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# WHAT DRIVES THEM TO INVEST IN THE SUSTAINABLE MOBILITY TRANSITION?

# EVIDENCE FROM A CONJOINT EXPERIMENT ON EUROPEAN INVESTORS' POLICY PREFERENCES

Eva BORTOLOTTI

# What Drives Them to Invest in the Sustainable Mobility Transition?

## Evidence from a Conjoint Experiment on European Investors' Policy Preferences

The Graduate Institute, Geneva*

Eva Bortolotti†

### Abstract

Substantial private investment is required if public policy objectives aim to increase the market share of Electric Vehicles (EVs) and prevent locking-in emissions-intensive development pathways. To maximize the effectiveness of future policies and successfully attract private capital, policy makers need to gain a better understanding of how investors behave, and of how policy design can drive investments decisions. This paper leverages an adaptive conjoint analysis (ACA) method to investigate the policy preferences of 41 European investors affiliated with different investment institutions. Findings reveal that investors' characteristics as institution type and size of assets under management affect investors' preferences over different e-mobility policy attributes. Furthermore, this study shows that behavioral factors, namely investors' a-priori beliefs on the impacts of climate change and the COVID-19 crisis, play a role in determining investors' policy preferences. By providing an analysis of investors' behavior, this research can support policymakers to design more effective policy instruments to attract investments in electric mobility during and after the COVID-19 crisis.

**Keywords**: conjoint analysis, behavioral finance, electric mobility policy, climate change, COVID-19 crisis.

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# 1. Introduction

The transportation sector is one of the main consumers of fossil fuels in Europe, accounting for 25% of total greenhouse gas (GHG) emissions (EuroStat GHG Emission Statistics, 2017) and therefore significantly contributing to climate change. Within the transport sector, 74% of GHS emissions are caused specifically by road transport, and 54% of road transport emissions are generated by light-duty vehicles such as passenger cars (Yang et al., 2017). It is estimated that the transport sector could have the potential to reduce emissions by 50% based on the existent technologies (GFEI, 2014). However, while GHG emission from other major European sectors have decreased in the last decades, the transportation sector continued to show an increase (EEA, 2016). With the trends estimated before the outbreak COVID-19, it was projected that the number of light-duty vehicles could double by mid-century (Creutzig et al., 2015), however the raising economic crisis induced by the pandemic could produce long-lasting impacts on the global mobility systems, driving changes in market shares, regulatory frameworks, technology growth and consumer behavior. It is already observed that the global electric vehicle market has diminished by 25 % during the first quarter of 2020 (McKinsey's proprietary Electric Vehicle Index, 2020), calling for the need for supporting policy packages to maintain consumers demand and de-risk private and institutional investments in the sector.

As a major source of pollution, the electrification of transport through a shift in the urban mobility systems from internal combustion engines (ICE) vehicles to electric vehicles (EVs) would not only contribute to climate change mitigation, but also produce other significative benefits. In fact, according to the European Environment Agency (EEA), in major European cities emissions from road vehicles cause concentrations of air pollutants – as nitrogen oxides ($NO_X$) and particulate matter (PM) – that do not meet air quality standards set by the EU and WHO, consequently threatening human health. Electric mobility (e-mobility) is instead clean at the tailpipe and does not produce noxious gas emissions. Secondly, it avoids problems of noise pollution, being EVs quieter than ICEs vehicles. Third, EVs can be three to five times more efficient than conventional vehicles, as well as often lighter, smaller and easier to handle in large urban areas. Lastly, e-mobility can contribute to increasing energy security, reducing the country's dependency on imported oil-based fuels, being electricity produced with resources which are often generated domestically (IEA, 2019a; Leal Filho and Kotter, 2015).

Decarbonizing the global mobility system will require large-scale investment flows, with a central role for finance in mobilizing private funds. Substantial private investment is necessary if public policy objectives aim to increase the market share of electric vehicles and prevent locking-in emissions-intensive development pathways. The private sector has the potential to play a crucial role in funding the transition to sustainable mobility, yet it seems to lack the correct policy stimulus. The European Investment Bank estimates the presence of a funding gap for European innovative transport start-ups and SMEs that ranges between €5.5bn and €13bn annually (European Investment Bank Advisory Services, 2018). Numerous policies implemented to stimulate the diffusion of clean technologies have attained only partial results, because they have been unable to influence the true drivers of the investment decision-making process (UNEP & NEF, 2009). To maximize the effectiveness of future policies and successfully attract private capital, policy makers need to gain a better understanding of how investors behave, and of how they asses their investments decisions. Policies should be designed to reduce market and political uncertainty, de-risking investment decisions and consequently reducing the cost of capital.

Recent literature in public policy has indeed started to focus on how policy is an important mean of influencing and guiding the behavior of people, and the search for the most appropriate policy measure is therefore expanding in the field of behavioral economics. While several studies both at the European and global level have explored the effectiveness of different e-mobility policies on EVs market penetration, there are currently no insights on investors' preferences over different policy instruments or the specific design of e-mobility policy attributes. Limited research has also been produced to explore how investors a-priori beliefs, namely behavioral factors that are a result of investors' personal history and education, can affect their policy preferences and allocation of capital in the cleantech and e-mobility sectors. This research intends to fill these gaps, shedding new light on first, how investors' characteristics – as institution type and size of assets under management (AUM) – influence their policy preferences over different policy attributes, and second, how their a-priori beliefs about climate change and the COVID-19 crisis may influence their perception of different e-mobility policy settings. This dissertation will therefore underline importance of cooperation between the private and public actors, highlighting the central role of a well-designed policy instrument in the mobilization of private funds. The two research questions that will be investigated are therefore the following: (1) Do institution type and size of assets under management affect investors preferences over different e-mobility policy attributes?; (2) Are e-mobility investments and policy preferences influenced by investors' a-priori beliefs about climate change and the COVID-19 crisis?

The research question will be investigated by collecting primary data from European investors through a survey using adaptive conjoint analysis (ACA). This research will therefore make several contributions. First, it will shed light on investors' decision-making process, eliciting their policy preferences and informing the design of more effective policy frameworks. Second, it will the extend the analysis of investors' policy preferences to a set of policies that have never been investigated in the literature from an investors' perceptive, namely e-mobility policies. Third, it will explore how investors' policy preferences might by influenced by behavioral factors. While some literature has explored the influence of a-priori beliefs on investors' policy preferences, no studies so far have been specifically explored investors' a-priori beliefs over the impact of climate change and the COVID-19 crisis. In the particular regarding the latter, this paper will provide a very first analysis of investors' perception of the impact of the crisis on their investment in clean technologies during a time of high political uncertainty, as the data have been collected in the month preceding the announcement of the Next Generation EU recovery plan.

The rest of the study is structured as follows: the subsequent sections provide a literature review on electric mobility policy, market trends and sustainable investments in Europe, as well as past research on behavioral factors affecting investment decisions. Section (3) presents the hypothesis related to investors' characteristics and their a-priori beliefs about the impacts of climate change and the COVID-19 crisis. Sections (4) explains the steps of the methodology and the design of the adaptive conjoint experiment. Section (5) illustrates the analysis of the data, and section (6) concludes with the main findings and implications for further research.

# 2. Literature review

## 2.1. Electric mobility: market development and policies in Europe

In 2018, the global stock of Electric Vehicles[1] (EVs) accounted for 5.1 million units, of which 24% was composed by the European stock, accounting for 1.2 million units. In the same year, Europe was also the second-largest electric car market after China, with over 285.000 sales units (IEA, 2019). Europe comprises also the countries with the highest penetration of electric car sales in 2018, as Norway (50%), Iceland (17.2%9) and Sweden (7.9%) (IEA, 2019). However, despite the proven environmental and social advantages of EVs, only four countries in Europe presented an electric car stock share over 1% in 2018: Norway, which dominated the rank with 10% of electric cars in its total car stock, followed by Iceland (3.3%), Netherlands (1.9%) and Sweden (1.6%) (IEA, 2019).

To understand the limited adoption of EVs, previous literature on electric mobility has focused on three major aspects. A first stream of literature explores the economic and technical challenges. Technological aspects that influence EVs adoption include characteristics as high battery costs (Nykvist and Nilsson, 2015), long charging times and charging infrastructure readiness (Flath et al.; Neubauer et al., 2012) and driving range (Lin, 2014). In particular, EVs prices have been identified as the major barrier for the adoption of EVs (Brownstone et al, 200). According to the IEA (2019b), the purchase cost of a standard medium size EV is 40% higher than an ordinary ICE of the same size. The essential component of the EV's costs is battery costs, and therefore the advancement of battery technology has become one of the main barriers for the commercialization of EVs (Axen et al., 2010). Catenacci et al. (2015) collected experts' judgments about the likely evolution of battery costs in the next decades, concluding that there is a high degree of uncertainty surrounding future estimated costs. Experts stressed the importance of improving safety, gain efficiency and lower costs with a learning-by doing process, as well as allocating R&D investments in different battery technology options. On the economic perspective, numerous studies also point out that the total cost of ownership (TCO) of a battery electric vehicle still remains higher than the one for an ICE vehicle (IEA, 2018a). Although EVs might not become cost competitive with ICE vehicles until 2025, the comparative cost efficiency of EVs usually increases for smaller vehicles and longer driving distances (Wu et al., 2015). A second area of research explores consumers' characteristics, posing marketing questions about their acceptance of EVs. Most of these studies identify consumers that express major interest in adopting EVs as having higher levels of education, income and environmental sensitiveness (Carley et al., 2013) as well as being technology enthusiasts. However, these factors – in particular environmental awareness – often play a minor role compared to the previously mentioned cost and performance barriers (Egbue and Long, 2012).

The last stream of literature addresses the policy measures designed to reduce GHG emissions and promote the market penetration of EVs. As highlighted by the Global EV Outlook 2019 from the IEA, policies play a major role for the development of electric mobility. Governments around the world are setting goals to expand their EVs market shares, driven by climate change mitigation objectives and the reduction of petroleum use. Policy approaches usually

[1] In this paper, the term electric vehicles (EVs) refer to battery electric vehicles (BEVs), plug-in electric vehicles (PEVs) and plug-in hybrid electric vehicles (PHEVs).

start with a set of targets: for example, with the 'Transport 2050' strategy the European Union aims to make urban transportation emission free and phase out the use of conventionally fueled cars by 2050. The strategy's objective is to drastically reduce GHG emissions and also diminish the European dependency on imported oil (European Commission, 2011). Furthermore, several local governments – also outside the European Union – have announced their ambitions for zero-emission vehicles to constitute 100% of new passenger vehicles sales. Norway's goal aspires to reach the target by 2025, followed by Denmark, Iceland, Ireland, the Netherlands, Slovenia and Sweden in 2030, until France and the United Kingdom by 2040 (Slowik et al., 2019). A second step usually sees the adoption of technology-standards for charging infrastructure, to operate the charging technology uniformly around geographic areas (Das et al., 2020).

A common policy approach is the use of demand-pull instruments as the provision of monetary incentives, usually in the form of tax credits and direct subsidies. Mock and Yang (2014) conducted a worldwide analysis of EV incentives policies, concluding that there is a significant relationship between the level of electric vehicles uptake and the presence of supportive national incentives schemes. For example, in Norway an overall fiscal incentive of 11,500 EUR for a BEV was equivalent to a 6% BEV market share in 2013. Their findings show that the most effective policy measures are the combination of direct subsidies in the form of one-time bonuses at the purchase of the EV, as well as fiscal incentives as tax reductions on VAT and annual circulation taxes (as applied int the most proactive countries, namely Norway and Netherlands). An additional global analysis has been completed by Sierzchula et al. (2014), who developed a study about the impact of fiscal incentives, charging stations and local EVs manufacturing on EVs market shares in 30 countries. The authors find market shares to be positively correlated with fiscal incentives, although the number of charging stations was a better predictor of a country's EVs market share. A similar research across 20 countries explored the influence of monetary incentives, traffic regulations favoring EVs and charging infrastructures, confirming that monetary incentives are particularly effective especially when combined with a developed charging infrastructure network (Rietman and Lieven, 2019).

However, while fiscal incentives play a role, they are surely not the only factor influencing EVs market growth, as demonstrates the case of the United Kingdom where significant fiscal incentives are provided, but EVs uptake remains relatively low compared to other markets (Mock and Yang, 2014). A number of countries also provide incentives for charging infrastructure development, which could come in various forms, as rebates for the installment of residential charging stations, as well as government purchase reductions for chargers. European countries as Belgium, Italy, Norway and the United Kingdom grant national incentives in the form of both subsidies and tax reductions for the installment of residential charging stations, as well as public funding and the free use of charging infrastructure (van der Steen et al, 2015). Further global research has been completed looking instead at the influence of fiscal incentives on consumers' preferences. However, literature in this field has presented conflicting results, with some studies highlighting consumers' affinity for financial incentives (Lieven, 2015) while others identifying only a very weak relationship between EV's purchase subsidies and willingness to buy an EV (Zhang et al., 2013).

Another common policy approach includes the use of command-and-control (performance-based standards) instruments, as $CO_2$ emissions performance standards or Corporate Average Fuel Economy (CAFE) standards for new cars. CAFE standards are adopted to enhance fuel efficiency in the United States, and have been proven to be succesful in accelerating

EVs market penetration, especially when implemented in conjunction with other financial incentives (Sen et al., 2017). In Europe, $CO_2$ emission performance standards for new passenger cars and for new vans are regulated by the Regulation (EU) 2019/631[2]. From 2012 to 2019, EU flee-wide average emission of new passenger cars were subjected to a standard of 130 grams of $CO_2$ per kilometer, which will be reduced to 95 g $CO_2$/km in 2021, and then further more to 59.4 g $CO_2$/km in 2030. Similar regulations have been instructed by non-EU states as Switzerland, which as part of the Energy Strategy 2050 has also introduced a 95 g $CO_2$/km standard from 2020, which will be further tightened in the incoming years. A recent study (Fritz et al., 2019) leveraged the data of car sales in Europe from 2010 to 2016 to predict future European sales and reductions in $CO_2$ emissions, to understand if the European regulation is likely to meet the desired targets. The authors' results demonstrate that emissions standards are likely to lead to PEV shares between 27 and 41% in 2030, and that therefore stringent command-and-control regulation is likely to be effective on the fast market diffusion of PEVs (Fritz et al., 2019).

Various countries also adopt policy measures that increase the value proposition of EVs, as parking fees or waivers to traffic restrictions. For example, in Germany, Norway and certain areas of Italy and the United Kingdom, EV owners are entitled to free or discounted parking slots (IEA-HEV, 2016). However, most of these measures have been applied in specific geographic areas and analyzed in isolation, and were not evaluated in comparison to each other's in terms of increase in EVs markets shares or consumers' acceptance.

Instead of regulations, governments can also stimulate the industry to increase R&D efforts with technology-push policies. Howell (2017), in his experimental evaluation of America R&D subsidies, analyzes the applicants to the US Department of Energy's SBIR grant program, discovering that the award of the grant during the early-stage nearly doubles the firm's probability to later receive VC founding. Olmos et al. (2012) similarly suggest that the use of direct support instruments as public grants and contracts are more effective in supporting pre-deployment innovation compared to public loans or tax credits. While these incentives in the field of climate-policy have proven to be effective, they do not provide sufficient motivation to private customers, and need to be accompanied by additional policies (Popp, 2006).

One last policy approach includes market-based instruments that have repressive effects on ICE vehicles. As mentioned by Kivimaaa and Kern (2015: 205), policy mixes for an effective transition to sustainability should include 'both policies aiming for the creation of new and for destabilizing the old'. Often defined as 'destructive policies', these approaches reduce the valued of existing practices and technologies, creating momentum for a transition to alternative solutions. It is argued that they gain particular importance when alternative innovations are already developed (Kivimaaa and Kern, 2015), as in the case of EVs. Taxes on combustion fuels are an example of destructive policies widely diffused in Europe: it is estimated indeed that 60% of the European fuel price is composed by taxes (IEA, 2018b). The adoption of a fuel tax reduces support for ICE vehicles by influencing consumption behavior towards the purchase of more fuel-efficient vehicles and EVs (Tscharaktschiew, 2015). Indeed, Mock and Yang (2014) identify fuel cost savings derived from taxation or lower energy costs as one of the elements influencing EV market shares worldwide. While at the beginning these taxation systems have been designed with mainly revenue-generating motives, their significant effects on carbon emissions made them one of the most

[2] The regulation started applying in January 2020 and maintains the targets of Regulations (EC) 443/2009 (cars) and (EU) 510/2011 (vans) for 2020, and adding then new targets for 2025 and 2030.

significant instruments in climate policy (Sterner, 2007). In fact, fuel taxes have been proven to impact vehicle ownership as well as fleet $CO_2$ emissions in Europe, with a 10% increase in petrol price estimated to produce a reduction in $CO_2$ emissions of 0.5 g per km on average for the fleet (Ryan et al., 2009). Eppstain et al. (2011) developed an agent-based model of vehicle consumers to explore interactions between diverse determinants of PHEV market penetration, discovering that an increase in fuel prices (determined either by taxes or market forces) has the potential to multiply PHEV market penetration, resulting in improved fleet efficiency.

