The Impact of Government Subsidies on EV Manufacturers

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Abstract

Government subsidies play a pivotal role in shaping the landscape of the electric vehicle (EV) industry in the United States. This research delves into the relationship between government support and the financial performance of EV manufacturers. This research aims to examine financial statements and market data to analyze the impact of government subsidies and incentives influence the revenue of EV manufacturers to provide a comprehensive understanding of the economic aspects of these policies on both individual companies and the EV sector as a whole. Beyond the financial aspects, this study will also address the ethical considerations associated with government support for EVs. What impact have US government subsidies had on EV manufacturers' sales?

Government Subsidies Impact on EV Manufacturers' Finances

Electric vehicles (EVs) have transformed the automotive industry, representing a paradigm shift in transportation. With each passing year, EV manufacturers introduce new models boasting increased efficiency, advanced technology, and purported environmental benefits. However, beneath the sheen of innovation, the EV industry, like any other, faces its own set of challenges. Chief among these are the intricate relationships between government subsidies and incentives and their impact on EV manufacturers' financial performance. While the appeal of EVs lies in their potential to reduce greenhouse gas emissions, lower fuel costs, and decrease maintenance costs, the pivotal role of government intervention cannot be overlooked. The year 2009 marked a pivotal moment when the Obama administration initiated tax credits, setting the stage for an unprecedented growth trajectory in the EV sector (Egg, 2023). These subsidies, often celebrated for propelling the industry forward, also introduce a complex set of implications. This thesis expands upon the intricate interplay between government support and the financial health of EV manufacturers in the United States. The purpose of this thesis involves a critical examination of financial statements, market data, and consumer choices. Subsidies and incentives shape the EV industry, with far-reaching implications for the future of transportation. This analysis seeks to unveil the multifaceted effects of government involvement on the sales performance of major EV manufacturers, while also considering the ethical implications and envisioning a sustainable and equitable automotive future. What has been the fiscal and cultural impact of government subsidies on the EV market as a whole?

The Attraction of EVs

The allure of electric vehicles (EVs) has captivated both the automotive industry and consumers alike, especially amongst democrats and moderates (Kennedy, 2023). In recent years, the EV market has experienced a monumental surge in interest, with Tesla at the forefront of this transformative movement. The question of what makes EVs so appealing arises, especially considering the amount of attention directed towards the EV market in recent years.

One cannot discuss the rise of EVs without acknowledging the pivotal role played by government incentives. Since the initial 2009 tax credits, the government has continued to offer federal tax benefits in addition to several state-level benefits to both consumers and EV manufacturers (IRS, 2024). These benefits might include further tax breaks, grants, or infrastructure support to encourage the manufacturing of EV plants in targeted areas. Some states such as California have implemented zero-emission vehicle mandates, which require auto manufacturers to produce a certain percentage of EVs. These incentives/mandates, often substantial, serve as a powerful motivator for consumers, making EVs not only environmentally friendly but also economically enticing.

The advantages of EVs over traditional vehicles are multifaceted. First and foremost, there's a substantial reduction in fuel costs. EV owners typically enjoy significantly lower operational expenses, with electricity typically being far cheaper than gasoline. Moreover, the promise of reduced maintenance requirements adds to the appeal (Bridi, 2024). EVs have fewer moving parts compared to internal combustion engines, which translates to fewer trips to the mechanic and lower overall ownership costs.

However, perhaps the most compelling aspect for consumers considering EVs is their contribution to environmental sustainability. With climate change concerns and a growing emphasis on reducing carbon footprints, EVs offer an environmentally responsible alternative. They produce zero emissions, mitigating air pollution and reducing reliance on fossil fuels (Abubakr, 2023). In today's culture where people are constantly online and making an effort to impress others, people want to visibly show that they are doing their part to have a positive impact on the planet. As individuals increasingly seek ways to make a statement about their commitment to environmental sustainability, driving an EV becomes even more attractive. According to a survey performed by Pew Research Center, “74% of Americans say they support the country’s participation in international efforts to reduce the effects of climate change” (Kennedy, 2023, p. 1).

