FROM GAS TO GREEN: ANALYZING THE U.S. TRANSITION TO ELECTRIC LIGHT-DUTY MOBILITY

by

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This thesis examines the roles of corporations, consumer demand, and government policy in the United States' shift toward electric vehicles (EVs). As the transportation sector accounts for nearly 28% of national greenhouse gas emissions, understanding the drivers of this transition is essential for meeting climate goals.

The research uses an analytical approach involving three regression models to evaluate data from 2016 to 2023. The study finds that economic and social variables, such as gasoline prices, per capita income, and social awareness, consistently correlate with increased EV adoption. However, the findings reveal a complex interaction in which political context acts as a critical mediator; for example, rising gas prices have a stronger positive effect on EV adoption under Democratic administrations than under Republican ones.

Key results indicate that while corporate strategy and social awareness influence market shifts, government incentives were statistically insignificant at both national and state levels in the long term. Ultimately, the paper concludes that the U.S. EV transition is market-responsive but policy-dependent, suggesting that neither market forces nor government policies act alone. Instead, sustained coordination among policymakers, industry leaders, and citizens is necessary to align economic incentives with long-term environmental goals.

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Project Description

This thesis examines the responsibilities of corporations and the role of policy in the United States' transition to electric light-duty vehicles (EVs), with a focus on the federal government, major automakers, and oil and gas corporations. This transition reflects a broader societal shift toward environmental sustainability and responsible consumption. The project explores how these influential institutions interact as the nation moves away from gasoline-powered transportation. Academically, this research contributes to the growing body of literature on energy transitions and business strategy by connecting key variables that influence long-term market adoption.

Background

In 2022, the U.S. transportation sector accounted for approximately 28% of national greenhouse gas emissions, with light-duty vehicles making up the largest share due to their reliance on petroleum (U.S. Environmental Protection Agency, 2025). In response, EVs have gained momentum through technological advancements, corporate investments, and changing consumer attitudes (Zaino et al., 2024). Regulatory support is also evident through subsidies, regulations, and other incentives. The government also offers political backing via investments in the public sector. Understanding how these factors interact, especially the tension between fossil fuel interests and automaker strategies, can provide insight into the potential for EVs to significantly cut emissions and transform the future of transportation.

EV adoption primarily serves as a mitigation strategy, reducing greenhouse gas emissions from the transportation sector to limit the long-term severity of climate change. At the same time, the transition reflects elements of adaptation, as stakeholders actively change their business models or decisions related to climate-related risks and shifting expectations surrounding sustainability. Automakers' investment decisions, government incentives, and consumer demand for EVs can therefore be understood not only as efforts to prevent future environmental harm, but also as adaptive responses to an economy increasingly shaped by climate constraints. Examining the drivers of these responses offers insight into how mitigation and adaptation responsibilities are distributed between private firms and the state.

Problem Statement

While EV sales have increased in recent years, their environmental benefits will remain limited unless adoption occurs on a broad and sustained scale (Zaino et al., 2024). It is not yet clear whether the shift toward EVs marks a permanent transformation in the U.S. auto industry or a temporary response to market and political pressures. This thesis examines whether consumer demand and firm-level strategy are sufficient to drive the transition independently, or whether government policy remains the indispensable force behind it.

Importance

Understanding the driving forces behind the EV transition is critical not only for assessing the future of the U.S. automotive industry but also for evaluating the credibility of corporate sustainability claims. By identifying whether this shift is **primarily policy-led or market-driven**, this study clarifies the degree of accountability that should be assigned to firms versus governments. Furthermore, the findings have broader implications for how other carbon-intensive industries may approach sustainability, not just as a compliance issue, but as a core element of corporate strategy. In a world increasingly shaped by climate goals and investor scrutiny, the answer to who leads and who follows in the EV transition will shape environmental responsibility for decades to come.

Literature Review

Infrastructure and Market Conditions for Electrification

Overview of Gas-Powered vs. EV Infrastructure

The United States operates an extensive legacy fueling network comprising approximately 160,000 gasoline stations and truck stops, collectively dispensing around 380 million gallons of fuel per day (U.S. Department of Energy, n.d.; Lommele et al., 2024). Most of these outlets are independently owned, anchoring local economies through jobs, retail spill-over, and “truck-stop" services that make long-distance travel virtually frictionless (Carlier, 2023). By contrast, the public EV charging network comprises just over 73,000 locations nationwide, fewer than half the footprint of gas stations (Howarth, 2025).

EV chargers are heavily clustered in metropolitan and suburban corridors, leaving many rural communities and interstate routes underserved. The imbalance is compounded by the fact that a sizable share of installed ports are restricted-access units, such as workplace or fleet-only stations, and are unavailable to the traveling public, further reducing functional coverage for rural drivers (Lommele et al., 2024). This geographic and accessibility gap feeds range anxiety and slows adoption where charging reliability is perceived as uncertain (Pamidimukkala et al., 2024; Spencer, Ross, & Tyson, 2023).

Range anxiety is one of the most decisive barriers for EV buyers. The anxiety constitutes the doubt that the battery charge will last the user on the journey to their planned destinations without stopping to charge the vehicle. However, researchers claim that range anxiety is unfounded for many average drivers, given that EVs' limited range is still theoretically sufficient to match the average drivers' usage patterns (Phoon, 2024).

Market Share of Gas vs. EVs in Recent Years

EV adoption in the U.S. has grown steadily in recent years. Between 2022 and 2023, global EV sales surged by more than a third, indicating a shift beyond early adopters toward mainstream consumers (International Energy Agency, n.d.; Ewing, 2024). By 2023, nearly one in five new vehicles sold globally were electric (Fischer, 2025).

Domestic sales continued to rise through 2024, maintaining a quarter-over-quarter growth pattern (Broberg, 2024). However, while EV sales reached a new high in early 2025, they still accounted for under 8% of the U.S. market, highlighting the continued dominance of gas-powered vehicles (Fischer, 2025).

