

Price, Performance, and Government Policy Affecting Purchase Intention for Plug-in Hybrid Electric Vehicles in Nanning, China

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Abstract: The research objectives were to study price, performance, and government policy in relation to consumers' purchase intentions regarding plug-in hybrid electric vehicles (PHEVs) in Nanning, and to analyze the effects of price, performance, and government policy on consumers' purchase intentions regarding plug-in hybrid electric vehicles (PHEVs) in Nanning. Conducted through a quantitative methodology involving a questionnaire survey of 400 residents in Nanning aged 18–60 who had not yet purchased PHEVs, the research utilized descriptive statistics, correlation analysis, and multiple regression analysis to test the hypotheses. The findings reveal that price, performance, and government policy are significantly related to consumers' purchase intentions ($p < .001$). Furthermore, the multiple regression analysis indicates that these variables have significant positive effects on purchase intentions, explaining 51.1% of the variance in the model ($R^2 = 0.511$). The analysis demonstrates that government policy exerts the strongest influence on purchase intention ($\beta = 0.371$), followed by price ($\beta = 0.277$) and performance ($\beta = 0.160$). These results highlight that consumers in Nanning prioritize government policy and economic feasibility when considering PHEVs, providing empirical evidence that policy support is the paramount driver for promoting consumers purchase PHEVs in Nanning.

Keywords: plug-in hybrid electric vehicle; purchase intention; government policy

1. Introduction

With the increasing awareness of global environmental protection, new energy vehicles (NEVs), as a substitute for traditional fuel vehicles^[1], have attracted extensive attention^[2]. Despite the rapid development of China's new energy vehicle industry in the past decade^[3], the charging facilities in underdeveloped cities such as Nanning are still not perfect^[4]. Plug in hybrid vehicles (PHEVs) have become the main choice in the market because of their advantages of both fuel and electric drive. However, consumers' awareness of PHEVs is insufficient and their purchase intention is weak^[5]. Therefore, it is of great significance to study the factors that affect consumers' willingness to buy PHEVs in Nanning.

1.1. Research Objective

1.To study price, performance, and government policy in relation to consumers' purchase intentions regarding plug-in hybrid electric vehicles (PHEVs) in Nanning

2.To analyze the effects of price, performance, and government policy on consumers' purchase intentions regarding plug-in hybrid electric vehicles (PHEVs) in Nanning.

2. Literature Review

2.1. Technology Acceptance Model

Technology Acceptance Model (TAM) proposed by Davis (1989) aims to explain and predict users' acceptance of information technology^[6]. TAM emphasizes that perceived usefulness and perceived ease of use are the core factors that determine users' adoption of new technologies. In the context of new energy vehicles, if consumers believe that PHEVs can significantly improve the quality of life or travel efficiency, and are easy to operate and master, they are more inclined to buy. In addition, TAM also introduces the use attitude as the intermediary variable. When consumers hold a positive attitude, the possibility of purchase increases. Although TAM initially focused on information technology, its considerations on cost savings and operational convenience are also applicable to the analysis of PHEVs' market acceptance^[7].

Based on TAM, when consumers perceive PHEVs as both economically beneficial and useful, technically reliable and easy to use, their attitude toward adoption becomes more positive, leading to a higher purchase intention. So price and performance may affect the purchase intention of PHEV consumers.

2.2. Theory of Planned Behavior

The theory of planned behavior (TPB), proposed by Ajzen, is an extension of the theory of rational behavior and is used to explain the motivation mechanism of human behavior^[8]. TPB believes that behavior intention is the best predictor of behavior, and behavior intention is affected by attitude, subjective norms and perceived behavior control. Consumers' personal attitude towards environmental protection, pressure or support from social relations, and sense of control over the actual use conditions such as charging infrastructure will affect their purchase intention^[9].

TPB highlights that consumer decisions are also reactions to the external environment. If the government policy lowers the barrier to entry (e.g., through financial incentives), the perceived difficulty of purchasing and using a PHEV decreases, thereby strengthening the intention to buy. So government policy may affect the purchasing intention of PHEV consumers.

2.3. Price

The price factor includes not only the initial acquisition cost of the vehicle, but also the operating costs (such as electricity, oil and maintenance costs) and the long-term residual value performance in the use process. Price is an important factor affecting consumers' purchase of new energy vehicles. Bi and Cao (2024) pointed out in the study of Northeast China that despite the advanced technology of new energy vehicles, consumers still pay high attention to the price factor, and high prices will restrict the development of the industry^[10]. Yang (2016) also confirmed that price is the key to influencing purchase intention^[11].

Therefore, the following hypothesis is proposed that Hypothesis 1 (H1): Price is a significant factor affecting consumers' purchase intentions of plug-in hybrid electric vehicles in Nanning.

2.4. Performance

The performance factor covers the technical specifications and actual driving performance of the vehicle, which is the key for consumers to evaluate the practicability of the product. This includes range, charging time, power performance (such as acceleration performance) and battery life and safety. Tian and Zhuo (2014) found that performance is the main factor affecting the purchase intention of electric vehicle consumers, and consumers pay attention to the maximum speed, charging convenience and safety^[12]. Lv (2024) reached a similar conclusion in Foshan, pointing out that performance is one of the most important factors in consumers' purchase decisions^[13].

Therefore, the following hypothesis is proposed that Hypothesis 2 (H2): Performance is a significant factor affecting consumers' purchase intentions of plug-in hybrid electric vehicles in Nanning.