It's impossible to discuss the appeal of electric vehicles (EVs) without acknowledging the pivotal role played by Tesla. Since Elon Musk assumed leadership in 2004, the company has experienced a surge in popularity. Musk's charismatic and visionary approach, combined with Tesla's iconic futuristic vehicle designs, has captured the public's imagination. It's no wonder that these cars have garnered widespread attention and admiration. In this context, government support acted as a catalyst, fostering a market for EV manufacturers like Tesla to flourish. The combination of financial incentives, environmental consciousness, and technological innovation has propelled EVs into the mainstream automotive market, making them a compelling choice for consumers seeking a sustainable and cost-effective mode of transportation. Electric vehicles (EVs) offer significant environmental benefits, but their widespread adoption poses challenges related to infrastructure, emissions, and resource limitations. One major concern is the lack of a

comprehensive charging infrastructure, especially in rural or less developed areas. This limited availability of charging stations contributes to range anxiety among EV owners, restricting the practicality and convenience of these vehicles (Mahmud, 2023).

Moreover, while EVs produce zero emissions, the environmental impact of their adoption is complex. The electricity used to charge EVs often comes from power plants that rely on fossil fuels, such as coal or natural gas. In 2022, 61% of global electricity production resulted from fossil fuels alone, with approximately 36% from coal, 22% from gas, and 3% from other fossils, contributing significantly to CO2 emissions (Abubakr, 2023).

Additionally, the production and disposal of lithium-ion batteries, a key component of EVs, present environmental challenges. The recycling of end-of-life EV lithium batteries is currently hindered by high costs and low profits, discouraging effective recycling practices among EV and battery manufacturers (Wang, 2022). Furthermore, the rapid increase in EVs will require a significant number of charging stations, creating a strain on the grid. The USA alone needs around 2 million charging stations, leading to increased peak power demand and system instability (Mahmud, 2023). Addressing these challenges requires sustainable practices in battery production, recycling, and a shift towards renewable energy sources for electricity generation to minimize the environmental impact of EVs. In 2022, the EV charging infrastructure was valued at approximately $3.2 billion, with a projected annual grow rate of nearly 30% (Soltani, 2024).

Literature Review

Government subsidies play a crucial role in influencing various industries, including the electric vehicle (EV) sector in the United States. These financial incentives are designed to

support specific activities, technologies, or sectors that align with national priorities. In the context of the EV industry, the U.S. government provides subsidies to encourage the adoption of electric vehicles. Common types of subsidies include tax credits, rebates, grants, and other financial incentives aimed at reducing the upfront cost of EVs for consumers. Additionally, the government may offer subsidies to EV manufacturers to spur innovation, research and development, and the expansion of charging infrastructure. These subsidies not only aim to accelerate the transition to cleaner and more sustainable transportation but also contribute to economic growth and job creation within the burgeoning electric vehicle market in the United States. Understanding the nature and impact of these government subsidies is essential for evaluating their effectiveness in achieving broader environmental and economic objectives within the U.S.

The U.S. government has actively promoted electric vehicle (EV) adoption through various incentives and subsidies. In 2009, former President Barack Obama allocated $2.4 billion to encourage car manufacturers to produce more electric and plug-in hybrid vehicles (Egg, 2023). This initiative included a $7,500 tax credit for consumers, mitigating the higher upfront costs of purchasing plug-in models. Despite the credit's availability for both plug-in hybrids and fully electric vehicles, it phases out for manufacturers, like Ford and Tesla once they sell 200,000 electric vehicles. Some states, such as California, offer additional rebates. Notably, Tesla has benefited from government loans, and the tax credit has played a role in making EVs more affordable for consumers. The recent $1 trillion infrastructure package signed into law includes funding for a national network of EV charging stations, reflecting the Biden administration's commitment to accelerating EV adoption (Naughton, 2021). Additionally, proposed legislative

changes aim to replace the existing $7,500 tax credit with a more extensive set of incentives, potentially totaling $12,500, with adjustments for factors like vehicle price, union labor use, and income caps. The article provides insights into the impact of government subsidies on the EV market, highlighting both successes and challenges in promoting sustainable transportation (Naughton, 2021).

The current scholarly discourse delves deeply into the complex repercussions of government subsidies on the financial landscape of electric vehicle (EV) manufacturers, reflecting a growing interest among researchers in understanding the intricate dynamics between policy interventions and the fiscal health of key players in the EV sector. Fournel (2022) contributes to this discourse by examining the potential for over-investment by EV manufacturers, suggesting that government subsidies not only stimulate immediate sales but also have far-reaching effects on future market dynamics. A notable illustration of this long-term impact can be seen in Tesla's strategic utilization of subsidies to enhance its charging infrastructure, leading to the establishment of a widespread network of over 50,000 Supercharger stations globally (Tesla, 2024). This strategic investment has not only contributed to Tesla's market dominance but has also positioned the company for sustained success. Even after the conclusion of the subsidy programs, Tesla's extensive charging infrastructure remains a strategic asset, bolstering consumer confidence and solidifying the company's market position. This example highlights the enduring and multifaceted effects that government subsidies can have on the financial viability and strategic positioning of EV manufacturers. Another potential concern associated with subsidy policies, as highlighted by Xing (2021), is the possibility of "non-additional" emissions reductions, wherein some EV buyers would have opted for EVs even