Despite the proven potential of electric mobility, it becomes clear that a number of barriers undermine its potential to acquire large-scale deployment. Introducing innovative policy frameworks will be essential to reach targets at the national and European levels, as the European 'Transport 2050' strategy.

## 2.2. Sustainable finance and e-mobility investments

Together with the expansion of the market, there has been an acceleration of investments in relevant e-mobility technologies. Investment in clean technologies[3] – such as e-mobility – can be categorized as part of the emerging work stream of sustainable finance, which is defined as an investment approach that accounts social, environmental, and governance (ESG) factors in portfolio selection and management (Swiss Sustainable Finance, n.d.). 'Sustainable finance' is often used as an umbrella term, which comprises different strategies that can be embraced by investors, as ESG criteria integration, active ownerships approaches or impact investing (SSF, 2019a). Institutions adopting a sustainable finance approach explicitly incorporate negative externalities of social and environmental nature in their decision-making processes (Schoenmaker, 2017). The role of sustainable finance is also recognized at the European level through the European Green Deal: in January 2020 the European Commission launched the European Green Deal Investment plan, with the objective of establishing an enabling framework to channel at least €1 trillion of both public and private investments to the transition to a greener economy (European Commission, n.d). Some countries drive the European cleantech investment landscape, as for example Switzerland, where sustainable investments directed to cleantech in 2018 accounted for CHF 1.8 billion (SSF, 2019b).

While sustainable and responsible investments are growing significantly, being estimated to account for more than 25% of professionally managed assets (UNEP Inquiry and FC4S, 2020), they are not allocated equally over different sectors. For example, the Global Impact Investing Network – through its 2018 survey of 229 impact investors – identifies transports as one of the sectors with the lowest allocations of AUM, while financial services and clean energy present the highest allocation of assets (Mudaliar, Bass and Dithrich, 2018). Even in Switzerland, despite the very active cleantech investment landscape, clean transport remains a less relevant sector, with 54% of the volume share of venture capital investment of the past 6 years allocated instead to energy and power ventures (Avery, 2020).

[3] In this study, 'clean technologies' are defined as those technologies, products and services that aim at sustainable utilization of natural resources and which provide for the production of renewable energy (CleantechAlps, 2017). This includes: renewable energy production and distribution (e.g. smartgrids, hydropower, energy storage), energy efficiency, resource efficency (e.g. water, waste, advanced materials), transportation (e.g. e-mobility), agritech (e.g. agronomy and sustainable food production), or other products (e.g. hybrid technologies, prevention of natural disasters).

The limited deployment of electric mobility is not only caused by the technical and consumers barriers mentioned in the previous section. Another obstacle can be identified in the presence of a significant funding gap for European innovative transport start-ups and SMEs, which the European Investment Bank estimates to range between €5.5bn and €13bn annually. This gap is identified in both equity and debt financing, and is wider in the case of investments in transport companies at their growth stage, particularly for investments in low carbon energy efficient road vehicles and urban e-mobility solutions (European Investment Bank Advisory Services EIBAS, 2018). While global investments in innovative mobility start-ups have increased significantly in the last years, with investors directing over $220 billion into more than 1,100 mobility start-ups across ten technology clusters[4] (McKinsey Center for Future Mobility, 2019), their distribution is concentrated mostly outside the EU. Despite the fact that the EU has nearly equal GDP, and larger population and automotive sector size compared to the US, only 29% of transport star-ups funded after 2010 was based in Europe, against 52% of new start-ups funded in the US. Furthermore, European companies also obtain less funding, representing only 12% of global investments into automotive and mobility start-ups, with Asia and America securing larger investments shares: 20% and 59% respectively (EIBAS, 2018). However, a significant amount of these investments are not dedicated specifically to electric mobility, but to a wider range of innovative technologies: e-haling, semiconductors and AV sensors are dominating the global investment ranks with a total of 124 billion disclosed investments since 2010, while electric vehicles and charging infrastructures are falling behind with 19 billion investments over the last decade (McKinsey Center for Future Mobility, 2019).

In fact, many cleantech ventures – including the ones innovating in e-mobility – face specific barriers that limit their access to capital. Firstly, investments in clean innovations are disincentivized because the benefits from lower pollution levels are excluded from market prices, and therefore individuals affected by the positive externality are not charged by firms for their gains (Brown, 201). Secondly, they present a number of characteristics that discourage investments, which include greater levels of technological uncertainty, slower scalability, asset heaviness and consequently longer payback periods (Migendt et al, 2017). In the specific context of e-mobility, charging infrastructure and batteries technologies share many of the characteristics mentioned above, and in particular asset heaviness, making them technologies particular challenging for investment. Numerous studies indeed describe how batteries' high production costs remain the main barrier for making EVs competitive with ICEs vehicles (Axsen, 2010; Catenacci et al, 2015).

Regarding the financial actors, it is estimated that 90% of global investment in mobility is driven by private equity firms and venture capitalists (McKinsey Center for Future Mobility, 2019). This fact justifies the lesser amount invested in European companies, being the European venture capital scene significantly less mature compared to the US, with total VC founding accounting for only a quarter of the US VC funding between 2013 and 2015 (EIBAS, 2018). However, when it comes in particular to investments in EVs, there are also other influencing players, as for example corporate investors in the automakers industry. An analysis from Router of 29 automakers worldwide disclosed that automakers were investing at least $300 billion in EVs in 2018, with more than 45% of investments directed in China, and in minor amount to Germany and France for the

[4] Autonomous-vehicle (AV) sensors and advanced driver-assistance system (ADAS) components, AV software and mapping, Back end/cybersecurity, Batteries, Connectivity/infotainment, Electric vehicles and charging, E-hailing, Human–machine interface and voice recognition, Semiconductors, Telematics and intelligent traffic.

European context (Lienert & Chan, 2019). Germany's Volkswagen determines the acceleration of global electric mobility investments, while Ionity – a charging infrastructure joint venture among BMW, Daimler, Ford, and Volkswagen – extensively investing in high-power charging across Europe (Slowik et al., 2019).

Furthermore, a recent stream of literature is starting to highlight how cleantech ventures are subjected also to a greater level of policy risk (Lüthi and Wüstenhagen, 2012). The government plays an essential role in ensuring the competitiveness and growth of innovative technologies and correcting the negative externalities associated with the traditional fossil fuel-based industry. Policies should therefore be designed to reduce technological, market and political uncertainty, de-risking investment decisions and consequently reducing the cost of capital. For example, a lower level of policy risk has been found to be particularly important in policy design because of its impact on the financing costs of renewable energy projects. Therefore, policies which diminish the perceived risk for investors become more likely to produce a large-scale deployment of renewables (Jager et al., 2008). The next section will be dedicated to exploring more in detail the influence of policies on investors' decision-making.

## 2.3. Behavioral factors affecting investment decisions

The roots of behavioral finance date back to the 1970s with the publication of the pioneering work of Tversky and Kahneman (1974). The authors disclosed the cognitive limitations of the decision-making process, underlying the existence of systematic biases that individuals undertake when making judgment under uncertainty. In contrast to the efficient market theory, behavioral economics argues that individuals are not fully rational but are characterized instead by bounded rationality, which leads them to apply mental shortcuts, known as heuristics, in the decision-making process. So far, behavioral finance has found various applications in the study of market-anomalies, as in the context of pension funds' underperformance (Markiel, 1995) and the equity premium puzzle (Bernantzi and Thaler, 1995).

In very recent years, a new stream of literature is emerging to study how environmental policy can influence individual beliefs and social norms. Until now, the majority of studies have focused exclusively on how policy interventions may affect societal norms, leading pro-environment norms and environmentally friendly behaviors become widely shared (Kinzig et al., 2013; Nyborg, 2018). However, much less attention has been dedicated to the study of how environmental policies may influence the individual decision making, and in particular the decision-making process of investors. In fact, environmental policies can convey information in indirect ways, as for example altering the beliefs that a decision-maker holds about relevant others, the situation in question or the regulator itself (Carlsson, & Stenman, 2012; Koessler & Engel, 2019).

In the context of beliefs about the regulator, it is worth asking whether the investor believes that the regulator has trust in her intrinsic motivation to act pro-environmentally. Indeed, evidence from behavioral research show that trust can be a powerful behavioral driver (Ellingsen & Johannesson, 2007). For the choice of environmental policies, we can thus state that investor perception of regulatory policies differs by the degree of trust conveyed by the responsible governing body. For example, very strict control and monitoring mechanisms are believed to be signals of distrust (Falk and Kosfeld, 2006). Instead, procedural fairness becomes a driver of trust when the regulation is perceived as legitimate (Tyler, 1990).

Furthermore, an investor may have particular beliefs about the policy (and the policy design) in question. As highlighted by Koessler and Engel (2019:19): 'the choice of a particular policy instrument helps to define the scope of the problem'. This is because the nature of the policy provides the decision-maker with clues about which behavior might be most appropriate. For example, the adoption of an environmental policy leveraging economic incentives may change the investor's perception of the most convenient behavior to adopt, leading him to invest only in incentivized projects. Furthermore, the level of the tax or subsidy transmits the level of effort requested by the regulator in question (Koessler and Engel, 2019). The choice of the policy instrument and possible policy attributes that convey trust in the regulator might therefore be crucial to influence investment decisions also in the case of policies in the mobility sector.

It becomes clear that, in order to exhaustively understand the policy preferences of investors, it is essential to firstly define which are the main policy elements that can de-risk their investment choices. Given the mentioned lack of literature on investors' perception of e-mobility policies, the reference literature for this exercise includes only studies in the context of renewable energy (RE) support policies. Policy elements that are often investigated in studies that explore investors' perception of RE policy include: the choice of the policy instrument (Bürer & Wüstenhagen 2009; Masini & Menichetti, 2012; Lüthi and Wüstenhagen 2012), the level of the support, and the duration of the support (Lüthi and Wüstenhagen 2012; Masini & Menichetti, 2012). From the analysis of investors' preferences over different policy instruments, it often emerges that feed-in tariffs (FITs) are usually seen as a preferred option by investors, especially if designed as providing a high incentive level in a limited amount of time.

However, the sole choice of the policy instrument has been recognized to matter only partially for the mobilization of private finance, as confirmed by Polzin et al. (2019) in a recently published review of 96 empirical studies. The authors produce an overview of RE policy instruments (fiscal, financial, regulatory and market-based) and their impact on two metrics of investors' decision-making: investment risk and return. Through the review of the empirical studies the authors explain that, no matter the choice of the instrument, the real determinants of policy effectiveness are better captured by the 'credibility' (composed of monitoring, evaluation and coordination) and 'predictability' (as the lack of retroactive changes to existing policies, or changing in existing policy targets) of the instrument design. Researchers are therefore missing the actual determinants of policy effectiveness, and only a small body of literature is looking at the neglected factors that may influence the success of the policy.

So far, there are no specific studies that explore investors' preferences over specific aspects of the credibility and predictability of e-mobility policies. However, the literature is starting to recognize the importance of these policy features. One essential element that is often mentioned is the role of policy flexibility, also defined as adaptability. There is indeed consensus that flexibility in the design of the environmental policy allows for policy experimentation (Nemet et al., 2014) and adaptability to technological change (Carlson and Fri, 2010; Polzin et al. 2019), given the falling RE costs. Another element that is emerging in the discussion on the credibility of the policy design is the presence (or lack thereof) of enforcement and monitoring mechanisms. Policy which include strict enforcement mechanism, as fines and penalties, are more likely to reach their goal, increasing policy credibility (Nemet et al., 2014). Furthermore, both Nemet. et al (2014) and Polzin et al. (2019) underline how also long-term policies targets increase predictability, given the fact that they are more likely to be met. Lastly, it the last years a debate around the socio-economic impacts of environmental policies is emerging. Social acceptance is indeed essential to maintain environmental policies stable in the long run. Masini and Menichetti's (2012) research have been the only one to analyze investors' perception of social acceptance, measuring investors' preferences over countries with low social acceptance ('anti-wind activism, negative press, anti-wind demonstrations') or high acceptance ('pro-wind activism, favorable press, pro-wind citizens' coalitions').

Besides the listed policy attributes, it is worth underling that most of the mentioned studies exploring investors' policy preferences focus on a specific group of investors. Venture Capital (VC) and private equity (PE) funds are the most analyzed in the literature (Bürer and Wüstenhagen 2009; Chassot et al. 2014; Rassenfosse and Fischer 2016), together with pension funds (Salm & Wüstenhagen 2018) and project developers (Botta 2019; Lüthi and Wüstenhagen 2012).

# 3. Hypotheses

## 3.1. Investors' characteristics

As it emerged from the literature review, so far there have been very few studies focusing on the policy preferences of different categories of investors. Further studying investors' characteristics and their heterogeneity is therefore important to understand whether their differences might affect their policy preferences.

The research of Masini and Menichetti (2012) shed light on this area, administering a discrete choice experiment to venture capital VC and PE funds as well as banks, insurance companies, pension funds, hedge funds, project developers and infrastructure funds. Their finding support that, generally, investors prefer feed-in tariffs (FITs) as policy instruments, and that policies with a high level of financial support for a limited amount of time are strongly preferred over those that provide a moderate support for a shorter amount of time. This finding was justified by the authors by the fact that their sample is skewed towards VC and PE investors, which have a rather short investment horizon. A segmentation analysis of their data indeed reveals that certain investors, as infrastructure funds and project developers, give lower importance to the level of incentive and higher importance instead to the type of policy and the duration of support.

Similar results are obtained by Lüthi and Wüstenhagen (2012) in their analysis of European early-stage project developers, who perceived the level of the policy as the second most important attribute in their decision to invest. In fact, a higher price tag reduced the perceived policy risk for these early-stage investors. While their study is not directly on VC funds, the results could be assumed to hold also for this category of investors, as VC funds are usually investing in early-stages projects compared to other investors types (Block et al., 2019). Furthermore, Bürer & Wüstenhagen (2009) further confirm that VC and PE investors perceived the feed-in tariffs as the most effective policy to drive investments, and that this finding was even more pronounced for investors based in Europe, and in particular because of the track record of FIT as a stable and effective policy in Germany. In fact, the strong track record of FITs in Europe increased investors' positive assessment of this market-pull policy.

Furthermore, the consistency and predictability of the policy framework also play a significant role for VC and PE funds, as confirmed by an analysis of VC investors from the United

Kingdom, where recent unexpected changes in the British and European FITs regime have discouraged investors' confidence in the FIT mechanism (Leete, Xu and Wheele, 2013). Policy stability has been deemed essential also in the choice experiment developed by Lüthi and Wüstenhagen (2012), where more stable policy frameworks (identified as no significant unexpected policy change in the last 5 years, or maximum one policy change on the last 5 years) show significant higher utilities compared to more frequent changes.

As the pervious literature on renewable energy policy underlines, VC and PE funds show clear preferences for market-pull instruments as the FIT, a high level of support and a stable policy framework within 5 years. In particular, the policy level appears to be more important for these investors compared to other policy attributes. As it was shown in the literature review, in the context of e-mobility policies, a market-pull policy that has quite strong track record in Europe is the provision of subsidies at the purchase of the electric vehicle. Therefore, it can then be concluded that:

**H1a***: VC and PE funds prefer market-pull instruments as subsidies for EVs at purchase and, compared to other investors, give higher importance to the policy level and prefer relatively stable policy frameworks within 5 years.*

Furthermore, Bürer and Wüstenhagen (2009) discover how fund size and investment stage can explain investors' policy preferences. In fact, larger funds and later-stage investors find $CO_2$ emission trading as a more effective policy compared to smaller early-stage funds, due to the fact that they often invest in technologies at a later stage of the innovation cycle and therefore benefit more from a trading scheme compared to early stage investors. In fact, investment stage is an important factor to take into account when looking at investor's characteristics. Literature in financial economics has also studied how investment preferences differ depending on the characteristics of the fund provider. Scherter's research (2005) support that non-financial corporations are more likely to provide capital investments for the development of new technologies that they are interested to incorporate in their production process on a later stage. Therefore, non-financial corporations, as for example big corporates in the automakers industry, have more interest for later-stage investments. Banks are also likely to provide capital only for a later-stage of the firm's development, because of their risk adversion. It is indeed important to remember that the risk to lose an investment decreases with the growth progress of the firm, and therefore the evaluation of risk and return is more difficult for early-stage investments compared to later-stage investments (Ruhnka and Young, 1991).

