



**THE PUBLIC POLICY EFFECT ON
CUSTOMER VALUE & TECHNOLOGY
ADOPTION IN THE UNITED STATES:
A CASE FOR PLUG-IN ELECTRIC
VEHICLES**

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ABSTRACT

The adoption of Plug-In Electric Vehicles (PEVs) worldwide has been a key research topic for the past twenty years. Particularly in the United States, we now find ourselves on the other side of the *chasm* described by Moore's (2014) adaptation of Rogers' (2003) technology diffusion curve – at the beginning of the early majority phase. Much of the previous research on PEV adoption was based on data obtained from potential buyers, innovators, and early adopters. This study draws on prior research grounded in the Technology Acceptance Model and the Theory of Planned Behavior to examine PEV adoption in the United States by actual adopters in the early majority. The study incorporates the influence of public policy on PEV adoption, intending to understand how it serves as both a moderator of adoption by the early majority and a direct correlate of it. Secondary data was used to examine the relationship between public policy and PEV adoption in the first part of the study. The research confirmed a positive correlation between public policy (represented by infrastructure deployment and financial incentive strength) and PEV adoption among the early majority. The second part of the dissertation evaluated the relationship between the four components of customer value as defined by Sweeney and Soutar (2021) and PEV adoption. Using survey data from actual adopters, the study yielded mixed results. Only financial incentive positively moderated the relationship between pricing value and PEV adoption. The study did not support the early majority considering quality a significant deciding factor for adoption, and it did not meet the statistical threshold to confirm that the early majority does not consider social benefit a deciding factor. The second study also failed to confirm that public policy influences the relationship between emotional value and PEV adoption. This research provides a fresh perspective on plug-in electric vehicle adoption in the United States by focusing on actual adoption as opposed to intentions to adopt.

Research Question 1: “What effect does public policy have on the early majority’s PEV adoption across the United States?”

Research Question 2: “How much of the effect is influenced by customer value for this target market?”

INTRODUCTION

What drives a critical mass of consumers in a particular market to adopt new technology? Research has identified many factors that drive overall technology adoption and technology diffusion. The innovators and early adopters will have different motivations than the early and late majority, who also differ from the laggards. Research by Schelly (2014), Simpson and Clifton (2017), and Palm (2020) highlighted early adopters being motivated by technical innovation, environmental aspects, and enjoyment or novelty. The next wave of adopters requires more practical reasons for jumping on board. In studying imaging and mobile communications technology adoption, Miranda and Lima (2013) wrote, “between the introductory and growth phases of the adoption trajectories there is a critical point, the takeoff point, in adoption of innovations after which the whole dynamics of adoption changes” (p. 1185). Miranda and Lima (2013) followed up by stating, “at this subsequent stage, customer requirements and preferences change from technical functionality to usability and reliability” (p. 1185). These types of consumers are at the beginning stage of mass adoption along the standard technology adoption curve championed by E. M. Rogers (2003) and G. Moore (2014); see Figure 1. Moore (2014) defined a gap between the early adopters of a new technology and the more mainstream consumers as the chasm. The first group of adopters on the other side of the chasm is referred to as the early majority, often labeled pragmatists, and they are the key to any technology being adopted by the mainstream market.

When considering what motivates pragmatists, we are led to look at customer value. Magotra et. al. (2018) studied the banking sector in India to understand the relationship between customer value and technology adoption. In their conclusion, it was noted that the adopters had a “favorable personal disposition towards technology adoption... the technology is useful in

serving their banking needs and easy to use, (p. 23). But Magotra et. al. (2018) also noted “available research in this field indicates that the phenomenon of customer value and technology adoption has been hardly studied in its entirety (p. 17). This research project explicitly seeks to understand what the early majority values in their adoption of new technology, specifically considering plug-in electric vehicles in the United States. The timing is right to study this phenomenon because some posit we are now just beyond the chasm that divides the innovators and early adopters from the mainstream market. Egbue et al. (2017) opined that we were in the early adopter stage based on 2.9% market penetration of electric vehicle sales at that time. Hailes (2024) wrote, “In 2023, the EV share of the total U.S. vehicle market was 7.6%, according to Kelley Blue Book estimates.” What is referred to as the *tipping point* for EV adoption (where 5% market share signals the beginning of mass adoption of a new technology) was surpassed in the United States in the fourth quarter of 2021, according to Randall (2024). Something has changed.