Reframing Gas and Oil's Role in the EV Transition

Oil and gas companies remain foundational to the automotive ecosystem, even in an era of electrification. While EVs do not burn gasoline, they still rely on a range of petrochemical inputs. Plastics, polymers, lubricants, and rubber used in tires and hydraulic systems are derived from oil. Even lithium-ion batteries contain petrochemical-based electrolytes. These material dependencies complicate the narrative of a fully "zero-oil" transportation future and reveal how fossil fuels remain embedded in vehicle production, regardless of powertrain (Palmer, 2024).

At the infrastructure level, oil incumbents are taking divergent approaches to the electrification shift. Shell and BP have invested heavily in EV charging networks, positioning themselves to support the growing demand for electric fueling infrastructure. In contrast, ExxonMobil and Chevron have resisted this pivot, focusing instead on biofuels, carbon capture and storage (CCS), and low-carbon fuels as parallel strategies (Nadig, 2024). These firms argue that electrification is not the only sustainable path forward, framing their investments as pragmatic and diversified rather than defensive (Chevron, 2022; ExxonMobil, n.d.).

From a supply chain perspective, systems for gas-powered vehicles are decades old and highly optimized, relying on the global oil supply for both fuel and key manufacturing inputs (Nadig, 2024). While EV production introduces new challenges, particularly regarding the emissions intensity of mining critical minerals, automakers are leveraging their long-standing expertise in mass production to reduce costs and scale up EV output (Ewing, 2024). Falling lithium-ion battery prices have further supported this shift, making EVs increasingly cost-competitive and accelerating their adoption (Precedence Research, 2024).

Structural, Social, and Policy Shifts

Shifts in Consumer Preferences

Growing public interest in sustainability is evident in the increasing volume of online searches for terms like "net zero" and "Tesla" (Howarth, 2025). In response to these shifts, and particularly in the wake of the 2008 financial crisis, domestic manufacturers like General Motors began investing in hybrid technology, launching models such as the Chevrolet Volt (Skemp, 2022).

By 2022, consumers had significantly shifted their attitudes, with one in four Americans reporting plans to purchase their next car as an EV (Aviles, 2024). There has been an explosion in the number of available EV models, with nearly 600 models available in 2023. The development in EV technology has allowed consumers to demand both sustainability and performance, opting for long-range, larger EVs over traditional compact urban models (International Energy Agency, n.d.).

Major Technological Advancements

Since 2000, manufacturers have explored ways to develop the lightest and most efficient batteries for powering light-duty vehicles (Anderson et al., 2024). The most popular battery models have been lithium-ion, solid-state, and silicon-anode batteries (Anderson et al., 2024; Howarth, 2025). All these innovations enable automakers to produce lighter vehicles due to increased energy density and reduced battery weight, thereby improving their efficiency (Anderson et al., 2024). Notably, advancements have enabled modern EVs to feature larger batteries and improved vehicle design, resulting in a 75% increase in average battery range from 2015 to 2023 (International Energy Agency, n.d.).

Another significant advance is the substantial decrease in the cost of lithium-ion batteries (Howarth, 2025). Automakers can now offer EVs that are more affordable and competitive, enabling them to reach new, cost-conscious markets (Zaino et al., 2024). Improved range also reduces range anxiety. Now that automakers can advertise technological advancements in battery technology, consumers are becoming more confident about adopting EVs, especially for long-distance travel (Shrestha, 2022).

Regulatory Milestones

U.S. vehicle regulations have evolved over decades to promote fuel efficiency and lower emissions. The first significant milestone came with the 1975 Energy Policy and Conservation Act, which established Corporate Average Fuel Economy (CAFE) standards that set nationwide fuel economy targets for the first time. In 1990, amendments to the Clean Air Act introduced stricter limits on pollutants and new requirements for vehicle technology, laying the foundation for cleaner automotive design (U.S. Environmental Protection Agency, 2025).

Since 2010, regulatory momentum has intensified. That year, the EPA and NHTSA introduced the first national greenhouse gas (GHG) standards for passenger vehicles, which were later strengthened in 2012. In 2014, Tier 3 standards were finalized, aligning fuel and vehicle emissions controls to achieve a more profound environmental impact. More recently, the 2023 Inflation Reduction Act (IRA) revised EV tax credit eligibility, expanded consumer eligibility, and allocated funding to install over 100,000 public EV chargers by 2026, directly addressing infrastructure concerns (U.S. Department of Transportation, 2025).

Rise of Sustainability Narratives in the Auto Sector

With transportation being the most significant source of greenhouse gas emissions in the U.S., reducing vehicle pollution is essential for both climate goals and climate justice. Low-income and minority communities suffer tremendous exposure to tailpipe toxins (Aviles, 2024). Policies such as the 2007 Renewable Fuel Standard aimed to promote cleaner fuels for these communities, but today automakers and oil majors are accused of using electrification as a marketing gimmick to demonstrate environmental leadership (U.S. Environmental Protection Agency, 2016; Bindman, 2023).

As corporate environmentalism gains traction, these firms are increasingly cast as climate problem-solvers. Yet, many co-opt sustainability rhetoric to defend business-as-usual expansion (Gunderson et al., 2018). The surge of battery-electric SUVs and pickups captures this tension. Each electric replacement can reduce CO_2 emissions and urban air pollution, yet mass adoption still lags behind firms' stated ambitions, exposing a widening gap between marketing claims and actual impact (International Energy Agency, n.d.; Aviles, 2024).

Drivers of EV Adoption: Economic, Social, and Political Influences

Economic Analyses of EV Adoption

Long-term cost savings play a crucial role in shifting consumer tastes towards EVs, especially given evidence of significantly lower lifetime ownership costs compared to gasoline vehicles (Penney, 2021). Thanks to their superior energy efficiency, EVs cost roughly half as much as gas-powered cars in annual fuel expenses (Lindwall, 2024). Similarly, the present data showing that rising fuel prices correlate with higher EV adoption suggests that consumer gas taxes can serve as an economic lever to promote EV uptake and reduce emissions (Fei et al., 2025). Despite these savings, the higher initial purchase price and battery replacement costs of EVs remain a persistent barrier to consumer adoption (Pamidimukkala et al., 2024).