Later-stage investors as banks and big corporates are usually also the institutions that manage larger funds. In the RE literature, it is noted then that smaller and bigger investors have different preferences over policy instruments, and this could be transferable to preference over e-mobility policies. As $CO_2$ emission trading is usually preferred by later-stage investors and bigger funds, regulatory policies as emission performance standards for new vehicles could similarly benefits larger funds in the case of e-mobility investments. Therefore, it can be concluded that:

**H1b**: *Institution size affect investors' policy preferences over different policy instrument. Smaller funds and early-stage investors prefer subsidies for EVs. Larger funds and later-stage investors prefer instead emission performance standards for new vehicles.*

### 3.2. A-priori beliefs on climate change

While the literature has not yet focused on how investors' beliefs on climate change may influence their policy preferences, it has been confirmed that climate change beliefs play a role in influencing investment choices. Jansson and Biel (2011) find that private and institutional investors' willingness to make Socially Responsible Investments (SRI) is often driven by environmental and social values. Gamel, Menrad and Decker (2016), in a more recent study on German private investors' preferences through conjoint analysis, show that investors are more willing to invest in wind energy when they have stronger environmental attitudes. Their findings demonstrate that, as the investment threshold decreases with investors' growing environmental attitude, environmental aware investors are more likely to invest in wind projects even if they present financial disadvantages. Similarly, Nilsson (2007) discovers how pro-social attitudes of private investors – including also their environmental attitudes – influence the proportion of mutual funds' portfolio invested in SRI.

Therefore, as the literature shows, environmental beliefs can influence the share of portfolio dedicated to sustainable investment. It follows that:

**H2a**: *Investors with stronger beliefs about the impact of climate change have a higher share of their portfolio invested in clean technologies or e-mobility.*

Furthenmore, numerous studies argue that the perception of the risks and impact of climate change explain people behavior, including their preference and support for different climate policies (Grothmann and Patt, 2005; Leiserowitz, 2005). Niles, Lubell and Haden (2013) confirm their hypothesis that farmer's perceived climate change risks have direct impact on their responses to different climate change policies. From the interviews and survey administered to farmers, the authors show that farmers that believe more in the risks and impacts entailed by climate change are more likely to support and participate in policies that address climate change. In another research from O'Connor, Bard and Fisher (1999) that analyzes a sample of 1225 mail surveys, it is further confirmed that environmental beliefs influence individuals' voluntary actions to address climate change, as well as their voting intentions. In case of voting intentions, respondents are given the option to express their preferences over different climate change policies, including tougher corporate average fuel efficiency (CAFE) standards for automobiles and a 60-cent ($1) a gallon tax on gasoline. The findings show how respondents rejects the gasoline tax, but that when climate change perceptions and environmental values variables are added, older respondents with higher education level are willing to support policies that imply public sacrifices, as the gasoline tax.

A similar study was completed by from Leiserowitz (2006), who analyzed American public risk perceptions regarding climate change. Findings reveal that, while Americans strongly oppose carbon tax proposals (including also gasoline taxes), affective images of global warming and values were strong predictors of higher support for a tax policy, even when compared to other sociodemographic variables as education. These studies therefore confirm how climate change perceptions and environmental awareness influence voting intentions and policy preferences, including preferences over different mobility policies. They also suggest that individuals that are more environmentally aware are more likely to accept a policy that entails public sacrifice, as for example a fuel tax.

Literature on the impact of climate policy on investments also suggest that financial actors that are more exposed to climate change-policy-relevant sectors (including the electric transport sector) favor a stable policy framework. Sudden and unpredicted changes in climate policies increase volatility in their portfolio, while stable and credible commitments allow for reliable asset value adjustments, avoiding shocks in asset prices (Battstion et al., 2017). However, although long-term commitment surely encourages investment, it may also entail costs if not accommodated with a certain degree of policy flexibility that allows for adjustment to new information or preferences (Brunner , Flachsland & Marschinski, 2012). This suggest that investors more exposed to cleantech, and that may therefore have stronger beliefs about climate change, are likely to prefer relatively stable policy frameworks, which however leave some room for policy flexibility.

Therefore, similarly to how climate change beliefs influence farmers' policy attitudes and policy preferences of Americans, it is likely that investors' climate change beliefs will play a role in determining their policy preferences over different e-mobility policies frameworks. It can be therefore concluded that:

**H2b**: *Investors' beliefs on climate change will influence their policy preferences. In particular, investors that believe more in the impacts of climate change are more willing to accept a tax on combustion fuels, prefer a higher policy level and a predictable policy framework.*

### 3.3. A-priori beliefs on the COVID-19 crisis

The economic crisis triggered by the COVID-19 pandemic is forecasted to be deepest since World War II (World Bank, 2020). The European Commission projects that the European economy alone will contract by 8.7% in 2020, and then grow by 6.1% in 2021 (European Commission, 2020b).

The recent nature of this crisis does not allow to have reliable and updated academic analysis on its effects on cleantech investments. However, important lessons learned could be derived from past literature on economic shocks. The 2008 financial crisis caused falling investment as a percentage of GDP around the world, including in Europe, because of a steep decline in business confidence. After the global downturn, investors struggled to restore their net worth, and therefore invested in assets earning zero or negative real interest rates, not being enough confident to invest in riskier productive assets due to the uncertainty around future demand (Zenghelis, 2012). However, in the case of renewable energy, a global growth in global investments was registered from 39$ billion to $257 billion between 2004 and 2011. This growth was driven by investments in asset finance for large utility scale projects, encouraged by the adoption of 'green stimulus' packages that boosted investments in deployment (Geels, 2013). However, many other investment categories decreased, including VC and PE investments which declined 6% from 2010 to 2011. In particular, differences emerged between early-stage and later-stage investment, with the former falling 21% while the later increasing 22%, suggesting how early stage investors were becoming more risk-adverse because of market volatility and policy uncertainty (Frankfurt School of Finance and Management, 2012). In its global analysis of the impact of the 2008 financial crisis on sustainability transitions, Geels (2013) concludes that the early crisis years (2008-2010) actually opened a window for opportunity for green innovations thanks to the green stimulus programmes that increased investors' confidence in new market opportunities.

Regarding specifically the effects of the crisis on the e-mobility market, in a recent study form the McKinsey Center for Future Mobility (2020) it is highlighted how EVs market share and total EVs sales are likely to remain on the same trajectory in Europe. Only in the short term, the crisis is likely to delay the advancement of more advanced technologies (e.g. autonomous driving and OEMs) with a drop of demand and investors reducing innovation funding to focus on day-today cash management issues. In the long-term, however, customers demand for technology that favors physical distancing as EVs and micromobility solutions is likely to rise, increasing attractiveness for investors. A recent study also reveals how investors' confidence in ESG funds remained strong throughout the crisis, with investment flows of US$4 billion per month between January and March 2020 (Mcdaniels, 2020). From the regulatory point of view, the McKinsey Center for Future Mobility (2020) predicts a general increase in regulatory uncertainty, with some geographical regions using the crisis as an opportunity to accelerate the green transition while others not. The authors affirm that most probably regulations will not be weakened in Europe, as governments are not likely to diminish existing emission regulation standards and the EVs market might instead obtain advantages from newly approved green mobility incentives. Modes of transport that reduce infection, as solutions for shared mobility and electric vehicles, are likely to gain appeal during the crisis and even more afterwards.

As the literature from past economic shocks shows, the economic crisis triggered by COVID-19 is likely to have some effects on investments due to market volatility and the risk-aversion of early-stage investors. However, as it happened after the 2008 financial crisis, the early crisis years actually triggered new opportunities for green innovation. Furthermore ESG funds, which are more likely to have a percentage of their portfolio invested in clean technologies or e-mobility, did not lose major investment flows in the months of the crisis, and new opportunities for investment in sustainable mobility solutions are likely arise. The commitment towards climate policy of Europe and of single European states is also likely to give more confidence to investors. Therefore, it can be concluded that:

**H3a**: *Investors do not believe that their investment in clean technologies and e-mobility will be strongly affected by the COVID-19 crisis in the short-term. The perceived impact varies according to institution type, the share of cleantech and e-mobility in the investment portfolio and to the political commitment of their country.*

In the context of this specific study, it is important to note that the data collection has been completed before the launch of the Next Generation EU recovery plan on 27 May 2020. The proposal of the European Commission included an economic stimulus plan of €750 billion, with 25% of the budget allocated to climate action. Therefore, the European Green Deal and its related climate change incentives were placed at the very core of the recovery and reconstruction package (European Commission, 2020a). These commitments of public investments are not only important for the recovery itself, but they also launch important signals to industries and investors to redirect their investment to climate-friendly technologies. However, this study has been concluded in the immediate month before the announcement of the recovery plan. That was a time of high political uncertainty, in which several automobiles corporates were also lobbying the European Union to push for the delay of the consultations for the implementation of emission targets (Colli, 2020).

Therefore, another question that raises is whether the crisis and the deriving political uncertainty actually affects investors' policy preferences. The evidence in this regard from previous studies is mixed. Botta (2019) leveraged a discrete choice experiment to investigate how policy uncertainties induced by the Brexit negotiations affect the cost of equity for renewable energy projects. Overall, the study finds weak evidence of Brexit's influence, but it confirms that investors find the period closer to the end negotiations highly turbulent, as they provided higher utilities for locking investment after negotiations are concluded, or during the central stage of the negotiation process. Barradale (2010), in a study on investors' perceived stability of different American renewable energy policy incentives during downturn investment years, finds that renewable portfolio standards and production tax credits provide more stable and long-term planning horizon for investment compared to production subsidies. Another study from Hofman and Huisman (2012) shed light instead on how the 2008 financial crisis affected PE and VC investors' preferences over different renewable energy policies. The authors hypothesize that the cuts in feed-in-tariffs subsidies introduced by several countries after the 2008 financial crisis – including Germany, Greece, Spain and Italy – could have influenced investors' policy preferences, reducing FIT's popularity. The study reproduces the same survey of Bürer & Wüstenhagen (2009), with a discrete choice experiment including the same attributes and levels. Findings revealed that most of the analyzed policies decreased in popularity for European investors between 2007 and 2011 however, contrary as expected, FITs remained the most popular policy even after the financial crisis. This is justified by the authors by the fact that FITs provide the most stable incentives for those investors that are more risk-adverse during a time of economic downturn, and therefore need more security in terms of price signals.

Therefore, while Barradale (2010) suggests that in a long-run planning horizon command-and-control and tax instruments might be preferred by investors, Hofman and Huisman (2012) highlight how market-pull policies might remain the favored policy for investors in the immediate aftermath of an economic shock. Therefore, these policies might be particularly important for those investors who are more risk-adverse and fear the most the impacts of the crisis on their investment in clean technologies.

**H3b**: *Different beliefs about the COVID-19 crisis influence investors' policy preferences. Investors which have negative perception of the crisis in relation to their cleantech investment have stronger preferences for market-pull policies as short-term signals of policy stability.*

# 4. Methods

The experimental design has been developed with a two-steps approach, in including a qualitative pre-study with interviews to relevant stakeholders, and a quantitative study consisting in the collection and analysis of primary data from European investors through a web survey using adaptive conjoint analysis (ACA). An overview of the full methodology is reported in Fig. 1.

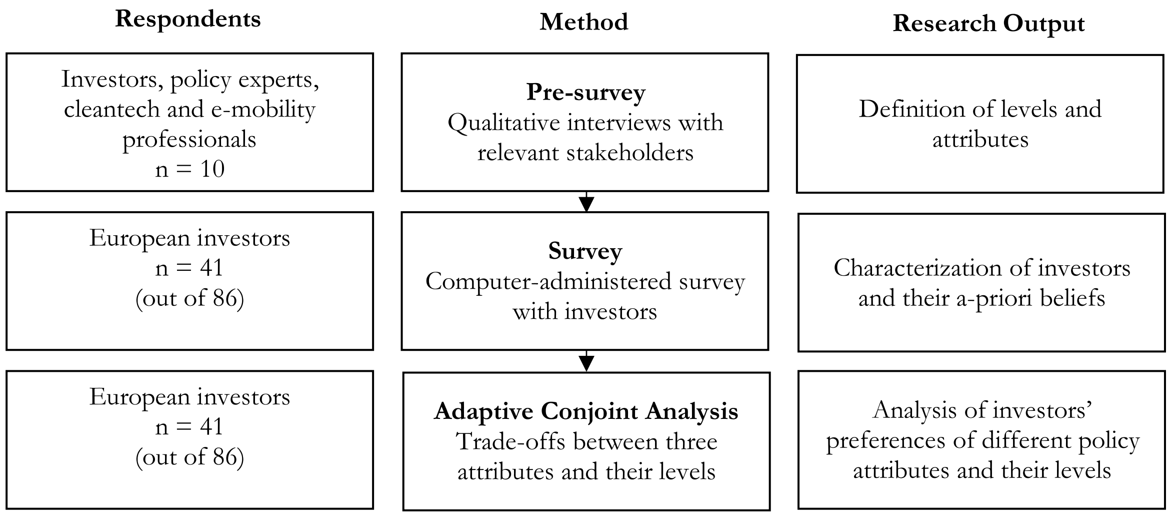


**Fig. 1.** Overview of the methodology including respondents, research methods and outputs.

## 4.1. Pre-survey: selection of attributes

In order to better understand the cleantech investment landscape and the possible policy attributes that might influence investors' policy preferences, ten semi-structured interviews with professionals have been completed during the pre-survey phase between November 2020 and April 2020. Decision-makers interviewed included investors, policy experts from international organizations or national governments, and professionals in the field of cleantech and specifically e-mobility. Interviews have been recorded, transcribed and then analyzed with qualitative methods techniques. The full list of interviewees and the description of interviews' structure are available in Annex II.

The interviews confirmed the role of the regulatory framework in driving private investments towards cleantech. One investor defined the cleantech sector as mainly '*policy-driven*', while an expert in e-mobility underlined how '*investors and companies need strong policy signals*'. Findings also confirmed how the e-mobility sector is quickly expanding within the cleantech industry, with one investor highlighting how investment in '*electric [vehicles] is compelling*'. Interviewees then underlined the importance of targeting different type of investment institutions in the survey, given the involvement of a wide range of actors in the cleantech investment landscape. The type of investors mentioned most frequently by respondents included venture capital and private equity funds, family offices, corporate investors, as well as institutional investors as banks, pension funds and hedge funds.

Policy uncertainty and the lack of policy predictability have then been identified as main obstacles for investment. When asked how policymakers could improve the credibility and predictability of policies, interviewees mentioned several policy attributes that emerged also in the literature review: choice of the policy instrument, policy flexibility and stability, policy level, duration of the policy, policy transparency, policy enforcement and policy fairness. Interviewees often focused on the nature of the different types of policy instruments in the e-mobility sector, and three main instruments emerged more frequently in the conversations: subsidies for EVs at purchase, emission performance standards for new vehicles, and taxes on combustion fuels. Mixed perceptions emerged from investors regarding the effectiveness of each instrument in driving investments: subsidies for EVs were described as appealing by an investor because they provide '*comfort and securities from guarantied prices*', while another investor expressed preference for a tax on combustion fuels because its nature as a '*technology neutral*' instrument.

Another factor what was deemed particularly important by interviewees was the trade-off between policy flexibility and policy stability. Seven interviewees across different expertise identified as necessary a certain degree of policy flexibility, which however should not entail any '*sudden*' or '*retroactive*' policy change. The policy should therefore be designed to be enough flexible to adapt to technological change, while at the same time give a sense of stability and predictability to investors. From the interview with a technical expert in the field of electric mobility, it emerged that five years is usually the time horizon after which a technology becomes obsolete, and therefore represents a relevant timeframe to review and adapt the policy accordingly. Lastly, the level of the policy has also been identified by interviewees as particular important, with one interviewee underlying how '*investors react to hard incentives*'. However, no common measurement has been identified by respondents to evaluate in a universal language the level of the policy, suggesting how each policy instrument requires its own scale of measurement.

Once the relevant policy attributes to include in the experiment have been identified, further questions were added to the interviews to develop a relevant investment scenario to be presented in the discrete choice experiment. In the context of e-mobility investments, interviewees often mentioned two particular mobility technologies that are relevant for investments: charging infrastructure and batteries. In particular, it was highlighted by a technical expert in electric mobility that the battery technology alone accounts for between 50% and 60% of the electric vehicle's cost. As confirmed also by the literature, batteries' cost has become one of the main barriers for the commercialization of EVs, and therefore they have been chosen as a relevant investment project to present in the experiment. Lastly, an in-depth interview with an e-mobility investor helped to identify factors that should be defined as constant when presenting the investment scenario in the experiment, namely: the technology stage of the battery project, the characteristics of the project team and the charging infrastructure network.

## 4.2. Adaptive Conjoint Analysis

The insights gained from the interviews have then be employed to design the conjoint analysis experiment. A choice experiment is a technique often used in market research which employs a stated preference approach to make respondents choose between hypothetical, but realistic, different scenarios. Recently, it has been adopted in the research domain of renewable energy investment decision-making (Chassot et al., 2014; Lüthi and Wüstenhagen, 2012; Masini and Menichetti, 2013). Different choice analysis techniques are available, as the choice-based conjoint analysis (CBC), the adaptive conjoint analysis (ACA), and the choice-based conjoint analysis (ACBC). This study employs the ACA method, namely an 'adaptive' method where the conjoint analysis software analyses data as the interview progress, and subsequently customizes the computer-administered survey for each respondent (Sawtooth Software, 2007). ACA is particular suitable for this survey because it works effectively for small sample sizes, providing a high ratio of information per respondent effort. In fact, the adaptive setting permits to reveal the most about the respondent's preferences in the least amount of time (Sawtooth Software, 2007). As investors are not easily accessible and usually time-constrained, the choice of a methodology that could be successful even with a small sample size is fundamental.