Predictive models often use survey data to understand what would drive people to adopt a new technology. Understandably, the research focused on potential buyers over the last decade because there were so few who had adopted during this timeframe. Rezvani, Jansson, & Bodin (2015) noted this in their own literature review, writing “our review of the literature shows that consumer EV adoption has mainly been studied by focusing on intentions for adoption in contrast to actual adoption” (p. 126). Understanding that we are now at the beginning of a mass adoption movement provides fertile ground to survey what drove the early majority to make the transition. We are at a critical juncture in PEV adoption in the United States where we can gather unique information from the early majority who have made the transition, and use that information to enhance marketing, public policy, and education on this newer technology.

SUMMARY OF THE LITERATURE REVIEW

The initial literature review to prepare for the first study focused on PEV adoption preferences in the United States, with conclusions on what individuals intending to purchase looked for. This provided insights into potential theories and what motivations could be hypothesized when looking at individuals considered to be early mass adopters. Much of this research was based on surveys of potential buyers and the general population that has not adopted PEVs. The next focus on literature was on customer value in relation to technology adoption. This encompassed various technologies and helped guide what type of theories and motivations could be applied to my research questions. The output of this part was an analysis of eleven studies from 2007 to 2021, common theories used, and what methods of measuring customer value were often utilized. This review highlighted the common use of the Technology Acceptance Model (Davis, 1989) and the Theory of Planned Behavior (Ajzen, 1985) in understanding customer value. Another component of the literature review focused on public policy effects on technology adoption. Prior to the 21st century, most research looking at this relationship was theoretical. We began to see empirical studies over the last twenty-five years. As a summary, the literature did support public policy having a meaningful impact on technology adoption and the intent to adopt.

The literature review continued for Study 2, which looked deeper into customer value and its relationship to technology adoption. In this part of the research, literature that spoke to the relationship between technology adoption and key components of customer value was referenced. The components of customer value identified were quality, emotional, price, and social values, based on research by Sweeney and Soutar (2001). Research consistently supports quality being a factor in driving technology adoption/acceptance. There has also been extensive

research on perceived quality and purchase intention, even if not directly focused on technology adoption. The relationship between emotion and technology adoption has been studied across different industries, and with mixed results. However, many studies have found positive relationships between the two, even though some were indirect. What is implied by the relationship of emotional value and technology adoption in this study is how adoption makes the consumer *feel* at the point of purchase. How pricing relates to consumption/adoption has been studied extensively. The research consistently shows that technology diffusion increases as prices decrease. The fourth factor in perceived customer value, social influence, has also been studied as a factor in technology adoption. Vannoy and Palvia (2010) boldly state, “social influence leads to technology adoption” (p. 149), while leaning on the Social Influence Model of Technology Adoption. Graf-Vlachy et al. (2018) posit “social influence has been shown to profoundly affect human behavior in general and technology adoption in particular.” (p. 37). Lee et al. (2013) note that the Bass model identifies innovators as those who are not dependent on social influences, and all others as influenced by their social systems. By studying the early majority, we will look to verify if social influence plays a role in their adoption of PEVs.

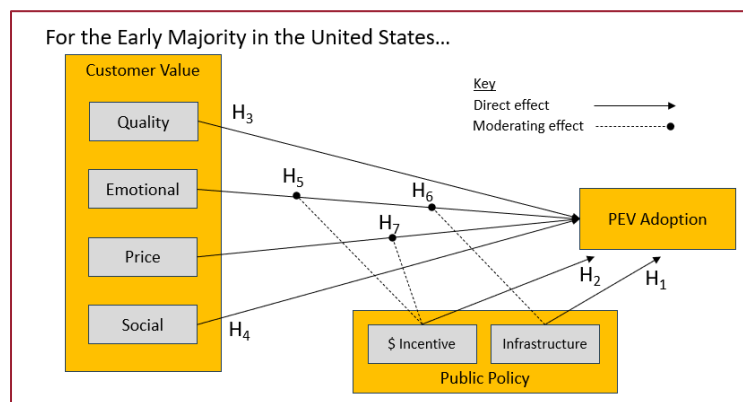
This study also reviewed literature to understand what has been written about the relationship between the early majority and technology adoption. There is not much literature that focuses on defining the early majority. In most research, this group is simply described in reference to early adopters and innovators, whom we can find plenty of literature on. Lin and Hong (2011) studied the difference in characteristics between early adopters and the early majority to ascertain how wide the chasm is for innovative products. Their research concluded that because they were close in characteristics, the early majority are influenced by advertisements, and a significant number agree with the use of innovative products by early

adopters. Recent research by Scherrer et al. (2026) concluded, “In contrast [to early adopters], the early majority is more cautious and requires clear evidence of an innovation's benefits and practicality before deciding to adopt” (p. 4).

