Facilitating a Transition towards a Sustainable Transportation Sector: To what extent are financial government incentives effective in facilitating electric vehicle adoption?

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Electric Vehicles – Facilitating a Transition towards a Sustainable Transportation Sector

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1. Introduction

Climate change and pollution has been one of the most critical issues of this century. According to the World Health Organisation (2022), nearly the whole of our global population consumes air that contains levels of pollutants which exceed WHO guidelines limits. Meanwhile, NASA Goddard Institute for Space Studies (2022) reported that two-thirds of this warming has occurred since 1975 which suggests that environmental challenges are worsening at an accelerated pace. As global warming intensifies, environmental consequences are expected to intensify. These can be natural hazards such as heatwaves, frequent flooding due to sea level rises, and habitat destruction (IPCC, 2018). Hence, climate change is a pressing issue whilst mitigative measures are essential (IPCC, 2018). In order to prevent or mitigate these environmental challenges, various organisations and governments have taken measures as part of their sustainability agendas. Governments are one of the key players involved in climate change mitigation (IPCC, 2018).

Alongside global warming, at the heart of the climate and sustainability agenda has been the topic of energy (IEA, 2022). The transport sector accounts for the greatest portion of fossil fuel usage, contributing to 37% of CO2 emissions from end-use sectors (IEA, 2022). Hence, facilitating a green transition within this sector has been of utmost importance and the Net Zero Scenario necessitates emissions from transport to decline by around 20% by 2030 (IEA, 2022). In order to realise this goal, a rapid electrification of vehicles and energy efficiency measures are essential (IEA, 2022). The electric vehicle (EV) has been considered a promising alternative for transportation, as it utilises a renewable form of energy, and therefore, produces lower greenhouse gas emissions and has better impact on the environment in comparison to conventional alternatives. Hence, EV usage has been considered a form of desirable pro-environmental behaviour. This desirability of EVs have compelled many governments to implement financial policy incentives, such as subsidies and tax benefits, in order to incentivise private vehicle consumers to ditch conventional vehicles for their environmentally-friendly alternatives - EVs (Helveston et al., 2015).

To address environmental challenges, governments around the world have been utilising policy instruments to promote pro-environmental behaviour of various forms amongst the public (Henstra, 2015; Klein et al., 2018). One such measure that is commonly used to encourage a desired behaviour is the subsidy, which is a monetary contribution disbursed by the government

to compensate and lower the costs of mitigation or adaptation measures granted to individuals (Henstra, 2015). Subsidies are commonplace in attempts to encourage individuals to purchase electric vehicles or solar panels (Helveston et al., 2015; van Valkengoed and van der Werff, 2013).

The Dutch government has also implemented such financial policy instruments with aims of prompting consumers towards these green vehicles. In specific, the Dutch government has administered a consumer subsidy scheme for EVs as well as tax benefits. Electric vehicle consumers in the Netherlands are eligible for an EV subsidy (Subsidie Elektrische Personenauto's Particulieren), Motor Vehicle Tax (motorrijtuigenbelasting) benefit and Private Vehicle and Motorcycle tax (belastingen op personenauto's en motorrijwielen) benefit (RVO, n.d.). The State Secretary for the Ministry of Infrastructure and Water Management, Van Veldhhoven, announced that the objective of the subsidy scheme was to improve the accessibility of green transportation and incentivise the public to purchase EVs over conventional engine vehicles (Mission Zero, 2019). This scheme was implemented with the expectation and intention of restoring air quality and bringing down greenhouse gas emissions (Mission Zero, 2019). With the subsidy, consumers can purchase EVs at a lowered cost. As for the tax benefit, vehicle owners driving fully-electric cars are fully exempted from the private motor vehicle tax (RVO, n.d.). Meanwhile, semi-electric vehicle types such as hybrid EVs which emit less than 50 gr CO2 per km are exempt from 50% of the motor vehicle tax (RVO, n.d.).

In recent times, it has been observed that electric vehicles have been becoming increasingly popular. From 2018 to 2021, the total number of EVs around the world have tripled to about 16.5 million (IEA, 2022). As such, there are other potential determinants of EV adoption which have been identified to have a causal impact on EV adoption. For instance, individual-level environmental concerns, intrinsic motivation, and satisfaction with EV charging infrastructure development. Apart from being motivated to perform an action out of extrinsic impetus, an individual may also have an actual and internal tendency to perform an action (Frey, 2012; Ryan and Deci, 2000). This form of a drive stems from within the individual and does not depend on any external incentive (Ryan and Deci, 2000; Budzanowska-Drzewiecka and Tutko, 2021; Chen et al., 2021). With worsening environmental conditions and improving technological pro-environmental innovations, one can also expect individuals to become increasingly intrinsically motivated towards adopting environmentally-friendly products, such

as the EV. Furthermore, alongside consumer subsidies, governments have also been investing into EV charging infrastructure, which has also been found by some studies to have a positive impact on EV purchasing (Huang & Ge, 2019; Hoen and Koetse, 2014; Krupa et al., 2014).

With that, how much of the observed spikes in EV adoption can actually be owed to the financial incentives being provided by governments? Are subsidies and tax benefits even causally related to EV adoption? By merely looking at the changes in the portion of vehicles which are EVs upon the implementation of these financial incentive policies, we cannot ascertain the effectiveness of these measures on EV adoption. Moreover, subsidies cannot be considered effective if they predominantly attract individuals, such as intrinsically motivated people, who would have purchased an EV or considered doing so even without the subsidy (Henstra, 2016; van der Werff and Valkengoed, 2022). Hence, by taking into consideration green intrinsic motivation levels, this paper aims to investigate if financial incentive policies have been effective in attracting even new groups of consumers who would not have preferred EVs if not for the impetus of these extrinsic fiscal incentives.

As such, this paper aims to answer the following research question:

"To what extent are financial government incentives effective in facilitating electric vehicle adoption?"

This paper aims to add to current research by not only studying the independent effects of extrinsic monetary fiscal incentives EV adoption, but also the interaction effect of extrinsic rewards and intrinsic drives on the final outcome of EV preferences. In studying the independent effects of these extrinsic incentives alongside the effects of intrinsic motivations and charging infrastructure satisfaction, as well as potential relationships between these variables, we can have a clearer and nuanced understanding on the impact of these financial policies and ward off any potential overestimations of incentive effects. This also allows us to distinguish the effects of fiscal incentives from existing intrinsic motivations that were already likely to prompt an individual towards electric vehicles. Such a distinction ensures a more accurate understanding of the effectiveness of monetary fiscal incentives in terms of encouraging individuals who would not have otherwise preferred an electric vehicle over a conventional vehicle.

Furthermore, this study explores the presence of any crowding effects that the incentives hold on green intrinsic motivation. In doing so, this research aims to dig deeper into understanding

the impacts of subsidies and tax benefits towards realising sustainable private transportation goals by screening for any detrimental impact these fiscal incentives could have on the intrinsic motivation of individuals. By testing for the impact of subsidies and tax benefits on intrinsic motivation effects in the context of EV adoption outcomes and different intrinsic motivation levels, we can understand if such extrinsic rewards are truly helpful in attaining goals for cleaner transportation. In the event that the financial government incentives provided to consumers affect the impact of their intrinsic motivation on EV adoption, these extrinsic rewards cannot be considered favourable.

Potential crowding-out effects of external incentives on the strength of intrinsic motivations are especially important to prevent and mitigate as these can induce negative spill over effects which also weaken other forms of green behaviours (Truelove et al., 2014; Frey, 2012; Coad et al., 2009). Such a spill over effect can lead to a downward spiral in terms of environmental outcomes as individuals anticipate financial compensation for pro-environmental actions and withhold from behaving in an environmentally-friendly manner otherwise.

Moreover, this paper takes on a micro-level approach to assessing the impact of financial fiscal incentives. Thus far, a vast majority of existing research on the effectiveness of fiscal incentives in encouraging environmental action have been conducted on a macro-level, with assessments based on aggregated outcomes (van Valkengoed and van der Werff et al., 2013, 2022). Various studies have reported conflicting findings on the impact of subsidies (e.g., Matisoff and Johnson, 2017; Mees et al., 2013; Nicolini and Tavoni, 2017; Sierzchula et al., 2014). Due to the presence of intrinsic motivations, one cannot definitely conclude that the subsidies and tax benefits are indeed effective in realising sustainable private transportation goals solely by considering the recent spikes in EV adoption rates. Hence, this paper aims to present nuanced findings on the basis of micro-level preferences in order to evaluate the value financial government incentives bring to spurring EV adoption. Thereafter, upon evaluating the impact of fiscal incentives and highlighting the various policy implications, this paper presents some policy recommendations which are made on the basis of empirical findings.

2. Theoretical Background

This chapter reviews academic literature relevant to extrinsic rewards and intrinsic motivations towards both general pro-environmental behaviour and EV purchasing, as well as literature on the role of charging infrastructure in consumer decisions to adopt EVs. In doing so, this chapter lays down the theoretical foundation for the subsequent research, forming a basis for the hypotheses developed within this study and guiding data analysis. Firstly, the concept of extrinsic incentives is introduced along with its impact on green behaviour or EV adoption. Thereafter, the concept of intrinsic motivation is presented and explored. Thirdly, existing literature on the relationship between extrinsic rewards and intrinsic motivation on green behavioural outcomes and EV adoption is examined, whilst introducing the motivation crowding theory. Lastly, the role of charging infrastructure on EV purchasing outcomes is explored. At the end of each subsection, hypotheses concerning these concepts and the relationships between them are constructed for further investigation of EV adoption.

2.1 Extrinsic Financial Government Incentives

As a relatively innovative fuel-efficient vehicle, the price of EVs tends to be higher than that of regular conventional vehicles (Coad et al., 2009; Lieven et al., 2011). This can cause consumers, who make price considerations during decision-making, to repel from EVs (Helveston et al., 2015; Bonges and Lusk, 2016). With EV usage, there is a latent conflict between collective benefits and private costs, which is also usually the case for many forms of green behaviour (Steg and Vlek, 2009). On one hand, EVs are considered to bring about significant collective benefits or positive externalities, for instance reduced air pollution and reduced fossil fuel dependency (Bockarjova and Steg, 2014; Pistoia, 2010). However, on the other hand EV usage entails private costs which are borne by the individuals who purchase EVs (Bockarjova and Steg, 2014). These private costs are present financially in the form of the typically higher purchasing prices of EVs in comparison to their conventional alternatives, as well as non-financially in the form of the behavioural adjustments which EV drivers have to undertake, in relation to their driving habits and charging, when switching to an EV from a conventional vehicle (Bockarjova and Steg, 2014).

In attempts to encourage consumers to make green choices, such that environmental challenges can be addressed, many governments have employed financial incentives as policy instruments to reduce consumers' financial barriers to adopting electric vehicles and improve the attractiveness of these green vehicles (Susilo, 2016; van der Werff et al., 2013; Diamond, 2009). Such external incentives are aimed to serve the purpose of a 'carrot' or reward, which can potentially induce a desired pro-environmental behaviour by reducing the financial costs of a requisite behaviour (Zyl, 2022; Costa, 2021). Therefore, improving the attractiveness of that particular behaviour. This approach of providing external rewards seeks to satisfy individualistic hedonic and gain goals by boosting the personal benefits or reducing the private costs of a particular desired behaviour (Steg et al., 2014; Lindenberg and Steg, 2007);). For instance, subsidies are provided to discount the costs of adopting an electric vehicle and improve their cost attractiveness to potential car owners (Helveston et al., 2015). These extrinsic rewards in the form of fiscal incentives can promote desirable green behaviour, even in situations whereby pro-environmental choices are relatively costlier than their alternatives or when it is less feasible to adopt an environmentally-friendly choice (Steg et al., 2016). In the case of pro-environmental behaviour, policymakers have been seen to utilise extrinsic fiscal incentives such as subsidies and tax benefits to prompt individuals to behave in a manner which is beneficial to the environment and prevent its further degradation, for example using greener transportation modes or recycling plastic. These policy instruments have been construed as a means to achieving sustainability goals and improved environmental outcomes and efficiency, such that EVs are not under consumed (Garella, 2021). The theoretical effects of these extrinsic incentives shall be discussed further in Section 2.3, as well as Figure 1 and Figure 2.

Policy incentives to stimulate electric vehicle use influence the attributes of the electric vehicle because they influence the generalised costs of EVs. Subsidies, tax rebates or congestion charge exemptions influence the price of the electric vehicle by lowering it. Such monetary fiscal incentives have been found to generally increase the attractiveness of electric vehicles, causing these fiscal tools to be considered an effective method of increasing EV adoption (Langbroek et al., 2016). Some studies, however, also raise doubts on the effectiveness of green subsidies in achieving environmental outcomes (Matisoff and Johnson, 2017; Mees et al., 2013; Nicolini and Tavoni, 2017; Sierzchula et al., 2014). Nonetheless, various studies have investigated the impact of fiscal incentive measures on EV adoption to find support for these policy instruments. Coad et al. (2009) divided consumers into extrinsically-motivated consumers and intrinsically-

motivated consumers; findings revealed that extrinsic financial incentive schemes may be more persuasive than information-provision policies in promoting the adoption of EVs as they appeal to individuals who have low intrinsic motivation. Fearnley et al. (2015) analysed the electromobility incentives across Europe and found that the electromobility incentives successfully motivate consumers to adopt EVs and furthering the green transportation market. Li et al. (2015) explored the factors affecting EV adoption in 14 international cities/regions and found that subsidies and tax incentives are indispensable in the development of EVs. A conjoint survey was conducted on EV preferences across USA and China by Helveston et al. (2015); results indicated that American consumers preferred plug-in hybrid EVs with low driving range despite subsidies and Chinese consumers are willing to purchase mid-range, but not low-range, EVs and and Plug-in EVs of low driving range at prices similar to their conventional, gasoline-based engine alternatives. Hence, suggesting that context matters for the success of financial fiscal incentives in realising desirable EV outcomes.

Theory postulates that subsidies have an important role to play in encouraging consumers to behave in a particular desired manner by reducing the costs of that behaviour, and therefore improving the attractiveness of it. Likewise, prior research has provided some evidence that financial incentive policy measures can lower the price of EVs and help consumers decrease the cost of adopting EVs, and facilitate EV adoption by spurring consumers towards EVs as opposed to their conventional alternatives (Potoglou and Kanaroglou, 2007; Li et al., 2016; Coad et al, 2009; Fearnley et al., 2015). Hence, it is reasonable to speculate that when financial government incentives are provided, consumers are more inclined to adopt EVs. Thus, this study proposes the following hypothesis:

Hypothesis 1: Financial fiscal incentives positively impact EV adoption in the Netherlands.

2.2 Intrinsic Motivation

Nonetheless, extrinsic incentives are not necessarily the only source of motivation for individuals to engage in environmentally-friendly practices. People are motivated by more than mere monetary external rewards. Intrinsic motivations also have a crucial role to play in

behavioural outcomes. Hence, it is useful to evaluate subsidy effectiveness by taking this factor into consideration. In fact, fiscal incentives can be considered effective if they encourage new groups of individuals to engage in a particular desired behavioural action, which they would otherwise would not have partaken in if not for the impetus of this extrinsic incentive (van Valkengoed and van der Werff, 2022). In order to assess the effectiveness of an incentive scheme in motivating a new group of individuals towards a desired action, we need to recognise which groups of individuals are likely to undertake an action even without the incentive and which individuals would not have done so (van Valkengoed and van der Werff, 2022). If one who was unlikely to undertake a particular preference or action, but they change their mind due to the extrinsic stimulus of a tax benefit or subsidy, we can consider these incentives effective. Hence, in this study, intrinsic motivation levels are taken into account to critically assess the impact of financial government incentives. As such, if fiscal incentives are found to have a positive and significant direct impact on EV adoption despite taking into consideration varying intrinsic motivation levels, we can consider these incentives effective.

The concept of intrinsic motivation has been emphasised through the self-determination theory (Ryan and Deci, 1985; Ryan and Deci, 2000). The self-determination theory distinguishes intrinsic motivation apart from extrinsic forms of motivation. In light of the self-determination theory, environmentally-friendly behaviour, such as EV usage, can be inherently rewarding to an individual regardless of the presence of extrinsic stimulants such as government incentives. Intrinsic motivation is defined as an actual and internal tendency to perform an action (Ryan and Deci, 2000). This form of a drive stems from within the individual and does not depend on any external incentive (Ryan and Deci, 2000; Budzanowska-Drzewiecka and Tutko, 2021; Chen et al., 2021). Intrinsic motivation primarily concerns the personal satisfaction or pleasure derived from performing a certain desirable action (Wu et al., 2019). In fact, some past studies have found intrinsic motivation, in general, to have a stronger impact on behavioural outcomes than extrinsic motivation (Harpine, 2015; Pinder, 2011). Ejelöv et al. (2022) posited that intrinsic motivation has a stronger impact, as opposed to extrinsic factors, on general pro-environmental purchasing behaviour (2022). Prior research has even found intrinsically-driven individuals to engage in environmentally-friendly practices in spite of it being costly or requiring additional effort (Steg et al., 2012) and regardless of the provision of external rewards (Steg et al., 2016; van der Werff et al., 2013). Such a motivation to make environmentally-friendly choices stems from within oneself due to their personal attitudes and norms, and not

due to external rewards (Frey, 2012; Ryan and Deci, 2000; van der Werff et al, 2013). This suggests that green intrinsic motivation levels could not only positively impact EV adoption, but also potentially act as a stronger determinant, in comparison to extrinsic rewards, in encouraging consumers to adopt electric vehicles as their personal transportation mode instead of their conventional alternatives. Hence, it is important to account intrinsic motivation as a factor while critically evaluating the success of EV subsidies and tax benefits. Especially considering that environmental issues, such as pollution and global warming, have also been exacerbated in the recent decades, to what extent are the spikes in EV adoption in fact due to these fiscal incentives and not merely due to increasing environmental intrinsic motivations?