As in previous studies, this research assumes that each e-mobility policy framework is composed of different attributes, and each attribute of different levels, and that each level has an impact on investor's policy preferences. The choice of attributes is essential in a conjoint experiment. However, in the case of ACA, the higher the number of attributes chosen, the longer is the number of possible combinations, and consequently the time that the investor takes to complete the survey. Consequently, it was chosen to limit the numerous attributes identified through the literature review and interviews down to the three most mentioned attributes by interviewees: type of policy instrument, policy level and policy flexibility. For each attribute, three different levels have been designed through the interviews' findings. Table 1 displays each attribute and the corresponding levels.

**Table 1. Attributes and corresponding levels selected for the experiment.**

| Attribute | Levels |
|---|---|
| Policy instrument | Tax on combustion fuels |
| | Emission performance standards for new vehicles |
| | Subsidies for EVs at purchase |
| Policy level* | Low policy level |
| | Medium policy level |
| | High policy level |
| Policy revision | Policy level revised every 2 years |
| | Policy level revised every 5 years |
| | Not defined when the policy level will be revised |

* To help respondents imagine the policy setting, a reading example has been provided for each policy level. A low policy level was expressed as tax of 0.065$/l diesel (i.e. 25$/tCO2); a 120gCO2/km standard; and a 2'500$ subsidy on EV purchase. A medium policy level was expressed as a tax of 0.13$/l diesel (i.e. 50$/tCO2); a 95gCO2/km standard; and a 5'000$ subsidy on EV purchase. A high policy level was expressed as a tax of 0.26$/l diesel (i.e. 100$/tCO2); a 80gCO2/km standard; and a 10'000$ subsidy on EV purchase.

The analysis of conjoint data has been completed with Sawtooth Software (SSI Web, ACA/HB and SMRT, Sawtooth Software 2007). Hierarchical Bayes (HB) estimation was used to calculate part-worth utilities, and part-worth utilities importance scores were derived (Sawtooth Software, 2006). Importance scores measure the relative importance of an attribute compared to another attribute. Part-worth utilities are instead interval-scaled data, normalized using the zero-centered differentials, which scale the data to sum to zero within each attribute. In this way, they allow to understand how a change in a variable level affect the preferences of investors for a policy framework. However, since they are scaled within each attribute, it is not possible to compare part-worth utilities between different attributes. This is surely a limitation of the method, as it does not allow to understand if the preference for, for example, and high or low policy level, is also dictated by the type of policy presented in the proposed policy framework. Policy scenario simulations were completed using the Sawtooth Market Simulator (Orme, 2003), which transforms the respondent's preferences into a model of projective market choices – called share of preferences (%) – for different products, which in this case are different e-mobility policy frameworks. The market simulator thus allows to estimate investors' preferences for the hypothetical policy scenarios chosen by the researcher. In this paper, potential scenarios are determined by varying the 'best case' scenario identified from the preference patterns of investors. This exercise is often called 'sensitivity analysis' (Orme, 2003) as it allows to see, by keeping other attributes constant, how much the change in one attribute level influence the share of preferences for a given policy framework.

### 4.3. The survey instrument

The survey has been designed and administered to investors in collaboration with another Master student in the context of the Swiss National Science Foundation SNSF-NRP73 research project. The data collection process involved as first step the creation of a database of European investors' contacts. Contact details were gathered from multiple sources including industry partners of the SNSF-NRP73 research project, a Crunchbase database of European VC funds, and professional contacts of the two researchers. Further contacts have been collected from the list of participants of a Swiss cleantech conference in November 2019.

The administration of the survey took place between 29 April and 28 May 2020. Before the official launch of the survey, it has been pre-tested with two of the previously interviewed investors. The survey has then been launched though individual invitations sent via e-mail, and a link to the survey was posted on the Green Growth Knowledge Partnership (GGKP)[5] website. In order to encourage responses to the questionnaire, a lottery of a premium has been added at the introduction to the survey, together with the promise to share the final results of the study with respondents.

Lighthouse Studio Version 9.8.1 has been used to design the web-administered survey. The survey was structured in three main sections. The first section aimed at determining demographic data about the respondent and its institution, including his position and years of experience in cleantech investments, the type, size of assets under management and country of headquarter of his institution, whether the institution have already invested in cleantech or e-mobility, and in case the top three countries in Europe where it focused its investments. It was also asked to investors the current percentage of cleantech and e-mobility[6] projects in their portfolio, and in which e-mobility technologies they invest in. Since this research target a diversified group of investors, which have different profiles and are involved at different investment stages, these demographic data were very important to understand the type of institutions involved.

[5] The GGKP is platform of experts from the Organisation for Economic Cooperation and Development (OECD), the United Nations Environment Programme (UNEP), the Global Green Growth Institute (GGGI), the United Nations Industrial Development Organization (UNIDO), and the World Bank.

[6] For the purpose of clarity and simplification, the questionnaire provided a definition of 'e-mobility' to respondents, which described e-mobility as including all electric urban means of transportation. This includes Electric Vehicles (EV) - such as full battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs) - as well as e-bikes, e-scooters, and e-busses. It does not include mobility-sharing platforms/software and automated vehicles.

The purpose of the second section was to measure investors' a-priori beliefs. Four a-priori beliefs were selected on the basis of previous literature and recent events: a priori beliefs about market forces, a-priori beliefs about e-mobility technologies, a-priori beliefs about climate change and a-priori beliefs about the COVID-19 crisis. This particular study focuses on the analysis of the last two. A priori beliefs questions were structured with 5-points Likert scales ranging from 'I strongly disagree' to 'I strongly agree'. At the end of this section, one open-ended question gave to respondents the possibility to elaborate on how the COVID-19 crisis is affecting their investments in clean technologies and specifically in e-mobility.

An index has then been constructed to measure investors' belief in climate change. Four items were used to measure the beliefs on the perceived impact of climate change. Two of them measured specifically climate change belief, namely if the respondents actually believed in the existence of climate change. The other two items measured whether climate change belief also influence in the investment decisions of the investment institution. Therefore, the climate change index constructed with factor analysis measured how much the respondent believes in the existence and impact of climate change, both in society and in regard to the investment choices of its company. The higher the index, the more the respondent believes in the impact of climate change. Questions on the beliefs about COVID-19 have been instead analyzed separately given their quite different formulation.

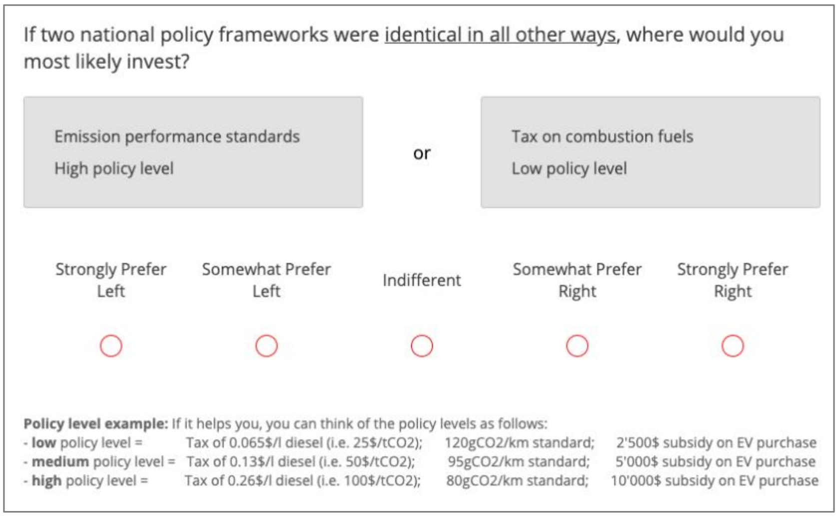


**Fig. 2. Example of the choice task in the ACA experiment.**

The third and last survey section was dedicated to eliciting investors' policy preferences over different e-mobility policy frameworks using the discrete conjoint experiment. Investors were first presented with an introduction to an investment opportunity which has been designed according to the findings from the pre-study interviews. The introduction stated the following: *'Now please assume that you have the opportunity to invest in an innovative battery project for electric vehicles (EVs). Consider the possibility that the investment could be in different European countries with different policy frameworks. Everything else remains constant. E.g. the technology of the batteries, the characteristics of the project team, and the charging infrastructure network are always the same. Since technological details and the investment type are irrelevant (e.g. equity or debt), please refer to the most common for your company'.* Subsequently, respondents were given an overview of the possible attributes and their levels. Then, the Sawtooth ACA questionnaire package showed to respondents a series of different computer screens: in the first stage, respondents were asked to rate how desirable is each attribute's level to be part of a policy framework. In the second stage, they were asked to state their preference of one attribute's level versus another. Finally, investors were confronted with six investment trade-off choices between different policy frameworks. An example of such trade-offs is reported in Fig. 2.

## 5. Descriptive statistics of the sample

The survey received 86 responses. However, 45 entries had to be discarded because highly incomplete. 12% of respondents stopped from completing the survey either during the a-priori beliefs questions or during the choice experiment, indicating a certain degree of respondent fatigue in line with past literature on discrete choice tasks (Savage and Waldman, 2008). The final sample size therefore included 41 questionnaires retained for analysis. Table 2 displays its descriptive statistics.

59% of survey respondents have a professional profile as partner or director within their institution, which is a positive sign in terms of quality and reliability of the responses. Investors are balanced in terms of experience with cleantech investments, as 44% of them had little experience (less than 5 years) while other 44% more than 5 years of experience with investments in clean technologies. In terms of the profile of the institution the respondent is affiliated with, the sample is skewed towards VC investors, which represent 46% of responses. However, other institutions are also fairly represented, as family offices (12%), PE funds (10%) and banks (10%). Being most of the respondents working in VC funds, 71% of entries have assets under management (AUM) of less than US$200 million. However, also bigger investment institutions are represented, with AUM between $200-1500 million (16%) or more than 1500 million (13%). In terms of geography, most of the investors are affiliated with institutions based in Western Europe (46%). This result was driven by the fact that 10 respondents are working with firms operating in Switzerland.

Regarding instead the characteristics of their investments, 80% of respondents are affiliated with institutions that had have already invested in clean technologies. The majority (36%) of those that have already invested in clean technologies also have a good proportion (from 10% to 49%) of their current portfolio invested in cleantech, and 12% invest their whole current portfolio exclusively in clean technologies. Instead, only 44% of the respondents invest in e-mobility, and the proportion of the portfolio dedicated to those investments is always inferior to 50%. This suggests that, even if an institution highly invests in cleantech, its investments are distributed over different cleantech products and rarely focused exclusively on e-mobility. Lastly, respondents reported in which mobility technologies they are currently investing. Only 5% of respondents state to invest in dirty technologies as internal combustion engines. The innovations that drive mobility investments are mobility sharing platforms and software[7] (32%), charging infrastructures (27%) and batteries (24%). This confirms that batteries have been correctly chosen as a relevant investment example for the ACA experiment.

[7] In this study, mobility sharing platforms and software are not considered an e-mobility technology, as only investments in physical appliances are included.

**Table 2. Final descriptive statistics for the research sample (N = 41)**

| | N | % | | N | % |
|---|---|---|---|---|---|
| **Respondent cleantech experience** | | | **Invest in cleantech** | | |
| No experience | 5 | 12% | Yes | 33 | 80% |
| Less than 5 years | 18 | 44% | No | 8 | 20% |
| Between 5 and 10 years | 9 | 22% | **Invest in e-mobility** | | |
| More than 10 years | 9 | 22% | Yes | 18 | 44% |
| **Respondent position** | | | No | 23 | 56% |
| Partner, Director or similar | 24 | 59% | **Percentage of portfolio invested in cleantech** | | |
| Investment Manager, Investment Analyst or similar | 13 | 32% | Less than 5% | 6 | 18% |
| Other | 4 | 10% | From 5% to 9% | 6 | 18% |
| **Institution type** | | | From 10% to 49% | 12 | 36% |
| Private Equity fund | 4 | 10% | From 50% to 99% | 5 | 15% |
| Venture Capital | 19 | 46% | 100% | 4 | 12% |
| Corporate investor | 2 | 5% | **Percentage of portfolio invested in e-mobility** | | |
| Bank | 4 | 10% | Less than 5% | 7 | 39% |
| Family Office | 5 | 12% | From 5% to 9% | 5 | 28% |
| Accelerator | 2 | 5% | From 10% to 49% | 6 | 33% |
| Other | 5 | 12% | From 50% to 99% | 0 | 0% |
| **Size of assets under management (US$)** | | | 100% | 0 | 0% |
| < 50 million | 14 | 37% | **Investment by mobility technology** | | |
| 50 - 200 million | 13 | 34% | Internal combustion motors & components | 2 | 5% |
| 200 - 1500 million | 6 | 16% | Hybrid motors & components | 3 | 7% |
| > 1500 million | 5 | 13% | Electric motors & components | 7 | 17% |
| **Institution location** | | | Automated road transport technologies & services | 7 | 17% |
| Eastern Europe | 7 | 17% | Batteries | 10 | 24% |
| Western Europe | 19 | 46% | Fuel cells & alternative fuels (e.g. biogas) | 4 | 10% |
| Northern Europe | 10 | 24% | Mobility-sharing platforms/software | 13 | 32% |
| Southern Europe | 5 | 12% | Charging infrastructures | 11 | 27% |
| | | | Other | 6 | 15% |

# 6. Analysis

## 6.1. Relative importance scores and part-worth utilities

To understand which policy attributes and policy levels are preferred by investors, average importances of attributes and part-worth utilities of each level were calculated. The results are displayed in Table 3. All three attributes were considered important by respondents, with importances ranging from 32.64% to 34.02%. Although with minor differences, the attribute 'policy revisions' was considered slightly more important, suggesting that the tradeoff between policy stability and flexibility should not be underestimated in policy design.

Part-worth utilities allow then to understand how investors' preferences for a given policy framework might be affected by a change in an attribute level. Regarding different policy instruments, 'subsidies for EVs at purchase' emerged as the most preferred instrument, showing the highest utility value (Utility = 15.33). The 'tax on combustion fuels' instead received the lowest utility score (Utility = -17.10). Standard deviations for different policy instruments are however quite high, suggesting high variations that will be further explored segmenting the data in the following sections. Investors also showed very high utility for a 'high policy level' (Utility = 50.27) and low utilities for a 'low policy level' (Utility = -49.75), with rather small standard deviations. Lastly, in the case of different policy revisions, the utility increases the more stable is the policy framework. A very low utility (-40.23) is reported for the uncertain scenario that does not specify when the policy revision will happen, while higher utilities are shown for a revision every 2 years (Utility 12.52) and every 5 years (Utility = 27.71).

**Table 3. Average importances of attributes and zero-centered utilities of levels.**

| Attribute | Average Importances | Standard deviations | Levels | Zero-centered utilities | Standard deviations |
|---|---|---|---|---|---|
| Policy instrument | 32.64 % | 10.92 % | Tax on combustion fuels | -17.10 | 41.74 |
| | | | Emission performance standards for new vehicles | 1.78 | 40.57 |
| | | | Subsidies for EVs at purchase | 15.33 | 42.75 |
| Policy level | 33.34 % | 11.07 % | Low policy level | -49.75 | 16.52 |
| | | | Medium policy level | -0.52 | 3.45 |
| | | | High policy level | 50.27 | 16.86 |
| Policy revisions | 34.02 % | 10.16 % | Policy level revised every 2 years | 12.52 | 37.26 |
| | | | Policy level revised every 5 years | 27.71 | 29.50 |
| | | | Not defined when the policy level will be revised | -40.23 | 35.53 |

It is important to highlight that a negative value associated with a given attribute level does not mean that the level is not attractive per se. Since the zero-centered diffs method is applied, utilities have been re-scaled to an arbitrary additive constant, and therefore their sum is zero within each attribute. Consequently, a low utility for the tax on confusion fuels does not mean that this policy instrument is not desirable in absolute terms, but only that it is less attractive for investors compared to the other policy instruments. Positive utility values therefore imply an increase in utility, while negative values imply a decrease.

To conclude, investors surveyed in this study demonstrated preferences patterns for a policy framework including 'subsidies for EV at purchase', a 'high policy level' and a 'policy revised every 5 years'. This policy framework has then been adopted as a 'best case' scenario to produce market simulations in the following sections of the research.

## 6.2. Influence of investors' characteristics

In order to test the first set of hypotheses, the average importance of each attribute and the part-worth utilities of each level have been segmented by institution type and institution size.

Figure 3 and 4 report the segmentation of the average importance scores for institution type and institution size. Visible differences in average importance scores across type of institutions and size of assets under management confirm that investors' characteristics play a role in determining preferences over different policy attributes. Regarding institution type, VC funds showed an importance score for the attribute 'policy level' of 33,8% (SD = 10.61), relatively higher than PI funds, corporate investors and accelerators. Banks also show high scores for the policy level, but with a high standard deviation (SD = 21.31). Family offices present high importance scores for the attribute 'policy level' (38,30%, SD = 11,28), and lower scores for 'policy instruments' and 'policy revisions'. PE funds instead behave differently as expected: they show higher average scores for the attribute policy instrument (38.65 %, SD = 7.09 %) and policy revisions (38.27 %, SD = 7.32), compared to 'policy level'.