without subsidies. Since early adopters of EVs often prioritize new technology and environmental concerns, it’s likely that some buyers have received a windfall gain without significantly altering their behavior. This underscores the importance of carefully evaluating the effectiveness and efficiency of subsidy programs to ensure that they align with broader environmental and economic objectives.

Jurlin (2023) and Gallagher (2011) performed research that provided a valuable lens through which to examine the effectiveness of different subsidy levels within the electric vehicle (EV) industry. Their findings indicated a 7%–12% increase in sales correlated with rebate levels in the $1000–$3000 range (Jurlin, 2023), and a 3%–5% boost in sales associated with a $1000 tax incentive for hybrid electric vehicles (HEVs) (Gallagher, 2011). These findings illuminate the critical role that subsidy structures play in shaping consumer behavior. This seemingly modest percentage difference holds substantial implications for manufacturers' revenue streams, acting as a decisive factor in the competitive EV landscape.

Kwon's (2023) examination of pass-through rates for electric vehicle (EV) subsidies across thirteen countries offers valuable insights into the intricate relationship between government incentives and consumer pricing on a global scale. The study highlights the significance of comprehending how subsidies manifest in the final cost of EVs for buyers, with an average pass-through rate of 70-80 cents on the dollar providing a clearer understanding of the dynamics involving global firms, pricing strategies, and the influence of different subsidy types. This observation underscores the critical role of subsidies in reducing the overall cost of EVs for consumers, particularly as pass-through rates are highest for global firms marketing identical EV models across multiple countries, indicating consistent pricing strategies and

uniform subsidy-related pricing practices across diverse markets. Concurrently, Peng's (2022) analysis of how subsidy policies affect manufacturers' eco-innovation levels and profits reveals that, for a given subsidy policy, an increase in the technology gap between manufacturers leads to higher eco-innovation levels and profits for the technology leader, while the technology follower experiences a decrease in eco-innovation levels. However, the impact of the spillover effect on manufacturers' profits and eco-innovation levels depends on the type of subsidy and the technology gap. This correlation suggests that higher pass-through rates, coupled with specific subsidy types that encourage eco-innovation, could lead to greater overall innovation and competitiveness within the EV industry. Understanding this relationship is pivotal for policymakers and industry stakeholders as they navigate the complexities of encouraging EV adoption, ensuring that the intended financial benefits reach consumers effectively, and fostering innovation and sustainability within the EV market.

Acknowledging the challenges and controversies within the literature is crucial for gaining insights into the broader implications of government subsidies on the financials of electric vehicle (EV) manufacturers. Jurlin (2023) highlighted debates surrounding the need for fiscal incentives, introduces a critical dimension to the discussion. While Breetz and Salon (2018) argued for the essential role of state incentives in ensuring cost-competitiveness for EVs, Santos and Rembalski (2021) present an opposing viewpoint, suggesting that some electric cars are approaching cost parity with internal combustion engine (ICE) cars even without government intervention.

This divergence in perspectives adds a layer of complexity to the discourse on the optimal level of subsidies. The nature of the research question, which focuses on how

government subsidies impact EV manufacturers' sales, necessitates a comprehensive understanding of the various perspectives and debates surrounding the effectiveness and necessity of these subsidies in shaping the economic landscape of the electric vehicle industry. If fiscal incentives are proven to be essential for cost competitiveness, as argued by some authors, then government subsidies become a critical factor in shaping the financial viability of EV manufacturers. On the other hand, if there is evidence that certain EVs are nearing cost parity with traditional vehicles without government intervention, it raises questions about the effectiveness and necessity of existing subsidy structures.

In summary, the literature paints a comprehensive picture of the multifaceted landscape surrounding government subsidies and their impact on the financial viability of EV manufacturers. From studies on subsidy effectiveness to debates on necessity and controversies surrounding the market, the current literature provides a rich foundation for understanding the economic aspects and challenges within the evolving EV industry.