There are two varied types of green intrinsic motivation: 1) enjoyment-based intrinsic motivation and 2) obligation-based intrinsic motivation (van der Werff et al., 2013; Steg et al., 2016). The first type of intrinsic motivation is one that stems from a particular behaviour being enjoyable for an individual to engage in, hence motivating them to partake in it. Such enjoyment-based intrinsic motivation is similar to the definition of intrinsic motivation in self-determination theory (Ryan and Deci, 2000), whereby intrinsic motivation is defined as a drive which prompts an individual to engage in a particular action because it is interesting or enjoyable by itself. Enjoyment is regarded as a hedonic and emotional aspect of one's perception and it arises from intrinsic motivation towards an object or behaviour that is of inherent interest to the individual (Ryan and Deci, 2000). Since EVs are relatively novel, environmentally friendly and innovative in comparison to conventional private transportation vehicles, it is likely that there is a presence of enjoyment-based intrinsic motivation for some consumers, which drives them to adopt these vehicles. This type of intrinsic drive is assumed by an individual in pursuit of hedonic gain and can explain situations where individuals take a certain course of action due to the fact that it is interesting or enjoyable to them (Ryan and Deci, 2000; Taufik et al., 2014). This includes the purchasing of environmentally-friendly products, such as eco-friendly apparel for example, because it is an enjoyable experience for the individual (Ahn et al., 2020).

Thus far, a vast majority of academic literature on pro-environmental behaviour has centred focus on obligation-based intrinsic motivation and ignoring enjoyment-based intrinsic motivation. However, moral obligation is not the only type of motivation relevant to pro-environmental behaviour. Several authors have posited the relevance of enjoyment-based

intrinsic motivation to environmentally-conscious behaviour (Ahn et al., 2020; Kim and Seock, 2019; Groot and Steg, 2010; Lindenberg and Steg, 2007; Taufik et al., 2014). This line of argument was also undertaken by De Young (2000) who noted that individuals can consider some pro-environmental actions as worth engaging in when these actions are consistent with the values that make them feel good in enjoyment. Hence, driving these individuals to partake in pro-environmental behaviour out of their own interest. Similarly, other studies have also proven that behaving in a pro-environmental manner is not merely just a moral obligation, but it can also be a hedonistic and enjoyable experience for the individual engaging in it (Kim and Seock, 2019; Ahn et al., 2020; Fatoki, 2022). For instance, Kim and Seock (2019) found evidence to show that enjoyment-based intrinsic motivation positively affects the purchase of eco-friendly apparel.

Nonetheless, it is relevant to note that some authors have argued that not all types of pro-environmental behaviour, however, can be considered for enjoyment-based intrinsic motivation. Lindenberg and Steg (2007) note that not all environmentally friendly behaviours are pleasurable or enjoyable, suggesting that individuals who want to plainly feel good might not necessarily participate in pro-environmental behaviour because it can involve personal sacrifices such as inconvenience.

Taking a similar stance, van der Werff et al, (2013) put forth their opinion that certain types of pro-environmental behaviour such as electricity-saving behaviour is difficult to justify in terms of inherent satisfaction, in the form of enjoyment, to the individual performing it. In an attempt to justify their point, van der Werff et al. (2013) provided more examples, noting that cycling can be more costly than driving in terms of effort and consuming a reduced amount of energy for heating at home also reduces the level of comfort to an individual. Hence, explaining that an individual might continue to partake in such green behaviour despite the costs attached to it due to the second type of intrinsic motivation instead, obligation-based intrinsic motivation. However, this line of argument has been refuted by several authors in their work. Taufik et al. (2014) showed that one can experience enjoyment regardless of the costs of green behaviour, experience a warm glow, and pursue their hedonic goals merely by engaging in it. Their study illustrates the warm glow effect experienced by individuals just from knowing that they had behaved in an environmentally friendly manner. Furthermore, Ahn et al. (2019) argued that individuals can get involved in pro-environmental behaviour simply because they feel

satisfaction from doing so. In fact, findings by Fatoki (2022) prove that both enjoyment-based and obligation-based intrinsic motivation is positively related even to energy conservation behaviour, an area for which Werff et al. (2013) had initially dismissed the relevance of enjoyment-based intrinsic motivation.

Moving further, the second type of intrinsic motivation, on the other hand, is a type of drive in which an individual feels compelled to perform a certain action due to a sense of obligation (van der Werff et al., 2013). Barbarossa et al. (2017) describe moral obligation as one's own inner state construct which focuses on how an individual feels a sense of responsibility to act morally in an ethical situation. For example, a sense of obligation to act in an environmentally-friendly manner in the face of global warming. Obligation-based intrinsic motivation aligns with personal norms which gives individuals the feeling of moral obligation to perform a behaviour (van der Werff, 2013; Steg et al, 2016). Moral obligations, or personal norms, have been found to cause preferences for pro-environmental behaviour. Individuals with obligation-based intrinsic motivation to perform a certain action choose to do so because they believe that it is the right thing to do. For example, one may feel a sense of moral obligation to behave in an environmentally-friendly manner and ensure that they reduce their negative impact on the environment, hence causing them to purchase an EV instead of a conventional vehicle. Or, they may feel a sense of guilt if they were to not behave in a manner that is environmentally-friendly and therefore, choose to purchase an EV instead of a conventional vehicle. Guilt has been found to consistently spur pro-environmental intentions and behavioural outcomes (Hurst and Sintov, 2022). This is a negative emotion which triggers action tendencies, such as compensatory efforts and apology, in response to an outcome for which one feels personally responsible (Hurst and Sintov, 2022; Haidt, 2003). EV drivers may intend to use this mode of transportation due to the relatively stronger negative environmental consequences of conventional transport (Egbue and Long, 2012; Krupa et. al, 2014).

Obligation-based intrinsic motivation holds an aspect of introjected regulation. Introjected regulation refers to a state of internalised guilt through which an individual feels motivated to partake in a certain type of behaviour out of a sense of seeking approval from either oneself or others as defined by Ryan and Deci (2000). This is a motivation that is formed on the basis of a commitment to principles, values and norms, as well as the personal pleasure, or warm glow, it gives the individual for acting out of their personal norms which are rooted in doing the right

thing. Such intrinsic motivation rooted in personal values has been argued to have a possible effect on one's personal choice to adopt green behaviour. The personal pleasure one may experience for acting out on the basis of their personal norms can be reflected as a literal warm glow, whereby the individual feels positive emotions (Taufik et al., 2014). However, some researchers argue that such a 'feel-good' effect of intrinsic motivation is contingent on the cost of the pro-environmental behaviour and may, therefore, such a drive may not be significantly predictive of all types of green actions (van der Werff et al., 2013). Hence, it would be important to confirm the effect of intrinsic motivation in the specific context of EV adoption within the Netherlands to confirm the relevance of green intrinsic motivation in this case. Findings from a study conducted by van der Werff et al. (2013) demonstrated that sentiments of moral obligation, also referring to one's personal norm, held a mediating effect on the relationship between environmental self-identity and environmental intentions.

The behavioural outcome stemming from obligation-based intrinsic motivation is one that is motivated by a normative goal frame, unlike a hedonic goal frame as in enjoyment-based motivation. When one's normative goal is strongest in comparison to hedonic or gain goals, they will particularly consider behaving in a manner in which they consider to be morally right (Steg et al., 2016). For example, by making personal contributions towards ensuring a clean environment because they believe that is the right thing to do. These individuals are particularly sensitive to what they ought to do according to themselves and others around them (Lindenberg and Steg, 2007). Thus, they are more likely to base their actions upon personal norms and injunctive norms, perceptions of what their counterparts would approve or disapprove of (Steg et al, 2016).

As far as the importance of obligation-based intrinsic motivation on environmental preferences and behaviours is concerned, some past research suggests that this drive stemming from within the individual has a lasting impact on desirable behavioural outcomes. It has been found that when people decide to act pro-environmentally out of intrinsic motivation because they believe it is the right thing to do, as opposed to an impetus from extrinsic rewards, change is much more likely to be stronger and sustained over time (van der Linden, 2015). In fact, one of the main insights of SDT is that control through internal regulation rather than through external intervention by a principal may be more efficient due to a cognitive-motivational positive feedback effect from the agent, which can warrant the sustainability of a desired behaviour into

the future (Ryan and Deci, 2000; Festre & Garrouste, 2014). In fact, prior research has often found that extrinsic incentives cease to bring about positive change in the long run (Lehman and Geller, 2004), at least partly due to removing focus from the intrinsic motivations underlying desirable behaviour (Dolan and Galizzi, 2015). Hence, it is likely crucial to preserve individual intrinsic motivations to effectively promote desirable green behavioural outcomes, such as EV adoption.

The fact that intrinsic motivations elicit long-lasting change and positive feelings, or a 'warm glow', suggests that behavioural policies targeted towards building and preserving public intrinsic motivations could be particularly integral to effectively promoting EV adoption. Nonetheless, one could still argue that extrinsic incentives also derive positive emotions within individuals. However, due to the supposed strength and sustained impact of intrinsic motivations on pro-environmental behaviour, it is important not to dismiss the possible relevance of intrinsic motivations in facilitating EV adoption. In fact, it has been found that intrinsic motivation has been the main driver for intention and behaviour to adopt an electric vehicle (Zhang et al., 2022). Intrinsic motivation can be an important determinant of consumer behaviour as it is a motivation to act that comes from within the individual (Coad et al., 2009). If individuals are genuinely concerned about the state of the environment, their behaviour can be guided by 'environmental morale' even if there is a cost involved (van der Werff et al., 2013). Furthermore, extrinsic incentives have been found by several studies to have crowding-out effects on intrinsic motivations, which will be further explained in the next subsection 2.3. In the case that these crowding-out effects do exist in the context of EV adoption, it will be important to pay attention towards it and possibly consider making revisions to green transportation strategies to emphasise intrinsic motivations. These findings point to the importance of considering green intrinsic motivation for policy making.

However, notably, it has also been found that there may be limits on the degree to which environmentally-friendly behaviour is impacted by intrinsic motivation: "People are prepared to follow their environmental conscience provided the cost of doing so is not too high" (Frey, 1999, p404). Hence, warranting further evaluation of the impact of green intrinsic motivation towards EV adoption behaviour as it is not necessarily always the case that green intrinsic motivations impact green preferences or behavioural outcomes. In the context of EVs, intrinsic motivation has been found to positively impact EV purchasing (Langbroek et al., 2016).

Meanwhile, results from a study conducted by Barbarossa et al. (2015) indicate the positive impact of personal norms, which is indicative of obligation-based intrinsic motivations, on preferences towards EVs in the context of Belgium, Italy, and Denmark. Likewise, Globisch et al. (2018) revealed through their study on German consumers that intrinsic motivation has a positive impact on battery-operated EV procurement. Van der Werff et al. (2013) studied the relationship between obligation-based intrinsic motivation and consumer intention to utilise green energy. Results from that study revealed that obligation-based intrinsic motivation is in fact a determinant of the intention to utilise renewable energy. Similarly, the study by Kim (2016) also found that obligation-based intrinsic motivation has a positive impact on eco-friendly clothing purchases, alongside enjoyment-based intrinsic motivation. Barbossa et al (2017) find that moral obligation is a significant antecedent to consumer intentions of utilising EVs. Hwang et al. (2015) examined the relationship moral obligation across Generation Y individuals and purchase intention of green products. Results from their study indicate a significant positive relationship between moral obligation and consumer intentions to use organic and recycled products over traditional products. These findings suggested that individuals with a strong obligation-based intrinsic motivation are likely to engage in pro-environmental behaviour, owing to their feelings of moral obligation.

Overall, it has been found that intrinsic motivation and relevant environmental attitudes can promote positive environmental behaviours in individuals (Kollmuss and Agyeman, 2022). Meanwhile, the positive impact of intrinsic motivation on EV adoption has also been found within various contexts (Barbarossa, 2015). Hence, theory and past research point to the following hypothesis:

Hypothesis 2: Green intrinsic motivation positively impacts EV adoption in the Netherlands.

2.3 The Interaction between Extrinsic Incentives and Intrinsic Motivation

Although intrinsic motivation can be an important source of environmental preferences, it can be "difficult to evoke and target" in order to achieve desired behavioural outcomes (Frey, 1999, p411). Furthermore, some individuals have low levels of green intrinsic motivation and this

alone might be insufficient to successfully prompt the masses towards green alternatives. As a result, under practical settings, environmental policy often attempts to complement intrinsic motivation with external interventions and incentives as these two can possibly work hand-in-hand to stimulate desired behavioural outcomes (Buenstorf & Cordes, 2008). However, for now, we shall look into various studies which have attempted to investigate the impact of extrinsic rewards on intrinsic motivations as suggested by the motivation crowding theory and cognitive evaluation theory.

Within the larger theoretical framework of the self-determination theory, there is a sub-theory that focuses on explaining the effects of external factors on intrinsic motivation levels - the Cognitive Evaluation Theory (CET) (Ryan and Deci, 1985; Ryan and Deci, 2000). Fiscal incentives can either crowd out intrinsic motivations or boost intrinsic motivations and have a combined effect along with intrinsic motivations on EV adoption (Ryan and Deci, 2000). The CET finds evidence for crowding-out effects only for behaviours where intrinsic motivation was high prior to the introduction of extrinsic rewards. The CET specifies that the social context will have an important impact on the direction and magnitude of the impact extrinsic rewards can have on intrinsic motivation, acknowledging that extrinsic rewards can be administered in some contexts without having no effect on inner motivation or even increasing the strength of intrinsic drives. This is in contrast to claims that all extrinsic rewards decrease intrinsic motivation, which seems to not necessarily be true. Hence, in order to ascertain the effect of extrinsic fiscal incentives on intrinsic motivations, case-specific research is helpful. In the event that financial fiscal incentives do crowd out green intrinsic motivations, one cannot come to a firm and assured conclusion that these external rewards are entirely helpful in facilitating environmentally-friendly behaviour such as EV usage. If fiscal incentives have a negative impact of watering down intrinsic motivations, which are also considered to be another important source of impetus for EV adoption and general green behaviour, they may be counterproductive in achieving sustainability goals. The contents of the Cognitive Evaluation Theory are also aligned with the motivation crowding theory, which suggests that external intervention through financial incentives (‘the carrot’) and punishments (‘the stick’) could change the impact of intrinsic motivation by either potentially undermining it or intensifying it under various other identifiable conditions (Frey and Jegen, 2001). The crowding-out effects are also alternatively referred to as ‘the cost of price incentives' or ‘the hidden cost of reward’ (Frey, 1999). According to Frey and Jegen (2001), external intervention in the form of

monetary rewards can transform the nature of a good or relationship fundamentally. Sometimes, the provision of a financial incentive even has a detrimental possibility of completely destroying hopes for a particular behaviour or good. Surely, due to the crowding-in effects of incentives in some situations, there is a possibility that environmental public policy could benefit from including both intrinsic and extrinsic factors in relation to consumer motivation. However, excessive or inappropriate administration of financial government incentives can undermine the environmental morale of individuals and crowd out the positive effects of intrinsic motivation (Frey, 1999; Coad et al., 2009).

There has been conflicting empirical evidence surrounding the interaction between extrinsic rewards and intrinsic drives (Frey and Jegen, 2001, Gneezy et al., 2011). Several studies conducted by behavioural economists found that when an action is driven by intrinsic impetus, offering people extrinsic rewards decreased people's intrinsic interest in the activity (Gneezy and Rustichini, 2000a). However, other studies have found that extrinsic rewards can increase or complement intrinsic interests rather than decrease them (Harackiewicz, 1979; Ryan, 1982; Disney et al., 2013). Considering these two conflicting viewpoints, further analysis was conducted within this paper, as reported in sections 4 and 5, to discern how extrinsic financial government incentives impacted the effect of intrinsic motivations on EV usage within the Netherlands.

Some past research points to the presence of crowding out effects of extrinsic rewards on intrinsic motivation in the context of environmental behaviour. Such negative moderating effects of extrinsic rewards on intrinsic motivation and its outcome have been alternatively known as the "undermining effect," "overjustification effect," "the hidden costs of reward", or "corruption effect" (Frey, 2012; Deci and Ryan 2000) by the psychological scholars involved. It has been argued that extrinsic rewards can compromise the purity of a pro-environmental choice and cause people to place their central focus on obtaining more extrinsic benefits, which results in the crowding-out of the influence green intrinsic motivation can have on green behavioural outcomes (Frey, 2012). Similarly, recently conducted field studies have commonly found that incentivized conservation programs reduced residents' pro-environmental motivation (Ling and Xu, 2021; Agrawal et al., 2015; Chervier et al., 2019; Moros et al., 2019). Nayum et al. (2022) found that extrinsic interference has a detrimental impact on intrinsic motivations to purchase an EV within the context of Norway. Similarly, Haustein and Jensen

(2018) argued that intrinsic motivations to purchase an electric vehicle would be undermined by extrinsic factors, such as excessive financial incentives. Furthermore, they provided a policy suggestion to reduce financial incentives. In justification for this recommendation, they explained that sustainable transportation goals are better achieved with reductions in financial incentives as normative factors become the primary motivations for battery-operated EV usage amongst the population of Danish and Swedish consumers.