Regarding instead institution size, the average importance of the attribute 'policy instrument' increases for larger institutions, with smaller funds (AUM < 40 million or between 50 - 200 million) showing average impotence scores around 31%, and bigger funds (AUM between 200-1500 million and >1500 million) around 36%. In contrast, the average importance of the attribute 'policy revisions' decreases the bigger the institution size, with average importance scores ranging from 37.5% for small funds (<50 million) until 21.9% for very big funds (>1500 million). Institution size seems not to influence the average importance for the attribute 'policy level', except for very big funds (>1500), which however represent a smaller part of the sample (N=5). Therefore, this particular result should be interpreted carefully, as it might not be representative of the true behavior of bigger institutions.


**Fig. 3. Average importance scores for institution type**


**Fig. 4. Average importance scores for institution size**

Table 3 and 4 summarize the utility scores segmented by institution type and institution size. VC funds and PE funds showed positive and higher utilities for 'subsidies for EV a purchase' (utility = 26.88 and utility = 40.37 respectively), confirming what emerged from the literature, namely that these categories of investors usually prefer market-pull instruments. Surprisingly, also banks show high utilities for 'subsidies for EVs at purchase' (utility = 46.17). Corporate investors show significantly higher utilities for 'emission performance standards' (utility = 46.04), and also PE funds show relative high utilities for this command-and-control instrument (utility = 22.30). Family offices show instead more centered utilities for different policy instruments, giving slightly more importance for emission performance standards (utility = 6.55).

Regarding institution size, clear differences in utility scores for different policy instrument emerge between a smaller and bigger funds. Small funds, with AUM <50 million and between 50-200 million show higher utility scores for 'subsidies at purchase' (respectively, utility = 25.31 and utility = 29.14). Funds with AUM between 200-1500 million show preference for 'emission performance standards' (utility = 33.97). Very big institutions with AUM > 1500 million display more centered utilities.

**Table 3. Part-worth utilities for institution type.**

| | PE Fund | VC Fund | Corporate Investor | Bank | Family Office | Accelerator | Other |
|---|---|---|---|---|---|---|---|
| **Policy Instruments** | | | | | | | |
| Tax on combustion fuels | -62.67 | -22.79 | -48.26 | -12.47 | -4.29 | 26.09 | 19.65 |
| Emission p. standards | 22.30 | -3.98 | 46.04 | -33.70 | 6.55 | -5.35 | 15.97 |
| Subsidies at purchase | 40.37 | 26.77 | 2.22 | 46.17 | -2.26 | -20.74 | -35.62 |
| **Policy levels** | | | | | | | |
| Low policy level | -34.77 | -50.41 | -37.86 | -50.90 | -57.28 | -43.91 | -57.88 |
| Medium policy level | 0.31 | -0.55 | -2.10 | -2.14 | -0.33 | -0.49 | 0.68 |
| High policy level | 34.47 | 50.96 | 39.96 | 53.04 | 57.61 | 44.41 | 57.20 |
| **Policy revisions** | | | | | | | |
| Revised every 2 years | -3.24 | 26.17 | -15.02 | -14.77 | 30.13 | -17.82 | 0.65 |
| Revised every 5 years | 55.30 | 28.68 | -5.32 | 26.98 | 17.58 | 77.12 | 6.11 |
| Revision not defined | -52.06 | -54.85 | 20.34 | -12.21 | -47.72 | -59.30 | -6.75 |

**Table 4: Part-worth utilities for institution size.**

| | < 50 million | 50 - 200 million | 200 - 1500 million | > 1500 million |
|---|---|---|---|---|
| **Policy Instruments** | | | | |
| Tax on combustion fuels | -25.30 | -23.80 | -29.28 | 0.17 |
| Emission p. standards | -0.01 | -5.34 | 33.97 | -6.99 |
| Subsidies at purchase | 25.31 | 29.14 | -4.69 | 6.82 |
| **Policy levels** | | | | |
| Low policy level | -47.23 | -48.27 | -46.26 | -63.17 |
| Medium policy level | -0.08 | -1.03 | -0.97 | -0.40 |
| High policy level | 47.31 | 49.30 | 47.23 | 63.57 |
| **Policy revisions** | | | | |
| Revised every 2 years | 17.81 | 10.08 | 15.21 | 8.04 |
| Revised every 5 years | 26.49 | 39.37 | 24.96 | 9.58 |
| Revision not defined | -44.30 | -49.44 | -40.17 | -17.62 |

Utilities for different policy levels instead do not differ significantly between different types of investors, as significantly higher utilities for ‘high policy level’ always emerge. Utilities for different levels of policy revisions also confirm the hypotheses. VC and PI funds show very low utilities for ‘revision not defined’ compared to other investors. PE funds then show preferences for a policy ‘revised every 5 years’ (utility =55.30), while VC funds show similar preferences for a revision every 2 or 5 years (respectively utility = 12.17 and utility = 28.68). Family offices attributed higher utility for a ‘revision every 5 years’, but showed a positive score also for a ‘revision every 2 years’.

To further investigate the influence of investors’ characteristics over their preferences for different e-mobility policy instruments, sensitivity simulations have been carried out with the Sawtooth Software Market Simulator, which allows to calculate share of preferences for different scenarios. The ‘best case policy scenario’ that emerged from the data, comprising a ‘high policy level’ and a ‘revision every 5 years’, has been compared with scenarios with different types of policy instruments. Figures 5 and 6 show the result of this analysis. The share of preferences for different policy instruments segmented by institution type confirm previous results, namely that VC funds significantly prefer ‘subsidies at purchase’ as a policy instruments, with acceptance rates of 73.7%. PE funds equally prefer ‘subsidies at purchase’ and ‘emission performance standards’, with acceptance rates of 50% for both. Corporate investors instead strongly prefer ‘emission performance standards, with acceptance rates of 100%. Regarding institution size, smaller funds (AUM <50 million and between 50-200 million) strongly prefer ‘subsidies at purchase’ (share of preferences of 64.3% and 61.5% respectively), medium funds prefer emission performance standards (66.7%), while the overall acceptance for a ‘tax on combustion fuels’ is good for very big investment institutions with AUM > 1500 million (41,7%).

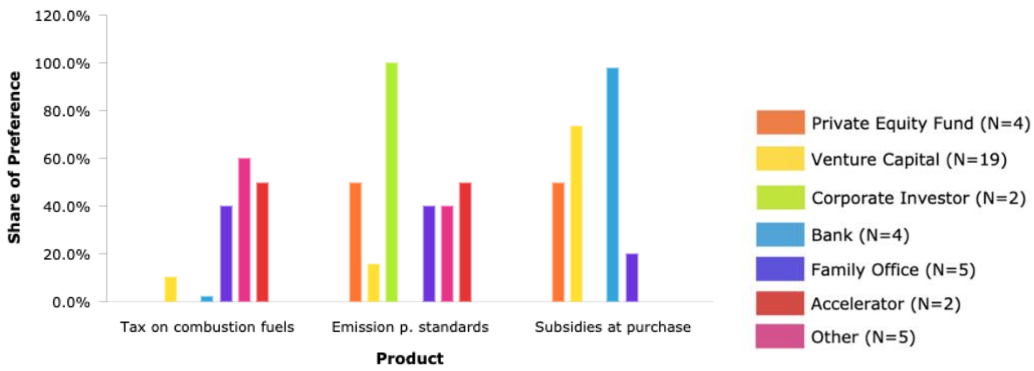


**Fig. 5. Market simulation: share of preferences over different policy instruments segmented by institution type**

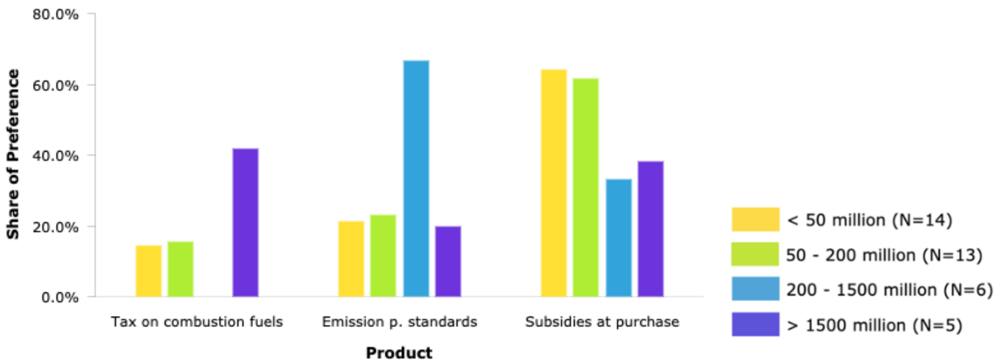


**Fig. 6. Market simulation: share of preferences over different policy instruments segmented by institution size**

Overall, these results support the first hypothesis. VC funds give a higher average importance to the policy level compared to other investors. Also, both VC funds and PE funds prefer EV subsidies at purchase as e-mobility policy instrument, and they also show clear preferences for a stable policy framework, in particular if revised after 5 years.

Furthermore, findings also shed light on new interesting trends that go beyond the hypotheses. First, differently from what emerged in the previous literature, VC and PE funds in this sample showed some differences in their importance scores for the attribute 'policy level', and in their utilities for different types of 'policy instruments'. PE show lower importance scores for the policy level compared to VC investors, and revealed a good acceptance also for emission performance standards as policy instrument. Their different policy preferences compared to VC funds could be driven by the fact that they often focus on a later-stage investments in companies with a stronger business model with proven market success. In this way, they lower investment risk and expect less volatility in investment returns (Block et al., 2019). Therefore, PE funds might benefit more from command-and-control instruments, as it is the case for corporate investors, which usually invest in innovations with a stronger track record (Schertler, 2005). While also banks were expected to show a similar behavior, this is not reflected in the data. However, it is worth noting that standard deviations for banks in the sample are significantly higher than those for PE funds and corporate investors.

Secondly, the findings shed light for the first time on policy preferences of family offices, which however appear to be more mixed compared to other investors types. Family offices show more centered utilities for different type of policy instruments, and lower importance scores for the attribute 'policy revision'. Those differences could be driven by the fact that they often invest in companies at all stages (Block et al., 2019), and therefore the policy preferences may change depending on portfolio of the family office in question.

Thirdly, findings confirm that institution size affect investors' policy preferences over different policy instruments. Smaller funds prefer subsidies for EVs at purchase, while larger funds emission performance standards. Very big funds in the sample, thought thy represent only a very small portion of the sample size, seem to be more willing to accept a tax on combustion fuels from the market simulation. Furthermore, findings show that that the average importance of the attribute 'policy instrument' increases with institution size. As affirmed by the OECD (2019: 71), 'carbon price signals is key to providing citizens and businesses with certainty for their long-term investment decisions'. The finding that bigger investors might be more willing to accept a policy framework including a fuel tax is therefore a positive sign for the use of taxes in encouraging climate action. Furthermore, the average importance of 'policy revisions' decreases the larger is the institution, showing that stability is particular important for smaller investors which might be more affected be unexpected changes in the policy frameworks.

### 6.3. Influence of a-priori beliefs on climate change

To explore whether investors' climate change beliefs might influence their investment choices, responses for climate change beliefs questions have been segmented by the percentage of the portfolio that the investors affirmed to dedicate to cleantech or e-mobility. It is important to highlight that, overall, investors in the sample demonstrated to have strong beliefs about the impact of climate change. A more detailed breakdown of their answers can be found in the descriptive statistics in Annex I.

Figures 7 and 8 give an overview of the results for the question 'Human activities are an important cause of climate change'. All the institutions in the sample that dedicate 100% of their portfolio to cleantech stated that they 'strongly agree' with the statement. Most of the investors which invested a lower proportion of their portfolio in cleantech (less than 5% or from 5 to 9%) were instead more likely to 'agree'. While only 44% of the investors that responded to the survey affirmed to invest a certain percentage of their portfolio in e-mobility, some similar trends emerged. 66.7% of the investors with a higher percentage of e-mobility technologies in their portfolio (from 10% to 49%) strongly agreed with the statement. Investors with a lower percentage invested in e-mobility (less than 5%) were likely to 'agree' (42.9%) or be 'indifferent' (14.3%).

As mentioned in the methodology, an index has then been constructed using the four climate change items, in order to measure investors' belief in the existence and impact of climate change, both in society and in regard to the investment choices of the company. The higher the index measured between a scale from 1 to 5, the more the respondent believed in the impact of climate change. As it was mentioned before, respondents demonstrated quite high beliefs in climate change, resulting in no data with an index lower than 2. The related hypothesis on policy preferences has then been tested with the use of the Sawtooth Software Market Simulator.

Sensitivity analyses has been completed for level of different policy attributes. Results are shown in different market simulations of Figure 9.

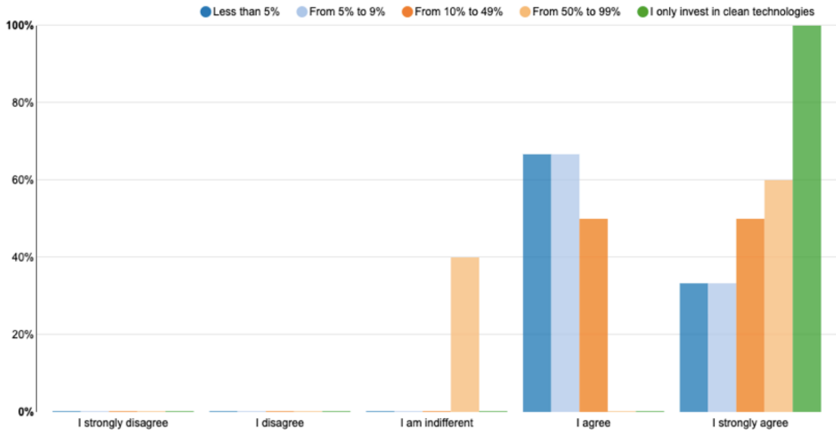


**Fig 7. Responses for '*Human activities are an important cause of climate change'* segmented by % of portfolio dedicated to cleantech**

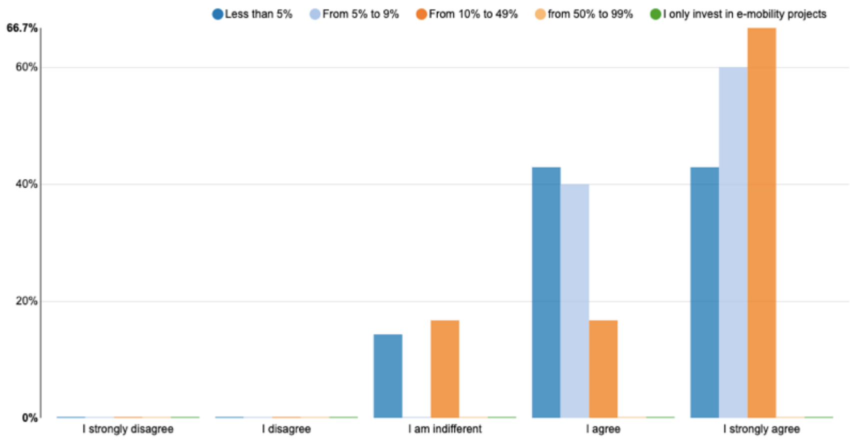


**Fig 8. Responses for '*Human activities are an important cause of climate change'* segmented by % of portfolio dedicated to e-mobility**

Share of preference for scenarios with different policy instruments, policy levels, and policy revisions confirm the hypotheses. While investors generally prefer 'subsidies at purchase' as policy instrument, their acceptance for a 'tax on combustion fuels' increases the higher are their beliefs on climate change: investors with an index of 3 show a share of preference for the scenario with a 'tax on combustion fuels' of 12.6%, which grows to 20.7% for those with an index of 4, and 25.5% for investors with an index of 5. The respondent which presented an index of 2 behaved differently than expected, presenting a high share of preference for a tax, however this finding cannot be generalized given that it represents the preferences of a single investor in the sample. Both emission performance standards and subsidies to EVs at purchase were nearly equally preferred by the investors that have strong belief about climate change (index = 5).

Regarding instead preferences for different policy levels, it is clear from the correspondent market simulation that the more the investors believes in the impacts of climate change, the more he is likely to present high shares of preference for an 'high policy level'. In facts, investors with a climate change index of both of 4 and 5 showed a 76.5% preference share for the scenario with a 'high policy level'. Coherently, the same investors show lower shares of preferences for a scenario with a 'medium' or 'low' policy level. Lastly, investors with stronger beliefs (index of 4 and 5) on the impact of climate change display very low shares of preferences for an uncertain policy framework with a 'revision not defined' (7.5% and 7.2% respectively), and preferences shares over 50% for a stable policy framework which entails a 'revision every 5 years'.