Social & Political Drivers of U.S. EV Adoption

Public concern about sustainability is on the rise, yet fewer than half of Americans list climate change as a top priority (Precedence Research, 2024). Adoption, therefore, hinges on how social attitudes intersect with policy incentives and equity gaps (Gunderson et al., 2018). Early buyers remain concentrated in higher-income, predominantly White households that typically own multiple vehicles and have access to home charging, which reinforces disparities for renters and lower-income drivers (Dugdale, 2022).

Five social influences that boost EV uptake are (Pamidimukkala et al., 2024; Spencer, Ross & Tyson, 2023):

1. A desire to reduce local air pollution and CO_2 emissions
2. Broad environmental concern
3. Peer pressure and evolving social norms
4. Openness to new technology and experiences

5. Strong personal moral commitments

Democrats, younger adults, and urban residents are the most likely to consider an EV, while interest lags among rural and conservative groups. Flagship purchase incentives at the federal and state levels enable buyers to claim up to $7,500 for a new EV (and $4,000 for a used vehicle), along with additional electricity rate subsidies and perks such as HOV lane access (Lindwall, 2024; Pamidimukkala et al., 2024). These policies have historically spurred registrations in regions offering the richest credits and rebates.

Policymakers, however, often favor short-term fixes over systemic solutions, creating both risks and opportunities for firms (Biella et al., 2024). Automakers like Ford and General Motors are reorganizing their lineups and marketing strategies to capitalize on shifting policies; however, their strategies can lag or outpace government actions (Lindwall, 2024). These corporations play a significant role in shaping compliance and market changes, sometimes more effectively than government policies (Coglianese & Starobin, 2020). In effect, consumer attitudes and political incentives now interact to determine whether EV adoption scales broadly or remains confined to niche early adopters.

Theorizing Demand Shifts

Demand shifts, loosely defined, refer to the changes in consumer preferences, perceptions, and behaviors in a market. These shifts are evident in how psychological, social, economic, and political factors combine to reshape the vehicle market. While approximately 38% of Americans are likely to consider EVs, half of the U.S. population still remains hesitant, suggesting uneven shifts in demand (Spencer, Ross, & Tyson, 2023).

Consumers are drawn to EVs not only because they perceive them as better for the environment but also because they are quieter and faster (Ewing, 2024). Practical experience with EVs shapes these positive attitudes more concretely since they are not based solely on abstract knowledge. A consumer's internal capacity (knowledge and confidence) and external capacity (infrastructure and resources) strongly predict their intention to adopt an EV (Pamidimukkala et al., 2024).

Additionally, Americans who are confident in the government's ability to follow through on national infrastructure expansion are more likely to consider EVs (Spencer, Ross, & Tyson, 2023). The government can be motivated to do so because the adoption of EVs offers national energy independence, reducing reliance on fossil fuels, which insulates the U.S. from geopolitical instability (Precedence Research, 2024). Despite growing demand, many Americans still resist policies like phasing out gas-powered vehicles by 2035, reflecting cultural and political divides (Spencer, Ross, & Tyson, 2023).

Strategic Responses from Automakers and Oil Majors

Ford and General Motors EV Transition Strategies

Ford and General Motors are two of the largest American automakers, and, concurrently, consumers are looking to their responses to the United States' transition to EVs (Haddi, 2022). Tesla's success as an American EV manufacturer has attracted these legacy automakers to the market (Carlier, 2024; Nadig, 2024). General Motors has demonstrated strong growth, with recent increases in domestic EV sales and the successful launch of key models in 2024. Ford's EV sales have grown more modestly, with mixed results across its lineup (Fischer, 2025). These contrasting performances illustrate how automakers' strategies differently impact their market positions amid the evolving EV landscape.

Ford has made a $50 billion investment in EVs through 2026, with a target of producing and selling over 2 million units by then. Additionally, the company aims to have 50% of its global production be electric by 2030. As part of their strategy, they have electrified some of their iconic models, including the Mustang, F-150, and Transit, to offer a diverse EV lineup and target clear customer segments. The company has also undergone organizational restructuring, dividing into two business units, Ford Blue (focused on gas-powered vehicles) and Model e (focused on EVs), to streamline operations and sharpen its focus (Haddi, 2022).

Since the announcement of Ford's EV models, the company has had to address recall issues and now focuses on embedding quality into its organizational culture. Ford strategizes to appeal to customers with accessible pricing and lower ownership costs. To more prominently promote these values, Ford is currently developing its BlueOval City mega-campus as a sustainable hub for automotive manufacturing, with a focus on EVs (Haddi, 2022).

On the other hand, General Motors has made a $35 billion investment in EVs (and autonomous vehicles) through 2025, with the intention of achieving 50% fleet electrification by 2030, including 100% of their passenger and light-duty vehicles to be electric by 2035 (Ainsworth, 2024; Haddi, 2022). More broadly, General Motors has committed itself to be carbon neutral by 2040. The company's EV journey is highlighted by its most prominent achievement: the Ultium battery platform, which enables modular and flexible development of EV models (Nolan, 2024)

General Motors targets the luxury and performance EV markets with models like the Cadillac Lyriq and Hummer, adopting a multi-brand, multi-segment strategy to grow its market share. The company collaborates with Honda and LG Chem to advance vehicle platforms and battery technology and has invested $750 million to improve charging infrastructure (Nolan, 2024; Ainsworth, 2024). However, GM has somewhat scaled back its complete EV transition by emphasizing plug-in hybrids to balance consumer demand and regulatory pressures (Ferris, 2024)

Ford and General Motors have each committed tens of billions of dollars to EV investments while restructuring operations to accelerate electrification. Ford focuses on iconic, affordable models and internal quality improvements, whereas General Motors emphasizes premium markets and vertical integration. GM is more responsive to shifts in customer demand, while Ford prioritizes internal transformation. Both face challenges from regulations, infrastructure gaps, and variable consumer demand (Ferris, 2024).

Chevron and Exxon's Responses to the EV Market

Chevron and Exxon are major players in the U.S. oil and gas industry. Their responses, whether defensive or adaptive, are important to analyze amid the global shift toward electrification. This is especially relevant given the EPA's electrification targets and the anticipated minimum 17% decline in oil demand by 2032 (Palmer, 2024).