In fact, such crowding-out effects of intrinsic motivations due to extrinsic rewards have seemed to be found even outside the context of environmental behaviour. Rommel et al (2015) as well as Benabou and Tirole (2006) provided evidence for disruptions to desirable pro-social behaviour upon the provision of incentives. Similarly, Uri Gneezy and Aldo Rustichini (2000b) found that fewer donations were collected by schoolchildren volunteering for charitable organisations when they were conferred with performance rewards; this points towards the deleterious effects of extrinsic incentives on intrinsic motivations. More recently, Weinberg (2016) found evidence for a similar negative impact of extrinsic rewards in the context of learning and performance quality among students. Findings from this study suggested that students display weaker intrinsic motivation and lesser subsequent interest in performing tasks upon receiving extrinsic rewards for completing a task. Upon conducting both laboratory and field experiments, Ostrom (2000) revealed that extrinsic rewards have a crowding-out effect on intrinsic motivations in collective action situations. Findings from a study by Ostrom (2014) suggest that individuals' motivation to cooperate is undermined when they are extrinsically prompted to cooperate. Houser et al. (2008) as well as Bracht and Feltovich (2007) find similar results in labs.

Figures 1 and 2 explain how the price effect and crowding-out effects stemming from extrinsic incentives manifest, as described by Weibel et al. (2014) and Frey (2000; 2012). As such the crowding-out effect and price effect, which both stem from the external incentives, work in opposing directions (Gneezy and Rustichini, 2011; Frey, 2012; Weibel et al., 2014). As depicted by Figure 1, the extrinsic incentive works to improve the behavioural outcome (in question. In this case, that outcome would be EV adoption. With the extrinsic fiscal incentive (FI), desired behaviour increases from A1 to A2. However, with a crowding-out effect, an extrinsic incentive can also potentially thwart the behavioural outcome and shifts the supply curve from S to S' as shown in Figure 2. Hence, causing the final behavioural outcome to have

a net decrease and reach A3. This is what is known as the 'hidden cost' of incentives (Frey, 2012). Hence, if crowding-out effects are present, fiscal incentives may be counterproductive.

Figure 1: Price Effect of Extrinsic Incentives (Weibel, 2014; Frey, 2012)

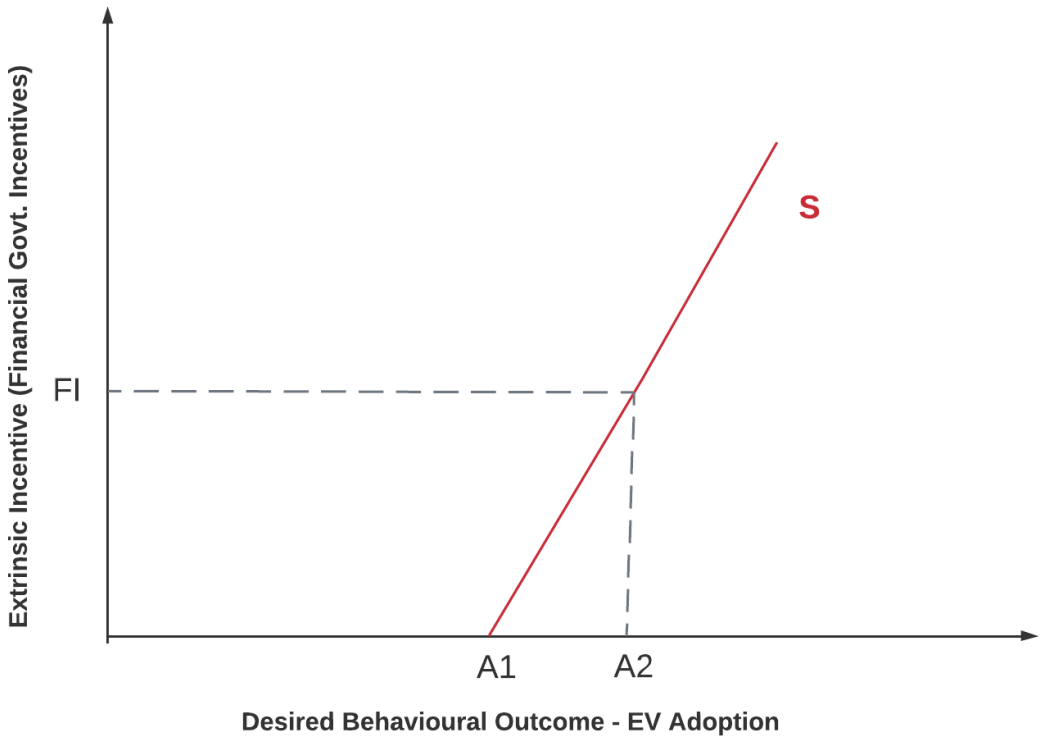
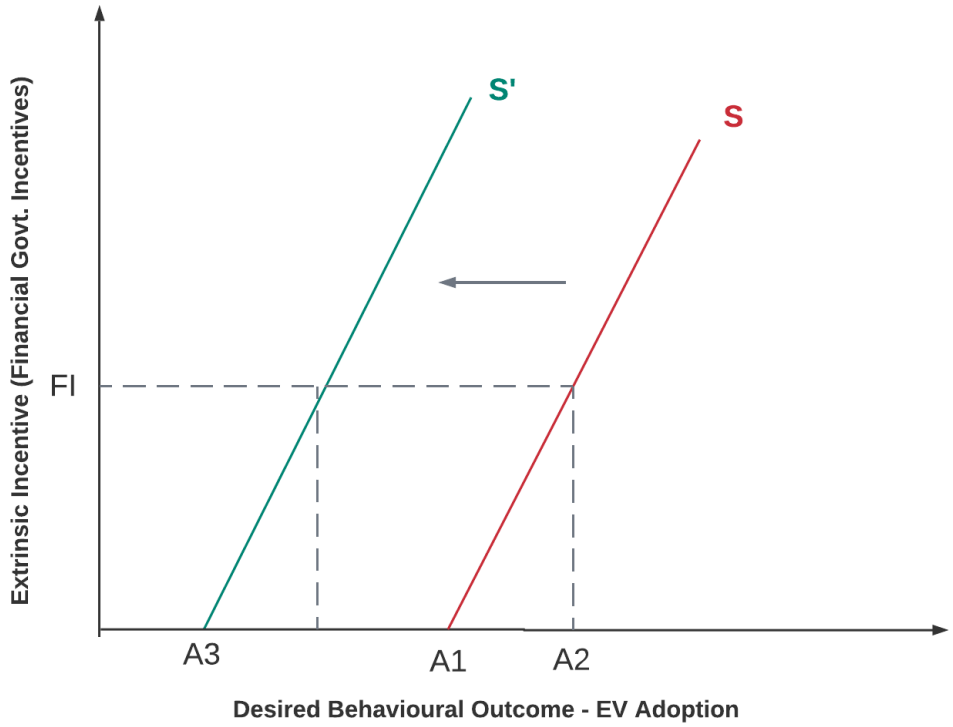


Figure 2: Net Price Effect and Crowding-out effects of extrinsic incentives on intrinsic motivation (Weibel, 2014; Frey, 2012)



Frey (2012) explains how financial incentives can shift the locus of control outside of the person, replacing intrinsic motivation with an extrinsic behaviour that responds to external stimuli. If individuals' behaviour is controlled by external factors, they view the environment as the responsibility of the government rather than as their own cause. As a result, cooperative behaviour may actually decrease after the introduction of financial incentives aimed at encouraging cooperative behaviour (the "carrot"). Due to this, otherwise green consumers may lose environmental morale when they notice that other consumers are 'getting away with' non-cooperative behaviour. To account for the crowding-out effect Frey (1999, p.410) argued: "[Environmental morale] may, in particular, suddenly drop when consumers realise that their responsible behaviour is being exploited by others. This 'sucker' effect is easily observable in everyday life and has been well documented in prisoner dilemma experiments." An additional danger with the administration of extrinsic price incentives is that consumers may be led to take on a market-based view of environmental behaviour in other areas where external

incentives are not yet in place, as they build an expectation of being rewarded for making environmentally-friendly choices and anticipate incentives. This is known as the 'indirect motivational spillover effect' (Frey, 2012). Also, if these incentives are perceived by consumers to not be 'sufficient enough of a reward or compensation for making a pro-environmental choice, they may refrain from choosing the environmentally-friendly alternative. Extrinsic incentives can reduce the effort individuals invest into behaving in an environmentally-friendly manner. These drawbacks of extrinsic financial tools to influence consumer behaviour are amplified by the challenges to monitoring and sanctioning the behaviour of whole populations of individual consumers.

According to some other studies, however, the strength of intrinsic motivation remained in place regardless of the provision of extrinsic incentives. Rommel et al. (2015) studied intrinsic and extrinsic motivation in the context of pro-environmental behaviour and they did not obtain any results in favour of the crowding out of intrinsic drives amongst German individuals. This was not the case in the aforementioned studies in relation to pro-environmental behaviour which found extrinsic rewards to have a detrimental effect on intrinsic motivations under differing contexts, amongst differing populations (Agrawal et al., 2015; Chervier et al., 2019; Moros et al., 2019; Nayum et al., 2022; Haustein and Jensen, 2017). Hence, results from Rommel et al. (2015) indicate that context is key in determining the presence and type of crowding effects which stem from extrinsic incentives on intrinsic motivation. Similar to the stand taken by Rommel et al. (2015), Ledford et al. (2013) refute arguments of motivation crowding out effects by external incentives and argue that such rewards do not undermine intrinsic drives. They dismiss the line of argument that external rewards are ineffective or counterproductive. According to Yasue and Akers (2019), evidence is available for the crowding-in effect of financial incentives on the intrinsic motivations of individuals to participate in ecosystem service schemes. Similarly, Fiorillo (2011) argued, on the basis of a survey regarding Italian volunteers, against the notion of motivation crowding out due to monetary rewards. Results from his study found that monetary payments and intrinsic motivation have complementary roles and work hand-in-hand to supply volunteer work. Despite noting that intrinsic motivation may be undermined by external rewards, Frey (2012) also pointed out that intrinsic motivation may also be increased due to these extrinsic factors. Therefore, the implications of extrinsic intervention may not only entail hidden costs but also hidden gains. According to Cerasoli et al. (2014), intrinsic motivation was less imperative to

the behavioural outcome when incentives were directly related to it, while its role was more pronounced when incentives were impacting the behavioural outcome only indirectly. In some cases, incentives and intrinsic motivation are not necessarily antagonistic to each other and are best considered concurrently. Thompson et al. (2010) conducted a natural experiment concluding in favour of motivation crowding in. The results show that paying previously volunteer referees of economics field journals significantly reduces review time, which translates into significant reductions in first-response time. Nonetheless, given the varying crowding effects external incentives have been found to have on autonomous motivations across different studies, the relationship between fiscal incentives and green intrinsic motivation towards EV adoption cannot be assumed and case-specific research is required.

Given the conflicting findings either confirming or disproving the crowding-out effects of extrinsic interventions on intrinsic motivation, researchers have attempted to account for these differences across findings. Although this paper shall only test for a crowding-out effect on not the reasons behind it, it is worth mentioning some of the explanations given by various researchers. There have been various conditions suggested to explain variations in the crowding effects of extrinsic interventions on intrinsic motivation. Frey and Jegen (2001) suggested that the direction of the crowding effect depends on the attitude individuals have towards the extrinsic motivation factor. The motivation crowding theory posits that the impact of a given extrinsic reward on intrinsic motivation levels is contingent on how the individual perceives the incentive to affect his or her autonomy; stating that freedom of choice is a precondition for an individual to take responsibility over their behaviour (Graafland, 2019; Frey, 2012; Velasquez, 2018). Hence, following this line of logic, we can expect the crowding effects of financial government effects on green intrinsic motivation to fluctuate based on an underlying factor of the extent to which an individual perceives their autonomy to be impacted by government intervention. If consumers believe they have the freedom of choice between EVs and conventional vehicles to a large extent, crowding-in effects may be observed and if not, final results will show crowding-out effects. Similarly, according to the Cognitive Evaluation Theory, crowding out is observed if external incentives are either perceived as controlling forms of intervention which remove the locus of control from the recipient or if they neglect the ability of individuals to act out of their intrinsic motivation (Deci and Ryan, 1999). Extrinsic interventions will only undermine, or crowd out, intrinsic motivation if they are perceived by individuals to be ‘controlling’ or condescending of their regular behaviour. However, if

external interventions are perceived in a positive light and elicit feelings of 'supportiveness', they are likely to have a positive effect on intrinsic motivation. When one perceives extrinsic incentives to be 'supportive', self-esteem is enriched and individuals feel that their self-determination is increased; this in turn boosts intrinsic motivation. Outside intervention undermines the actor's intrinsic motivation if it carries the notion that the actor's intrinsic motivation is not acknowledged (Frey, 2012). The person affected feels that his or her competence in performing a particular action is not appreciated, which leads to impaired self-confidence, resulting in reduced effort in the direction of a desired behavioural outcome (Frey, 2012). For instance, it may reduce their environmental morale from the 'sucker effect' suggested by Frey (1999; 2012). Due to the EV subsidy which is available for all EV consumers, intrinsically motivated individuals who have been genuinely pro-environmental in their actions, even beyond EV purchasing, may feel that others who are not intrinsically-motivated are also receiving the same reward as them. Hence, causing them to feel that other consumers are 'getting away' with their behaviour. In that way, they may perceive fiscal incentives to be unsupportive or failing to acknowledge their personal norms as non-intrinsically motivated individuals are also given the same incentives anyways. In addition to such demotivating effects of extrinsic interventions, Frey (2012) also provided another explanation for the crowding-out effects of these external factors on intrinsic motivation; he argued that when one is deprived of the opportunity to display their inner motivation to other individuals, they relinquish their intrinsic drive. As for the crowding-out effects of intrinsic motivations stemming from extrinsic rewards, Frey (2012) further explained that external incentives can impact the values held by individuals internally. In other words, these extrinsic incentives can affect the norms individualised by individuals and therefore, induce a shift from other-regarding or group-regarding preferences to more self-centred proclivities and behaviour. Nonetheless, theory and past research indicate that extrinsic incentives have the ability to transform intrinsic motivations and their effects on an outcome. Hence, pointing towards the following hypothesis:

Hypothesis 3: Financial government incentives moderate the relationship between intrinsic motivation and EV adoption.

2.4 Charging Infrastructure

Charging infrastructure is a form of facilitating conditions for EV usage. Facilitating conditions, which are relevant to technological product acceptance, are defined as "the objective factors of technical and organisational infrastructure which supports the use of specific systems (Venkatesh et al., 2012)". Such facilitating conditions have been found to affect sustainable behavioural outcomes (Levinson and West, 2018; Huang & Ge, 2019; Egbue & Long, 2012; Wang et al, 2017). In a similar context of bicycle-sharing, a form of pro-behaviour, it was found that the facilitating conditions available to individuals have a moderating effect on the relationship between their motivations and usage intention of bicycle sharing (Wu et al., 2019). This was because people may feel that shared bicycles are useful to improve travel efficiency and hence worth using, especially if the government and service providers pay enough attention to the shared bicycle system. For example, through the provision of parking facilities and special lanes. They may feel that shared bicycles are an ideal form of transport, and their usage intention will be greatly enhanced. However, even if people feel that bicycle sharing is helpful for travel when facilitating conditions are lacking, people may experience a great deal of frustration, and their usage intention will decline. Charging infrastructural development concerns the improvement of the availability and costs of EV charging facilities. It is a core constituent of a functional EV ecosystem and requires sufficient planning and designated electrical infrastructure at multiple levels of the distribution grid.

The extent of development of charging infrastructure within a country or the level of consumer satisfaction towards national charging infrastructure, can indicate the level of convenience presented to electric vehicle drivers in owning and using an electric vehicle throughout that particular country. This can have an impact on consumer intention to purchase an electric vehicle, by shaping their attitude towards electric vehicles, perceived behavioural control, and subjective norms. Studies have presented findings proving that charging infrastructure accessibility or consumers' level of satisfaction with it has a significant positive effect on consumers' electric vehicle purchase intentions and adoption behaviours (Huang & Ge, 2019; Wang et al., 2017; Hoen and Koetse, 2014; Graham-Rowe et al., 2012; Krupa et al., 2014; Dhar et al., 2015; Lieven et al., 2011).

Greater availability of public charging stations per capita, or public charging density, is associated with higher rates of BEV adoption (Sierzchula et al., 2014; Egner and Trosvik, 2018; Mersky et al., 2016). As found by White et al. (2022), this has been the case for BEV adoption intent as well. One possible explanation for the positive association between charging station density and BEV adoption, as given by White et al. (2022), is that charging stations may reduce concerns about BEV range, commonly known as 'range anxiety'. Range anxiety is a psychological construct in which an EV driver experiences worries of being stranded in the midst of their journey due to their vehicle being out-of-charge and unavailability of charging facilities (Tate et al., 2008). White et al. (2022) raised attention towards this concept of perceived mobility restriction while warning that improvements in charging infrastructure alone may not address the psychological experience of perceived mobility restrictions. Hence, it is useful and relevant to understand individual perceptions of the extent to which they believe an EV would limit their mobility and their level of satisfaction with charging infrastructure. Individual perceptions towards the driving range and charging of EVs have been noted to be a strong impediment to EV adoption (Noel, 2019; Egbue and Long, 2012). A second possibility stated by White et al. (2022) for this relationship between charging infrastructure and EV uptake rates is that a widespread presence of charging stations sends a signal to consumers that EVs are a desirable product, paving the way for EV adoption through subjective norms. Nonetheless, the perception consumers hold towards charging infrastructure has been found by various earlier studies to have an impact on EV purchasing (Sierzchula et al., 2014; Egner and Trosvik, 2018; Mersky et al., 2016; White et al., 2022). Although a number of studies found charging infrastructure to have a positive impact on EV adoption, Axsen et al. (2017) opened up room for speculation by not finding public charging to have a significant impact on consumer interest for EVs,

Nevertheless, Krupa et al. (2014) found that public infrastructure such as public recharging stations and battery exchanges at service stations would have a positive influence on their willingness to consider a Plug-in Hybrid EV. Furthermore, participants also indicated that having recharge facilities at home for easy overnight recharge would be important. Hoen and Koetse (2014) conducted research on Dutch private car owners and found that consumers' preference for EVs increases significantly with the improvement of cruising range, charging time and supporting infrastructure of EVs. As studied by Hennlock (2019), an increased number of public charging points causally impact the uptake rate of electric vehicles, especially

in urban locations. Differences in the expansion of public charging infrastructure across municipalities could explain why the adoption rate of electric vehicles was faster in some municipalities. Hennlock (2019) also tested for reverse causality between charging infrastructure on the BEV share in their regression analysis to establish a causal relationship between charging infrastructure and EV adoption.