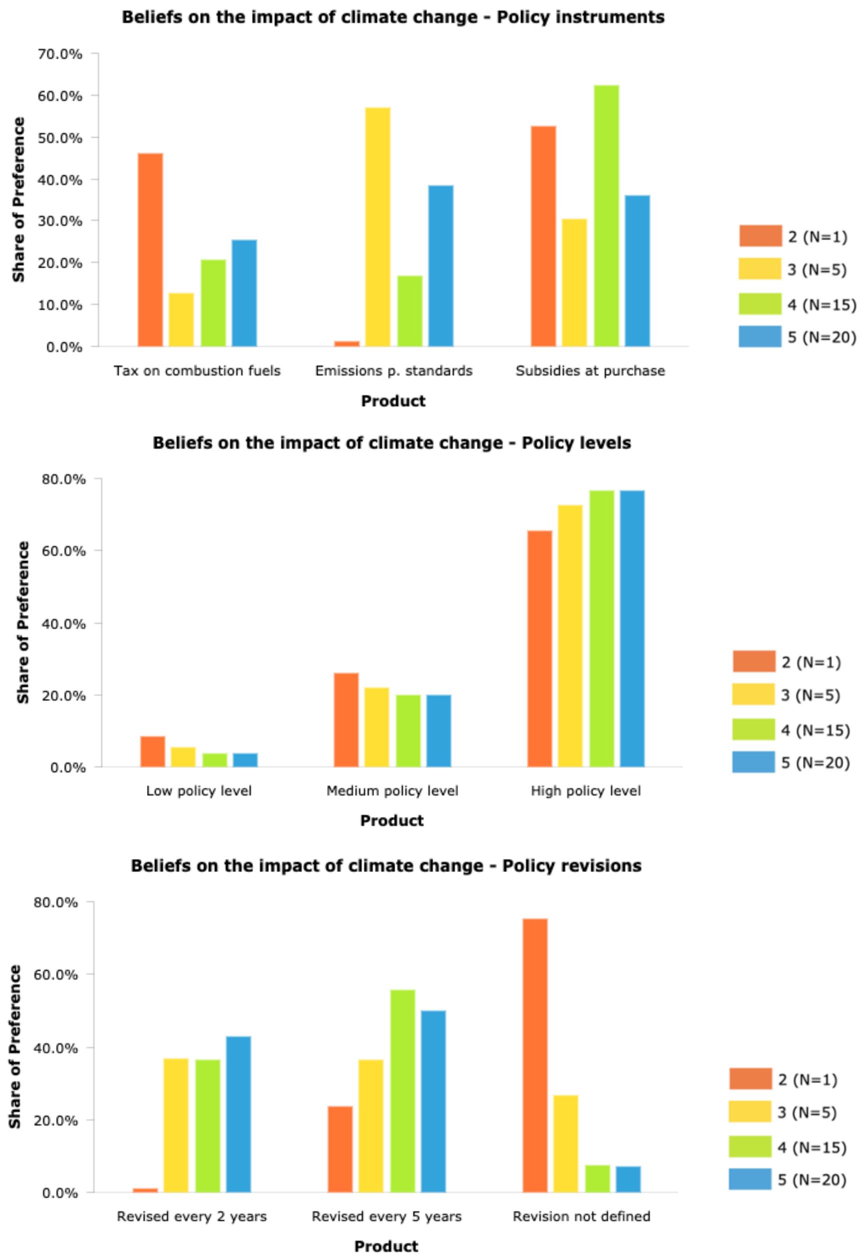


**Fig. 9. Market simulations: share of preferences over different policy instruments, policy levels and policy revisions segmented by the climate change index**

Overall, the results support the second set of hypotheses, namely that investors' beliefs on the impacts of climate change influence the proportion of their portfolio invested in cleantech. Investors that strongly believe in climate change are more likely to invest 100% of their portfolio in cleantech, or a significant proportion of their portfolio in e-mobility. This confirms that environmental attitude of investors influences their willingness to invest in clean technologies.

Furthermore, the data also confirm how climate change beliefs have a role in determining policy preferences. Investors that are more aware about the impacts of climate change are more willing to accept a policy that entails public sacrifice, as a tax on combustion fuels, confirming the findings of previous literature on publics' policy preferences (O'Connor, Bard and Fisher, 1999). They have also show preferences for a higher policy level, which might reflect their support for a stronger policy commitment. Investors believing more in the impacts of climate change also prefer a predictable policy framework. This finding is not surprising, as environmental aware investors are also those that invest more in clean technologies. As the literature analyzing the behavior of financial actors that are largely exposed to climate-policy-relevant sectors confirms, uncertainty of the climate policy framework undermines the reliability of the probability distributions of asset returns (Battstion et al., 2017). The preferences of survey respondents for a 'revision every 5 years' entails that a stable policy framework is preferred, but also that a certain degree of flexibility every 5 years is accepted as it allows investors to adapt to new market information (Brunner, Flachsland & Marschinski, 2012).

### 6.4. Influence of a-priori beliefs on the COVID-19 crisis

Four items were used in the survey to measure investor's a-priori beliefs on the COVID-19 crisis. Results for each question are reported in Table 5. Two of them measured their beliefs about related policy changes. 49% of respondents agreed that the COVID-19 crisis is likely to shift the political support from clean technologies to other areas, and 5% strongly agreed. However, 29% of respondents disagreed. Different perceptions have been revealed also by investors based in the same country as Germany, Switzerland and the United Kingdom, confirming that the period before the announcement of the European recovery plan was perceived as very politically uncertain by investors all over Europe. However, 59% of respondents agreed that the COVID-19 economic stimulus programmes can be an opportunity to promote cleantech policies and build a greener economy. This highlights a positive vision of investors towards the future of European policies. Investors that agreed with the statement were also more likely to strongly believe about the impact of climate change. In fact, 57% of respondents that 'strongly agreed' with the statement 'Human activities are an important cause of climate change' also agreed about the possibility to use economic stimulus programmes to build a greener economy.

The other two items investigated instead investors' beliefs about the impact of the COVID-19 crisis on their investments. 49% of respondents agreed that 'The COVID-19 crisis will have a lasting impact on my investment behavior', while 29 % disagreed. Most of VC funds (63.2%) and family offices (60%) agreed with the statement, while banks and PE funds were more likely to disagree or be indifferent. This confirms that the effects of the crisis on investments are likely to be felt more by early-stage investors as VCs.

**Table 5. Descriptive statistics of responses to the a-priori beliefs question on COVID-19**

| Question | Label | N | % |
|---|---|---|---|
| "The COVID-19 crisis is likely to shift the political support from clean technologies to other areas" | I strongly disagree | 0 | 0% |
| | I disagree | 12 | 29% |
| | I am indifferent | 9 | 22% |
| | I agree | 20 | 49% |
| | I strongly agree | 0 | 0% |
| "COVID-19 economic stimulus programmes can be an opportunity to promote cleantech policies and build a greener economy" | I strongly disagree | 0 | 0% |
| | I disagree | 4 | 10% |
| | I am indifferent | 6 | 15% |
| | I agree | 25 | 61% |
| | I strongly agree | 6 | 15% |
| "I expect that the COVID 19 crisis will have a lasting impact on my investment behavior" | I strongly disagree | 0 | 0% |
| | I disagree | 12 | 29% |
| | I am indifferent | 6 | 15% |
| | I agree | 21 | 51% |
| | I strongly agree | 6 | 5% |
| "My current investments in clean technologies are at risk due to the COVID-19 crisis" | I strongly disagree | 1 | 2% |
| | I disagree | 17 | 41% |
| | I am indifferent | 11 | 27% |
| | I agree | 11 | 27% |
| | I strongly agree | 1 | 2% |

The most interesting insights emerged from investors' beliefs about the impact of the COVID-19 crisis on their investments in clean technologies. Respondents were asked to which extent they agreed to the statement: 'My current investments in clean technologies are at risk due to the COVID-19 crisis'. 41% of respondents disagreed, confirming the third hypothesis, namely that investors still have confidence in their cleantech investment in the short-term. Their confidence in their cleantech investments varied depending on the location of the company. In fact, 47% of the investors that disagreed with the statement were based in Switzerland. Some trends emerged also depending on the share of the portfolio invested in clean technologies, as shown in Figure 10. 66.7% of the respondents that invest between 10% to 49% of their portfolio in cleantech, representing the majority (37%) of the sample, disagreed with the statement. Respondents which invest a higher proportion (50% to 99%) were divided between 40% that agreed and other 40% that disagreed with the statement. Those that only invest in clean technologies, which represent a minority (9%) of the sample, were equally likely to agree or be indifferent. Therefore, while most investors are confident that their cleantech investments are not highly impacted, those that have a very high proportion of their portfolio in cleantech (>50%) present less consistent beliefs.

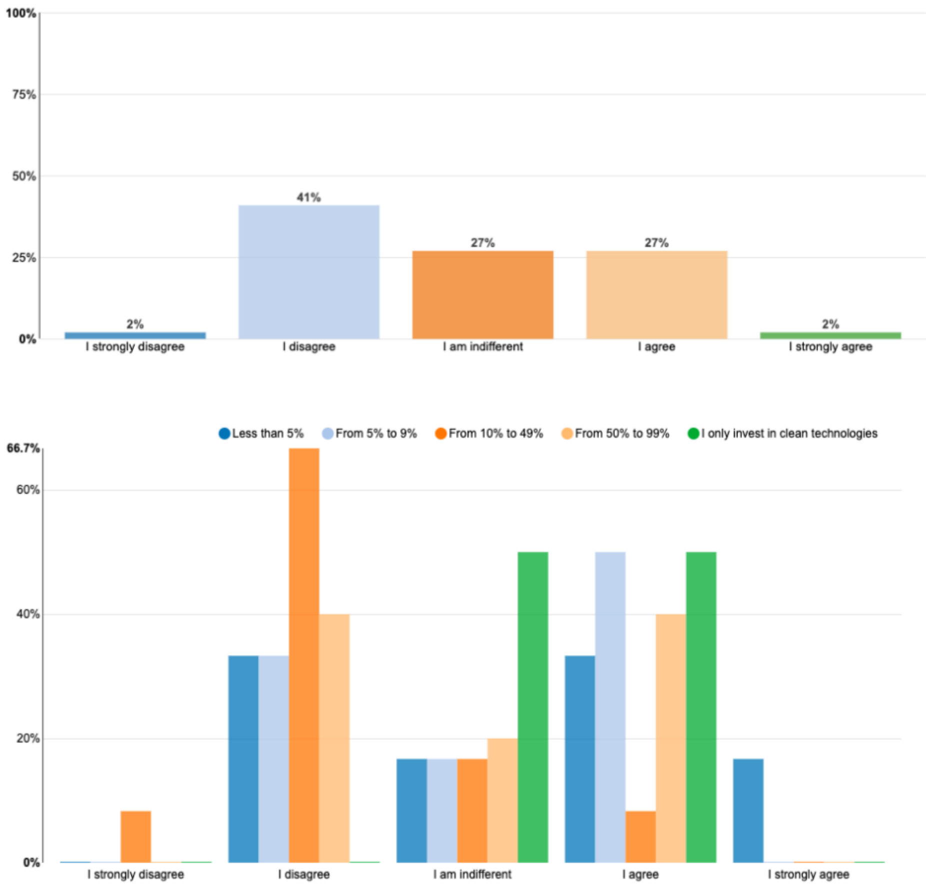


**Fig. 10. Responses for 'My current investments in clean technologies are at risk due to the COVID-19 crisis', then segmented by % of cleantech in the portfolio**

To understand whether beliefs about the COVID-19 crisis might affect investors' policy preferences, several market simulations have then been conducted. Overall, weak or not consistent evidence emerged about the influence of COVID-19 beliefs on the preferences for different policy levels and policy revisions. However, investors with different beliefs about the impact of the crisis on their cleantech investments showed some variations in preferences over different policy instruments. Figure 11 reports a market simulation for different policy instruments, keeping other attributes constants. Investors that agreed to the statement 'My current investments in clean technologies are at risk due to the COVID-19 crisis' registered a 54% preference share for the attribute 'subsidies at purchase', and preference shares under 24 % for the other attributes. While also investors that disagreed to the same statement generally preferred subsidies (40.8% share of preference), they also showed good acceptance for 'tax on combustion fuels' (27.4% share of preference) and for 'emission performance standards' (31.9% share of preference). This confirms that investors who are more worried about the fate of their cleantech investments have stronger preferences for demand-pull policies, which provide short-term stable policy signals and reduce uncertainties associated with the reduction of demand.

In the final question of the a-priori beliefs section of the survey, respondents had the option to reply to an open-ended question which investigated how the COVID-19 crisis will affect their investment in clean technologies e-mobility. 29 out of the 41 respondents provided an answer to this question: some investors gave more general answers about cleantech investments, others more specific about the future of e-mobility. Responses have been coded qualitatively and, as a result of the analysis, some major negative and positive effects on investment emerged.

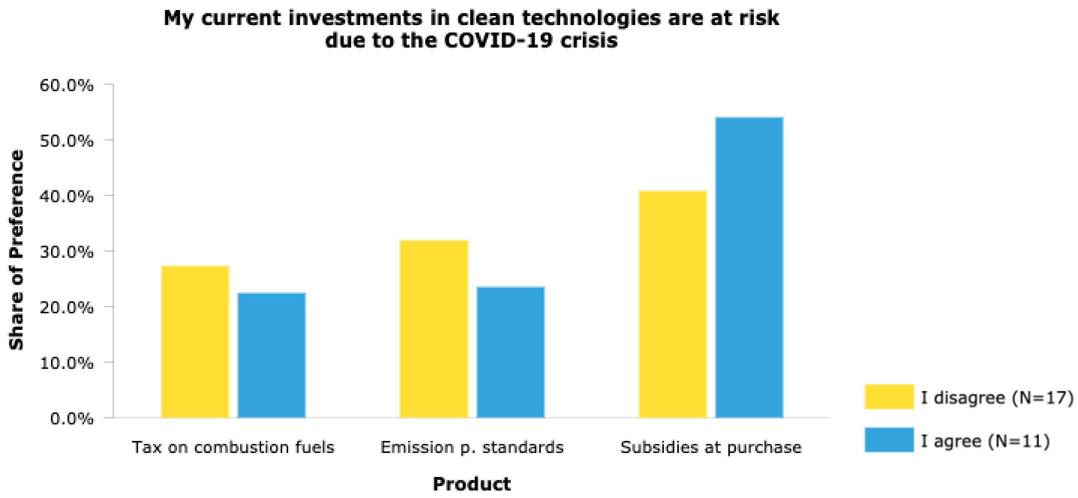


**Fig. 11. Market simulation: share of preferences for different policy instruments, segmented by '*My current investments in clean technology are at risk due to the COVID-19 crisis*'.**

On the negative side, the most significant concern for investors regarded the lack of funding driven by market disruptions, volatility and uncertainty, which can negatively affect investments. These issues were raised by five respondents affiliated with VC and PE firms. One VC respondent further affirmed that: '*Right now mobility demand is down, short term, but we don not know when and how the demand will return. Companies have shorter runways due to missed revenue projections and VCs are somewhat preoccupied with their own portfolio companies and not looking as aggressively for new investments*'. Three respondents from different investment institutions also raised concerns about the rising oil prices. If oil prices remain low in the long term, they will lower the competition for those new cleantech companies entering into the market, creating new entry barriers. Investors also described how lower oil prices will make fuel-based technologies more attractive than EVs. Three respondents also raised concerns about social distancing-related delays, for example due to difficult access to resources and logistics, as well as longer sales cycles as mentioned by one corporate investor. Two respondents then highlighted the likelihood that cleantech investments will be negatively affected in the short term, specifying how growth rates and adoption of cleantech will decrease in the next 12-24 months, and that the use of e-mobility will be constrained by the confinement measures. Lastly, some other specific obstacles were mentioned. An investor affiliated with a family office underlined how finding early adopter clients for the start-up's products will become more difficult, while an VC investor specified how cleantech startups are struggling to implement pilot projects, which are fundamental to prove the effectiveness of their products and raise investments.

Despite the emerging obstacles undermining cleantech investments, numerous respondents also raised also positive trends. Five investors including family offices, PE funds and a VC fund explained how their cleantech investments will not be impacted by the COVID-19 crisis. Two respondents from PE firms specified how most of their portfolio companies are in growth and not affected, or that they are high-tech companies with a long-term vision which that are not likely not to be significantly impacted. Four respondents from VC funds were confident about an increasing focus on cleantech and e-mobility investments driven by the newly emerging tech opportunities that favor physical distancing. One respondent from a VC fund indeed affirmed: '*We are considering investing in e-mobility. We expect many interesting solutions on the market in connection with the COVID-19 crisis*'. Another respondent also affirmed that valuations might come down, making investing in equity for VCs more favorable. Two investors affiliated with banks also highlighted that, while COVID-19 is likely to affect short-term investments, in the long-term the attention is very likely to shift again to cleantech. Other two VC investors explained how different types of technologies are like to be differently affected, and that the attention is likely to shift from physical infrastructure to digital investment (e.g. sharing economy e-mobile platforms/operators). Four respondents also underlined the increasing importance of the role of policy, and that government support for clean technologies is likely to remain stable or increase. One VC investor from the United Kingdom affirmed that *'COVID is causing most governments – e.g. the United Kingdom – to fast track plans to introduce e-mobility, such as scooters, as a way to avoid a reliance on public transport. More generally COVID has put governments at the heart of economies globally and so policy regulation and public funding is more important than ever to investment decision making'*.