Financial Analysis

Based on the current literature, there are many different factors that have an effect on the financial success on EV manufacturers. It is without question that one of these is the assistance provided by the US government through the form of grants, tax credits, and other incentives (Hardman, 2017). In order to gain a complete understanding of the fiscal impact made by the US government, a comprehensive approach can be taken. Estimating the financial impact of government subsidies on electric vehicle (EV) manufacturers involves an analysis that considers various factors. Two primary aspects include estimating the number of EV buyers who

purchased or were influenced to buy due to the savings from tax credits, and assessing the direct subsidies or grants provided to EV manufacturers. Additionally, there is a third, less tangible impact related to the free marketing and promotion of EVs as part of a broader push for clean energy. However, quantifying this impact poses challenges due to the complex nature of consumer behavior, the dynamic market environment, and the diverse range of government incentives and initiatives. Despite these challenges, understanding the extent of government support and its influence on consumer decisions is essential for evaluating the overall effectiveness of EV subsidies and their contribution to the financial performance of EV manufacturers. In order to limit the scope of this study, only the direct-to-consumer subsidies will be evaluated.

In acknowledging the inherent constraints of this research endeavor, it's imperative to highlight the reliance on existing data sources to inform the numerical aspects of the analysis. Due to the limitations of time and available tools, the majority of the numerical data presented in this essay is drawn from reputable research studies and industry reports. This approach ensures the integrity and accuracy of the information presented, as it's based on established research methodologies and comprehensive data collection efforts. By utilizing external sources, a deeper understanding of the subject matter can be found while encouraging readers to critically engage with the provided information and seek out additional sources for further validation and context.

As mentioned previously, there are two primary subsidy types that have a net positive impact on EV manufacturers' finances: direct research and development (R&D) subsidies, and acquisition subsidies (Peng, 2022). R&D subsidies target manufacturers, encouraging investment in EV technological innovation. On the other hand, acquisition subsidies, aimed at consumers,

incentivize EV purchases by offering financial assistance. These subsidy schemes can take the form of static or dynamic subsidies, with the former remaining constant over time and the latter adjusting in value, often decreasing (Yina, 2023). In the U.S., subsidies are typically offered in the form of a static R&D subsidy or one lump sum, and dynamic acquisition subsidies.

In reviewing literature, it has been challenging for researchers to accurately assess the role subsidies have played in consumer behavior due to various influencing factors. According to Hardman (2017), several other factors affect consumer decisions, including charging infrastructure availability, urban density, level of education, environmental awareness, fuel prices, EV purchase price, the presence of PEV production facilities, vehicles per capita, and electricity prices, among other variables. This complexity underscores the difficulty in isolating the direct impact of subsidies on consumer choices regarding electric vehicles (EVs). Moreover, Sheldon (2022) found that estimates for the federal tax credit, including or excluding state subsidies, range from 14% to 50%, with a mean of approximately 30%. This suggests that roughly two out of every three PEVs purchased would have been bought regardless of the federal tax credit, highlighting the nuanced nature of consumer decision-making in the EV market. However, this wide gap in estimates from different studies, once again, affirms the difficulty in nailing down the precise effect these subsidies have on consumers and therefore the finances of EV manufacturers.

For instance, Tal (2016) found through customer surveys that 86.1% of Tesla Model S buyers would still have purchased their BEV without the federal tax credit. However, for the Nissan Leaf buyers, only 50.9% of consumers would have purchased their vehicle without the federal tax incentive (Tal, 2016). As one might expect, this implies that an incentive is more

important for a low-end EV such as the Nissan Leaf than a higher end BEV such as the Tesla Model S. In evaluating the subsidy effects on the EV market as a whole, this complicates the process since Tesla is a market leader in the EV market but is also a luxury car manufacturer. It is reasonable to assume that while subsidies do have a positive effect on all EV customer behavior, it's probably overestimated since over 80% of Tesla Model S customers would have been indifferent in their decision without the subsidy.

For the purposes of this research, using conservative statistics for the evaluated companies seems appropriate. The companies to be evaluated are Tesla, Ford, and Nissan. As mentioned earlier, on the conservative end, about 13.9% of Tesla model S customers purchased their EV due to the tax rebate offered. On the other end of the spectrum, approximately 49.1% of Nissan leaf customers bought their EV because of the tax rebate. For Ford, we will use the average of the studies evaluated by Hardman (2017) which was 30%. This will provide a comprehensive understanding of the governments effect on low, medium, and high end EV manufacturers.