Exxon has committed up to $30 billion over five years to lower-emission investments, primarily in carbon capture and storage, as part of its strategy to reduce emissions and improve its public image. The company emphasizes upstream technological innovation rather than competing in EV infrastructure (ExxonMobil, n.d.).

In contrast, Chevron has invested $8 billion in low-carbon initiatives and $2 billion in carbon reduction projects through 2028, with a focus on enhancing energy efficiency and promoting electrification. Chevron publicly acknowledges a longer energy transition timeline, advocating for the continued use of fossil fuels to ensure energy security while promoting renewable energy development. By highlighting the greater efficiency of EVs' electricity use compared to gasoline, Chevron aims to position itself as pragmatic and technology-focused rather than defensive (Bradstock, 2025; Chevron, 202).

Research on Incumbent Firm Responses to Disruptive Innovation

Incumbent automakers, such as General Motors and Ford, recognize that electrification is undeniably reshaping the competitive landscape through emissions regulations and rapid technology innovation. However, when it comes to breaking traditional mindsets, legacy automakers face resistance when changing long-established ways of thinking and operating. Ultimately, automakers must make tough trade-offs, focusing on core competitive advantages, such as innovation, efficiency, quality, or customer responsiveness, to navigate disruption effectively (Haddi, 2022).

With the evolution of EVs, technological disruption tends to unfold over decades, giving incumbents time to respond and reposition. These companies often respond to changes by launching competing products and directly challenging disrupters. For example, major automakers are pivoting into EVs to compete with Tesla and other startups (Birkinshaw, 2022). Tesla, the dominant U.S. EV producer, is cutting prices by nearly $20,000, reshaping the intial EV landscape away from “premium pricing” (International Energy Agency, n.d.).

While aggressive countermoves can improve an incumbent firm's chances of success, they are often challenging to time and execute effectively. For example, General Motors struggled with its Maven car-sharing initiative, which failed to compete with Uber. The EV transition now provides a clear test of how legacy automakers navigate profound, market-defining change (Birkinshaw, 2022).

Research Questions

Main Questions

1. Has there been a significant shift in U.S. consumer demand for EVs?
2. Is the transition to sustainable transportation in the U.S. primarily market-led (by firms and consumers) or policy-led (by government)?

Sub-Questions

1. How do oil and gas companies indirectly influence EV adoption?
2. What role does social awareness or social justice activism play in accelerating EV demand?
3. How do economic variables like income and gas price interact with consumer choice?

Methods

Data & Variables

All variables were collected as annual averages by state, except for variables 4, 5, and 6, which were measured at the national level.

Dependent Variable

To answer my research questions, I examined U.S. EV adoption using new-registration counts for fully battery-electric and plug-in hybrid vehicles from the U.S. Department of Energy (U.S. Department of Energy, 2023). All further references to "EVs" will be to this combination of light-duty vehicles.

Independent Variables

1. Average retail gasoline price drawn from the U.S. Energy Information Administration and AAA Gas Prices (a public service of the largest U.S. motoring and leisure travel membership organization) (U.S. EIA, 2024; AAA Gas Prices, 2025).

2. Social-awareness index defined by search intensity for "environmental issues" generated by Google Trends (Google Trends, 2026)

3. Per capita personal income from the Federal Reserve Bank of St. Louis (Federal Reserve Bank of St. Louis, 2024)

4. Summed proportionate percentage of total EV models in the lineups of Toyota, Ford, Chevrolet, and General Motors using data from J.D. Power (J.D. Power, 2026)

5. Dummy variable indicating presidential party (1 = Republican, 0 = Democrat) drawn from U.S. House of Representatives (U.S. House of Representatives, 2026)

6. Volume of government incentives related to alternative fuels and advanced vehicles enacted on either a federal or state-wide level, measured by the U.S. Department of Energy Alternative Fuels Data Center (U.S. Department of Energy, 2023)

Analytical Approach

To analyze the extent that the above independent variables have on the U.S. EV adoption between 2016 and 2023, three separate regression models are used:

1. Baseline Market-Policy Model
2. State-Adjusted Model
3. Synergy & Political Context Model

All models include a logged version of the dependent variable and one-year lags of each independent variable. Logging EV registrations made the data and analysis more stable by reducing the impact of extreme outliers. Consequently, coefficients should be interpreted as approximate percentage changes in EV registrations associated with a one-unit increase in the independent variable in the previous year, assuming all other factors remain constant.

Additionally, to control for potential multicollinearity between the political context and government incentive activity, the *Government Incentives* variable was mean-centered within each political control category. This adjustment isolates within-administration variation in incentive volume, allowing the model to capture the effect of changing policy intensity independent of party affiliation.

Baseline Market-Policy Model

$$EV_{Adoption_t}$$
$$= \beta_0 + \beta_1 GasPrice_t + \beta_2 Income_t + \beta_3 FirmStrategy_t + \beta_4 PoliticalControl_t$$
$$+ \beta_5 GovernmentIncentives_t + \beta_6 SocialAwareness_t + \epsilon_t$$

This pooled OLS model is the simplest of the three. It treats all 350 state-year observations as one large, pooled sample. This characteristic means that the model treats all states as identical, refuting the premise that some states may systematically differ from others. In terms of validity, this model sacrifices consistent estimates of causal effects to estimate the impact of variables that do not change over time. Consequently, the purpose of this model is to identify the overall relationship between the independent variables and EV registrations. If coefficients are significant here, they will illustrate broad national correlations. As stated above, this does not make the variables necessarily causal, since state-specific differences aren't controlled for.

State-Adjusted Model

$$EV_{Adoption_t} = \beta_0 + \beta_1 GasPrice_t + \beta_2 Income_t + \beta_3 FirmStrategy_t + \beta_4 PoliticalControl_t + \beta_5 GovernmentIncentives_t + \beta_6 SocialAwareness_t + \epsilon_t$$

In contrast to the first model, this fixed effects model accounts for state fixed effects. It attempts to control for unobserved, time-invariant differences between states while focusing on within-state changes over time. By controlling for fixed-state traits, this model will provide more credible causal interpretations of the relationship between the variables. If the variables from the above model remain significant, those relationships are notable both within states and at the national level. However, if their significance declines, this indicates that much of the variation in EV adoption is attributable to long-term state differences.