As EVs become more widespread, access to public charging will need to expand in order to satisfy the demand. Additionally, that also means that vehicle consumers will increasingly expect the same level of convenience for EVs as they assume for conventional vehicles (IEA, 2022).

The study conducted by Wang et al. (2017) conducted on the purchase intention of Chinese citizens towards EVs showed that the charging infrastructure has a significant positive impact on consumers' purchase intention. Likewise, Egbue and Long (2012) found that charging infrastructure was one of the biggest concerns surrounding electric vehicles, in the eyes of consumers. Consumer perceptions of their accessibility to charging infrastructure have been found to positively and significantly influence their electric vehicle purchase intentions (Wang et al., 2017; Sobiech-Grabka et al., 2022), hence the development of charging infrastructure holds a crucial role in mitigating range anxieties and improving the popularity of electric vehicles (Wang et al, 2017).

When examining antecedents of the usage intention toward bicycle sharing, understanding the moderating factors is also important. Researching the moderating factors intervening in the relationship between the extrinsic fiscal incentives and usage intention can help us understand under which conditions the effects of motivations increase or decrease. In this way, more controllable means can be provided for public service providers and operators.

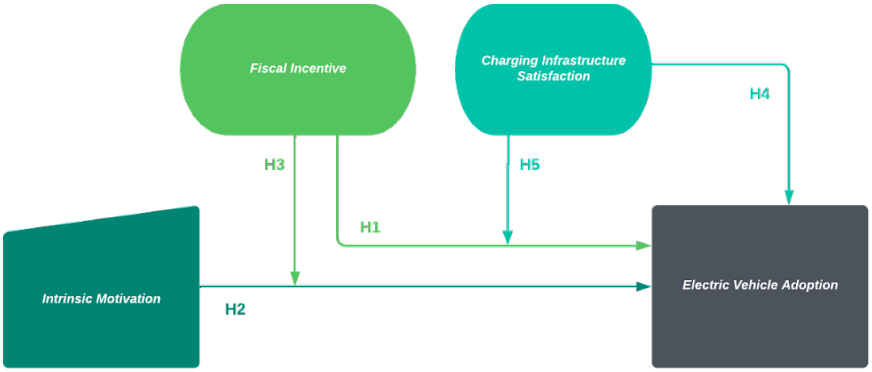
While investigating the impact of charging infrastructure on EV adoption, it is also relevant to take note that earlier studies find intrinsically motivated individuals to be willing to engage in a particular behaviour despite it being costly or requiring much effort (Steg et al, 2016). As explained by van der Werff et al. (2013), If individuals are genuinely concerned about the state of the environment, their behaviour can be guided by personal environmental norms even if

there is a cost involved in terms of price or convenience. Hence, we can expect intrinsically motivated individuals to prefer EVs regardless of their perceptions towards charging infrastructure. This would mean that we cannot expect charging infrastructure to have an interacting effect with green intrinsic motivation in relation to EV adoption, but only with extrinsic determinant – financial government incentives. Therefore, the literature points to the following hypotheses:

Hypothesis 4: Charging infrastructure satisfaction positively impacts EV adoption in the Netherlands.

Hypothesis 5: Charging infrastructure satisfaction and financial government incentives positively interact with each other to boost EV adoption in the Netherlands.

2.5 Conceptual Research Design



Hypotheses	
Hypothesis 1	Financial fiscal incentives positively impact EV adoption in the Netherlands.
Hypothesis 2	Green intrinsic motivation positively impacts EV adoption in the Netherlands.
Hypothesis 3	Financial fiscal incentives moderate the relationship between intrinsic motivation and EV adoption.
Hypothesis 4	Charging infrastructure satisfaction positively impacts EV adoption in the Netherlands.
Hypothesis 5	Charging infrastructure satisfaction and monetary fiscal incentives positively interact with each other to boost EV adoption in the Netherlands.

3. Methodology

3.1 Sample

This study was conducted on vehicle owners and potential vehicle buyers within the Netherlands. In this study, adults aged above 25 have been identified as potential buyers of vehicles who have the choice of deciding to either purchase conventional vehicles, electric vehicles, or ultimately refrain from purchasing any vehicle. The age range of individuals holding the majority of cars in the Netherlands is 25 to 79 (Statistics Netherlands, 2020). Thus, individuals below the age of 25 have not been considered potential car owners. Responses were collected only from individuals above this age in an attempt to increase the likelihood that results can be generalised to the target population of Dutch car owners and potential car owners.

Since the target population for this research is specifically potential car owners and car owners residing in the Netherlands and this survey was distributed in the form of an anonymised link which can be answered by anyone who has access to the link, initial screening questions have been included in the questionnaire to filter out responses from individuals who do not fall into the target population group. The following three initial screening questions were included:

- 1) Are you above the age of 25?
- 2) Do you either use a car now or intend to purchase a car within the next 5 years?
- 3) Do you reside in the Netherlands?

The sample has been divided into 5 distinct age categories: 25-34, 35-44, 45-54, 55-64, and 65 and above. Furthermore, classifications were also made on the basis of income, gender, and educational background. Respondents were originally distinguished across 7 income groups: 'Below 10, 000', '10,000 to 30,000+', '31,000 to 50,000+', '51,000 to 70,000+', '71,000 to 90,000', and 'above 90,000' of annual income in Euros. Thereafter, due to the small number of observational points per category, respondents were split into 3 main distinct income groups for the purpose of the logistic regression analysis. These income groups were as follows: 1) low-income ('Below 31,000 Euros), middle-income ('31,000 to 70, 000+') and high-income ('71,000 and above'). Gender classifications were made on the basis of respondents identifying as either 'male', 'female', or 'third gender/non-binary'. However, as no complete set of survey responses were obtained from third-gender/non-binary individuals, gender was converted to a

binary variable for data analysis. Meanwhile, the educational backgrounds of respondents were differentiated on the basis of the highest educational level attained, with the options of 'primary education and below', 'secondary education', 'undergraduate tertiary education', and 'graduate tertiary education'; since only a modest number of two observations were obtained for the first two categories, participants were regrouped into two categories 'undergraduate education and below' and 'graduate education'.

The respondents were informed about the purpose of the survey and the estimated time to complete it prior to completing the survey. They were also informed of the researcher's email address such that they can contact the researcher in the event that they have any further questions or clarifications to make regarding the study and their participation. The survey link has also been anonymised completely to ensure that respondents are not identifiable with their answers and that individual data is maintained with confidentiality. This had also been communicated with respondents prior to them beginning the survey. Participants provided informed consent to participate in the study prior to answering the survey questions by agreeing to the following statement - "I have read and understood the provided information. I agree to participate in this study. I understand that my participation is voluntary, that I am able to ask questions, and that I am free to withdraw at any time, without giving a reason."

3.2 Data Collection

A survey questionnaire was distributed to collect micro-level primary data on vehicle consumer preferences and evaluate the effectiveness of monetary fiscal incentives eventually. The survey questionnaire was designed in English and developed utilising the Qualtrics platform. Thereafter, it was distributed on social media groups and online car marketplaces and interest groups, whereby potential and existing vehicle owners are likely to be present. The survey was conducted completely online. A total count of 136 responses was obtained from voluntary respondents within the period of 11-16 December 2022. The data obtained through the survey was cross-sectional in nature as it was over a fixed period of time and across multiple different subjects. Out of the 136 respondents, 111 respondents completed the survey successfully. This results in a response rate of 81.6%. This percentage indicates a relatively high response rate for this survey. Such a high response rate reduces bias arising from selective non-participation.

In order to achieve a good response rate, the survey questionnaire was kept concise so as to motivate survey respondents to complete the survey and ensure good quality of their responses.

It was found that a survey over 25 minutes loses more than three times as many respondents as one that is under 5 minutes (Kantar, 2022). Considering that the quality of responses and completion rates decrease as the length of a survey increases, it was only ideal to ensure that the survey questionnaire was kept as concise as possible. Question items that could be rated under the same and falling under the same variable were condensed in the form of a matrix question. A matrix survey question groups together all the relevant questions on a particular topic in a simplified row-column format. With this condensed formatting, respondents can view questions in a single glance, improving the level of ease with which respondents could provide their answers. This format is most useful and convenient for respondents when they are presented with multiple questions which are to be rated on the same scale (Qualtrics, 2022.). Keeping in mind the convenience of respondents, the survey link was able to allow respondents to return to the question they last left off if they were to discontinue the survey so that they can return to it later on in ease. On average, respondents took 4.50 minutes to complete the questionnaire and submit it. This is a short duration of time, and well suited to the attention span of an average survey respondent.

Only data from fully completed questionnaires were used to conduct analysis and preserve the quality of insights developed from the primary data obtained. Overall, of the 111 observations made across all the variables, a total sum of 100 valid observations were present.

Given the presence of a time constraint for this study, an initial convenience sampling was performed to identify potential individuals so the survey link could be sent out. This method is a non-probability sampling whereby the researcher selects observational units for inclusion in the study due to convenience. However, this method is susceptible to bias and concerns regarding the generalisability of the results due to respondents not being fully representative of the target population (Etikan et al., 2016). Individuals of varied age categories, income levels, educational backgrounds, and genders who were existing vehicle owners or considering to purchase vehicles were purposively selected Thereafter, the survey link was sent to these individuals via social media platforms. In the event that the respondent is not an actual existing or potential vehicle owner, they would anyways not be allowed to continue with the survey due to the set of initial screening questions presented within the survey questionnaire.

Along with the convenience sampling technique, the snowballing technique was also employed. Along with the survey link, a description of the study was provided and a prompt to share the survey within their social circles. Since the convenience sampling method deals with

a group of easily accessible participants, there is a risk of not obtaining an adequate number of observations or results may not be truly representative of the entire target population. Hence, the snowballing method was used to potentially gain access to a broader range and number of individuals within the target population, beyond the initial convenience sample. Despite a purposive selection of the initial convenience sample, both these methods - convenience sampling and snowballing -, however, could potentially lead to responses from individuals who are similar on the basis of characteristics such as gender, income, educational background and ages. Hence, in order to reduce the manifestation of bias in the results obtained, sociodemographic control variables on the front of gender, income, educational background and age, were included within the model.

Notably, one advantage of the snowballing method is that it is relatively more likely to result in a higher response rate as respondents would be receiving the survey links from members of their social circle (Johnson, 2014). Hence, this can cause them to feel more willing to complete the survey as opposed to receiving the link from an unknown source (Johnson, 2014). The high response rate could possibly be owed, to some extent, to the snowballing method. The snowballing method would enable potential respondents to be reached upon receiving the survey link from someone within their social circle, and this could cause them to feel more encouraged to complete the survey. Nonetheless, this benefit comes with a trade-off between a selective non-participation bias and a selection bias from non-randomised sampling.

A pilot test was conducted on an initial 10 respondents before launching this research study and feedback was obtained from these initial respondents in order to ensure that there were no major issues with the research items and questionnaire wording or structure. Furthermore, no issues were found concerning the reliability and validity of the measures in this study.

3.2.1 Questionnaire Design

The survey has been organised into 6 sections. The first section consisted of the 3 aforementioned initial screening questions found in Section 3.1. Since the target population for this research is potential car owners and car owners residing in the Netherlands and this survey was distributed in the form of an anonymised link which can be answered by anyone who has access to the link, initial screening questions have been included in the questionnaire to filter

out responses from individuals who do not fall into the target population group. If the respondent meets the survey requirements, they would be led to the following section on their attitude towards extrinsic fiscal incentives. Thereafter, the third section entailed green intrinsic motivations and the fourth constituted charging infrastructure satisfaction. Next, in the fifth respondents could provide their preference between electric vehicles and conventional vehicles. Lastly, socioeconomic-related inquiries were made and respondents had the choice to prefer not to provide their answers to personal questions. A copy of the survey questionnaire can be found in Appendix A.

3.3 Operationalisation of Variables

Upon completing the conceptualisation through a literature review, the variables were operationalised to obtain measurable observations that can be easily compared across the sample. The surveys were conducted to investigate the hypothesised relationship between extrinsic monetary fiscal incentives, green intrinsic motivation and charging infrastructure on EV adoption. Hence, the independent and dependent variables were operationalised in order to be measured through the survey questionnaire and examined through data analysis. Along with the independent and dependent variables, the control variables - income level, age, gender, and educational background - were also operationalised. The measurement of these variable types is explained in detail within the subsequent subsections, along with Cronbach's alpha values which indicate scale reliability and the principal component analysis which was performed to test for construct validity.

3.3.1 Measuring the Dependent Variable

The dependent variable consists of consumer preferences for vehicles. The two types of vehicles are EVs and conventional vehicles, with electric vehicles being a broad term used to refer to battery-operated EVs, hybrid EVs, plug-in hybrid EVs and fuel-cell EVs. To avoid instances of misunderstandings on the definition of an EV, such as whether or not a hybrid EV is considered an EV too, a clarification has been made within the survey to inform participants that battery operated EVs, hybrid EVs, plug-in hybrid EVs and fuel cell EV shall be considered EVs within the scope of this study.

The dependent variable has been operationalised in the form of a dummy or binary variable which takes either of 2 values. Survey respondents are asked to indicate their choice between

one of two options presented to them: “I have bought (or would like to buy) an electric vehicle” and “I have bought (or would like to buy) a conventional vehicle”. The first option which represents electric vehicle adoption has been coded as 1 and the latter option as 0 to indicate that the respondent does not ultimately prefer an electric vehicle over a conventional vehicle. The answers selected by individuals would provide data for EV adoption, the dependent variable, at a micro-level.

3.3.2 Measuring the Independent Variables

The 3 independent variables - 1) external monetary fiscal incentives 2) green intrinsic motivation and 3) charging infrastructure satisfaction - were measured on a 7-point semantic differential scale. A 7-point semantic differential scale was utilised within this study as it yields relatively greater accuracy in results in comparison to the 5-point scale, by allowing respondents to provide a more nuanced response. The semantic differential scale was employed within this study instead of a Likert scale as it entails polar options which require the respondent to provide specific responses reflecting their attitudes and does not allow them to give neutral responses as they would be able to on the Likert scale, compelling them to pick a side with regards to the question on hand. Often, respondents who are less inclined to express their opinion or unwilling to exert the cognitive effort to form an opinion have the tendency to pick the ‘neutral’ option rather than reflecting on their preferences. This does not provide the researcher with meaningful information to draw insights. In order to overcome this issue, the semantic differential scale has been utilised within this study as it forces respondents to pick a side on the issue. In doing so, we are better able to achieve a dataset in which responses are reflective of which side respondents are on with regard to the various variables being examined within this study.

3.3.2.1 Financial Government Incentives (FI)

The measure of the monetary fiscal incentives was constructed with a total of 3 constituent items which were inputted into the logarithmic regression models. The survey questionnaire used to obtain data on the attitudes of consumers in relation to financial fiscal incentives covered the following 3 items under this variable:

1. “I often think about incentives when buying green products.”

2. “I believe that the EV subsidy is useful in improving my affordability to purchase an EV.”

3. “I believe that the EV tax benefit is useful in improving my affordability to purchase an EV.”

The first item was derived from an existing study conducted by Ali et al. (2020) on the intrinsic-extrinsic motivation mechanism in the context of electronic products. Next, the second and third items were adapted from Coad et al. (2009). The wording of the question, however, was modified to suit the context of Dutch monetary fiscal incentives for EVs, namely the EV subsidy (Subsidie Elektrische Personenauto’s Particulieren) and tax benefits (Motor Vehicle Tax [motorrijtuigenbelasting] benefit and Private Vehicle and Motorcycle tax [belastingen op personenauto’s en motorrijwielen] benefit). All of these 3 items were measured on a 7-point semantic differential scale. This indicator took the form of an ordinal variable, with survey respondents providing their responses from a range of answers coded from ‘1’ to ‘7’. In order to verify the reliability, or internal consistency, of this measure of fiscal incentive attitudes, a Cronbach's alpha computation was performed (Taber, 2017). A Cronbach’s alpha coefficient of 0.951 confirms the reliability of this measure as the general range considered acceptable for this value, in order for the measure to be considered reliable, is around the values of 0.70 to 0.95 (Tavakol and Dennick, 2011).

3.3.2.2 Intrinsic Motivation (IM)

As identified by existing literature reviewed under Section 2, there are two types of intrinsic motivation in the context of pro-environmental behaviour - ‘obligation-based intrinsic motivation’ and ‘enjoyment-based intrinsic motivation’. Enjoyment-based intrinsic motivation has also been considered given that various recent studies have established that it accounts for purchasing behaviour of pro-environmental products and general pro-environmental behaviour (Ahn et al, 2020; Kim and Seock, 2019). Some individuals enjoy behaving in an environmentally-friendly manner and doing so elicits positive feelings in the form of a ‘warm-glow’ as they feel good in doing so (van der Linden, 2015; Taufik et al., 2014).