Beginning with Tesla, for the year 2023, automotive sales totaled $15,656 million (Tesla, Inc., 2023). Due to Tesla solely being an EV manufacturer, we can directly multiply our percentage by this number to get the total number of sales attributed to government incentives. However, the percentage found in the study done by Tal (2016), only applied to the Tesla Model S. The Tesla Model S is their median model having some vehicles priced lower and some priced higher (Tesla, 2024). Because of the pattern seen with the Nissan Leaf, it appears that cheaper/lower end models have a higher correlation between sales and government incentives. For this reason, using the 13.9% for all Tesla models is practical since it's approximately the

average as the less expensive models would use a higher statistic and the more expensive models would use a lower statistic. Multiplying 13.9% by the $15,656 million in sales, gives an estimate of $2,176.2 million in EV sales resulted by government incentives.

Moving on to mid-range EVs, Ford is a suitable company to evaluate. Ford offers three prominent EVs, the F-150 Lightning, Mustang Mach-E, and E-Transit Van. According to Ford (2024), the company sold 72,608 Evs in the year 2023. Ford's total vehicle sales for the year 2023 were 1,995,912. Dividing 72,608 by 1,995,912 provides an accurate estimate of 3.64% for total vehicles sales. Multiplying this by the total vehicle revenue for year 2023, $162,925 million, results in $5,930.5 million (Ford Motor Company, 2024). This approximates Fords EV revenue, which can now be multiplied by 30% to find the figure attributable to government incentives: $1,779.1 million.

Lastly, Nissan is the lower end EV to be evaluated. Nissan offers two EVs: the Leaf and the Ariya. Both are affordable SUVs that are bought by consumers who on average value the federal tax credit incentive more than high end EVs such as Tesla customers (Hardman, 2017). For the year 2023, Nissan's revenue was 1,206,771 million yen. This equates to $7,960.9 million USD. They sold 7,152 Leaf models and 13,464 Ariya models in the US (Nissan Motor Corporation, 2023). The starting price for these two vehicles is $28,140 and $43,190 respectively. Using these conservative numbers, Nissan's total EV revenue for the year 2023 in the US was $782.8 million. This represents 10.2% of Nissan's total revenue. Multiplying $782.8 by 49.1% gives the approximate revenue resulted due to government intervention: $384.4 million.

To summarize, US government subsidies has had varying degrees of effect on manufacturer's customers and finances depending on the manufacturer and quality of EV. For Tesla, which sells mid-high end EVs, government subsidies had less of an impact on buyers' decision as over 85% reported that they would have purchased their EV regardless of the subsidy (Tal, 2016). $2,176.2 million of Tesla's revenue can be attributed to government subsidies. Ford, which produces more mid-range EVs, was slightly more affected by government subsidies. However, due to less EV market share, while a higher percentage of Ford's EV sales revenue is attributable to government subsidies, the total EV revenue attributable to the government is smaller: $1,779.1 million. Lastly, Nissan, which was the most affected by government as nearly 50% of their customers bought their EVs as a result of subsidies. Nissan's EV market share is much smaller in the US compared to their global presence which results in a significantly smaller figure of $384.4 million of EV sales attributable to subsidies.

Evaluation of Market Conditions and External Factors

Beyond the intricacies of marketing strategies, the success trajectory of EV manufacturers is intricately linked to external factors shaping the automotive landscape. Market conditions, competition dynamics, technological advancements, and global expansion strategies all play pivotal roles in determining the future outlook of this industry. Much of this section will focus on Tesla since they are currently the major leading player in the EV market.

EV success is linked to its adept alignment with market conditions, notably the surging global enthusiasm for sustainable transportation solutions. Over the past 15 years, EVs have transitioned from niche novelties to mainstream symbols of innovation and environmental

responsibility. This transformative shift has been fueled by a combination of the novelty associated with EVs and a resounding societal commitment to environmental preservation—a commitment that finds expression in the substantial government subsidies provided to bolster the adoption of eco-friendly vehicles. Tesla's direct-to-consumer approach has adeptly tapped into this evolving trend, propelling the company into a position of dominance within the rapidly expanding EV market.

In the dynamic realm of electric vehicles, Tesla stands as a trailblazer, navigating through a fiercely competitive landscape where innovation and strategic positioning are paramount. The last decade has witnessed a remarkable surge in competitors entering the EV market, each vying for a slice of the burgeoning eco-friendly transportation sector. However, Tesla's success transcends the mere production of electric vehicles; it rests on the strategic foundation of being an industry innovator.