Synergy & Political Context Model

$$EV_{Adoption_t} = \beta_0 + \beta_1 GasPrice_t + \beta_2 Income_t + \beta_3 FirmStrategy_t + \beta_4 PoliticalControl_t + \beta_5 GovernmentIncentives_t + \beta_6 SocialAwareness_t + \beta_7 GasPrice * PoliticalControl_t + \beta_8 Income * SocialAwareness_t + \epsilon_t$$

The second fixed-effects model introduces interactions to test how variables combine to shape EV adoption, making it the most complex of the three. The two interaction terms below were included in this model because of the economic and political implications of these variables on one another and the potential of these relationships to shape consumer adoption of EVs. Each interaction term is therefore designed to capture conditional effects that cannot be identified through the main variable analysis alone.

The interaction between *Gas Price* and *Political Control* will be tested to determine whether the effect of gas prices differs under Republican versus Democratic presidencies. This interaction is introduced because gas prices have become a salient political issue in recent U.S. elections, suggesting that their influence on consumer behavior may depend on the broader political context rather than operating uniformly across time. If this coefficient is negative and significant, it indicates that high gas prices boost EV adoption more under Democratic administrations. If it's positive, the reverse holds.

How *Income* and *Social Awareness* interact will highlight whether the social consciousness of wealthier states amplifies the effect of income on adoption. This term is included to reflect the historically higher upfront costs associated with environmentally sustainable products. A positive coefficient would mean that as awareness rises, higher-income consumers become more likely to adopt EVs. On the other hand, if it's negative, it suggests that social awareness may offset income advantages.

As a result, this model will capture synergies among market, policy, and social forces. This makes it ideal for addressing discussion questions, especially those on combined market-policy dynamics.

Limitations

This analysis faces several limitations, particularly regarding data precision and causal inference. First, there is a risk of measurement error, particularly in constructing the index of social awareness. This relies on a proxy, which may not fully capture the depth or nuance of public sentiment.

Changes in firm strategy or rising fuel prices may not reflect a one-year delay in EV adoption. Instead, they may influence consumer behavior sooner than a year or delay consumer response by multiple years.

Lastly, the study is limited by the lack of granular, consumer-level data. For example, the share of EVs in automakers' product portfolios is measured at a high level and may not accurately reflect production volumes or regional availability. Additionally, the government incentives variable relies on national-level data rather than examining state-level policies.

These limitations, while significant, do not undermine the study's core objective: to assess which factor has had the greatest influence on shaping the U.S. transition to EVs.

Results

Variance inflation factors (VIFs) were calculated for the logged dependent variable and lagged independent variables. All VIF values were below 5, indicating no serious multicollinearity concerns. This suggests that coefficient estimates in the regression models are not inflated by linear dependence among other variables.

EV Adoption: Log DV with Lagged Independent Variables			
	1: Baseline Market	2: State-Adjusted	3: Synergy Context
Dependent Variable	**Log (EV Registrations)**	**Log (EV Registrations)**	**Log (EV Registrations)**
Gas Price (t-1)	44.9%*** (0.141)	13.4%*** (0.032)	18.2%*** (0.038)
Income (t-1)	0.01%*** (0.00001)	0.01%*** (0.00000)	0.01%*** (0.00001)
Firm Strategy (t-1)	-1,324%* (7.400)	-211.7%* (1.243)	-300.0%** (1.297)
Political Control (t-1)	-2.1% (0.177)	12.2%* (0.031)	34.0%*** (0.098)
Government Incentives (t-1)	0.02% (0.002)	0.02% (0.0003)	0.02% (0.0003)
Social Awareness (t-1)	7.1%*** (0.009)	1.2%*** (0.004)	-3.9%*** (0.011)
Gas Price * Political Control (t-1)			-9.6%** (0.044)
Income * Social Awareness (t-1)			0.00%*** (0.00000)
Constant	179.3** (0.788)		
Observations	350	350	350
R2	39.7%	94.3%	94.7%
Adjusted R2	38.7%	93.2%	93.7%
F Statistic	37.673*** (df = 6; 343)	804.847*** (df = 6; 294)	652.924*** (df = 8; 292)
Model	Pooled OLS	Fixed Effects	Fixed Effects

*p< 0.1 **p< 0.05 ***p<0.01

Table 1: Comparative table of regression results across all three models.

Primary Drivers of EV Adoption

Gas price, firm strategy, income, and social awareness consistently correlate with EV adoption across models. Below are the results model by model.

The first model presents the national, market-driven story before controlling for state heterogeneity. If gas prices rise by $1, EV registrations increase by approximately 45% the following year. Income is statistically significant but has a small economic impact. The large coefficient for firm strategy (-1,324%) should be reconsidered as a 10-percentage-point increase in EV model share, corresponding to a -132% decrease in EV registrations the next year. Political control shows no clear national effect in pooled data. Government incentives also show no significance. Lastly, a 1-point increase in the sustainability index is associated with a 7.1% increase in EV registrations in the next year.

In the second model, which adjusts for state-level differences and employs a fixed-effects approach, R^2 increases from 39.7% to 94.3%, indicating that this model accounts for most of the variation in EV registrations. Gas prices remain positive and significant, though their impact is smaller. Income also remains significant with the same minimal coefficient of 0.01%. The effect of firm strategy stays negative but is much smaller. Conversely, the effect of political control becomes positive and significant. Government incentives still show no significance. The impact of social awareness on next-year EV registrations is only 1.2%, yet it remains significant.

The third model explores interaction and synergy effects. The first interaction examines the relationship between gas prices and political control. Results show a coefficient of -9.6%, meaning that under Republican presidencies, the positive impact of gas prices on EV adoption is notably weaker. The second interaction considers income and social awareness, and the effect is positive and significant. Interestingly, the main effect of social awareness turns negative. Political control becomes more significant when interactions are taken into account.

Quantifying Consumer Responsiveness

	Baseline-Market-Policy	State-Adjusted	Synergy & Political Context
Income	0.01%	0.01%	0.01%
Gas Price	**44.9%**	**13.4%**	**18.2%**

Table 2: Table of gas and income elasticities by model (all significant at the 1% level).