CONCEPTUAL MODEL & HYPOTHESES

In both studies, the focus areas from previous literature were key. They inspired the creation of a conceptual model and hypotheses to guide my research methods in assessing what components of customer value and public policy drove the early majority of PEV adopters to purchase recently in the United States (as opposed to understanding the intent to purchase in the future).

Figure 1. Conceptual Model



Hypothesis 1 (H₁): For the early majority, infrastructure deployment positively correlates with PEV Adoption

Hypothesis 2 (H₂): For the early majority, financial incentive positively correlates with PEV Adoption

Hypothesis 3 (H₃): For the early majority, quality value positively correlates with PEV Adoption

Hypothesis 4 (H₄): For the early majority, social value does not correlate with PEV Adoption

Hypothesis 5 (H₅): For the early majority, financial incentive positively moderates the relationship between emotional value and PEV Adoption

Hypothesis 6 (H₆): For the early majority, infrastructure positively moderates the relationship between emotional value and PEV Adoption

Hypothesis 7 (H₇): For the early majority, financial incentive positively moderates the relationship between pricing value and PEV Adoption

This research is being conducted in two studies to answer the seven hypotheses. The conceptual model illustrates the relationship between public policy and PEV adoption, and the relationship between customer value and PEV adoption, often with public policy as a moderator (see Figure 1). The first two hypotheses are tested in the first study, with the expectation that both infrastructure deployment and financial incentive positively correlate with PEV adoption. The remaining five hypotheses are tested in the second study. We expect that quality value will positively correlate with PEV adoption, while social value will show no correlation. We also hypothesize that aspects of public policy (infrastructure deployment and financial incentive

strength) will positively moderate the relationship between certain components of customer value and PEV adoption.

STUDY 1 METHODOLOGY & RESULTS

Secondary data acquisition and analysis were used to test the first two hypotheses. The first step was to gather data on PEV registrations in the United States from 2021 through Q3 of 2025. Because some Original Equipment Manufacturers (OEMs) do not provide sales data by State, vehicle registration data for each State was the most accurate available to represent PEV adoption. The Alliance for Automotive Innovation provided the percentage of new plug-in electric vehicles among all new vehicles registered by year. This data, from their “Get Connected: Electric Vehicle Quarterly Reports,” provided a stronger indication of the adoption of the technology because it looked specifically at consumers purchasing or leasing a new vehicle. Public data on the number of installed charging stations and charging ports (a proxy for public policy via infrastructure investments) were also obtained. This data, from the U.S. Department of Energy’s Alternative Fuels Data Center, captured the public charging infrastructure, not private. This was used as a proxy for public policy through infrastructure because some of it was put into operation by OEMs (e.g., Tesla and its network of chargers) and businesses (e.g., highway fueling stations). There is no data available distinguishing how many charging stations and ports were funded directly by State governments, the Federal government, or private entities. And there was no data that highlighted what infrastructure installed by private entities was reimbursed by government funding set aside to encourage the building of this infrastructure. However, it is common for infrastructure installed by private entities to be aided by publicly funded grants. As an example, in describing electric vehicle chargers installed in downtown Detroit by the company, *it’s electric*, Lawrence (2025) wrote:

“Grants from the Michigan Economic Development Corp. Office of Future Mobility and Electrification, DTE Emerging Technology Fund, Michigan Central Scale Fund, and federal Ride and Drive funding support the initial deployments in Detroit, according to information provided about the ribbon cutting. The grant total for the company's work in Detroit is \$1.78 million, although the largest piece, from the federal government, also funds deployments in three other cities” (Lawrence, 2025).

Additional secondary data acquired for this research were the total financial incentives and penalties made available to consumers (a proxy for public policy via financial instruments) from 2021 to 2025. Incentives included tax breaks, discounts applied directly to the purchase price, and other financial benefits, such as charging credits. Penalties included additional registration taxes for PEVs that offset lost municipality revenues from gas tax, and the like. The sources of this data included U.S. News (which compiled data on each State's EV tax credits and penalties) and Compare.com's auto insurance resource list (which tallied registration & air quality/emissions inspection fees). This combined data represented the direct effect of public policy. Because the financial incentive/disincentive data were not uniform across jurisdictions, a five-point Likert scale was developed to indicate how favorable or unfavorable each jurisdiction is to PEV adoption. As an example, California offered an EV purchase tax credit of up to \$7,000 until November of 2023 (via the Clean Vehicle Rebate Project), but it also levied an additional \$108 vehicle registration fee, in addition to its universal \$64 fee for gas-powered vehicles.¹ Montana provides no tax credits or incentives for a new electric vehicle, but does charge a one-time penalty of \$260 or \$380, and up to \$1,100 per year based on vehicle weight.² The scale, shown in Figure 2, ranges from 1 (unfavorable) to 5 (favorable) and was analyzed for 50 States and the District of Columbia for all five years of the period of interest.