For enjoyment-based intrinsic motivation, already established and validated items were adopted from Ali et al. (2020) for the measurement of green intrinsic motivation: “(1) I enjoy accepting new green ideas and products; (2) I enjoy solving environmental problems through green measures; (3) I enjoy searching for new green products; (4) I enjoy giving feedback to

improve existing green products; (5) I feel excited when I have green products. Likewise, existing scale items from E. van der Werf et al. (2013) were utilised for obligation-based intrinsic motivation: "(1) I feel morally obliged to act in an environmentally-friendly manner; (2) I would feel guilty if I did not act in an environmentally-friendly manner; (3) I would be a better person if I would act in an environmentally-friendly manner." This indicator also took the form of an ordinal variable, numbered from '1' to '7'. A Cronbach's alpha value of 0.977 was derived for the green intrinsic motivation measure, confirming the reliability of this measure.

3.3.2.3 Charging Infrastructure Satisfaction (CIS)

In order to measure charging infrastructure satisfaction levels, Ma and Yang (2020) used a scale which took into account both charging fees and availability. This existing scale used by Ma and Yang (2020) was employed in this study. Under the principle of charging cost, Ma and Yang measured time cost and charging fee. Meanwhile, under the factor of charging availability, the following sub-principles were regarded: density, illegal occupation ratio, and business hours. Density, however, can differ across various locations and in terms of regular EV charging points and rapid charging stations. Hence, an existing scale initially constructed by BritainThinks (2020) to advice UK's Department for Transport was utlised to measure public satisfaction in terms of charging density. Charging point densities were specified in terms of the following factors: Charging from home, local community charging hub, Charging at your workplace, Charging at your supermarket, Charging at leisure activities, Rapid charging stations, On-street charging at home. Similar to the two other aforementioned independent variables, extrinsic fiscal incentives and green intrinsic motivation, this variable took an ordinal form. The 7-point semantic differential scale was the basis upon which respondents could rate their satisfaction levels with charging infrastructure in their residential areas. Hence, data for this independent variable also ranged from '1' to '7'. A Cronbach's alpha value of 0.968 was computed for the charging infrastructure satisfaction scale, confirming the reliability of this measure.

3.3.3 Measuring the Control Variables

Factors concerning the demographic and socioeconomic characteristics such as gender, age, income, and education level of respondents were controlled in this model for their potential alternative effects (Dimitrova et al., 2018). The gender variable included three categories: male,

female, and third gender or non-binary. However, as no complete set of responses were obtained for 'third gender or non-binary' individuals, the gender variable was converted to a binary variable for analysis. The age control variable measure constituted of the following groups: 1) 25 to 34 2) 35 to 44 3) 45 to 54 4) 55 to 64 5) 65 and above. The income variable was measured across 6 categories: 1) Below 10,000 Euros, 2) 10, 000 to 30, 000+ Euros, 3) 31,000 to 50, 000+ Euros, 4) 51,000 to 70, 000+ Euros 5) 71,000 to 90, 000 Euros and 6) More than 91, 000 Euros. However, for the purpose of the data analysis it was re-grouped into the following 3 groups: 1) Below 30,000 Euros 2) 31,000 to 70,000 Euros and 3) Above 70,000 Euros such that the number of observations available for each group would be higher. Lastly, the variable representing education backgrounds was measured in terms of highest level of education completed. This was measured across 4 main categories: 1) Primary education and below, 2) Secondary education 3) Tertiary Undergraduate Education 4) Tertiary Graduate Education. However, since an overwhelming majority of 108 out of 110 survey respondents who had answered this question fell into the last two categories of educational backgrounds ('undergraduate and 'graduate tertiary education') and there were insufficient observations for the first two categories, participants were regrouped into two categories 'undergraduate education and below' and 'graduate education'.

3.4 Principal Component Analysis

Since the measures for the 3 independent variables included multiple question items for which data was collected, a principal component analysis (PCA) was conducted to investigate construct validity and reduce the dimensionality of the dataset.

Prior to the PCA, a Kaiser-Meyer-Olkin (KMO) test of sampling adequacy was performed to examine the strength of partial correlation between the variables and how suited the data is for factor analysis. This test was used to ensure the validity of the observed data. In order for sampling to be considered adequate, the KMO value requirement lies between 0.8 and 1 (Shrestha, 2020) The KMO value for this sample was significant at 0.909, confirming that the sampling is adequate and that a factor analysis will be useful and plausible for these variables. Additionally, the Barlett's Test of Sphericity was also performed to verify if the null hypothesis that the correlation matrix is an identity matrix could be rejected. An identity correlation matrix would imply that variable items are not correlated and therefore, unsuitable for factor analysis. A statistically significant result of less than 0.05 (Curran-Everett, 2020) on this test rejects the null hypothesis and implies that the correlation matrix is indeed not an identity matrix. In this

case, the value was 0.000, denoting that the data is suitable for factor analysis and allowing the null hypothesis to be rejected. Hence, not requiring further remedial action in order to perform the PCA.

Upon completing the KMO and Bartlett's tests, a PCA was performed and completed. The PCA showed 3 principal components to be present, relating to charging infrastructure satisfaction, green intrinsic motivation and fiscal incentives.

Additionally, none of the sub-items under each of the 3 principal components - fiscal incentive attitudes, green intrinsic motivation or charging infrastructure satisfaction - were considered by the PCA to fall under a different component other than what was postulated by the theory. As indicated by PCA, all the 3 survey question items under the fiscal incentive attitude variable component belonged together under one principal component. The same goes for the 8 items under green intrinsic motivation and 11 items under charging infrastructure satisfaction. Furthermore, the communalities for all of the items were above 0.70, confirming that a high portion of variance for each of these items could be explained by their respective factors. Hence, confirming construct validity of the independent variable measures. The scree plot results, component matrix, and communalities table from the PCA can be found in Appendix B.

3.5 Data Analysis Strategy

Logistic regression was the statistical method employed to analyse the primary micro-level data collected from the surveys conducted. Logistic regression is useful when an outcome is categorical and predictor variables are either continuous or categorical (Field, 2018). This statistical analysis method is commonly used to model binary outcomes (Edgar & Manz, 2017), such as the choice between either an electric vehicle or a conventional vehicle in this case. Considering that this research posits hypotheses in relation to consumer preferences between either an electric vehicle or a conventional vehicle, which is a binary outcome, logistic regression makes an appropriate method for statistical analysis. Logistic regression uses a maximum-likelihood estimation to estimate the likeliness that the observed values have occurred (Field, 2018). This, along with an appropriate research design strategy, allows us to infer whether or not a causal relationship exists between the independent and dependent variables. For each of the hypotheses, the effects of the aforementioned independent or moderating variables - monetary fiscal incentives, green intrinsic motivation, and charging

infrastructure satisfaction - are studied on the outcome of consumers choosing between either electric vehicles or conventional vehicles. A cut-off value of $p = 0.05$ will be used to consider the significance of the results.

One challenge faced within this study was making causal inferences without experimental manipulation given the nature of the EV fiscal incentive. Fiscal incentives such as subsidies are implemented to mitigate financial inequalities amongst a social population and they are available to all who are in need of them or qualify to obtain these incentives. It would be considered unethical to hold back such an incentive provided to individuals on altruistic grounds with the purpose of addressing inequalities and improving the affordability of individuals for a certain good or service. Hence, this study is limited to remaining observational in nature as experimental manipulation is not feasible in this case. Research methods involving manipulation, such as randomised controlled trials are considered the gold standard for causal inference. However, in this case, the study could not employ the technique of manipulation or intervention due to the ethical concern of withholding a fiscal incentive from some individuals when they are rightfully entitled to it. This research was a large-N observational study in which causal inferences can be drawn by detecting and isolating a 'systematic signal' from the 'noisy data' present within the real world (Toshkov, 2020). Such isolation of a hypothesised causal factor is possible through conditioning on the basis of demographic variables which can hold a potential effect, alongside the causal factor, on the final outcome of EV adoption (Toshkov, 2020). In large-N research designs such as this one, conditioning for demographic-based control variables, along with the inclusion of other potential determinants into the model such as green intrinsic motivation and charging infrastructure, improves the chances of drawing a sound causal inference on the main explanatory variable being tested, which is monetary fiscal incentives, for its effects on EV adoption (Toshkov, 2020).

In order to mitigate the challenge surrounding causal inference in this context of fiscal incentives, the control variables included allowed for ceteris paribus to be maintained across other socioeconomic dimensions, namely age, gender, income, and education levels. The inclusion of these potential determinants reduces the omitted variable bias within this model and accounts for other factors that can have a simultaneous impact, along with the main effects being studied, on the final outcome with regard to EV adoption. With such conditioning and attempts to reduce the omitted variable bias, we can improve the degree of confidence that a causal relationship exists between independent variables and outcomes (Toshkov, 2016).

3.5.1. Assumptions - The logistic regression method requires some basic assumptions to be fulfilled in order to function. These assumptions include the independence of errors, linearity in the logit for continuous variables, lack of multicollinearity, and an absence of strongly influential outliers (Stoltzfus, 2011). Logistic regression is performed while keeping these main assumptions in consideration. Furthermore, the outcome variable should be in the form of a binary variable that takes on the values of either '0' or '1'. Within this study, all of these basic assumptions have been met. In general, an absolute Pearson correlation coefficient value close to 0.8 denotes multicollinearity (Young, 2018; Belinda and Peat, 2014; Shrestha, 2020). As seen in Table 2 below showing a correlation matrix of all the variables used within this study, all coefficients are well below 0.8. Hence, there is no major concern about multicollinearity. Furthermore, a Variance Inflation Factor (VIF) test was also performed to confirm that multicollinearity is not present. In general, VIF values of 5 to 10 and tolerance values lower than 0.1 to 0.2 would indicate the presence of multicollinearity (Kim, 2019). Hence, all of the VIF and tolerance values shown in Table 3 indicate that multicollinearity is absent. Additionally, the logistic regression method requires a sufficient quantity of events per independent variable in order to prevent overfitting of the model. As a 'rule of thumb,' the minimum number of events recommended ranges from 10 to 20 events per covariate. The dataset for this research satisfies this recommendation with 111 rows of units for analysis from completed questionnaires and 100 valid observations upon the removal of missing values. Thus, the study meets all the fundamental requirements for logistic regression analysis to be performed.

Table 2. Correlation Matrix

	FI	IM	CIS	Age	Gender	Income	Education	EV Adoption
FI	1	-.115	.265**	-.125	.094	-.292**	-.033	-.046
IM	-.115	1	.091	-.014	-.058	.108	-.023	.577**
CIS	.265**	.091	1	-.007	.045	.069	-.017	.333**
Age	-.125	-.014	-.007	1	.050	.402**	-.175	.084
Gender	.094	-.058	.045	.050	1	-.052	-.105	.001
Income	-.292**	.108	.069	.402**	-.052	1	.063	.213*
Education	-.033	-.023	-.017	-.175	-.105	.063	1	-.013
EV Adoption	-.046	.577**	.333**	.084	.001	.213*	-.013	1

**. Correlation is significant at the 0.01 level (2-tailed)
*. Correlation is significant at the 0.05 level (2-tailed)

Table 3: Collinearity Statistics

IM	Tolerance	VIF
FI	.951	1.052
CIS	.781	1.280
Age	.877	1.140
Gender	.754	1.326
Income	.966	1.035
Education	.725	1.380

3.6 Correlation

As seen in Table 2, there are some correlation analysis results which point towards some interesting relationships that can possibly be explored further. Firstly, green intrinsic motivation is found to have a significant positive correlation (r = .577**) with the EV adoption variable at the 0.01 level. Similarly, charging infrastructure satisfaction also holds a significant positive correlation with EV adoption (r = .333**). Lastly, income level seems to significantly and positively correlate with EV preferences (r = .213*). This is as expected and makes logical sense as theory and past research in Section 2 also suggested that green intrinsic motivation and satisfaction with charging infrastructure can bring individuals to hold preferences for EVs.

Apart from the correlations between the independent variables and the EV adoption dependent variable, there is also another significant bivariate correlation that is worth mentioning. Income

is seen to have a significant negative correlation with individual ratings of fiscal incentives (r = -.292**). This means that as one's income level decreases, one considers fiscal incentives to be more useful to themself and takes fiscal incentives into greater consideration while making the decision to purchase green products. Likewise, as an individual's income rises, their regard for fiscal incentives lowers.

3.7 Descriptive statistics

Table 4 below shows the overall descriptive statistics of the independent, dependent, and control variables which were analysed by the logistic regression model. Amongst the independent variables, charging infrastructure satisfaction was the least spread out with a minimum of 1.64 points and a maximum of 6.64 on a 7-point scale. As for fiscal incentives, respondents gave a minimum score of 2.00 and a maximum score of 7.00 on a 7-point scale. As for green intrinsic motivation levels, there was a minimum score of 2.50 and a maximum score of 7.00. Charging infrastructure satisfaction levels also hold the lowest minimum and maximum scores in comparison to green intrinsic motivation and charging infrastructure satisfaction. Meanwhile, the mean rating of charging infrastructure is 4.0197 while the mean rating given for fiscal incentives is 4.9159 and the mean green intrinsic motivation level is 5.0788. This suggests that, in general, the level of satisfaction private vehicle consumers in the Netherlands have with charging infrastructure within their respective cities is poorer than their levels of green intrinsic motivation and attitudes towards the financial government incentives provided to them. It does not seem to be the case that the population of private vehicle consumers in the Netherlands have a high level of satisfaction with charging infrastructure presently. Furthermore, it seems to be that the typical EV consumer in the Netherlands has a high level green intrinsic motivation. The standard deviation values for fiscal incentive attitudes, green intrinsic motivation, and charging infrastructure satisfaction are adequately high at 1.53509, 1.33803, and 1.29034 respectively. This indicates that the data obtained for the independent variables is sufficiently spread out from the mean and hence, reliable.

As for the binary dependent variable in question – EV adoption, there is a minimum score of 0 and maximum score of 1. Meanwhile, the average extent of EV adoption is at 0.68, above the mid-point of 0.50. This indicates that Dutch private vehicle consumers, in general, seem to have an inclination towards EVs in comparison to conventional vehicles.

Furthermore, the mean age group for vehicle consumers within the Netherlands as indicated by the survey results is 2.0467. This means that the average vehicle consumer, as described by data from this study, belongs to the second age category of 35 to 44 years old. Meanwhile, the mean income level of a vehicle consumer in the Netherlands is 2.0841. This value suggests that vehicle owners and potential buyers within the Netherlands tend to fall under the second income category with a middle-income level of '31,000 to 70,000+ Euros'.

Table 4. Descriptive Statistics

Variable	N	Minimum	Maximum	Mean	Std. Deviation
Fiscal Incentives	111	2.00	7.00	4.9159	1.53509
Green Intrinsic Motivation	111	2.50	7.00	5.0788	1.33803
Charging Infrastructure	111	1.64	6.64	4.0197	1.29034
Income	107	1.00	3.00	2.0841	.55152
Age	107	1.00	4.00	2.0467	1.09358
Gender	108	1.00	2.00	1.5463	.50017
Education	110	1.00	2.00	1.5909	.49392
EV Adoption	111	0	1	.68	.467
Valid N (listwise)	100				

4. Results

The following section presents the results of the logistic regression analyses which were performed in order to test the hypotheses presented within Section 2 of this study. Four models were tested consecutively to test the various hypothesised relationships between the variables. The first model tests the plain, direct effects of the independent variables of fiscal incentive (FI) attitudes, green intrinsic motivation (IM), and charging infrastructure satisfaction (CIS), as well as the interaction term (FI*IM) on the dependent variable, EV adoption. The second model tests the effects of FI, IM, CIS, and a three-way interaction between FI, IM, and CIS (CIS*IM*FI) alongside the interaction term FI*IM. Thirdly, a logistic regression model with the direct effects of FI, IM, and CIS was tested along with the following interaction terms: FI*IM, CIS*FI, and CIS*IM*FI. Meanwhile, the last model tests all three main direct effects alongside the interaction terms FI*IM, CIS*FI. Each subsection reports the results in terms of the hypotheses and thereafter, discusses the consequences of the results.

Table 5 shows an overview of the results. In the last part of this section, robustness checks will be discussed. Thereafter, in the following chapter - Section 5 - the results reported in this section will be discussed further in terms of policy implications and policy recommendations.