Given the structure of the regression models, the variable coefficients can be translated into economically meaningful responsiveness measures, such as semi-elasticities. Quantifying responsiveness involves two key variables: gas prices and income. Using the State-Adjusted Model, it can be inferred that:

1. A $1 increase in gas price results in a 13.4% rise in EV registrations the next year.
2. A $1,000 increase in income leads to a 0.1% increase in EV registrations the next year.

Income remains relatively consistent across all models, whereas gas prices are more volatile but remain significant. Both fixed-effects models have considerably lower coefficients than the baseline market model, but the gas price coefficient in the interaction model is slightly higher (18.2%).

Measuring Social Influence

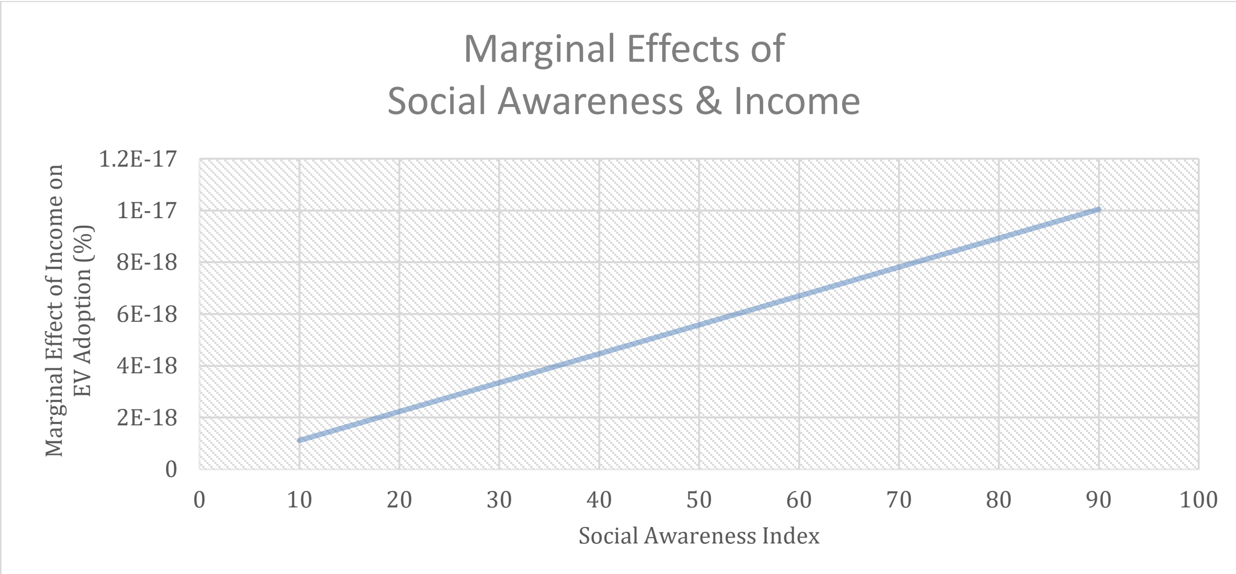

Figure 1: The marginal effect of income on EV adoption across varying levels of social awareness.

In the Baseline Market and State-Adjusted models, social awareness is primarily significant and positive. However, when interactions are added, the link between social awareness and EV registrations becomes negative. Statistical significance remains. This means that the effect of social awareness depends on income level but also has a strong, independent, and additive impact on EV registrations.

As shown in Figure 1, the marginal effect of income changes is linear in social awareness, indicating that income responsiveness increases systematically as social awareness rises.

Assessing Corporate Influence

	Baseline Market-Policy	**State-Adjusted**	**Synergy & Political Context**
Firm Strategy	-1324.0%*	-211.7%*	-300.0%**

Table 3: Table summarizing firm strategy coefficients across models with significance.

The share of EVs in the total models offered has a consistently negative coefficient across all models. It remains negative but shows greater precision in the two fixed-effects models (State-Adjusted and Synergy & Political Context). It stays significant after controlling for interactions in the third model.

Exploring Interaction Effects

The two interactions selected evaluated (1) whether political context affects consumer decisions related to gas prices, and (2) the premium price popularly associated with sustainable products.

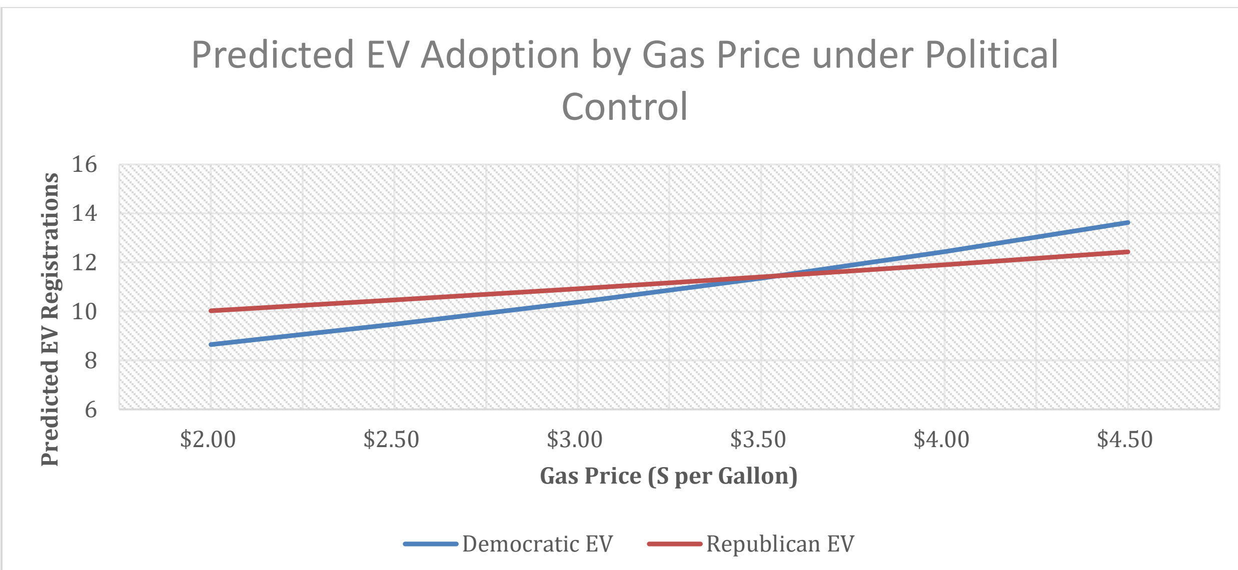

Figure 2: Interaction plot illustrating the marginal effect of gasoline prices on EV adoption across varying political contexts.