¹ <https://cars.usnews.com/cars-trucks/advice/california-ev-tax-credits>

² <https://cars.usnews.com/cars-trucks/advice/montana-ev-tax-credits>

Figure 2. Scale for Financial Incentive by Jurisdiction, 2021-2025

Scale	Meaning	Description
1	Unfavorable	Penalties greater than \$100 annually with no incentive
2	Slightly Unfavorable	Low incentives + annual penalties, or penalties less than or equal to \$100
3	Neutral	No penalties or incentives
4	Slightly Favorable	Incentives less than \$1000, even with small penalties
5	Favorable	Incentives greater than \$1000, even with penalties

To test the first hypothesis, a Pearson correlation analysis was performed to examine the relationship between the number of available charging ports and the percentage of new PEVs registered. That was complemented by a linear regression analysis with the same inputs: with the number of charging points being the independent variable and the percentage of new PEVs registered serving as the dependent variable. The correlation test was followed by a regression analysis for the same hypothesis.

To test the second hypothesis, Spearman's correlation was computed to assess the relationship between the proxy for financial incentives and the percentage of new PEVs registered. This method was used based on our PEV adoption proxy (registrations) being continuous and our financial incentive scale being ordinal (Likert scale ranking of 1 – 5). Since the financial incentive is ordinal and served as the independent variable, no regression analysis was performed on its relationship to the percentage of new PEVs registered.

This research study is focused on the early majority of PEV adopters in the United States, which is why the data collected has been from 2021 (significant as the year before the passage of the Inflation Reduction Act and other legislation promoting the technology) through Q3 of 2025 (a bookmark for the purpose of concluding my doctoral research). Focusing on the 50 States and the District of Columbia, the United States, as a whole, did pass the 5% threshold into the early

majority in 2022. But we still see variation across the jurisdictions. There was a total of 100 locations with an adoption rate greater than 5%, which defined our early majority for Study 1.

Table 1:

Jurisdictions Which Surpassed the “Tipping Point” for PEV Adoption (> 5%) by Year

Year	US Adoption	Above 5%
2021	3.17%	4
2022	5.64%	14
2023	7.62%	22
2024	8.14%	25
2025*	10.60%	35

* YDT, through 3 Quarters

IRA Passage

+

OBBBA Passage

-

Source: Alliance for Automotive Innovation

(H₁): For the early majority, infrastructure deployment positively correlates with PEV Adoption.

For the post-chasm group (i.e., the Early Majority), the Pearson correlation between new PEV registrations and charging ports per 100K people is 0.556, with a p-value <.001. The dependent variable, new PEV registrations, was also regressed on the predictor, charging ports per 100K people. The independent variable significantly predicted PEV registrations: $F(1, 98) = 43.899$, $p < .001$, with an R^2 of .309, explaining 30.9% of the variance in the outcome. As a result, we reject the null hypothesis and thus support H_1 .

(H₂): For the early majority, financial incentive positively correlates with PEV Adoption.

After ranking the jurisdictions by year on a Likert scale for financial incentive favorability, the Spearman correlation of this variable to new PEV registrations was run in SPSS. In the instance we included the 100 data points, the correlation coefficient was 0.229 with a significance of .022, indicating a weak-to-moderate positive correlation that is significant.

Because the independent variable was ordinal, we did not run a linear regression analysis for these variables. Based on the Spearman correlation results, we reject the null hypothesis and support H_2 .

STUDY 2 METHODOLOGY & RESULTS

How should researchers study what motivates adopters of newer technology? This study does so by actually asking them – specifically, adopters at the beginning of the mass market. The second study was guided by reaching out to said consumers to ascertain what values drove them to purchase or lease a plug-in electric vehicle.

For this part of the research, the data from Study #1 that defined which locations exceeded the 5% adoption rate were used to separate individuals into early adopters and the early majority. Thus, only survey respondents who registered their PEVs in locations with an adoption rate above 5% were considered part of the early majority when assessing H_3 through H_7 . A PERVAL scale survey was distributed electronically throughout the United States. Social media sites like LinkedIn and Facebook were used to distribute among my personal and professional networks, with the request that they share it among theirs. The same was done on digital communication platforms like Discord and WhatsApp. I also shared the survey with electric vehicle support organizations. The Electric Vehicle Association and Plug-In America were two such organizations that have chapters throughout the United States. I personally contacted national and chapter officers across the country and asked them to share the survey with their organizations. The snowball effect was seen as a more efficient way to reach actual adopters, as opposed to casting a general net that only reached a small percentage of consumers in the U.S.