In contrast, legacy automakers, exemplified by Ford Motors, have adhered to the traditional dealership model, characterized by physical showrooms and a network of dealers. While ingrained in the automotive industry for decades, this model has faced challenges in the era of electric vehicles. As Ford has slowly entered the EV market with the Mustang Mach-E and the F-150 Lightning, the company has decided to shift towards the direct-to-consumer model. One of the reasons for this, is that Ford and other traditional automakers typically produce EVs in limited numbers, leading to supply shortages and lengthy waiting lists for potential buyers. This stands in stark contrast to Tesla's more direct approach, where the company's ability to control production and distribution enables a more responsive system to meet the demand for EVs.

As EVs transitioned from being futuristic concepts to mainstream alternatives, Tesla's early foray into this domain positioned it as a trendsetter. The company's relentless pursuit of innovation, from cutting-edge battery technology to autonomous driving capabilities, has elevated it beyond a mere automaker to a symbol of technological advancement. In understanding the dynamics of competition, it becomes evident that Tesla's competitive edge is not solely in the products it offers but in its ability to continuously push the boundaries of what is possible in the EV space.

Navigating the competitive landscape necessitates a keen awareness of emerging technologies, changing consumer preferences, and the evolving regulatory environment. With legacy automakers like Ford and new entrants, such as Rivian and Polestar, intensifying their focus on electric mobility, Tesla's capacity to innovate and stay ahead of competitors becomes pivotal. Continuous research and development, strategic partnerships, and advancements in manufacturing processes will be integral for Tesla to maintain its leadership position. In this context, the landscape of electric vehicles evolves not just as a market but as a technological arena, where the ability to anticipate and lead innovation will shape every company’s trajectory in the future automotive industry.

At the core of EVs lies an unwavering commitment to technological innovation. The race among several companies to introduce the most cutting-edge technologies has not only characterized the EV boom but has also favorably positioned EVs in the broader vehicle market. Beyond the confines of traditional automotive manufacturing, EVs have become synonymous with technology advancements that extend from propulsion systems to autonomous driving capabilities.

The integration of artificial intelligence (AI) permeates various aspects of Tesla's operations, contributing to its comprehensive influence across the automotive landscape. Beyond enhancing marketing strategies, AI plays a pivotal role in areas such as research and development, production processes, customer service, and overall operational efficiency. In research and development, AI can aid in the design and innovation of new vehicle features, ensuring Tesla stays at the forefront of technological advancements. In production, AI-driven automation can optimize manufacturing processes, increasing precision and efficiency. Additionally, AI-powered customer service applications contribute to a more personalized and responsive interaction with EV owners. The widespread adoption of AI across these diverse functions underscores Tesla's commitment to leveraging technology for holistic improvement throughout its business operations.

As the automotive industry undergoes a profound transformation, characterized by the rise of electric vehicles, autonomous driving, and sustainable practices, Tesla's commitment to staying at the forefront of technological advancements becomes increasingly critical. The ability to innovate in battery technology, enhance autonomous driving capabilities, and introduce novel features that captivate consumers will be instrumental in maintaining Tesla's competitive edge. In summary, technological advancements are not merely an aspect of Tesla's operations; they are the cornerstone of its identity, shaping its trajectory in the ever-evolving landscape of the automotive industry. However, Ford is not far behind and are catching up to Tesla. With the introduction of compelling electric models like the Mustang Mach-E and F-150 Lightning, Ford is positioning itself as a strong competitor in the EV market. While Tesla has a head start and a

reputation for innovation, Ford's longstanding presence in the automotive industry, coupled with its commitment to electrification, suggests that there will be competition.

In the landscape of an increasingly globalized automotive industry, expansion strategies wield paramount significance for sustained success. Tesla and Nissan have orchestrated a strategic approach to global expansion that extends beyond simply selling cars. Both companies venture into international markets involves a multifaceted strategy encompassing the establishment of robust charging infrastructure and the construction of production facilities on a global scale.

One of the pivotal elements of EV global expansion is the emphasis on creating an extensive charging network. Recognizing the critical role of charging infrastructure in alleviating range anxiety and promoting electric vehicle adoption, multiple EV manufacturers have undertaken initiatives to build Supercharger stations worldwide. This strategic move not only facilitates long-distance travel for EV owners but also contributes to the normalization and accessibility of EVs, thereby fostering a conducive environment for global market penetration.