Overall, the findings from the COVID-19 questions highlight three interesting trends. First, the month before the announcement of the Next Generation EU recovery plan has been perceived as very politically uncertain by investors. Respondents felt the risk that the crisis could shift the political support form clean technologies to other areas, however they still believed that economic stimulus programmes could become an opportunity to promote cleantech policies and build a greener economy in the future.

Secondly, it is confirmed that most investors do not think that the COVID-19 crisis will strongly affect their investment in clean technologies in the short-term. This is true in particular for PE funds investing in high-tech growth companies and investors with a medium proportion of cleantech in their portfolio. Policy commitment of the country also influence investors' confidence in their cleantech investments, as it was the case for Switzerland. In fact, also in the qualitative questions, a Swiss investor affirmed how '*politicians and governments will not stop supporting the [cleantech] sector*'. Furthermore, interviewees also confirmed the Swiss strong political commitment towards cleantech in the pre-survey phase. Investors also felt that newly emerging investment opportunities in the e-mobility sectors are likely to arise, most probably for technologies that favors physical distancing, as EVs and micromobility solutions.

Lastly, the findings provide some evidence on how market-pull policies − as subsidies for EVs − are more favored by investors that fear the most the impact of the crisis on their cleantech investment. Therefore, it will be essential for government to maintain them to give stable short-term policy signals and reduce uncertainties associated with the immediate demand of e-mobility technologies.

## 7. Conclusions

E-mobility technologies have the potential to play a crucial role in the sustainability transition. To maximize the effectiveness of e-mobility policies and attract private capital towards clean technologies, it is essential for policymakers to gain a better understanding of investors' policy preferences. This study contributes to the growing research streams that uses discrete choice experiments to investigate investors' behavior in relation to energy policy, transferring the same methodological approach to the analysis of investors' policy preferences over e-mobility policy attributes.

Findings illustrate that investors' characteristics influence their policy preferences. The study confirms findings from previous literature on the policy preferences of VC and PE funds, while discovering also some newly emerging trends on the preferences of the latter. Furthermore, it illustrates how early-stage, small investors and later-stage investors present different preferences over e-mobility policy instruments. While small and early-stage investors, as VC funds, prefer market-pull instruments as subsidies for EVs at purchase, larger and later-stage investors show preferences for command-and-control instruments as emission performance standards for new cars. As family offices invest in companies at all stages, their policy preferences are less well-defined. Furthermore, the larger are the AUM of the investment firm, the more importance is given to the type of policy instrument adopted in the policy framework, and the less instead to its stability and flexibility. Smaller investors are therefore likely to be more concerned about the possibility of unexpected changes in a policy setting.

The survey further shed light on how investors with stronger environmental beliefs are more likely to invest a larger proportion of their portfolio in cleantech and e-mobility. This confirms findings from previous studies on SRI and on how the environmental attitude of investors influences their willingness to invest in clean technologies. The results also reveal how investors' policy preferences are influenced by their beliefs on the impact of climate change. This is a relevant contribution to the literature, as previous research has focused exclusively on the influence of environmental beliefs on the policy preferences of the general public, and not of investors. Investors who have stronger beliefs about climate change are more likely to accept policy instruments that entail public sacrifice, as the tax on combustion fuels, and prefer a high policy level and a relatively stable policy framework, which allows for the predictability of climate policy changes.

This study also attempted a very first analysis of investors' beliefs regarding the COVID-19 crisis. The month proceeding the announcement of the Next Generation EU recovery plan has been perceived as very uncertain by investors, which identified the risk that the crisis could shift the political attention away from clean technologies. However, investors remained confident that the crisis will not disrupt their investment in clean technologies in the short term because of the political commitment of certain countries, as for example Switzerland, and because of the newly emerging investment opportunity in the e-mobility sector. Furthermore, investors that saw their investment in clean technologies more at risk because of the crisis revealed stronger preferences for market-pull instruments. Policy tools as subsidies for EVs will therefore be essential to give stable short-term policy signals and reduce uncertainties associated with the immediate demand of e-mobility technologies.

Overall, this research confirms that investors' characteristics and their a-priori beliefs about the impact of climate change and the COVDI-19 crisis influence investors' e-mobility policy preferences. By providing an analysis of investors' behavior, this study can support policymakers to design more effective policy instruments to attract investments in electric mobility during and after the COVID-19 crisis.

Being the very first attempt to apply a discrete choice experiment in the context of e-mobility policies, this study is subject to some limitations, which also provide a framework for further research. First, the findings on the relative importance of different attributes and the utilities of different levels provide information on investment preferences only for the attributes and levels chosen to design the experiment. Therefore, the research does not cover all the policies that play a role in the expansion of the e-mobility sector, as for example R&D grants, tax waivers for EVs holders or waivers to traffic restrictions. It would be therefore relevant to develop future studies which include other policy instruments and policy attributes that emerged from the interviews – as policy transparency, policy enforcement and policy fairness – which have not been included in this survey to simplify the choice task for investors. For example, identifying whether investors have different preferences for the introduction of taxation policies with or without a redistribution mechanism would provide new insights on the role of social acceptance in the implementation of stable environmental policies.

Furthermore, while the attributes and levels have been selected through the qualitative expert interviews to realistically represent a policy setting, they are not able to reflect the complexity and interdependency of real policy frameworks, which usually apply more than one policy instrument at a time. Future research could therefore focus on exploring policy preferences over policy mixes, to understand which combination of policy might be more effective to attract investment.

Secondly, this study employs a stated preference approach, which has been purposely chosen because this research aims to understand present and future policy preferences rather than choices on past investment decisions. However, stated preference methodologies are in general subjected to the so-called 'hypothetical bias'. Investors do not take real decisions but make trade-offs between hypothetical scenarios, and therefore their choices might not always reflect the real life decision-making processes (Portney, 1994). Furthermore, there is the risk that they evaluate their answer on the basis of their positive or negative past experience with a specific policy application in a given country, and this might undermine the comparison of findings at the European level. Further research could focus on comparing these findings with data collected with revealed preference approaches, to understand whether preferences are corroborated.

A third limitation regards the small sample size employed in this study, as the sample is composed of 41 European investors across different types of investment institutions. The ACA methodology has been purposefully chosen because it is suitable for small sample sizes, as it allows to gain a high ratio of information per respondent effort. However, while the sample comprised six major categories of investors with different size of AUM and focusing on different investment stages, it was still significantly skewed towards VC funds. Findings about the other investment firms in the sample should be therefore validated with further research. It would be relevant for future studies to assess a larger and more balanced sample size, in particular with more observations from corporate investors, banks and in general institutions with very large assets under management. For doing so, closer academic collaboration with bigger institutional investors will be essential in order to collect reliable data.

A fourth and last limitation of this research is that the survey has been administered in a time of health, economic and political crisis, and therefore investors' a-priori beliefs and policy preferences might have been distorted by their perception of the impacts of the crisis in their country. Furthermore, investors were struggling with the day-to-day management of their operations, and surely had limited bandwidth to reflect on the development of future mobility polices. As the present survey has been conducted precisely the month before the announcement of the Next Generation EU recovery plan, the public announcement of the European commitments toward the European Green Deal could have significantly changed investors' policy preferences. As it was done by Hofman and Huisman (2012), who reproduced the same survey of Bürer & Wüstenhagen (2009) after the 2008 financial crisis discovering some changes in European investors' policy preferences, it would be relevant for future research to reproduce a similar survey within the following year. This could reveal important changes in investment behavior and policy preferences, triggered by the new environmental commitments under the European recovery plan.

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# 9. Annexes

## 9.1. Annex I: Descriptive statistics of the a-priori beliefs questions on climate change

| Question | Label | N | % |
|---|---|---|---|
| "Human activities are an important cause of climate change" | I strongly disagree | 1 | 2% |
| | I disagree | 1 | 2% |
| | I am indifferent | 2 | 5% |
| | I agree | 16 | 39% |
| | I strongly agree | 21 | 51% |
| “In our investment decision, my company also considers recent scientific information on the effects of climate change” | I strongly disagree | 0 | 0% |
| | I disagree | 4 | 10% |
| | I am indifferent | 6 | 15% |
| | I agree | 26 | 63% |
| | I strongly agree | 5 | 12% |
| "The issue of climate change is exaggerated by the media and politicians" | I strongly disagree | 13 | 32% |
| | I disagree | 22 | 54% |
| | I am indifferent | 3 | 7% |
| | I agree | 3 | 7% |
| | I strongly agree | 0 | 0% |
| "Investing in climate change mitigation technologies constitutes more risk than benefits for my company" | I strongly disagree | 14 | 34% |
| | I disagree | 18 | 44% |
| | I am indifferent | 3 | 7% |
| | I agree | 5 | 12% |
| | I strongly agree | 1 | 2% |

## 9.2. Annex II: List of interviewees and interviews structure

Interviews were structured in eight sections which usually covered the following topics: (1) Landscape of cleantech and e-mobility investments in Europe; (2) Obstacles to investment; (3) Relevant policy instruments; (4) Relevant policy attributes; (5) Policy credibility and predictability; (6) Concrete examples; (7) Suggestion on survey structure. Questions for each interview have then been further personalized depending on the background and expertise of the interviewee.

| n | Profile | Company | Job Title |
|---|---|---|---|
| 1 | Investor | CleanTech Capital | Managing director |
| 2 | Investor | Emerald Technology Venture | Partner |
| 3 | Investor | Switzerland Global Enterprise | Head of Cleantech |
| 4 | Investor | Verbier Mobility Investment Forum | Founder and Investor |
| 5 | Cleantech expert | CleanTech Alps | Secretary General |
| 6 | E-mobility expert | Shematic | Chief Executive Officer |
| 7 | E-mobility expert | World Business Council for Sustainable Development | Manager, Mobility |
| 8 | Policy expert | EBP Consulting | Project Manager |
| 9 | Policy expert | OECD Environment Directorate | Empirical Policy Analysis Unit |
| 10 | Policy expert | Swiss Federal Office of Environment | Head of Section Innovation and Member of the Expert Committee of the Swiss Technology Fund |

## 9.3. Annex III: Survey questionnaire

Start

### Survey on Cleantech Investments and Public Policies

You have been invited to participate in this survey because of your professional experience in investment management.

In the following, you will be asked about the main policy factors that influence investments in clean technologies and, in particular, in **e-mobility projects**. However, no specific investment experience in cleantech or e-mobility is required to complete the survey.

This survey is part of the Research Project 'Financing Investments in Clean Technologies' funded by the **Swiss National Science Foundation (SNF)**. The project is expected to produce **concrete policy recommendations** to steer financing towards cleantech investments in Switzerland and Europe.

By entering your email address at the end of the survey you automatically take part in the drawing of one annual subscription to the Bloomberg Businessweek. Also, all participants who provide their addresses will receive a **free copy of the final report**.

**All the answers will be treated confidentially**, and only aggregate results will be made available in our final report.

The survey will take **10 minutes** of your time.

For more information on the research project, please contact cleantech@graduateinstitute.ch.

Thank you very much for the time you'll be investing!

Next

RspndCTExperience

How many years of experience in cleantech investments do you have?

RspndCTExperience=1 ◯ No experience

RspndCTExperience=2 ◯ Less than 5 years

RspndCTExperience=3 ◯ Between 5 and 10 years

RspndCTExperience=4 ◯ More than 10 years

RspndPosition

Which of the following best describes your position in your institution?

RspndPosition=1 ◯ Partner, Director or similar

RspndPosition=2 ◯ Investment Manager, Investment Analyst or similar

RspndPosition=3 ◯ RspndPosition_3_other Other (please specify) [ ]

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0% 100%

InstType

Which of the following categories best describes your institution?

InstType=1 ○ Private Equity Fund

InstType=2 ○ Venture Capital

InstType=3 ○ Corporate Investor

InstType=4 ○ Public Pension Fund

InstType=5 ○ Private Pension Fund

InstType=6 ○ Mutual Fund / Hedge Fund

InstType=7 ○ Bank

InstType=8 ○ Foundation (Charity)

InstType=9 ○ Family Office

InstType=10 ○ InstType_10_other Other (please specify) [ ]

InstSizeWords

What's the approximate total size of assets managed by your institution (in million US$)?
*e.g. "approx. $250 million"*

[ ]

InstLocationOp

Please indicate in which country the headquarter of your institution is located.

[ ]

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0% 100%

InstCTyn

Has your institution already invested in *clean technologies* (cleantech)?

*NOTE: We define cleantech as those technologies/products/services that aim at sustainable utilization of natural resources and which provide for the production of renewable energy. This includes:*
- ***renewable energy production and distribution*** *(e.g. smartgrids, hydropower, energy storage)*
- ***energy efficiency, resource efficency*** *(e.g. water, waste, advanced materials)*
- ***transportation*** *(e.g. e-mobility)*
- ***agritech*** *(e.g. agronomy and sustainable food production)*
- *or other products (e.g. hybrid technologies, prevention of natural disasters).*

InstCTyn=1 ◯ yes

InstCTyn=2 ◯ no

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0% 100%

InstCTEuroTop1

Please indicate the European countries where you invest most in terms of **cleantech**?

first

Please select country ▼

InstCTEuroTop2

second

Please select country ▼

InstCTEuroTop3

third

Please select country ▼

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0% 100%

InstCTpp

What percentage of your total portfolio (or of your portfolio companies) is dedicated to cleantech?

InstCTpp=1
Less than 5%

InstCTpp=2
From 5% to 9%

InstCTpp=3
From 10% to 49%

InstCTpp=4
From 50% to 99%

InstCTpp=5
I only invest in clean technologies

Back Next

0% 100%

InstMtype

What **mobility** technologies have you invested in?

- InstMtype_1 ☐ I do not invest in mobility technlogies
- InstMtype_2 ☐ Internal combustion motors & components
- InstMtype_3 ☐ Hybrid motors & components
- InstMtype_4 ☐ Electric motors & components
- InstMtype_5 ☐ Automated road transport technologies & services
- InstMtype_6 ☐ Batteries
- InstMtype_7 ☐ Fuel cells & alternative fuels (e.g. biogas)
- InstMtype_8 ☐ Mobility-sharing platforms/softwares
- InstMtype_9 ☐ Charging infrastructures
- InstMtype_10 ☐ InstMtype_10_other Other (please specify) ________

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0% 100%

InstEMpp

What percentage of your total portfolio is in ***e****-mobility* projects?