The survey used is an adaptation of the Sweeney and Soutar (2001) PERVAL scale, modified to address actual adopters as opposed to potential buyers. Obtaining and analyzing the survey results determined if the remaining five hypotheses (H₃ through H₇) could be accepted. Given that the PERVAL scale has been widely used to measure consumer value across many research studies, there was confidence that it would allow us to gain the insight needed to test the remaining hypotheses. To keep the survey brief, a modified version of the PERVAL survey with twelve questions as opposed to the standard nineteen-question instrument was used. Each question was assessed on a 7-point Likert scale. As with previously crafted PERVAL scales, a Principal Component Analysis (PCA) was run to confirm that the twelve questions could be transformed into four components (Quality, Emotion, Price, and Social). An overall Cronbach's Alpha of 0.791 demonstrated an effective variable reduction for the purpose of analysis. Combined with some introductory questions in the beginning and demographic questions at the end, the full survey is twenty-four questions in length. IRB approval was obtained, and the final version of the survey distributed is shown in Appendix A. The goal was to obtain enough completed surveys to analyze and provide strong evidence to support the additional five hypotheses.

Using the PERVAL scale, Study # 2 sought to capture what customers valued at the time they purchased or leased their PEV. Over a five-month period, a total of 236 surveys were collected via Qualtrics XM®. Of those respondents, 200 properly completed the PERVAL section, where the data could be used to test the remaining five hypotheses. One of those 200 received a reCAPTCHA score of 0.1, which strongly suggested it was completed using a bot (less than 0.5); so that survey was eliminated from consideration, leaving the pool at 199 valid responses. Of the 199, 122 were designated the early majority, as they had indicated a purchase

or lease in a jurisdiction with an adoption rate greater than 5% at the time of acquisition. These 122 early majority respondents represented twenty-one states across five years, with the highest adoption represented by California in 2025 (26.03%) and the lowest adoption represented by Wisconsin in 2025 (5.10%) and Michigan in 2024 (5.11%).

All quantitative data collected by the surveys were downloaded and analyzed using IBM SPSS Statistics, Version 31.0.1.0. The transformed components all trended towards the upper end of the scale (1-7) with the exception of Social, which scored an average of 4.17 with a standard deviation of 1.08.

(H₃): For the early majority, quality value positively correlates with PEV Adoption

A Pearson correlation coefficient was computed to examine the relationship between PEV adoption (DV) and quality value (IV) among the early majority, $r(122) = .117$, $p = .200$. As a result, we conclude that PEV adoption and quality value are not significantly correlated. A linear regression analysis was also run to predict PEV adoption based on quality value. A significant regression was not found ($F(1,120) = 1.657$, $p = .200$, $R^2 = .014$), and the hypothesis was not supported.

(H₄): For the early majority, social value does not correlate with PEV Adoption.

A Pearson correlation coefficient was computed to examine the relationship between PEV adoption (DV) and social value (IV) among the early majority, $r(122) = .002$, $p = .984$. This indicates that PEV adoption and social value are not significantly correlated. We also conducted a linear regression analysis to predict PEV adoption as a function of social value. A significant regression was not found ($F(1,120) = 0.000$, $p = .984$, $R^2 = .000$). Although it appears social

value does not correlate with PEV adoption, because we failed to meet the significance threshold, there was insufficient evidence to support the hypothesis.

(H₅): For the early majority, financial incentive positively moderates the relationship between emotional value and PEV Adoption.

A moderation analysis was conducted using the PROCESS macro to test whether financial incentive moderated the relationship between emotional value and PEV adoption. Results indicated a non-significant interaction ($b = .000$, $SE = .004$, $t = .029$, $p = .977$). The relationship between emotional value and PEV adoption was not moderated by financial incentive. This study did not support H₅.

(H₆): For the early majority, infrastructure positively moderates the relationship between emotional value and PEV Adoption.

A moderation analysis was also conducted using the PROCESS macro to test whether infrastructure moderated the relationship between emotional value and PEV adoption. Again, the results indicated a non-significant interaction ($b = .000$, $SE = .000$, $t = .249$, $p = .804$). Therefore, the relationship between emotional value and PEV adoption was not moderated by infrastructure either. This study did not support H₆.

(H₇): For the early majority, infrastructure positively moderates the relationship between emotional value and PEV Adoption.