Moreover, Tesla's approach to establishing production facilities globally is a testament to its commitment to meeting the demands of diverse markets. By situating manufacturing plants in key regions, Tesla aims to streamline production and distribution, reducing logistical complexities and potentially mitigating challenges associated with international supply chains. This decentralized production strategy not only enhances operational efficiency but also positions Tesla to navigate regional regulatory challenges effectively. Other companies will need to follow suit in order to remain competitive, efficient, and profitable in the EV market.

Understanding how EV manufacturers navigate the intricacies of global expansion provides valuable insights into future market position. While success in established markets like the United States is evident, the ability to adapt to diverse consumer preferences, regulatory landscapes, and infrastructural variations across the globe will be pivotal for all competitors in the EV sector. Challenges such as varying consumer behaviors, regional competition, and geopolitical considerations may pose hurdles, making global expansion a delicate strategic endeavor.

In summary, the evaluation of external factors unveils a dynamic interplay between market conditions, competition, technological advancements, and global expansion strategies for EV manufacturers. As companies navigate these external forces, adaptability and ability to leverage market trends will be instrumental in shaping future trajectory in the ever-evolving automotive industry.

Ethical Considerations

The transition to EVs is hailed as a pivotal step in decarbonizing the transportation sector, yet ethical dilemmas surface concerning various aspects of this shift. Governmental initiatives, driven by a commitment to environmental sustainability, have introduced grants and financial subsidies to encourage the adoption of EVs. However, a critical examination of these incentives reveals various ethical considerations.

Income Disparities and Access to EVs: The income and equity gap highlighted by Caulfield's study (2022) introduces a multifaceted ethical dilemma in the realm of electric vehicle (EV) adoption, resonating particularly in urban areas. This scenario raises critical

questions about fairness, accessibility, and the societal impact of EV subsidies, with implications that extend to Tesla and its market dynamics. EVs, often perceived as symbols of environmental consciousness, bring forth a paradox. While they represent a sustainable choice, the financial barriers faced by lower-income households create a scenario where those who may benefit the most from reduced environmental impact are disproportionately excluded. This raises ethical questions about the fairness of environmental initiatives that inadvertently favor wealthier demographics. The ethical dilemma deepens when considering the potential consequences of inequitable access to EVs. If subsidies predominantly benefit higher-income households, it could perpetuate existing social and economic disparities. This misalignment with principles of social justice triggers concerns about whether EV incentives are serving the broader societal goal of creating an environmentally conscious and equitable transportation landscape.

Tesla, as a leading electric vehicle manufacturer, plays a pivotal role in shaping the narrative around EVs. The brand is often associated with cutting-edge technology and environmental innovation. However, if the benefits of owning a Tesla, or any EV, are more accessible to higher-income groups due to financial incentives, it could unintentionally contribute to the exclusivity of electric mobility. Tesla has an opportunity and, some argue, a responsibility to address these equity concerns. By actively working towards making its vehicles more accessible to a broader demographic, Tesla could align its market strategies with ethical considerations. This may involve exploring subsidy structures that cater to a more diverse income spectrum or introducing entry-level EV models that are economically viable for lower-income consumers.

Supply Chain Requirements and National Interests: The policy changes outlined by Politi (2023), incorporating active cathode and anode materials as "critical minerals," present an intricate ethical landscape within the electric vehicle (EV) industry. These changes, driven by national interests to bolster domestic production, raise ethical considerations that extend beyond economic goals. Examining these complexities provides insights into the global implications and prompts questions about fairness and inclusivity. As policies like those outlined by Politi unfold, companies must navigate the balance between complying with national regulations and advocating for global cooperation. The ability for EV manufacturers to influence and adapt to these changes will shape their roles in the broader ethical discourse surrounding EV adoption.

Shifting EV manufacturing and assembly to North America is an understandable pursuit from a national interest standpoint. However, ethical considerations arise concerning the global impact of such policies. EVs are recognized as a key component in addressing climate change. Still, if the pursuit of national interests hinders the global adoption of EVs, it raises questions about the ethical responsibility to collectively address environmental challenges on a worldwide scale. While promoting domestic manufacturing aligns with economic and employment objectives, there is a risk of unintentionally creating barriers to entry for countries with less developed EV industries. This could impede the global transition to sustainable transportation and perpetuate technological disparities. Ethical questions emerge about whether national interests should take precedence over fostering a globally inclusive EV landscape.