The interaction between gas price and political control is significant and negative. As shown visually in Figure 2, at lower gas prices, predicted EV adoption is higher under Republican control. However, as gas prices increase, EV adoption accelerates more under Democratic control, leading to a crossover point at a price slightly above $3.50 per gallon.

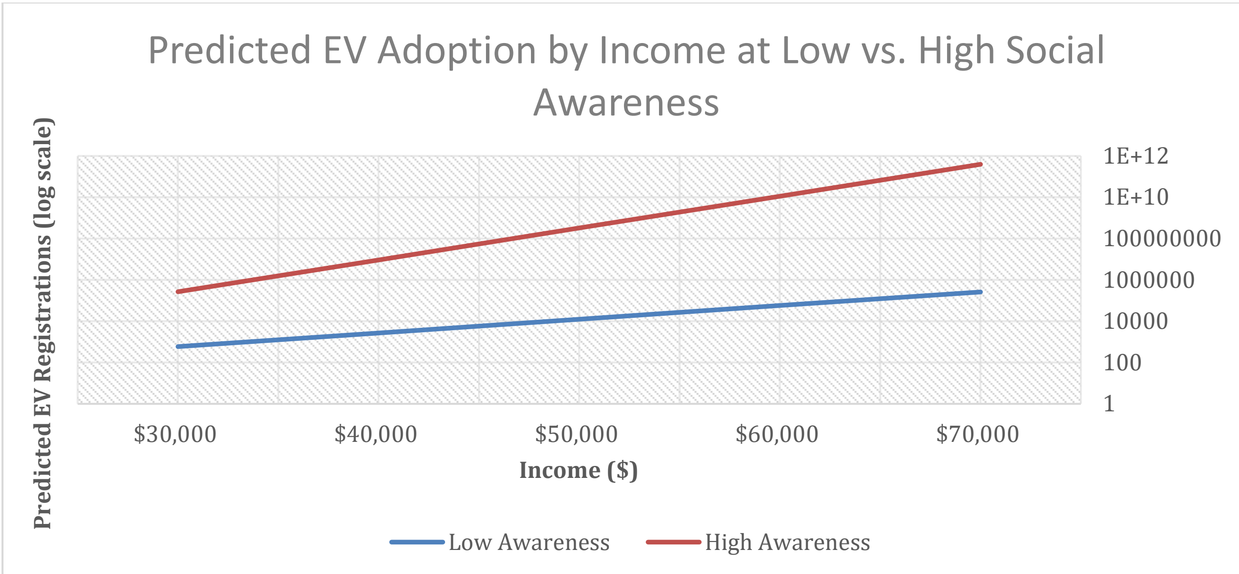

Figure 3: Interaction plot showing predicted EV registrations across income levels at low and high levels of social awareness.

With respect to income and social awareness, income effects differ notably across levels of social awareness. The positive coefficient suggests that as awareness increases, higher-income individuals are more likely to purchase and register an EV the next year.

With the addition of the interaction terms, nearly all of the original variables changed, either in magnitude, in direction, or both. The coefficient for gas price increased, but the effect of political control nearly tripled (from a 12.2% to a 34% increase in registrations, on average, under Republican presidents). The coefficient of social awareness increased in magnitude (from 1.2% to -3.9%), also becoming negative. Income's coefficient remained unchanged. Additionally, including both interaction terms improves model fit, with R^2 increasing by 0.04%.

In both Figures 2 and 3, predicted EV values (y-axis) reflect model-estimated adoption levels and are not direct predictions of actual EV registrations.

Summary of Key Findings

After a thorough review of the results from all three models, the following can be concluded with statistical significance:

1. Economic and social variables (gas prices, income, social awareness) consistently relate to EV adoption.
2. Political factors (political control) become more prominent in fixed-effects models.
3. Corporate strategy shows a steady negative correlation.
4. Interaction effects indicate context-dependent relationships.

With respect to the research questions, a demand shift is addressed through consumer responsiveness and the importance of market variables. The difference between market-led and policy-led approaches is clarified by the relative influence of firm-level strategy and consumer-level variables (e.g., income, social awareness) versus political control and incentives.

Discussion

Has There Been a Significant Shift in U.S. Consumer Demand for EVs?

The central question of this research is to identify the drivers of EV demand and quantify their magnitude. The results show an evolving cultural and economic response among car buyers toward EVs, albeit delayed and context-dependent. Nearly all variables (excluding firm strategy and social awareness in the third model) are consistently positive, indicating that as income, gas prices, and other variables increase, EV registrations will increase as well. For example, rising consumer awareness of sustainability, lower cost of ownership, and increased charging infrastructure all contribute to the conclusion that there was a significant shift in demand for EVs between 2016 and 2023. A majority of these relationships are significant at the 10% level or lower.

Is the Transition to Sustainable Light-Duty Transportation in the U.S. Primarily Market-led or Policy-led?

The Synergy & Political Context Model shows that political control and social context materially shape adoption, precluding a definitive conclusion about whether demand is market- or policy-led. Diving deeper, it is essential to examine more closely the drivers of consumer behavior in the EV transition for several reasons: to ensure equitable distribution, to develop effective future policy strategies, and to help automakers adapt to a changing market (to name a few).

Examining the elasticity findings, income is significant but has a small economic impact. Income does facilitate adoption once social norms are in place, but its minimal impact indicates that it does not drive adoption independently. Conversely, the link to gas prices is among the largest economic effects in the analysis. The social environment also significantly influences who responds consistently to income across models. These economic and social impacts point towards a market-led transition.