For the final hypothesis tested in this study, a moderation analysis was conducted using the PROCESS macro to test whether financial incentives moderated the relationship between price value and PEV adoption. For this analysis, the results indicated a significant interaction ($b = .007$, $SE = .003$, $t = 2.209$, $p = .029$), confirming that the relationship between price value and

PEV adoption was moderated by financial incentive. Performing a slope analysis revealed the effect of price value on PEV adoption was not significant at the lowest level of financial incentive ($b = -.009$, $SE = .008$, $t = -1.046$, $p = .298$) but was significant at the highest level of financial incentive ($b = .018$, $SE = .009$, $t = 2.125$, $p = .036$). It is interesting to note that pricing value and PEV adoption have no significant direct correlation ($r = .045$, $p = .312$). This study does support H₇.

The second study provided interesting results with only one hypothesis being confirmed. One hypothesis not supported by this study was the prediction that quality value would correlate positively with PEV adoption. Smith and Ulu (2012) highlighted how quality uncertainty slowed adoption. What was expected in studying the early majority was that quality would be a significant factor in driving adoption, given that this target market is described as being pragmatic. The research also failed to confirm that the early majority did not place significant weight on social value as it pertained to PEV adoption. This is similar to part of the conclusion in a study by Malhotra and Galletta (1999), basing their work on the Technology Acceptance Model to understand social influences on behavioral intention to adopt a new technology. Their study verified that social influences have a positive effect on perceived usefulness and attitude towards using new technology, but did not directly affect behavioral intention to adopt.

The true challenge came in confirming the moderating effects of public policy on components of customer value (H₅ through H₇). However, research notes that sample size could be the issue with this particular study. Dawson (2014) noted, “sample size is the single biggest factor affecting power; however, a number of factors have been shown to reduce power for moderator effects specifically” (p. 14). This study likely required a larger sample size and one that was more balanced among the ordinal categories of financial incentive. Even in the case of

H₇ (where the hypothesis was supported), a low R^2 of .033 suggests a very weak fit of this model.

Another significant impact on the second study was the determination of the “Early Majority.” This study defined an individual in the early majority as one who purchased or leased a PEV in a year when their location had a 5% or greater registration rate of new PEVs. One of the survey questions asked, “*Have you ever owned/leased a PEV prior to this current one?*” A resounding 63.1% answered yes, and another 5.7% answered they previously owned/leased a PHEV. Less than one-third of what was considered the early majority in this study had adopted a PEV for the first time. The other 69% of responders may have been innovators / early adopters in disguise. This factor cannot be ignored. Depending on when and where those individuals adopted their first PEV, research says their motivations were different from those of people who recently adopted the technology in a location on the other side of the chasm. This, too, could explain the results of the second study in this research. As an exploratory exercise, I compared a correlation analysis between emotional value and PEV adoption, considering the full group of “early majority” respondents: $r(122) = .047$, $a = .607$, and the true “early majority” respondents: $r(38) = .349$, $a = .032$. The first-time adopters in this study had a higher correlation coefficient with results that were statistically significant. This is in stark contrast to the full group of early majority adopters queried.

CONCLUSION

In summary, three of the seven hypotheses were supported, but the second study could be strengthened by a larger sample of early adopters.

Table 2

Summary of Hypotheses

<i>Relationship</i>	<i>Key Statistics</i>	<i>Sig.</i>	<i>Decision</i>
H ₁ : For the early majority, infrastructure deployment positively correlates with PEV Adoption	$\beta = .556, R^2 = .309$	< .001	Supported
H ₂ : For the early majority, financial incentive positively correlates with PEV Adoption	$r = .229$	0.022	Supported
H ₃ : For the early majority, quality value positively correlates with PEV Adoption	$\beta = .117, R^2 = .014$	0.200	Not Supported
H ₄ : For the early majority, social value does not correlate with PEV Adoption	$\beta = .002, R^2 = .000$	0.984	Not Supported
H ₅ : For the early majority, financial incentive positively moderates the relationship between emotional value and PEV Adoption	$\beta = .000, t = 0.029, R^2 = .000$	0.977	Not Supported
H ₆ : For the early majority, infrastructure positively moderates the relationship between emotional value and PEV Adoption	$\beta = .000, t = 0.249, R^2 = .000$	0.804	Not Supported
H ₇ : For the early majority, financial incentive positively moderates the relationship between pricing value and PEV Adoption	$\beta = .007, t = 2.209, R^2 = .033$	0.029	Supported

In the first study, this research supported the infrastructure's significant correlation with PEV adoption among the early majority. It also showed a significant, albeit weak, correlation between financial incentives and PEV adoption. The research was based on looking at the deployment of infrastructure to support PEVs over a five-year period, and financial incentive levels by location during the same timeframe, relative to the number of new PEVs registered. The second study showed mixed results in understanding the role of customer value in PEV adoption.