*NOTE: We define e-mobility as including all electric urban means of transportation. This includes Electric Vehicles (EV) - such as full battery electric vehilces (BEVs) and plug-in hybrid electric vehicles (PHEVs) - as well as e-bikes, e-scooters, and e-busses.*

InstEMpp=1 ◯ Less than 5%

InstEMpp=2 ◯ From 5% to 9%

InstEMpp=3 ◯ From 10% to 49%

InstEMpp=4 ◯ from 50% to 99%

InstEMpp=5 ◯ I only invest in e-mobility projects

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0% 100%

InstEMEuroTop1

Please indicate the European countries where you invest most in terms of **e-mobility**?

first

Please select country ▼

InstEMEuroTop2

second

Please select country ▼

InstEMEuroTop3

third

Please select country ▼

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ApBeliefsMarket

Please state to what extent you agree with the following statements:

| | I strongly disagree | I disagree | I am indifferent | I agree | I strongly agree |
|---|---|---|---|---|---|
| "Government intervention is needed to regulate the market economy" | ApBeliefsMarket_r1=1 ○ | ApBeliefsMarket_r1=2 ○ | ApBeliefsMarket_r1=3 ○ | ApBeliefsMarket_r1=4 ○ | ApBeliefsMarket_r1=5 ○ |
| "The necessary change in technology to mitigate climate change will happen even without government intervention" | ApBeliefsMarket_r2=1 ○ | ApBeliefsMarket_r2=2 ○ | ApBeliefsMarket_r2=3 ○ | ApBeliefsMarket_r2=4 ○ | ApBeliefsMarket_r2=5 ○ |
| "Government intervention does more harm than good, let governments stay out of the way" | ApBeliefsMarket_r3=1 ○ | ApBeliefsMarket_r3=2 ○ | ApBeliefsMarket_r3=3 ○ | ApBeliefsMarket_r3=4 ○ | ApBeliefsMarket_r3=5 ○ |
| "My company's investments are likely to be negatively impacted by climate change policies" | ApBeliefsMarket_r4=1 ○ | ApBeliefsMarket_r4=2 ○ | ApBeliefsMarket_r4=3 ○ | ApBeliefsMarket_r4=4 ○ | ApBeliefsMarket_r4=5 ○ |

ApBeliefsEMobility

Please state to what extent you agree with the following statements:

| | I strongly disagree | I disagree | I am indifferent | I agree | I strongly agree |
|---|---|---|---|---|---|
| "Due to the technical advantages of e-mobility, they will automatically be deployed on a large scale" | ApBeliefsEMobility_r1=1 ○ | ApBeliefsEMobility_r1=2 ○ | ApBeliefsEMobility_r1=3 ○ | ApBeliefsEMobility_r1=4 ○ | ApBeliefsEMobility_r ○ |
| "My company sees e-mobility as an investment opportunity" | ApBeliefsEMobility_r2=1 ○ | ApBeliefsEMobility_r2=2 ○ | ApBeliefsEMobility_r2=3 ○ | ApBeliefsEMobility_r2=4 ○ | ApBeliefsEMobility_r ○ |
| "I believe that the future of mobility are EVs rather than internal combustion engine vehicles" | ApBeliefsEMobility_r3=1 ○ | ApBeliefsEMobility_r3=2 ○ | ApBeliefsEMobility_r3=3 ○ | ApBeliefsEMobility_r3=4 ○ | ApBeliefsEMobility_r ○ |

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0% 100%

ApBeliefsCC

Please state to what extent you agree with the following statements:

| | I strongly disagree | I disagree | I am indifferent | I agree | I strongly agree |
|---|---|---|---|---|---|
| "Human activities are an important cause of climate change" | ApBeliefsCC_r1=1 ○ | ApBeliefsCC_r1=2 ○ | ApBeliefsCC_r1=3 ○ | ApBeliefsCC_r1=4 ○ | ApBeliefsCC_r1=5 ○ |
| "In our investment decision, my company also considers recent scientific information on the effects of climate change" | ApBeliefsCC_r2=1 ○ | ApBeliefsCC_r2=2 ○ | ApBeliefsCC_r2=3 ○ | ApBeliefsCC_r2=4 ○ | ApBeliefsCC_r2=5 ○ |
| "The issue of climate change is exaggerated by the media and politicians" | ApBeliefsCC_r3=1 ○ | ApBeliefsCC_r3=2 ○ | ApBeliefsCC_r3=3 ○ | ApBeliefsCC_r3=4 ○ | ApBeliefsCC_r3=5 ○ |
| "Investing in climate change mitigation technologies constitutes more risk than benefits for my company" | ApBeliefsCC_r4=1 ○ | ApBeliefsCC_r4=2 ○ | ApBeliefsCC_r4=3 ○ | ApBeliefsCC_r4=4 ○ | ApBeliefsCC_r4=5 ○ |

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0% 100%

ApBeliefCorona

Given the current health crisis, this survey will also explore the impact of the COVID-19 outbreak.

Again, please state to what extent you agree with the following statements:

| | I strongly disagree | I disagree | I am indifferent | I agree | I strongly agree |
|---|---|---|---|---|---|
| "I expect that the COVID 19 crisis will have a lasting impact on my investment behaviour" | ApBeliefCorona_r1=1 ◯ | ApBeliefCorona_r1=2 ◯ | ApBeliefCorona_r1=3 ◯ | ApBeliefCorona_r1=4 ◯ | ApBeliefCorona_r1=5 ◯ |
| "The COVID-19 crisis is likely to shift the political support from clean technologies to other areas | ApBeliefCorona_r2=1 ◯ | ApBeliefCorona_r2=2 ◯ | ApBeliefCorona_r2=3 ◯ | ApBeliefCorona_r2=4 ◯ | ApBeliefCorona_r2=5 ◯ |
| "My current investments in clean technologies are at risk due to the COVID-19 crisis" | ApBeliefCorona_r3=1 ◯ | ApBeliefCorona_r3=2 ◯ | ApBeliefCorona_r3=3 ◯ | ApBeliefCorona_r3=4 ◯ | ApBeliefCorona_r3=5 ◯ |
| "COVID-19 economic stimulus programmes can be an opportunity to promote cleantech policies and build a greener economy" | ApBeliefCorona_r4=1 ◯ | ApBeliefCorona_r4=2 ◯ | ApBeliefCorona_r4=3 ◯ | ApBeliefCorona_r4=4 ◯ | ApBeliefCorona_r4=5 ◯ |

CoronaOpen

How do you think the COVID-19 crisis will affect your investments in clean technologies and specifically e-mobility?

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Intro1

Now please assume that you have the opportunity to invest in an **innovative battery project for electric vehicles (EVs).** Consider the possibility that the investment could be in different European countries with **different policy frameworks.**

**Everything else remains constant.** E.g. the technology of the batteries, the characteristics of the project team, and the charging infrastructure network are always the same.

Since technological details and the investment type are irrelevant (e.g. equity or debt), please refer to the most common for your company.

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Intro2

In the following questions, **3 characteristics of the policy framework** will be investigated: policy instruments, policy levels and policy revisions. Each characteristic can come in 3 forms (listed in the table below).

| Policy instruments: | Policy levels*: | Policy revisions: |
|---|---|---|
| Tax on combustion fuels | Low policy level | Policy level revised every 2 years |
| Emission performance standards for new cars | Medium policy level | Policy level revised every 5 years |
| Subsidies for EV at purchase | High policy level | Not defined when policy level will be revised |

***Reading example:** If it helps you, you can think of the policy levels as follows:
- **low** policy level = Tax of 0.065$/l diesel (i.e. 25$/tCO2); 120gCO2/km standard; 2'500$ subsidy on EV purchase
- **medium** policy level = Tax of 0.13$/l diesel (i.e. 50$/tCO2); 95gCO2/km standard; 5'000$ subsidy on EV purchase
- **high** policy level = Tax of 0.26$/l diesel (i.e. 100$/tCO2); 80gCO2/km standard; 10'000$ subsidy on EV purchase

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0% 100%

ACAtry759_Rating1

How desirable are the following policy instruments to be part of a policy setting regarding your investment in the battery project?

| | Not Desirable | Somewhat Desirable | Desirable | Very Desirable | Extremely Desiral |
|---|---|---|---|---|---|
| Tax on combustion fuels | ACAtry759_Rating1_1=1 ○ | ACAtry759_Rating1_1=2 ○ | ACAtry759_Rating1_1=3 ○ | ACAtry759_Rating1_1=4 ○ | ACAtry759_Rating1_ ○ |
| Subsidies for EV at purchase | ACAtry759_Rating1_3=1 ○ | ACAtry759_Rating1_3=2 ○ | ACAtry759_Rating1_3=3 ○ | ACAtry759_Rating1_3=4 ○ | ACAtry759_Rating1_ ○ |
| Emission performance standards | ACAtry759_Rating1_2=1 ○ | ACAtry759_Rating1_2=2 ○ | ACAtry759_Rating1_2=3 ○ | ACAtry759_Rating1_2=4 ○ | ACAtry759_Rating1_ ○ |

ACAtry759_Rating3

How desirable are the following policy revisions to be part of a policy setting regarding your investment in the battery project?

| | Not Desirable | Somewhat Desirable | Desirable | Very Desirable | Extremely Desirable |
|---|---|---|---|---|---|
| Policy level revised every 2 years | ACAtry759_Rating3_1=1 ○ | ACAtry759_Rating3_1=2 ○ | ACAtry759_Rating3_1=3 ○ | ACAtry759_Rating3_1=4 ○ | ACAtry759_Rating3_1=5 ○ |
| Not defined when policy level will be revised | ACAtry759_Rating3_3=1 ○ | ACAtry759_Rating3_3=2 ○ | ACAtry759_Rating3_3=3 ○ | ACAtry759_Rating3_3=4 ○ | ACAtry759_Rating3_3=5 ○ |
| Policy level revised every 5 years | ACAtry759_Rating3_2=1 ○ | ACAtry759_Rating3_2=2 ○ | ACAtry759_Rating3_2=3 ○ | ACAtry759_Rating3_2=4 ○ | ACAtry759_Rating3_2=5 ○ |

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Intro3

In the following questions you will be asked to weight the 3 caracteristics (policy instruments, policy levels, and policy revisions) by stating the importance of the difference between your most preferred and least preferred choice.

ACAtry759_Importance1

If two national policy frameworks were identical in all other ways, how important would the following difference be for your decision to invest in this country?

| | Not Important | Somewhat Important | Important | Very Important | Extremely Imp |
|---|---|---|---|---|---|
| Tax on combustion fuels *---instead of---* Subsidies for EV at purchase | ACAtry759_Importance1=1 ◯ | ACAtry759_Importance1=2 ◯ | ACAtry759_Importance1=3 ◯ | ACAtry759_Importance1=4 ◯ | ACAtry759_Import ◯ |

ACAtry759_Importance2

If two national policy frameworks were identical in all other ways, how important would the following difference be for your decision to invest in this country?

| | Not Important | Somewhat Important | Important | Very Important | Extremely Importan |
|---|---|---|---|---|---|
| High policy level *---instead of---* Low policy level | ACAtry759_Importance2=1 ◯ | ACAtry759_Importance2=2 ◯ | ACAtry759_Importance2=3 ◯ | ACAtry759_Importance2=4 ◯ | ACAtry759_Importance2 ◯ |

ACAtry759_Importance3

If two national policy frameworks were identical in all other ways, how important would the following difference be for your decision to invest in this country?

| | Not Important | Somewhat Important | Important | Very Important | Extremely Importan |
|---|---|---|---|---|---|
| Policy level revised every 2 years *---instead of---* Not defined when policy level will be revised | ACAtry759_Importance3=1 ◯ | ACAtry759_Importance3=2 ◯ | ACAtry759_Importance3=3 ◯ | ACAtry759_Importance3=4 ◯ | ACAtry759_Importance3 ◯ |

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Intro4

In this last part, you will be asked to indicate your preferences in **six trade-off choices**.

Please keep in mind that **the technology of the batteries, the characteristics of the project team, the charging infrastructure network remain always constant**. The only differences are the ones explicitly shown in the choice.

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0% 100%

ACAtry759_Pair1

If two national policy frameworks were identical in all other ways, where would you most likely invest?

| High policy level<br>Not defined when policy level will be revised | or | Medium policy level<br>Policy level revised every 2 years |
|---|---|---|

| Strongly Prefer Left | Somewhat Prefer Left | Indifferent | Somewhat Prefer Right | Strongly Prefer Right |
|---|---|---|---|---|
| ACAtry759_Pair1=1 | ACAtry759_Pair1=2 | ACAtry759_Pair1=3 | ACAtry759_Pair1=4 | ACAtry759_Pair1=5 |

**Policy level example:** If it helps you, you can think of the policy levels as follows:
- **low** policy level = Tax of 0.065$/l diesel (i.e. 25$/tCO2); 120gCO2/km standard; 2'500$ subsidy on EV purchase
- **medium** policy level = Tax of 0.13$/l diesel (i.e. 50$/tCO2); 95gCO2/km standard; 5'000$ subsidy on EV purchase
- **high** policy level = Tax of 0.26$/l diesel (i.e. 100$/tCO2); 80gCO2/km standard; 10'000$ subsidy on EV purchase

ACAtry759_Pair2

If two national policy frameworks were identical in all other ways, where would you most likely invest?

| Emission performance standards<br>Policy level revised every 5 years | or | Subsidies for EV at purchase<br>Not defined when policy level will be revised |
|---|---|---|

| Strongly Prefer Left | Somewhat Prefer Left | Indifferent | Somewhat Prefer Right | Strongly Prefer Right |
|---|---|---|---|---|
| ACAtry759_Pair2=1 | ACAtry759_Pair2=2 | ACAtry759_Pair2=3 | ACAtry759_Pair2=4 | ACAtry759_Pair2=5 |

**Policy level example:** If it helps you, you can think of the policy levels as follows:
- **low** policy level = Tax of 0.065$/l diesel (i.e. 25$/tCO2); 120gCO2/km standard; 2'500$ subsidy on EV purchase
- **medium** policy level = Tax of 0.13$/l diesel (i.e. 50$/tCO2); 95gCO2/km standard; 5'000$ subsidy on EV purchase
- **high** policy level = Tax of 0.26$/l diesel (i.e. 100$/tCO2); 80gCO2/km standard; 10'000$ subsidy on EV purchase

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0% 100%

ACAtry759_Pair3

If two national policy frameworks were identical in all other ways, where would you most likely invest?

| Emission performance standards<br>Medium policy level | or | Tax on combustion fuels<br>Low policy level |
|---|---|---|

| Strongly Prefer Left | Somewhat Prefer Left | Indifferent | Somewhat Prefer Right | Strongly Prefer Right |
|---|---|---|---|---|
| ACAtry759_Pair3=1 | ACAtry759_Pair3=2 | ACAtry759_Pair3=3 | ACAtry759_Pair3=4 | ACAtry759_Pair3=5 |
| ◯ | ◯ | ◯ | ◯ | ◯ |

**Policy level example:** If it helps you, you can think of the policy levels as follows:
- **low** policy level = Tax of 0.065$/l diesel (i.e. 25$/tCO2); 120gCO2/km standard; 2'500$ subsidy on EV purchase
- **medium** policy level = Tax of 0.13$/l diesel (i.e. 50$/tCO2); 95gCO2/km standard; 5'000$ subsidy on EV purchase
- **high** policy level = Tax of 0.26$/l diesel (i.e. 100$/tCO2); 80gCO2/km standard; 10'000$ subsidy on EV purchase

ACAtry759_Pair4

If two national policy frameworks were identical in all other ways, where would you most likely invest?

| Tax on combustion fuels<br>Policy level revised every 2 years | or | Subsidies for EV at purchase<br>Policy level revised every 5 years |
|---|---|---|

| Strongly Prefer Left | Somewhat Prefer Left | Indifferent | Somewhat Prefer Right | Strongly Prefer Right |
|---|---|---|---|---|
| ACAtry759_Pair4=1 | ACAtry759_Pair4=2 | ACAtry759_Pair4=3 | ACAtry759_Pair4=4 | ACAtry759_Pair4=5 |
| ◯ | ◯ | ◯ | ◯ | ◯ |

**Policy level example:** If it helps you, you can think of the policy levels as follows:
- **low** policy level = Tax of 0.065$/l diesel (i.e. 25$/tCO2); 120gCO2/km standard; 2'500$ subsidy on EV purchase
- **medium** policy level = Tax of 0.13$/l diesel (i.e. 50$/tCO2); 95gCO2/km standard; 5'000$ subsidy on EV purchase
- **high** policy level = Tax of 0.26$/l diesel (i.e. 100$/tCO2); 80gCO2/km standard; 10'000$ subsidy on EV purchase

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0% 100%

ACAtry759_Pair5

If two national policy frameworks were identical in all other ways, where would you most likely invest?

| Subsidies for EV at purchase<br>High policy level | or | Tax on combustion fuels<br>Low policy level |
|---|---|---|

| Strongly Prefer Left | Somewhat Prefer Left | Indifferent | Somewhat Prefer Right | Strongly Prefer Right |
|---|---|---|---|---|
| ACAtry759_Pair5=1 | ACAtry759_Pair5=2 | ACAtry759_Pair5=3 | ACAtry759_Pair5=4 | ACAtry759_Pair5=5 |
| ○ | ○ | ○ | ○ | ○ |

**Policy level example:** If it helps you, you can think of the policy levels as follows:
- **low** policy level = Tax of 0.065$/l diesel (i.e. 25$/tCO2); 120gCO2/km standard; 2'500$ subsidy on EV purchase
- **medium** policy level = Tax of 0.13$/l diesel (i.e. 50$/tCO2); 95gCO2/km standard; 5'000$ subsidy on EV purchase
- **high** policy level = Tax of 0.26$/l diesel (i.e. 100$/tCO2); 80gCO2/km standard; 10'000$ subsidy on EV purchase

ACAtry759_Pair6

If two national policy frameworks were identical in all other ways, where would you most likely invest?

| Low policy level<br>Policy level revised every 2 years | or | Medium policy level<br>Policy level revised every 5 years |
|---|---|---|

| Strongly Prefer Left | Somewhat Prefer Left | Indifferent | Somewhat Prefer Right | Strongly Prefer Right |
|---|---|---|---|---|
| ACAtry759_Pair6=1 | ACAtry759_Pair6=2 | ACAtry759_Pair6=3 | ACAtry759_Pair6=4 | ACAtry759_Pair6=5 |
| ○ | ○ | ○ | ○ | ○ |

**Policy level example:** If it helps you, you can think of the policy levels as follows:
- **low** policy level = Tax of 0.065$/l diesel (i.e. 25$/tCO2); 120gCO2/km standard; 2'500$ subsidy on EV purchase
- **medium** policy level = Tax of 0.13$/l diesel (i.e. 50$/tCO2); 95gCO2/km standard; 5'000$ subsidy on EV purchase
- **high** policy level = Tax of 0.26$/l diesel (i.e. 100$/tCO2); 80gCO2/km standard; 10'000$ subsidy on EV purchase

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Interview

Would you be available for a 15-20 minutes follow-up interview via phone or Skype?

Interview=1 yes

Interview=2 no

Contact

If you would like to participate in the drawing of the Bloomberg Businessweek subscription and receive a copy of the reports, please write your contact below. The results of the research project are expected to be available after July 2020. We will use this contact in case you agreed to have a follow-up interview.

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ThankYou

Thank you for filling in this survey!

0% 100%