Environmental Impact and Equity: Foy's (2019) study, suggesting that tax subsidies for electric vehicles (EVs) contribute to a significant reduction in CO2 emissions, raises important ethical considerations surrounding the environmental impact of such incentives. However, it’s

crucial to note that other studies offer contrasting perspectives, emphasizing the need for a complete evaluation of the true effectiveness of EV subsidies in achieving substantial emissions reductions. If the financial investments in these incentives do not yield substantial environmental gains, questions arise about the ethicality of allocating resources in a manner that may not be optimally beneficial for the broader ecosystem. EV manufacturers have a responsibility to critically evaluate the environmental impact of its vehicles and the subsidies supporting them. Ethical considerations should extend beyond market dynamics to assess the genuine contributions to global sustainability.

The ethical considerations surrounding EV subsidies encompass a spectrum of issues, from income disparities and international cooperation to supply chain dynamics and environmental impact. Striking a balance that ensures fairness, accessibility, and a global perspective is crucial as governments navigate the complex terrain of incentivizing sustainable transportation. The ethical implications of EV subsidies extend beyond national borders, emphasizing the need for a nuanced and inclusive approach that addresses both environmental and social justice concerns.

Conclusion

The transformation of the automotive industry through electric vehicles brings about a new era in transportation. At the brink of a transformative point in history, driven by technological progress, evolving market dynamics, and unparalleled government backing, it becomes essential to evaluate the decisions made thus far and envision a future characterized not only by electric but also by sustainability and equity.

The allure of EVs, epitomized by industry trailblazer Tesla, lies in their promise of reduced greenhouse gas emissions, lower fuel costs, and decreased maintenance expenses. Tesla's meteoric rise to prominence underscores the shift in consumer preferences towards cleaner, more sustainable modes of transportation. The company's ability to captivate the market can be attributed to a combination of cutting-edge technology, visionary leadership, and, significantly, robust government support.

Government subsidies have proven instrumental in fostering the growth of the EV sector. These financial incentives, ranging from tax credits to grants, are strategic interventions designed to align with national priorities. The aim is not only to accelerate the adoption of EVs but also to stimulate innovation, research, and development, and the expansion of crucial charging infrastructure. As the US government continue to invest in sustainable transportation, understanding the impact and effectiveness of these subsidies becomes paramount. Currently, the subsidies appear to have a larger percentage effect on cheaper affordable models as intended. However, they have had a larger overall impact on higher end models as well. While subsidies are intended to incentivize the purchase of EVs, there is concern that they may be benefiting consumers who would have bought EVs even without the subsidies. This raises further questions about the cost-effectiveness of subsidies and whether they are achieving their intended goals.

The automotive landscape is shaped by a dynamic interplay of market conditions, competition, technological advancements, and global expansion strategies. For Tesla, navigating these external forces requires adaptability and a keen understanding of market trends. The company's ability to leverage these factors will be instrumental in steering its trajectory within

the ever-evolving automotive industry. As competition intensifies and technology continues to evolve, Tesla's resilience and strategic foresight will determine its future standing.

The ethical considerations surrounding EV subsidies are multifaceted, spanning income disparities, international cooperation, supply chain dynamics, and environmental impact. Income inequalities in EV adoption, as highlighted by Caulfield (2022), underscore the need for a more inclusive approach to ensure that the benefits of subsidies extend across income brackets. Recent policy changes, as reported by Politi (2023), emphasize national interests in EV manufacturing, raising questions about the global impact and the fairness of such policies. Foy's (2019) study, while showcasing the potential for emissions reduction, prompts ethical inquiries into the cost-efficiency and broader equity implications of EV subsidies.

In concluding this exploration, it’s clear that the path to an equitable and sustainable EV future demands a delicate balance. Governments, manufacturers, and consumers must collaborate to ensure that the benefits of EV adoption are accessible to all, irrespective of income level or geographical location. International cooperation is essential to address global challenges, and policies must be crafted with a holistic understanding of the intricate web of ethical considerations.

In conclusion, the financial implications of government subsidies on electric vehicle (EV) manufacturers cannot be overstated. Government interventions have played a monumental role not only in shaping public perception but also in influencing the financial landscapes of key industry players. Tesla's transformative journey, marked by substantial government backing, underscores the profound impact of subsidies on the company's financial health. The relationship

between policy interventions and the flourishing EV industry is evident in the unprecedented growth trajectory, technological advancements, and market expansion facilitated by government support. As the future of sustainable transportation continues to develop, it's evident that government actions wield significant influence, shaping not only the roads EVs travel but also the financial success of the manufacturers that drive this transformative movement.

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