This study contributes to academic research by building upon the existing theories of the Technology Acceptance Model and the Theory of Planned Behavior. Whereas much of our recent research on the adoption of Plug-In Electric Vehicles has been obtained by studying potential buyers, innovators, and early adopters, there is room to add to those theories by understanding adoption by the early majority who are driven by different motivations. This research highlights the relationship of adoption by the early majority and public policy, using infrastructure deployment and financial incentive levels as proxies. The second part of this research serves as a baseline for advancing studies examining the components of customer value and their relationship to PEV adoption at the beginning of mass adoption.

This study also contributes to public policy by providing policymakers with a fresh perspective on evaluating incentive and regulation proposals to drive the intended adoption rates in their locations once they reach the tipping point of adoption. The timeliness of this research could be valuable to those looking to adjust policies as the needs of consumers ready to purchase change.

Lastly, this study benefits business leaders by providing insight as to where they can predict future increases in technology adoption (based on infrastructure deployment and financial incentive levels), allowing them to better forecast their own investments, marketing strategies,

and relationship/partnership strategies to meet the future demand for their products and services. It encourages targeted marketing where demand is higher, specifically as it applies to pragmatists (early majority). Overall, this study reinforces the relationship between public policy, customer value, and PEV adoption, but further along the Technology Adoption Curve.

LIMITATIONS

The aforementioned insights into who the true early majority are and the sample size collected are limiting factors in this study. Unless studying significant effects, a sample size of 122 (early majority adopters) is likely too small to get strong results. Moderation analysis requires a higher statistical power than standard regression analysis. Although this survey was distributed throughout the United States via electronic means, it did not offer the opportunity for follow-up with potential respondents or to combat survey fatigue. Spikes in responses followed personal conversations with PEV enthusiasts, such as attending public electric vehicle demonstrations or having meaningful conversations with leaders of electric vehicle advocacy groups. This research requires more engagement with potential survey participants, especially since it is geared to a very specific audience (recent adopters of plug-in electric vehicles in specific locations).

Also, changing from early adopters to the early majority (crossing the chasm) does not happen abruptly. There is a transition period across that chasm where adopters may fall into either category. There were not enough first-time adopters of PEVs in the survey to yield significant results on what we intended to study.

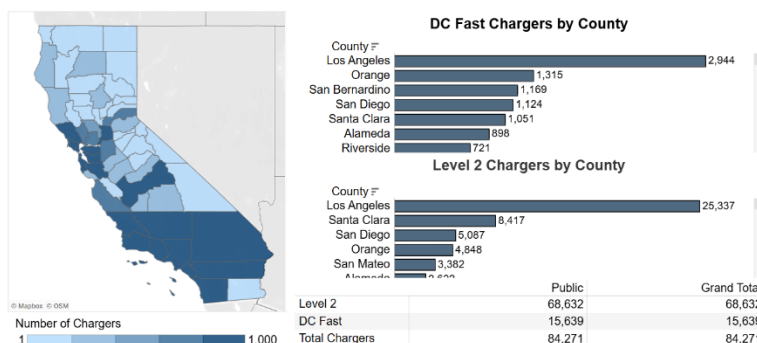
Another limitation of this research concerns retrospective reflection and recall errors. In the survey, the PERVAL scale questions all began with “*Thinking back to when I purchased/leased my PEV...*” The longer the time lapse between acquiring a PEV and completing the survey, the more bias the person may place on what they value about their PEV in the present. Clark et al. (2008) noted “recall error increases with window length, but a longer window is likely to provide more (albeit imperfect) information” (p. 1276). In this study, 38.5% of the early majority who answered the survey acquired their PEV in 2023 or earlier. It can certainly be challenging to truly capture how you felt at the time of purchase when it was two or more years ago. To overcome these limitations in future research, I suggest three actions:

1. Only include consumers truly adopting a new PEV for the first time
2. Administer the survey at the time of acquisition or shortly thereafter
3. Collect a much larger sample size (estimated 300 to 400) across locations where the adoption rate is 5% or higher.

CONSIDERATIONS FOR FUTURE RESEARCH

In addition to continuing this work while following the three suggestions noted under study limitations, I suggest further studies using the same PERVAL scale targeted to early majority adopters. A potential modification would be to take a more granular approach to examining infrastructure versus PEV adoption at the state level. Infrastructure varies within a jurisdiction as much as it varies across the United States. In California, public charging infrastructure is concentrated heavily in metropolitan areas and the Southwest (Figure 8). Registration data can also be obtained by county. This would enable a more focused study to assess the relationship between public policy and PEV adoption.

