	110	95,7	96,5	100,0
	Total	114	99,1	100,0	
Missing	System	1	,9		
Total		115	100,0		

How many days a week you drive your car?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	3	2,6	2,6	2,6
	2	10	8,7	8,7	11,3
	3	13	11,3	11,3	22,6
	4	9	7,8	7,8	30,4
	5	10	8,7	8,7	39,1
	6	7	6,1	6,1	45,2
	Less than once a week	25	21,7	21,7	67,0
	Everyday	38	33,0	33,0	100,0
	Total	115	100,0	100,0	

When you will buy a new car, will you consider a usership/long-term rental solution for a Gasoline car?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	35	30,4	30,4	30,4
	No	80	69,6	69,6	100,0
	Total	115	100,0	100,0	

How likely are you to consider buying a Gasoline car versus an Electric car?-Gasoline Vehicle

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very Unlikely	6	5,2	5,2	5,2
	Unlikely	6	5,2	5,2	10,4
	Somewhat Unlikely	8	7,0	7,0	17,4
	Undecided	13	11,3	11,3	28,7
	Somewhat Likely	23	20,0	20,0	48,7
	Likely	27	23,5	23,5	72,2
	Very Likely	32	27,8	27,8	100,0
	Total	115	100,0	100,0	

When you will buy a new car, will you consider a usership/long-term rental solution for an Electric Vehicle?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	48	41,7	41,7	41,7
	No	67	58,3	58,3	100,0
	Total	115	100,0	100,0	

How likely are you to consider buying a Gasoline car versus an Electric car?-Electric Vehicle

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very Unlikely	20	17,4	17,4	17,4
	Unlikely	14	12,2	12,2	29,6
	Somewhat Unlikely	11	9,6	9,6	39,1
	Undecided	19	16,5	16,5	55,7
	Somewhat Likely	20	17,4	17,4	73,0
	Likely	23	20,0	20,0	93,0
	Very Likely	8	7,0	7,0	100,0
	Total	115	100,0	100,0	

At the moment, are you considering the purchase of a new car?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	32	27,8	27,8	27,8
	No	83	72,2	72,2	100,0
	Total	115	100,0	100,0	

How many cars do you/does your family own?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	None	8	7,0	7,0	7,0
	1	39	33,9	33,9	40,9
	2	39	33,9	33,9	74,8
	3	20	17,4	17,4	92,2
	4+	9	7,8	7,8	100,0
	Total	115	100,0	100,0	

Would you consider yourself familiar with electric cars?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	13	11,3	11,3	11,3
	Disagree	22	19,1	19,1	30,4
	Somewhat Disagree	22	19,1	19,1	49,6
	Neither Agree nor Disagree	14	12,2	12,2	61,7
	Somewhat Agree	32	27,8	27,8	89,6
	Agree	11	9,6	9,6	99,1
	Strongly Agree	1	,9	,9	100,0
	Total	115	100,0	100,0	

Do you or does your family own an electric car at the moment?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	4	3,5	3,5	3,5
	No	110	95,7	96,5	100,0
	Total	115	99,1	100,0	
Missing	System	1	,9		
Total		115	100,0		

Do you or does your family own an electric car at the moment?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	4	3,5	3,5	3,5
	No	110	95,7	96,5	100,0
	Total	115	99,1	100,0	
Missing	System	0	,0		
Total		115	100,0		

How many days a week you drive your car?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	3	2,6	2,6	2,6
	2	10	8,7	8,7	11,3
	3	13	11,3	11,3	22,6
	4	9	7,8	7,8	30,4
	5	10	8,7	8,7	39,1
	6	7	6,1	6,1	45,2
	Less than once a week	25	21,7	21,7	67,0
	Everyday	38	33,0	33,0	100,0
	Total	115	100,0	100,0	

When you will buy a new car, will you consider a usership/long-term rental solution for a Gasoline car?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	35	30,4	30,4	30,4
	No	80	69,6	69,6	100,0
	Total	115	100,0	100,0	

How likely are you to consider buying a Gasoline car versus an Electric car?-Gasoline Vehicle

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very Unlikely	6	5,2	5,2	5,2
	Unlikely	6	5,2	5,2	10,4
	Somewhat Unlikely	8	7,0	7,0	17,4
	Undecided	13	11,3	11,3	28,7
	Somewhat Likely	23	20,0	20,0	48,7
	Likely	27	23,5	23,5	72,2
	Very Likely	32	27,8	27,8	100,0
	Total	115	100,0	100,0	

When you will buy a new car, will you consider a usership/long-term rental solution for an Electric Vehicle?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	48	41,7	41,7	41,7
	No	67	58,3	58,3	100,0
	Total	115	100,0	100,0	

How likely are you to consider buying a Gasoline car versus an Electric car?-Electric Vehicle

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very Unlikely	20	17,4	17,4	17,4
	Unlikely	14	12,2	12,2	29,6
	Somewhat Unlikely	11	9,6	9,6	39,1
	Undecided	19	16,5	16,5	55,7
	Somewhat Likely	20	17,4	17,4	73,0
	Likely	23	20,0	20,0	93,0
	Very Likely	8	7,0	7,0	100,0
	Total	115	100,0	100,0	

At the moment, are you considering the purchase of a new car?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	32	27,8	27,8	27,8
	No	83	72,2	72,2	100,0
	Total	115	100,0	100,0	

How many cars do you/does your family own?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	None	8	7,0	7,0	7,0
	1	39	33,9	33,9	40,9
	2	39	33,9	33,9	74,8
	3	20	17,4	17,4	92,2
	4+	9	7,8	7,8	100,0
	Total	115	100,0	100,0	

Would you consider yourself familiar with electric cars?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	13	11,3	11,3	11,3
	Disagree	22	19,1	19,1	30,4
	Somewhat Disagree	22	19,1	19,1	49,6
	Neither Agree nor Disagree	14	12,2	12,2	61,7
	Somewhat Agree	32	27,8	27,8	89,6
	Agree	11	9,6	9,6	99,1
	Strongly Agree	1	,9	,9	100,0
	Total	115	100,0	100,0	

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