Table 5. Logistic Regression Coefficients

	Model 1		Model 2		Model 3		Model 4	
Variables	β	Exp(β)	β	Exp(β)	β	Exp(β)	β	Exp(β)
(Constant)		0.000		0.000		0.000		0.000
Age								
25-34	-2.020	.133	-2.497	.082	-2.044	.129	-1.916	.147
35-44	-1.642	.194	-2.330	.097	-2.808	.060	-1.680	.186
45-54	-.573	.564	-1.036	.355	-.488	.614	-.476	.621
Gender								
Male	-.710	.492	-.735	.480	.077	1.080	-.580	.560
Income								
Income 2	-1.967	.140	-1.663	.190	-3.296	.037	-2.252	.105
Income 3	.491	-.541	-.672	.511	-2.192	.112	-.944	.389
Education								
Undergrad & Below	.258	1.295	.324	1.383	.453	1.573	.222	1.249
Independent Variables								
FI	6.734*	840.506	6.766**	867.944	.053	1.054	5.695*	297.306
GIM	9.547**	12998.79	9.445***	12646.588	9.163**	9537.014	9.624**	15123.952
CIS	1.259**	3.522	3.135**	22.994	-3.162	.042	-.299	.742
FI*IM	-1.448*	.235	-1.118*	.327	-.712	.491	-1.482**	.227
CIS*FI					1.702	5.486	.278	1.321
CIS*IM*FI			-.067	.935	-.173*	.841		
Nagelkerke R Square	.698		.720		.761		.701	

4.1 Direct Effects of Financial Government Incentives, Intrinsic Motivation and Charging Infrastructure

4.1.1 Relationship between Financial Government Incentives and EV Adoption (H1)

This subsection is in relation to Hypothesis 1 which explores the effects of fiscal incentives and EV adoption within the Netherlands. As indicated by all 4 models, financial government incentives positively affect EV preferences. Model 1 indicates a positive and significant impact of Monetary Fiscal incentives on EV uptakes, with a coefficient of 6.734. This effect is observed with control variables for income, gender, age, and educational background added. Meanwhile, the odds ratio of Exp(β) = 840.506 indicates that monetary fiscal incentives, alone, are very likely to lead to EV uptake. Likewise, Model 2 which includes the three-way interaction effect of fiscal incentives, green intrinsic motivation, and charging infrastructure on EV adoption indicates that monetary fiscal incentives, alone, have a direct impact on EV adoption. It reflects a positive and statistically significant relationship between monetary fiscal incentives and EV adoption, with a coefficient of β = 6.766. This impact also holds a high odds ratio of 9.959, which suggests that these extrinsic incentives are very likely to increase the likelihood of EV adoption by 9.959 times. Similarly, Model 3 (β = .053) and Model 4 (β = 5.695*) also indicate a positive relationship between fiscal incentives and EV adoption, although the result in Model 3 is not significant. Nonetheless, Models 1, 2, and 3 successfully reflect the significance of the positive impact subsidies and tax benefits have on EV adoption. Therefore, as the results show to be significantly positive and in support of Hypothesis 1, the null hypothesis can be rejected. This shows that the financial government incentives in place are successful in achieving the goal of nudging consumers towards EVs and effective in realising ambitions of improving sustainability within private transportation.

In fact, financial incentives provided by the government remain to have a positive and significant impact on EV adoption (as seen by Models 1, 2, and 3), in spite of the inclusion of green intrinsic motivation into the models which also, in turn, held significant and positive effects on the shared outcome of EV adoption. Hence, this confirms the effectiveness of subsidies and tax benefits in EV adoption.

To note, Models 1 to 4 hold adequate Nagelkerke R-squared values of 0.698, 0.720, 0.760, and 0.701 respectively. These high values for the goodness-of-fit of the logistic regression models suggest that these models are appropriate to make conclusions from.

4.1.2 Relationship between Green Intrinsic Motivation and EV Adoption (H2)

As posited by Hypothesis 2, green intrinsic motivation levels of consumers have a positive direct impact on EV adoption. All 4 models reflect that green inherent motivation is positively related to consumer preferences for EVs. There has been clear evidence found for the impact of green intrinsic motivation on EV adoption. As indicated by a statistically significant coefficient ($\beta = 9.547^{***}$) within Model 1, green intrinsic seems to be positively impacting EV adoption. Nonetheless, results from Model 2 ($\beta = 9.445^{***}$), Model 3 ($\beta = 9.163^{***}$) and Model 4 ($\beta = 14.244^{***}$) align with the results generated by Model 1, confirming the strong positive impact green intrinsic motivation holds in shaping one's preference or decision to utilise an EV instead of a conventional vehicle. Hence, results show strong support for Hypothesis 2 and largely confirm the direct impact of green intrinsic motivation on EV adoption and the null hypothesis may be rejected.

Furthermore, green intrinsic motivations is found to have a more positive and significant effect on EV adoption than fiscal incentives.

4.1.3 Relationship between Charging Infrastructure and EV Adoption (H4)

This sub-section is with regards to Hypothesis 4 which proposes charging infrastructure satisfaction levels of individuals have a positive effect on the outcome of having a preference for EVs over conventional vehicles. Models 1 and 2 provide insight into how consumer satisfaction with charging infrastructure translates to better EV adoption outcomes. As indicated by Model 1, charging infrastructure satisfaction positively and significantly impacts EV adoption ($\beta = 1.259^{**}$). The odds ratio of 3.522 shows that improvements in charging infrastructure satisfaction experienced by consumers are 3.522 times more likely to nudge them to prefer EVs over conventional vehicles. These results suggest that improved consumer satisfaction with charging infrastructure does cause them to either buy or consider EVs. Model 2 also generated a similar result in terms of the outcomes in relation to the green alternative to conventional vehicles ($\beta = 3.135^{**}$). Significant results for the impact of charging

infrastructure on EV adoption are positive in nature. Hence, results indicate support for Hypothesis 4.

4.2 Moderation Effects

4.2.1 Moderating Effect of Financial Government Incentives on the Relationship between Green Intrinsic Motivation and EV adoption (H3)

All 4 models consider the moderating effects of monetary government incentives on the relationship between green intrinsic motivation and EV preference outcome. As indicated by Model 1 (β = -1.448*), Model 2 (β = -1.118*), and Model 4 (β = -1.482**), fiscal incentives present a negative moderating effect between green intrinsic motivation and EV adoption. These 3 models have also found this moderating effect to be significant in nature, hence suggesting that the EV consumer subsidies and tax benefits do indeed have a crowding-out effect on the strength of green intrinsic motivation in the context of EV adoption within the Netherlands.

Nonetheless, these models have put forth evidence to support the idea that both fiscal incentives and green intrinsic motivation, individually, have a positive and significant impact on EV adoption. Notably, however, green intrinsic motivation is seen to have a more beneficial and significant impact on EV adoption in comparison to fiscal incentives. Hence, these crowding-out effects caused by fiscal incentives can reduce the extent to which the sustainable transportation goals of policymakers can be successfully met. Policy implications will be discussed further under Section 5. Nonetheless, results show strong support for Hypothesis 3 and establish that there are crowding-out effects present in this context. With the significance of the results established, the null hypothesis may be rejected.

4.2.2 Interaction Effect - Charging Infrastructure Satisfaction and Fiscal Incentives on EV Adoption (H5)

Results for Hypothesis 5 have been coined by Model 3 (β = 1.702) and Model 4 (β = .278). Although the coefficients yielded within are positive, neither of the 2 models reflects significance of these coefficient results yielded upon data analysis. Therefore, charging infrastructure or fiscal incentives do not significant interact with each other to further enhance EV adoption. Hence, Hypothesis 5 is not supported by results and the null hypothesis cannot

be rejected. This means that any fluctuations in charging infrastructure satisfaction levels do not have any impact on the relationship between fiscal incentives and EV adoption outcomes; the impact of fiscal incentives in bringing about EV usage remains as is and any additional increments in charging infrastructure satisfaction shall not be expected to cause even further improvements in preferences towards EVs. Nonetheless, increments to charging infrastructure satisfaction alone already aid to improve EV usage preferences, as reported in Section 4.1.3. Hence, charging infrastructure remains beneficial, although Hypothesis 5 is unsupported. Likewise, fiscal incentives also do not positively interact with charging infrastructure to further spur EV adoption rates to extents further than they do individually.

4.2.3 Three-way Interaction between Fiscal Incentives, Green Intrinsic Motivation, and Charging Infrastructure

An additional interaction was tested in Models 2 and 3 in an attempt to discover any further insights on the relationship between the three independent variables. A significant effect was found by Model 4 (β = -.173*) between the Fiscal Incentives, Green Intrinsic Motivation, and Charging Infrastructure. Results suggest that charging infrastructure can regulate the impact the fiscal incentives have on the relationship between green intrinsic motivation and EV adoption. It is interesting to observe that although this three-way interaction is not significant as shown by Model 2, it has a negative coefficient (β = -.067) and the moderating effect of fiscal incentives on green intrinsic motivation is seen to have been reduced in magnitude (β = -1.118*) in Model 2 as compared to Model 1 (β = -1.448*). This suggest that charging infrastructure satisfaction can bolster the crowding-out effects of fiscal incentives on green intrinsic motivation to some extent. This can be useful to note during decision-making surrounding policy initiatives to improve EV adoption. This will be discussed further in terms of the relevance of charging infrastructure developments in Section 5.

4.3 Robustness Checks

Robustness checks were carried out to test the robustness of the findings obtained within this study. In order to verify the robustness of results, the 4 logistic regression models were run again upon the exclusion of control variables – income, age, gender and educational background.

Results of the robustness checks are reported in Table 6. There have been some differences observed in terms of the level of significance of the results upon the exclusion on control variables. Notably, in the three-way interaction term. Nonetheless, the main insights from Model 1 to 4 remain relevant as robustness checks also reveal similar results in terms of the direction in which all the various variables being examined are found to be related to each other. The conclusions made on each of the 5 hypotheses remain intact based on the robustness checks conducted.

In Model 6 (which is testing for the same effects as Model 2 except that the sociodemographic variables have been excluded) the negative three-way interaction between fiscal incentives, green intrinsic motivation and charging infrastructure satisfaction is found to be significant (β = -.056*). Under the robustness check, not just one model, but both models which tested for the interaction effect CIS*IM*FI showed that this negative interaction effect is significant.

Table 6. Robustness Checks (Excl. Income, Age, Gender, Education)

	Model 5		Model 6		Model 7		Model 8	
Variables	β	Exp(β)	β	Exp(β)	β	Exp(β)	β	Exp(β)
(Constant)		0.000		0.000		0.000		0.000
FI	4.486**	88.764	5.351***	210.004	.846	2.330	4.405*	81.825
GIM	6.395***	598.850	7.452***	1723.007	6.179***	482.508	6.360***	578.004
CIS	1.124***	3.078	2.868**	17.595	-.566	.568	1.038	2.824
FI*IM	-.962**	.382	-.898**	.407	-.454	.635	-.958**	.384
CIS*FI					1.000*	2.719	.015	1.015
CIS*IM*FI			-.056*	.945	-.130*	.878		
Nagelkerke R Square	.664		.694		.721		.664	

5. Discussion

The goal of this thesis is to examine the effectiveness of financial government incentives and the level of importance these policy instruments hold in achieving sustainability goals for the transport sector. In order to do so, two other factors, green intrinsic motivation levels and charging infrastructure, were also analysed in order to determine the importance of subsidies in relation to other determining factors. Furthermore, this research also aimed to screen for any detrimental crowding-out effects these extrinsic incentives may have on green intrinsic motivation, which is also very important to realising ambitions for a sustainable private transportation ecosystem. Now that results have been established, subsection 5.1 discusses the main insights developed through this research as well as policy implications. Furthermore, section 5.2 presents policy recommendations which are underlined on the basis of the insights developed through this research. Thereafter, in the latter part of the discussion, the limitations of this study and the scope for future research are further explored in subsection 5.3.

5.1 Main insights and Policy Implications

Through the results, we can conclude that the financial incentives provided by the government seem to be useful in prompting consumers towards EVs instead of their conventional alternatives. According to van Valkengoed and van der Werff (2022) and Rogers (2002), subsidies can be considered effective if they encourage new groups of individuals, who would have otherwise not partaken in a particular desired action, to take that action. If they were to not be likely to partake in the desired behaviour without the incentive but they change their mind upon being offered the incentive, we can consider the incentive to be effective. Following the logic presented by van Valkengoed and van der Werff (2022), we can consider EV subsidies and tax benefits within the Netherlands effective. This is because results from Models 1 and 2 indicate their positive and significant direct impact on EV adoption despite the logistic regression models taking into consideration green intrinsic motivation levels of consumers. Furthermore, a descriptive statistical exploration indicated a significant portion (43.42%) of EV owners and potential buyers are individuals who would not have preferred EVs if not for the extrinsic impetus of a subsidy and/or tax benefit.

However, the results also bring attention to one detrimental impact that these financial incentives may have on EV adoption. Results find that these extrinsic incentives do have a

moderating effect on the main effect of green intrinsic motivation in the context of EV adoption.

As shown by Models 1, 2 and 4, fiscal incentives significantly reduce the strength of green intrinsic motivation on the vehicle preference of consumers. This moderating effect, or crowding-out effect, seems to be having a detrimental impact on the final outcome of EV adoption, as it seems to be watering down the strength of the positive and significant effect that intrinsic motivation alone holds on preferences for EV purchases. There is one possible explanation for this. Perhaps, due to the presence of EV subsidies and tax benefits, intrinsically-motivated consumers who would have otherwise preferred EVs might have eventually opted for a conventional vehicle instead upon taking into consideration this new factor and eventually, coming to a conclusion that it is not useful or sufficient to them in improving their affordability. This is congruent to the line of argument that extrinsic incentives taint the integrity of green behaviour (Frey, 2012), which was introduced in the theoretical background. Findings from this study seem to be consistent with past studies which have posited arguments in favour of the idea that extrinsic rewards have a crowding-out effect on intrinsic motivation. Hence, results refute the arguments of Rommel et al. (2015) and Ledford et al. (2013) who posited that such crowding-out effects do not exist.

Additionally, these results would reject the notion that extrinsic incentives and intrinsic motivation work simultaneously to achieve even higher rates of the desired outcome in question, which was put forth by Buenstorf and Cordes (2008). In fact, it seems to be clear that the EV subsidies and tax benefits do not have any crowding-in effects on green intrinsic motivation. In a practical setting, these fiscal incentives and green intrinsic motivation coexist in impacting EV adoption and seem to be useful in improving EV rates independently. However, it does not seem to be the case that EV subsidies and tax benefits are complementing green intrinsic motivation to further maximise EV adoption conjunctly. Surely, fiscal incentives and intrinsic motivation can complement each other and work hand-in-hand in some other areas but in the context of EV adoption in the Netherlands, this seems to not be the case. As such, given this drawback of a crowding-out effect in place, EV subsidies and tax benefits are not necessarily an ideal policy measure to realise the ambitions of a sustainable private transport ecosystem. Furthermore, findings from Model 1 (β = 9.547**), Model 2 (β = 9.445***), Model 3 (β = 9.163**), and Model 4 (β = 9.624**) reflect that green motivation, individually, has the most positive and significant impact on EV adoption in comparison to

fiscal incentives and charging infrastructure. They have also been noted to have a sustainable and long-lasting impact on green consumption, alongside positive spill over effects into other areas of green behaviour as well (Truelove et al., 2014). By undermining green intrinsic motivation, these financial incentives may be doing more harm than good.

Apart from the crowding-out effects of fiscal incentives on green intrinsic motivation as shown by results, there is another potential implication of relying on the extrinsic stimulation from these financial policy instruments which can negatively affect EV adoption. There lies a risk of information asymmetry surrounding the personal intentions of consumers in the case of EV financial fiscal incentives. This information asymmetry can potentially lead to an issue of moral hazard whereby consumers misuse EV fiscal benefits. In fact, there is no plausible way for policymakers and EV vendors to accurately and surely determine the personal interests of consumers before disbursing subsidies and granting tax benefits. Personal intentions can only be known to the consumer himself or herself. Hence, this is a problem which exists in terms of risk as we cannot fully be certain of it until its consequences manifest in reality. For instance, consumers may purchase electric vehicles at lower prices, due to the subsidy, only with hidden intentions to sell them in future at a higher price for profits. This moral hazard can have a serious and detrimental impact on the affordability, attractiveness and future of green transportation as a whole, risking monetary fiscal incentives to potentially be counterproductive as they cause EVs to become even more expensive. Hence, the presence of this moral hazard, alongside the positive impact of financial government incentives alone on EV adoption, would also mean that it is imperative for policymakers and EV sellers to not consider these spikes in EV sales that we are currently experiencing as a reason to celebrate for the green transport sector unless these preferences for green vehicles are genuine and sustained over the long term. Although the moral hazard can possibly be mitigated by implementing an additional measure of not allowing EV owners who benefited from the subsidy to sell their vehicles for a certain period of time, implementing such a policy is likely to also undermine the appeal of purchasing an EV. This further contributes to the existing drawbacks of EV usage, such as a limited driving range or charging infrastructure dissatisfactions which Model 1 (β = 1.259**) and Model 2 (β = 3.135**) have already been found to be impacting EV adoption poorly. Due to the moderating effect of fiscal incentives and the likelihood of a moral hazard, increasing the generosity of these rewards or continuing to rely upon these extrinsic incentives can only further undermine the positive impact of intrinsic drives across time and eventually, have a poor outcome for sustainable transportation. By exploring the effects of these financial

incentives across panel data in future research, over different time periods, we can obtain further nuance on how this crowding-out effect manifests over time and confirm if the moral hazard has been manifesting. Section 5.3 covers all suggestions for future research in further detail.

Furthermore, there is another drawback of relying on these extrinsic incentives to further EV adoption. Monetary fiscal incentives directed particularly towards only some forms of green behaviour has been argued to possibly have negative spill over effects in other areas of green behaviour (Truelove, 2014; Coad et al., 2009). As individuals try to make use of the financial benefit they can enjoy from a subsidy or tax rebate, they comply to engage in a particular green behaviour in order to be eligible for the subsidy or tax rebate. However, they may lag in areas outside of transportation. A spill over effect, however, cannot be confirmed from the scope of this particular research paper as the study conducted has observed only EV preferential outcomes. However, future research (refer to Section 5.3) initiatives can consider investigating the spill over effects of financial government incentives in various areas of green behaviour. Albeit, results of this study indicate that these policy instruments may lead the public to emphasise their focus on superficial extrinsic rewards instead of being predominantly guided by intrinsic motivations to 'do the right thing', as reflected in the crowding-out of green intrinsic motivation as shown by results.