Figure 3: Number of Charging Stations by County in California (2025)



Source: <https://www.energy.ca.gov/data-reports/energy-almanac/zero-emission-vehicle-and-infrastructure-statistics-collection/electric>

Another recommendation for future research on this topic is to develop a standard for financial incentives that is variable (instead of ordinal). Having such a validated standard would allow for linear regression and other robust analyses of the relationship between financial incentives and PEV adoption. Future research can also incorporate annual household income and standard costs of living by location into a relative impact of financial incentives on PEV adoption.

In addition, future research should take into account the long-term costs of ownership for PEVs, and how they may factor into price, driving adoption. Given that the early majority considers price in their decisions in adoption, providing Total Cost of Ownership (TCO) data can provide added clarity for those under consideration. Hagman et al. (2016) noted that, during their research timeline, it was challenging to develop a reliable TCO model for consumers to incorporate into their purchasing decisions. Ten years have passed, and there should now be ample data to solidify that model. In the survey, question 14 asked, “Thinking back to when I purchased/leased my PEV, I felt it offered value for the money”. The term “value” can mean

many things to consumers. This can be expanded to specify both short-term and long-term value (the latter of which includes TCO).

With a sufficiently large sample size, future research could also determine which factors of customer value differ most between the early majority (in this study, the 122 respondents who purchased/leased a PEV with registrations greater than 5%) and early adopters (the other 77 respondents). The contrasts could prove useful for managerial decisions on marketing and education pertaining to plug-in electric vehicles.

My final point of future research is framed around the timing of this study. To conclude my doctoral studies, I framed my timeline from 2021 through Q3 of 2025. This was exactly the time the One Big Beautiful Bill Act of 2025 took effect, altering the federal policies for PEV adoption on a scale not seen since the implementation of the Inflation Reduction Act of 2022. If we want to obtain a clearer understanding of how financial incentives and infrastructure relate to PEV adoption by State, examining data collected after the \$7,500 federal tax credit and infrastructure funding dried up could be profound. Lowering the water level by \$7,500 should yield a clearer relationship between variables. The State of Texas was rated a 3 on the financial incentive scale for 2021-2024, offering no significant benefits or imposing significant penalties for PEV adoption. But in 2025, when the Federal tax incentive expired, the State launched a \$2,500 incentive for qualifying PEVs (Mossi, 2025), moving its ranking to a 5 on the Likert scale. Similar action was taken by the State of Oklahoma in 2025 (rated a 4 on the financial incentive scale 2021-2024) with the passage of OK SB51. This law granted up to \$5,500 in tax credits for purchasing an alternative-fuel vehicle, including PEVs (McDevitt, 2025). It will certainly be interesting to track any changes in adoption rates in Texas (7.06% in 2025) and Oklahoma (1.42% in 2025) over the next year. It would be even better to contrast their adoption

rates with other States with similar Financial Incentive scores that did not adjust their policies when the Federal policies shifted. There is fertile ground for further research into these relationships, especially when focusing on the early majority of adopters.

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APPENDIX

A. Survey for Study 2

Dear Participant:

Thank you for participating in this brief anonymous survey! This survey was crafted by a Doctoral student at Temple University and should only take less than 15 minutes to complete. The aim of this survey is to understand what components of customer value and public policy influenced consumers' decisions to adopt a plug-in electric vehicle (purchase or lease) in the United States.

We appreciate your input in advance!

For this Survey, please think back to the time when you actually purchased or leased your current Plug-in Electric Vehicle (PEV).

Introduction:

Q1: Did you purchase or lease your PEV?

Q2: In what year did you purchase/lease your newest PEV?

Q3: In what State (or District of Columbia) did you reside in when you made your purchase/lease?

Q4: Is this PEV your primary or secondary vehicle?

Q5: Have you ever owned/leased a PEV prior to this one?

Q6: What percentage of time would you estimate that you charge your PEV at the following locations?
[home, work, public charging locations]

Thinking back to when I purchased/leased my PEV:

Q7: I felt it had consistent quality

Q8: I felt it was well-made

Q9: I felt it had an acceptable standard of quality

Q10: I felt it was something that I would enjoy

Q11: I felt it would make me want to use it

Q12: I felt it would make me feel good

Q13: I felt it was reasonably priced

Q14: I felt it offered value for the money

Q15: I felt it was a good product for the price

Q16: I felt it would help me feel acceptable

Q17: I felt it would improve the way I am perceived

Q18: I felt it would make a good impression on other people

Q19: Are there any other factors that convinced you to purchase/lease your recent PEV?

Demographics:

Q20: What is your gender?

Q21: What is your age (in years)

Q22: What is the highest degree or level of school you have completed?

Q23: What is your household income?

Q24: Please state where you received the link for this survey from?

Thank you!