For automakers, the variable firm strategy is consistently negative across all models, indicating no expansionary effect. It could instead reflect strategic misalignment or transitional inefficiencies. Supply expansion may lag demand, or firms may expand EV offerings in response to regulation rather than consumer demand. However, its significance across all models indicates that the availability of EVs in automakers' annual lineups influences EV registrations, providing evidence of market factors shaping the transition.

Political control becomes significant and positive in the latter models, suggesting that EV registrations increase in the year following a Republican administration. This trend could reflect traditional tax cuts under such administrations, which increase disposable income and, concurrently, purchases of goods (Brocker, 2024). Another explanation is that if Republican administrations signal the reduction or elimination of EV subsidies, consumers may accelerate purchases before incentives expire (Ewing, 2025).

The crossover in Figure 2 indicates that substitution for EVs occurs when gas prices rise, but the extent varies by context. Demand has shifted under certain political conditions. For example, consumers respond differently to the same price signals depending on the political environment, suggesting that EV demand is partly politically influenced rather than purely economic. Conversely, government incentives remain insignificant at the national and state levels, suggesting that their effects on customer purchasing decisions are minimal in the long term. Nevertheless, there is no evidence of a nationwide demand shift that is largely independent of political contexts.

Neither markets nor policy acts in isolation. Policy shapes how market signals are interpreted, acting as a market mediator. However, social context shapes who responds to economic capacity. Although social awareness is not a formal policy, it functions as an institutional or cultural channel that amplifies income effects and adoption responsiveness. The EV transition is market-responsive, but policy-conditioned.

How do Oil and Gas Companies Indirectly Influence EV Adoption?

The relationship between gas prices and presidential political control best explains how oil and gas companies indirectly influence EV adoption. Although this analysis does not directly observe lobbying behavior or regulatory actions, it shows how national political leadership affects consumers' responses to changes in fuel prices. In this way, oil and gas firms might influence perceptions by shaping expectations regarding EVs and the broader energy market. These narratives could influence consumer decision-making.

The results show that rising gasoline prices are associated with increased EV adoption in subsequent periods, but this association is notably weaker during Republican presidential administrations than during Democratic ones. This suggests that under Republican leadership, higher gas prices lead to smaller behavioral responses toward EV adoption. One explanation consistent with this pattern is that Republican administrations may prioritize energy independence, particularly by supporting the stability of the fossil fuel sector (Colman, 2025). This stance would, in turn, reduce consumers’ sensitivity to price changes in EVs.

Conversely, Democratic administrations tend to support clean energy and EV subsidies, making higher gas prices a stronger incentive to switch to electric vehicles (Weisman, 2023). In these scenarios, increases in gas prices appear to more effectively encourage EV adoption, as consumers may view EVs as a more stable or policy-aligned response to rising fuel costs.

Taken together, these findings suggest that oil and gas companies indirectly influence EV adoption by shaping the contexts in which energy prices are understood. Instead of outright suppressing EV demand, promoting political contexts aligned with fossil fuel interests seems to lessen consumers' sensitivity to gas price changes. Additionally, the importance of political messaging and energy narratives is emphasized. The shift to EVs is affected not only by prices and technology but also by the broader institutional and political frameworks through which consumers interpret these signals.

What Role Does Social Awareness or Social Justice Activism Play in Accelerating EV Demand?

In the analysis, social awareness is positively associated with EV adoption in models that do not include interaction effects. When a state becomes more socially aware than it was in the past, EV adoption increases the following year. Along these lines, when a state becomes more socially aware, the same increase in income yields a substantially larger increase in EV adoption. Awareness acts as a cultural catalyst, enabling consumers to translate capacity into sustainable action.

However, when interactions are introduced, the main effect of social awareness is negative, meaning that increases in awareness alone do not uniformly translate into higher EV adoption across all income levels. Put differently, social awareness facilitates EV adoption when economic capacity is present, rather than serving as a standalone driver.

Cultural readiness alone does not overcome affordability constraints. At lower income levels, rising awareness has less of an effect. The clean energy transition risks deepening existing inequalities if affordability barriers persist. Social justice considerations, therefore, become central: awareness and activism can amplify adoption only when structural access is in place (Lee et al., 2024).

How Do Economic Variables like Income and Gas Price Interact with Consumer Choice?

The findings on income elasticity and social interactions indicate that economic factors influence EV adoption differently across contexts. Income and gas prices both exhibit strong, statistically significant relationships across models, but their effects vary with the surrounding conditions that shape consumer perceptions and responses. Consumer choices are shaped by the interaction between economic conditions and social and political environments. Rising income and fuel costs can lead to increased adoption, but how much that potential is realized depends on cultural awareness and the national policy environment.

Conclusion

Recommendations

The findings of this thesis suggest that the U.S. EV transition is neither solely market- nor policy-driven; market forces operate within social and political contexts rather than in isolation. Consumer demand for EVs is emerging gradually, reflecting delayed behavioral adjustment and increasing cultural readiness within states over time. Economic capacity enables adoption, but social awareness and political context determine the extent to which income and prices translate into EV demand. Public policy does not directly drive EV adoption. Instead, it shapes the environment in which market signals influence consumer choice, amplifying or dampening their effects. If stakeholders can use these forces strategically, consumer readiness can be turned into lasting structural change.

Policy Relevance

The results highlight that policy remains a critical mediator between market capacity and cultural motivation. The policy environment determines how economic forces translate into adoption. The political tone influences how consumers interpret fuel prices, while social awareness amplifies the effects of income. These dynamics underscore that the EV transition cannot rely solely on market forces; sustained leadership from both government and industry is necessary to align economic incentives with long-term environmental goals. By clarifying these interdependencies, this research helps frame the EV market not as an inevitable outcome of innovation, but as an evolving system shaped by deliberate coordination among policymakers, corporations, and citizens.

Future Directions

Future research could expand this analysis to global contexts, especially in countries that are environmentally and economically significant. Comparative studies could identify which governance models or firm strategies are most effective across regions. In addition, incorporating qualitative methods, such as consumer or automotive executive interviews, would provide valuable insight into motivations and barriers that quantitative data alone may not capture. Lastly, given the importance of EV infrastructure in facilitating adoption, future studies might examine the geographic and demographic distribution of charging stations and whether income or race influences access to this critical resource.

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