Additionally, these policy instruments can also feed public expectations of financial compensation for green behaviour or fuel the perception that green products or behaviours are 'inconvenient' or 'unattractive', hence requiring the state to offer incentives to make them more attractive. After all, conventional vehicle purchasing is not incentivised through subsidies or tax benefits for consumers. Yet, consumers continue to buy these vehicles to meet their needs for private transportation. If public expectations for fiscal incentives in return for EV adoption continue to rise, these demands would be difficult to satisfy in the long-term and exhaustive of financial resources, we should not even be thinking of going down that route. Although subsidies and tax benefits seem to be positively impacting consumer preferences for EVs, it is crucial not to overestimate the importance of fiscal incentives due to their shortcomings. Such overestimations can aggravate environmental neglect, or even cause it to become a bigger or more persistent issue in future.

Additionally, there are further policy implications to take note of in terms of charging infrastructure. As indicated by the results in Model 1 ($\beta = 1.259^{**}$) and Model 2 ($\beta = 3.135^{**}$),

charging infrastructure seems to have a significant, positive, and direct impact on EV adoption. These results indicate that taking a slack approach towards charging infrastructure development and underestimating its importance could have a detrimental outcome on EV adoption; dissatisfactions in relation to EV charging result in poor green transportation outcomes with regard to EV preferences as this causes consumers to hold back from EVs.

It has also been found that financial incentives do not have any significant interacting with charging infrastructure on EV adoption. By increasing the level of fiscal incentives, one cannot expect any significant additional improvement to EV adoption, apart from the positive main direct impact these incentives have on EV adoption. In fact, even that positive main effect of subsidies and tax benefits come along with the woe of the aforementioned crowding-out effect on green intrinsic motivation. Hence, this further stresses on the importance of refraining from overestimating the benefits of financial government incentives, or extrinsic factors, in improving EV adoption outcomes.

Nonetheless, charging facility development makes a more sustainable approach to improving EV adoption outcomes than financial incentives. In comparison to subsidies, it does not merely improve the attractiveness of EVs financially as a one-off payment to incentivise EV purchases. It improves the overall convenience and practicality of EV usage, allowing EV consumers to consistently benefit from this form of public investment and not just once during the time of their purchase. Also, a widespread presence of EV charging points creates a positive impression to consumers that EVs are desirable, making room for improved EV adoption through subjective norms (White et al., 2022). Therefore, it is not advisable to compromise on charging infrastructure development while administering subsidies and tax benefits, or exhaust financial resources on the provision of these one-time incentives instead of charging infrastructural developments.

Notably, as indicated by results, it also seems to be that charging infrastructure satisfaction brings about the benefit of reducing the degree to which fiscal incentives can undermine the impact of green intrinsic motivation in encouraging EV adoption. The two-way interaction effect between the fiscal incentives and green intrinsic motivation is stronger in intensity in Model 1 (β = -1.448*) and Model 5 (β = -.962**) than in comparison to Model 2 (β = -1.118*) and Model 6 (β = -.898**), whereby the three-way-interaction including charging infrastructure alongside green intrinsic motivation and fiscal incentives is taken into consideration. As seen from the significant negative coefficient of the three-way interaction

term (CIS*IM*FI), we can understand that charging infrastructural developments reduce the extent to which the subsidies and tax benefits crowd-out green intrinsic motivation effects. This further the benefits of charging infrastructural development.

However, despite the clear benefits of charging infrastructural developments such as its positive effect EV adoption and its role in balancing out the crowding out effects of fiscal incentives on green motivation, it seems that there is more work to be done in terms of satisfying consumers on the aspect of charging infrastructure. Vehicle owners and potential buyers in the Netherlands indicated a mean satisfaction of score of only a meagre 4.0197. Meanwhile, a majority (51.35%) of them have an overall charging infrastructure satisfaction indicated by fewer than 4 points. In spite of the Netherlands being a frontrunner within Europe in terms of charging facilities in Europe, it does not seem to be that consumers are satisfied with the current level of charging costs and availability (IEA, 2022). Given the relationship between charging infrastructure satisfaction and EV adoption, such dissatisfactions limit EV adoption as consumers hold back from making considerations of buying these green vehicles. This points to a need for further improvement in the area of EV charging infrastructure.

5.2 Policy Recommendations

Noting the aforementioned policy implications and potential concerns underlined within this section, we can consider what policy adjustments are necessary and what measures can be taken in future to better achieve green transportation ambitions. Given the importance of green intrinsic motivation and the crowding-out effects on intrinsic motivations, reliance on the financial fiscal incentives of subsidies and tax benefits is not recommended. This is especially so because the crowding-out effects can be even worse than it is already found to be in the long run. It is ideal for policymakers to make serious considerations to cut back on the levels of financial fiscal incentives provided to consumers for EV purchases. This is despite the positive impact they have individually on EV adoption, which gives the impression that these policy incentives are ideal.

Furthermore, in order to successfully realise goals in relation to environmental outcomes and facilitate a smooth transition towards a green private transport sector, it would be wise to invest sustained efforts into actively building green intrinsic motivation across the public, ensuring limited external conditions which undermine green intrinsic motivations. Although fiscal incentives can be beneficial in improving the attractiveness of EVs, the potentially detrimental

impacts of underlying motivations behind the purchase of these vehicles on final outcomes for the environment or the green transport and energy sector should not be underestimated. Meanwhile, the relative strength of green intrinsic motivation in impacting EV adoption in comparison to monetary fiscal incentives fuels the proposal for policymakers to place an emphasis on green intrinsic motivation when devising policy mechanisms to facilitate EV adoption. With weak intrinsic motivations and expectations of rewards for green consumption, individuals may not sustain their preferences for environmentally-friendly vehicles in the long term.

Admittedly, cultivating green intrinsic motivation can be a tedious and challenging process. However, there is no shortcut to achieving environmental goals. Cutting back on subsidies and relying on policy initiatives to strengthen green intrinsic motivation to boost EV appeal may in fact even be a cost-effective way of promoting environmentally-friendly vehicles since costly external consumer incentives in the form of subsidies may no longer be necessary. Hence, making it more ideal for policymakers to implement measures that fuel intrinsic rather than extrinsic motivations to stimulate such pro-environmental behaviour. This would be a promising approach to ensuring the sustainability of pro-environmental behaviour and EV adoption (Truelove et al., 2014).

Policymakers can cut back on these extrinsic incentives either by completely phasing them out or employing means-testing to cut back on the fiscal total expenditure towards subsidy provisions. These means-tested subsidies can be reserved only for lower-income individuals who cannot afford an EV but settle for cheaper conventional vehicles due to their unaffordability of EVs. Hence, these subsidies should be administered only in a manner that allows EVs to match the prices of conventional vehicles. Further eligibility conditions can be set to restrict the type and costs of EVs that can be purchased using the subsidy in order to ensure that these incentives are only disbursed to individuals on the basis of genuine need. Notably, as indicated by the correlation matrix - Table 2 in Section 3.4 - income is found to be significantly and positively ($\beta = .213^{*}$) related to EV adoption although it was not found to have a direct and independent causal impact on EV adoption by the regression analyses. Through means-testing policymakers can ensure more genuine intentions surrounding subsidy provisions. However, the risk of a moral hazard still remains as lower-income consumers might purchase EVs with the intention to improve their income levels by reselling them at higher prices to the rest of the consumer population. In that case, policymakers can consider providing

means-tested subsidies in conjunction with price controls for EVs even in the second-hand resale market.

Meanwhile, the recommendation to strengthen green intrinsic motivations can be materialised in a twofold manner. Either through consistent investments towards innovation in the field of green transportation, which can improve the enjoyment consumers experience with EVs or by fostering a social culture whereby one is more likely to feel obligated to behave in an environmentally-friendly manner. The latter can be done by leveraging upon the presence of subjective norms or stressing the current state of environmental affairs to induce a sense of accountability within the public. Relying on subjective norms alone however may not be feasible or guarantee results, however, as this is less likely to impact individuals who have a strong sense of individuality and little regard for the opinions of others around them. Furthermore, personal norms and a sense of obligation itself cannot be enforced upon individuals and is challenging, in terms of ethicality and feasibility, to monitor and keep track of. Nonetheless, initiatives can be directed towards boosting enjoyment-based intrinsic motivation levels. Since it is challenging and unfeasible to strengthen one's personal sense of obligation or shift their personal norms, an approach to improving overall intrinsic motivation that is more feasible to be undertaken would be to focus on improving public enjoyment-based intrinsic motivation levels towards EVs. This can be done by strengthening fiscal investments towards innovation and supporting research and development initiatives behind EVs.

In order to strengthen the 'enjoyment' of utilising an EV, the government can channel fiscal investments in providing subsidies and tax benefits towards research and development initiatives of EVs to improve their design and technological functions. Additionally, policymakers can also make investments towards improving the availability of public charging infrastructure. Turning a blind eye towards the relevance of enjoyment-based intrinsic motivation in improving EV adoption can be relative to leaving an important stone unturned in initiatives to build a sustainable transport ecosystem. Doing so can squander the untapped potential of innovation in terms of bringing about improvements towards the attractiveness of EVs. Dedicating investments towards improving the innovative and technological appeal of EVs can also encourage a market-based diction of EV sales and pricing, reducing dependence on fiscal involvement for green behaviours. This can allow consumers to take the centre stage in the improvement of sustainable transportation outcomes as they increasingly demand innovative green products. Nonetheless, as more consumers gravitate towards these green

vehicles due to improved levels of enjoyment and charging infrastructure satisfaction, economies of scale can be expected to strengthen (Nykvist and Nilsson, 2015). Economies of scale would pave way for EV production costs and purchasing prices to shrink as the quantities demanded and supplied increase (Nykvist and Nilsson, 2015). This would be an alternative and more sustainable route of achieving improvement , as prices would reduce to make the product affordable to more consumers but not on the basis of temporarily offered one-time payments from the government. In doing so, we can potentially also bring about more sustainable change with positive spillover effects in other areas of green consumption (Truelove, 2014), as consumers transition further away from the limiting traditional mindset that green products are not attractive or user-friendly. As improvements in overall green intrinsic motivation are also likely to have positive spill over effects in other areas of green behaviour (Truelove et al., 2014), this, therefore, makes a more sustainable and reliable approach to achieving improved environmental outcomes as opposed to fiscal incentives. Therefore, improving the 'enjoyment' levels experienced by consumers is a more propitious approach to boost the appeal of EVs and make them preferable to more consumers in comparison to their conventional alternatives. In fact, Frey (2012; 2000) himself argued that economists should pay more attention to intrinsic motivation as a viable and essential instrument for realising policy goals; asserting in his work that it is crucial to make constitutional decisions which support individuals' own initiatives.

Ideally, in order to reap the advantages of charging infrastructural development in proliferating sustainable transport consumption, policymakers should further initiatives to enhance charging infrastructure satisfaction in terms of cost and availability. This is so as findings from Models 1 and 2 suggest that vehicle owners and potential buyers make significant considerations over the factors of EV charging cost and charging availability during their decision-making process. Hence, EV charging infrastructural development is recommended to be pursued in order to realise improved EV outcomes. As consumers' decisions to purchase an EV are found to be affected by their cost considerations, the provision of charging fee rebates can also be useful in achieving goals of improved EV adoption. In fact, the subfactor of 'charging fee' received the second lowest satisfaction rating in comparison to other charging factors. The mean charging satisfaction rating given by consumers in terms of charging fees was 3.73, which is much lower than the overall average charging infrastructure rating which is 4.0197. Hence, charging rebates are likely to catch the attention of vehicle consumers and improve their impression towards EV usage.

With respect to charging availability, investments towards increasing the density of charging stations (especially rapid charging stations) and preventing illegal parking occupations can be impactful in improving EV adoption. In fact, these forms of fiscal investment directed towards improving charging satisfaction are likely more sustainable than government support in the form of consumer subsidies. Public charging facility development does not merely improve the attractiveness of EVs financially, as a one-off payment to incentivise EV purchases, but it also improves the convenience and practicality of EV usage throughout the period of time consumers own the vehicle. Out of all charging factors, charging availability during business hours seems to be the most disappointing to vehicle owners and potential buyers out of all charging factors. This is indicated by the lowest mean satisfaction score of 3.70 in comparison to all other charging sub-factors; this number is also far below the overall charging infrastructure satisfaction score of 4.0197. Due to this and the significance of charging infrastructure in realising EV adoption outcomes as shown by the results, policymakers can consider investing in EV charging development to improve the availability of these sustainable vehicles.

Furthermore, as EV charging at home increases household electricity consumption, consumers may consider this to be costly and unsatisfactory. This is indicated through the survey findings as well as 36.04% of vehicle owners and potential buyers are unsatisfied with at-home charging (as indicated by a score of below 4). As for EV drivers, this can deter them from purchasing another EV in future, and potential EV owners, causing them to shy away from this pro-environmental mode of transportation. Such dissatisfactions can be mitigated by increasing the density of public charging infrastructure such that more consumers can make use of public facilities and providing rebates for public charging. Furthermore, paying attention to increasing the density of rapid charging stations can also be useful in addressing these concerns surrounding charging density. Rapid charging points allow EVs to be successfully charged over a shorter duration of time, as compared to slow charging facilities. Therefore, these would allow a greater number of vehicles to be charged within a particular fixed period of time in comparison to slow chargers. Presently, there are 2,600 public rapid charging stations in the Netherlands (IEA, 2022). However, this seems to be inadequate in the view of vehicle consumers residing in the Netherlands. Descriptive findings from this survey suggest that a minority of only 20.72% of vehicle owners and potential buyers indicated good satisfaction (with a score of either 6 or 7) towards the availability of rapid charging facilities in their cities. In terms of quantity, a smaller number of rapid charging stations can achieve the same level of

charging station availability as slow charging stations. Furthermore, since it requires a fewer number of hours to charge an EV and will not require overnight charging unlike slow charging points, it can address range anxieties of being stranded in the midst of a journey during the day and allow EV drivers or potential buyers to feel more assured of being able to quickly charge these environmentally-friendly vehicles in case of an emergency during travel. This also ties in with the concept of enjoyment-based intrinsic motivation as it can improve the convenience, and hence enjoyment, of utilising an EV.

However, notably, rapid charging stations require a high voltage of electricity and are more expensive than slow charging stations (Li et al., 2018). Hence, it is important for policymakers to also optimise the ratio of fast chargers to slow chargers based on cost considerations. In order to determine an optimal level of rapid charging stations while ensuring EV charging consumer satisfaction, policymakers can make use of a probabilistic user-equilibrium-based location model. One such model was constructed by Li et al. (2018) whereby EV drivers' charging behaviour was taken into consideration, alongside conditions of traffic congestion. These considerations were made to determine an appropriate number and spread of rapid charging stations across a country or city, while also avoiding traffic congestion. This can prevent overestimations of the number of rapid charging stations to be set up. Results by Li et al. (2018) indicate the usefulness of such a probabilistic model in identifying locations for charging stations while ensuring consumer satisfaction. It also prevents charging stations to be set up where they could cause additional traffic congestion. This model proposed by Li et al. (2018) can assist decision-makers in developing policies that encourage the use of EVs, and it will also be useful in developing an appropriate budget plan for implementing charging infrastructural development. Nonetheless, results from this study assure that charging infrastructure does have a positive and significant causal relationship with EV adoption outcomes in relation to conventional vehicle purchasing. Hence, dedicating time and resources towards the development of EV charging infrastructure would be useful in realising goals to improve the usage of these environmentally-friendly vehicles in comparison to their conventional alternatives.

Meanwhile, it is also important to take note that the mere construction of charging facilities to improve their availability to consumers does not necessarily shift perceptions of consumers regarding EV usage as this alone does not address the problem of range anxiety (White et al.,2022). Range anxiety is a psychological construct in which EV drivers are stranded during

their journey due to unavailability of charging facilities. Hence, it remains pivotal to engage in information campaigns which factually communicate EV charging technological and infrastructural developments with consumers, and provide clear directions to where they can find EV charging points around them. Informational campaigns conducted by trusted subject-matter experts who are able to objectively communicate directions on the usage of EVs can help to address the issue of range anxiety. In addition, public investments towards EV research and development initiatives can support the development of EVs with better driving ranges. Hence, improving EV usage experiences and allowing drivers to charge their EVs less frequently while travelling further distances without charging. Informational campaigns are important especially as existing EV drivers who are highly range-anxious could occupy for an excessive period of time and cause the usage of charging facilities to be inefficient as they prevent other drivers from making use of these public facilities when needed (Mashhoodi and van der Blij, 2020).

5.3 Limitations and Scope for Future Research

There are several limitations to this research that shall be acknowledged and discussed within this section. Furthermore, suggestions for future research shall also be made.

Firstly, due to the presence of a time constraint, this study was limited to cross-sectional data. For this particular research, cross-sectional data were used to examine not only the main effects but also the moderation effects involving the impact extrinsic rewards hold on the effect of intrinsic motivation on the final outcome in relation to EV purchasing. Primary data was collected over a fixed period of time across multiple individuals. Due to this, the temporal aspect of the link between EV adoption and the interaction effect of extrinsic rewards and intrinsic motivation cannot be determined from this study. In this case, panel data could have provided further insight into how the crowding-out effect of extrinsic rewards on intrinsic motivation manifests over time. Studying crowding-out effects using panel data would be an interesting consideration for future research and an opportunity to further insights into intrinsic motivation crowding effects.

Additionally, there is a risk of a self-selection bias. Due to financial constraints, incentives were not offered in exchange for involvement in this study and respondents' participation in this study was purely on a voluntary basis. This has two implications - respondents who continue to take part in the study despite not receiving an incentive may be individuals who

have a lower inclination towards extrinsic rewards, to begin with, or hold strong opinions on the topic of fiscal incentives, sustainability, or EVs. Since this study aims to examine the impact of intrinsic motivation levels and different attitudes towards extrinsic monetary government incentives, if data is predominantly from individuals with a lower inclination towards extrinsic rewards would be a limitation for conducting research. With this arises the risk of obtaining primary data from individuals who are not necessarily representative of a typical vehicle owner or potential vehicle owner.

Furthermore, it was not feasible to perform experimental manipulation for this study. Neither is it a possibility to change the amount of monetary incentive given to some individuals nor is it possible to withhold fiscal incentives from some individuals and not others. Fiscal incentives are implemented, for altruistic and efficiency purposes, to improve the affordability of EVs for all members of the public. Withholding such a benefit from selected groups of individuals would go against the very purpose and ethics behind these fiscal measures. Furthermore, the amount of subsidies disbursed to each individual is fixed and decided upon by policymakers. These decisions are not within the power of researchers. This is also the case for tax concessions. Any individual who meets the requirements stipulated by the government is rightfully eligible to use these incentives. Unless policy makers themselves withhold the provision of financial incentives, it would not be possible to study a counterfactual situation of motivation levels and EV adoption behaviour devoid of fiscal incentives whereby all else is the same except for the variables being examined. Even in the case that these incentives are withheld or changed in amount for only some groups of individuals, it would likely be on the basis of socioeconomic factors such as income upon means testing. Hence, groups of individuals with and without fiscal incentives would not be comparable with each other and ceteris paribus cannot be assumed. Although it could have also been insightful to assess the impact of government incentives at varying amounts, it is not within the power of researchers to make such changes. Hence, a presumable alternative was to ask individuals directly about their perceived level of usefulness of the fiscal incentives available to them so as to operationalise the extrinsic fiscal incentive variable for analysis and study how this translates to EV adoption. Randomised controlled trials, a form of experimental research which warrants the ceteris paribus assumption, would have been ideal for causal inference. It is considered the gold standard for causal inference as the two main groups of study participants are supposed to differ only on the basis of treatment. However, in the case of this study, a randomised controlled trial was not feasible to be conducted. Future research could continue to explore motivation

crowding effects if changes are made to the amount of monetary incentive provided to each individual or if fiscal incentives are discontinued. Such contextual changes could provide observational opportunities for the development of further insights into the trajectory of individual motivations in EV adoption. Future studies can also consider involving experimental research designs for this purpose in order to achieve greater robustness of findings.

Furthermore, since the sample size for this research is limited, this can impact the extent to which results can be generalised to the entirety of the EV consumer population. The limited sample size contributes to the risk of an under-coverage bias. An under-coverage bias means that the data collection mechanism of the survey might have missed selecting some elements of the target population, causing the sample to not be fully representative of the target population (Bethlehem, 2010). This poses a hindrance to findings from being extrapolated and generalised successfully to the entirety of the target population. Hence, it is recommended for future research to use a larger sample size in future research initiatives concerning this topic.

Lastly, the final limitation concerns the data collection strategies employed within this research. During data collection, there was a trade-off between successfully reaching the target population of EV owners and potential buyers in time, on one hand, and pursuing randomisation, on the other hand. As mentioned in Section 3, convenience sampling and snowballing strategies were employed as a part of this study. Survey questionnaires were distributed amongst social media groups and Facebook vehicle marketplaces. Although there are advantages to convenience sampling, such as the ease and swiftness of data collection through this method, especially in the face of a time constraint, there exist some limitations with this sampling method. This is a non-probability sampling technique and can result in a potential selection bias which can restrict the large-scale generalisability of findings (Emerson, 2021). Due to non-randomised sampling, in case there are additional underlying socioeconomic factors unknown to us which can also affect final results, there would be a risk of confounding bias which can affect the accuracy of the final results obtained. In order to address this potential risk of bias, conditioning was performed for income, age, gender and education level. However, in case there are other unknown socioeconomic factors which lie beyond our existing knowledge, which can also potentially impact the final outcome of EV adoption, there still remains a risk of bias. Nonetheless, with the incorporation of additional sociodemographic variables into the models constructed within this study, we can still ensure some level of mitigation towards the risk of a bias. Future research can take this into consideration and

explore the impacts of fiscal incentives using a different sampling method which can achieve better randomisation and possibly, attain a greater extent of accuracy and generalisability of findings.

Future research can consider exploring the specific causal mechanisms behind the crowding-out effects of fiscal incentives can be explored in terms of micro-level perceptions towards these extrinsic incentives in terms of the locus of control, and their extent of 'supportiveness' or self-esteem impacts. As posited within the cognitive evaluation theory, crowding-in effects of extrinsic intervention can be observed on intrinsic motivation when the extrinsic intervention is perceived to be ''supportive'' and fostering self-esteem (Ryan and Deci, 2000). However, as indicated by the results of this study, EV subsidies and tax benefits do not have a crowding-in effect on green intrinsic motivation, but rather the opposite as seen these extrinsic incentives are seen to have a negative moderating impact on the relationship between green intrinsic motivation and EV adoption This raises doubts about the extent to which consumers even view financial government intervention to be positive and encouraging. If these incentives are not perceived positively by consumers and are poorly impacting their self-confidence in engaging in pro-environmental behaviour and achieving environmental goals, they cannot be considered effective. Since such low self-esteem can potentially cause individuals to hold back from engaging in pro-environmental behaviour, which is undesirable, it would be worthwhile for future research to explore if the financial government interventions are having such a negative impact.

Lastly, future research may also entail an exploration into the possible spill over effects of EV subsidies and tax benefits onto other areas of green behaviour. As financial benefits are offered for making an environmentally-friendly choice specifically with regard to transport behaviour, it is possible that other areas remain neglected or even worsen. Conversely, it is also possible that it motivates individuals towards environmentally-friendly behaviour by improving their perceptions towards it as they engage further in it. In studying spill over effects, we can receive further nuance into the impacts of these extrinsic incentives on general green behaviour and whether or not these benefits are constructive in nature.

6. Conclusion

In summary, results found evidence in support of hypotheses 1 to 4. However, hypothesis 5 was disproven as results were not significant. Through this research, financial government incentives were found to have a positive direct effect on EV adoption. Thus, these financial fiscal incentives seem to be effective in encouraging preferences towards EVs, regardless of intrinsic motivation levels. Nonetheless, it is important not to overestimate the role of these fiscal incentives alone in facilitating a transition towards green private transportation.

Hypotheses		
Hypothesis 1	Financial fiscal incentives positively impact EV adoption in the Netherlands.	Supported
Hypothesis 2	Green intrinsic motivation positively impacts EV adoption in the Netherlands.	Supported
Hypothesis 3	Financial fiscal incentives moderate the relationship between intrinsic motivation and EV adoption.	Supported
Hypothesis 4	Charging infrastructure satisfaction positively impacts EV adoption in the Netherlands.	Supported
Hypothesis 5	Charging infrastructure satisfaction and monetary fiscal incentives positively interact with each other to boost EV adoption in the Netherlands.	Unsupported

Findings also point towards a 'hidden cost' of these incentives. Despite having a positive direct impact on EV usage, these benefits have also been found to have a negative moderating effect on the relationship between intrinsic motivation and EV adoption. This suggests the presence of a crowding-out effect due to the incentives. Such an effect is undesirable especially because results have revealed that intrinsic motivations are in fact the strongest determinant of EV adoption. Additionally, they are also considered to be more sustainable than financial incentives in spurring green behaviour.

Hence, findings are congruent with the argument of Frey (2012) and Ryan and Deci (2000) that extrinsic incentives can impact intrinsic motivations by weakening the extent to which these inner drives eventually lead to the type of desirable behaviour in question. In the context of EV adoption, results validate the motivation crowding theory and cognitive evaluation theory while

further specifying that the type of crowding effect these incentives present is a crowding-out effect on intrinsic motivations and not a crowding-in effect. Hence, findings refute arguments of Rommel et al. (2015) and Ledford et al. (2013) who posited that extrinsic incentives do not have any crowding out effects on pro-environmental behaviour. Results also do not align with Thompson et al. (2010) who argued for crowding-in effects of extrinsic incentives.

Furthermore, charging infrastructure has also been found to have a positive and significant effect on EV adoption. Although, it has not been found to have a significant positive interaction effect alongside the fiscal incentives to further boost EV adoption. Hence, further emphasising on the need to refrain from overestimating the positive outcomes from the provision of extrinsic stimulus such as fiscal incentives or charging infrastructure, although these do have a positive effect of encouraging the desired behaviour independently.

Lastly, several policy recommendations have been presented based on the empirical findings and justifications were provided for the prescribed policy adjustments. Several limitations of this research paper were also highlighted, alongside suggestions for future research.

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Appendix A. Survey Questionnaire

Introduction:

This survey is to contribute towards research for the purpose of a master's thesis. This research aims to understand preferences with regards to electric vehicle (EV) adoption and the incentives available to support EV adoption. This survey questionnaire shall take an approximated time of 5 minutes for completion and all responses remain anonymous. Your responses are greatly appreciated! For any further questions, please send an email to tolety.kushala@umail.leidenuniv.nl.

Informed consent:

I have read and understood the provided information. I agree to participate in this study. I understand that my participation is voluntary, that I am able to ask questions, and that I am free to withdraw from this study at any time, without giving a reason. By proceeding with this survey, I provide my consent to participate in this study.

Screening Questions:

In order to determine your eligibility to participate in this survey, please answer the following screening question(s). If you meet the eligibility criteria, you would be able to proceed to the questionnaire.

1) Are you above the age of 25?
    a. Yes
    b. No
2) Do you either use a car now or intend to purchase a car within the next 2 years?
    a. Yes
    b. No
3) Do you reside in the Netherlands?
    a. Yes
    b. No

Note: Within this survey, the term 'Electric Vehicle' (EV) shall be used to broadly refer to Battery Electric Vehicles (BEV), Hybrid Electric Vehicles (HEV), Plug-in Hybrid Electric Vehicles (PHEV), or Fuel Cell Electric Vehicles (FCEV).

Financial Government Incentive (FI):

4) On a scale of 1 to 7, to what extent do you agree or disagree with the following statements?
    a. I often think about incentives when buying green products.
    b. I believe that the EV subsidy is useful in improving my affordability to purchase an EV.
    c. I believe that the EV tax benefit is useful in improving my affordability to purchase an EV.

Green Intrinsic Motivation (GIM)

5) On a scale of 1 to 7, to what extent do you agree or disagree with the following statements?
    a. I feel morally obliged to act in an environmentally-friendly manner.
    b. I would feel guilty if I did not act in an environmentally-friendly manner.
    c. I would be a better person if I would act in an environmentally-friendly manner.
    d. I enjoy accepting new green ideas and products.
    e. I enjoy solving environmental problems through green measures.
    f. I enjoy searching for new green products.
    g. I enjoy giving feedback to improve existing green products.
    h. I feel excited when I have green products.

Charging Infrastructure Satisfaction (CIS)

6) On a scale of 1 to 7, how would you rate the EV charging infrastructure in the city you reside in based on the following factors?
   a. EV Charging Time
   b. Charging Fee
   c. Charging from home
   d. On-street charging at home
   e. Charging from your local community charging hub
   f. Charging at your workplace
   g. Charging at your supermarket
   h. Charging at leisure activities
   i. Rapid charging Availability
   j. Preventing Illegal Charging Spot Occupation
   k. Availability during business hours (9AM to 6PM)

7) Vehicle Ownership
   a. I use (or would like to buy) an EV.
   b. I use (or would like to buy) a conventional vehicle.

8) Which of the following age categories do you fall into?
   a. Below 25
   b. 25-34
   c. 35-44
   d. 45-54
   e. 55-64
   f. 65 and above

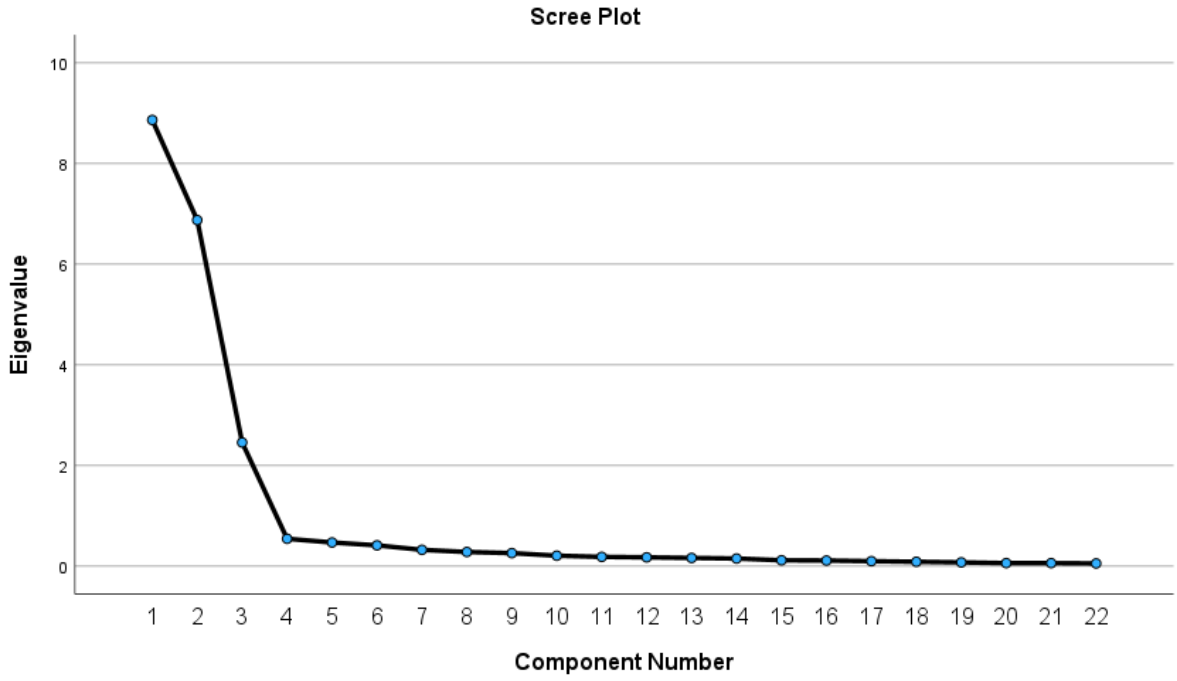
9) What is the gender you personally identify yourself with?
   a. Female
   b. Male
   c. Third gender / non binary
   d. Prefer not to answer

10) Which of the following categories does your personal income belong to?
   a. Below 10,000
   b. 10, 000 to 30, 000+
   c. 31,000 to 50,000+
   d. 51,000 to 70,000+
   e. 71,000 to 90,000+
   f. Prefer not to answer

11) What is your highest level of education completed?
   a. Primary and below
   b. Secondary Education (VMBO, HAVO, VWO or equivalent)
   c. Tertiary undergraduate education (MBO, HABO, WO Bachelor or equivalent)
   d. Tertiary postgraduate education (HBO Master, WO Master, PhD and above)

Appendix B. Factor Analysis Results

Scree Plot



Component Matrix

	Component		
	1	2	3
Rapid charging availability	.905		
Charging at your supermarket	.903		
Charging Time	.900		
Charging Fee	.893		
Charging at Leisure Activities	.883		
On-street charging at home	.875		
Availability during business hours (9AM to 6PM)	.856		
Charging at your local community charging hub	.849		
Charging at your workplace	.836		
Charging from home	.827		
Preventing illegal charging spot occupation	.799		
I enjoy giving feedback to improve existing green products		.947	
I enjoy accepting new green ideas and products		.944	
I would be a better person if I would act in an environmentally-friendly manner		.941	
I enjoy solving environmental problems through green measures		.934	
I would feel guilty if I did not act in an environmentally-friendly manner		.927	
I feel morally obligated to act in an environmentally-friendly manner.		.919	
I feel excited when I have green products		.913	
I enjoy searching for new green products		.912	
I believe that the EV subsidy is useful in improving my affordability to purchase an EV.			.952
I often think about incentives when buying green products.			.935
I believe that the EV tax benefits are useful in improving my affordability to purchase an EV.			.927

Extraction Method: Principal Component Analysis
Rotation Method: Varimax with Kaiser Normalisation
a. Rotation converged in 4 iterations.

Communalities Table

	Initial	Extraction
I often think about incentives when buying green products.	1.000	.895
I believe that the EV subsidy is useful in improving my affordability to purchase an EV.	1.000	.943
I believe that the EV tax benefits are useful in improving my affordability to purchase an EV.	1.000	.902
I feel morally obligated to act in an environmentally-friendly manner.	1.000	.853
I would feel guilty if I did not act in an environmentally-friendly manner.	1.000	.876
I would be a better person if I would act in an environmentally-friendly manner.	1.000	.897
I enjoy accepting new green ideas and products.	1.000	.895
I enjoy solving environmental problems through green measures.	1.000	.880
I enjoy searching for new green products.	1.000	.844
I enjoy giving feedback to improve existing green products.	1.000	.901
I feel excited when I have green products.	1.000	.844
EV Charging Time	1.000	.812
Charging Fee	1.000	.798
Charging from home	1.000	.685
On-street charging at home	1.000	.777
Charging from your local community charging hub	1.000	.721
Charging at your workplace	1.000	.716
Charging at your supermarket	1.000	.849
Charging at leisure activities	1.000	.823
Rapid charging availability	1.000	.838
Preventing illegal charging spot occupation	1.000	.685
Availability during business hours (9AM to 6PM)	1.000	.756