2.5. Government Policy

Government policy is an important external variable to promote the market acceptance of new energy vehicles, including financial subsidies, tax relief, free parking, special licenses and charging infrastructure construction support. Zhang (2016)'s research shows that government factors are the most important factors influencing consumers' purchase decisions, and their explanatory power is stronger than psychological and technical factors^[14]. The research of Li and Guo (2022) in Wuhan also confirmed that the subsidies and preferential policies provided by the government have greatly promoted market acceptance and significantly reduced the cost of buying cars^[15]. Government factors are the most important factors affecting consumers' purchase decisions.

Therefore, the following hypothesis is proposed that Hypothesis 3 (H3): Government policy is a significant factor affecting consumers' purchase intentions of plug-in hybrid electric vehicles in Nanning.

2.6. Conceptual Framework

Conceptual framework as show in Figure1.

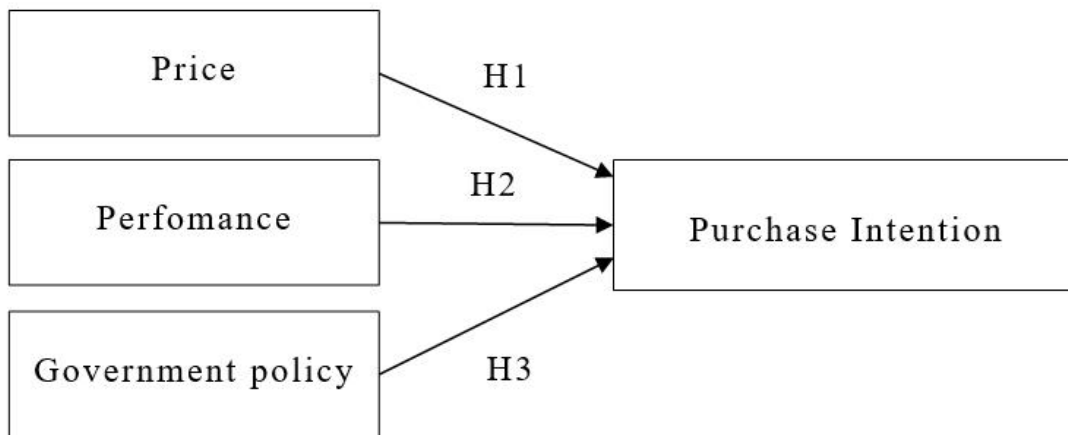


Figure 1. Conceptual Framework

2.7. Research Hypothesis

Hypothesis 1 (H1): Price is a significant factor affecting consumers' purchase intentions of plug-in hybrid electric vehicles in Nanning.

Hypothesis 2 (H2): Performance is a significant factor affecting consumers' purchase intentions of plug-in hybrid electric vehicles in Nanning.

Hypothesis 3 (H3): Government policy is a significant factor affecting consumers' purchase intentions of plug-in hybrid electric vehicles in Nanning.

3. Research Methodology

3.1. Research Design

This study employs a quantitative research approach using a questionnaire survey to analyze consumers' perceptions and purchase intention regarding plug-in hybrid electric vehicles (PHEVs) in Nanning. The study examines the effects of price, performance, and government policy on PHEVs

purchase intention.

3.2. Population and sample size

The population of this study consists of individuals aged 18 to 60 residing in Nanning who have not purchased plug-in hybrid electric vehicles (PHEVs) and are potential buyers of PHEVs, research population of approximately 8.74 million. The formula developed by Yamane (1973) was found to be appropriate for determining the sample size^[16].

$$n = \frac{N}{1 + N(e^2)}$$

The n is signifies the sample size (95% confidence interval), N is signifies the population under study, e is signifies the margin error (0.05), research population of approximately 8.74 million.

$$n = \frac{8.74 \times 10^6}{1 + 8.74 \times 10^6 \times (0.05^2)} \approx 400$$

The expected sample size is 400 respondents who the individuals aged 18 to 60 who reside in Nanning.

3.3. Questionnaire Design

The questionnaire for this study was designed to gather data on the factors affecting consumers' purchase intention of plug-in hybrid electric vehicles (PHEVs) in Nanning, questionnaire consists of four main sections. To ensure consistency and comparability, use close-ended questions (multiple choices) for section 1-2. And use 5 Likert scale for section 3-4, ranging from "Strongly Agree" (5 points) to "Strongly Disagree" (1 point).

1. Demographic Information

This section collects basic demographic details such as age, gender, income level, education background, and current vehicle ownership status. These data will be analyzed using descriptive statistics to provide a comprehensive profile of the respondents.

2. Measurement Items about Perceptions of consumers in Nanning PHEVs

This section evaluates consumer perceptions of plug-in hybrid electric vehicles (PHEVs) in Nanning. It includes consumers' level of understanding and acceptance of plug-in hybrid electric vehicles (PHEVs).

3. Measurement Items about price, performance and government policy affecting PHEVs purchase intention

This section includes questions related to the key factors hypothesized to influence purchasing intentions: price, performance, and government policy.

Price Factors: Questions assessing the importance of initial purchase cost, operational costs, and maintenance costs.

Performance Factors: Questions evaluating vehicle performance metrics such as acceleration, range, battery life, and overall reliability.

Government Policy Factors: Questions gauging awareness and perceived impact of government incentives, subsidies, and regulations supporting PHEVs.

4. Measurement Items about the purchase intention of PHEVs in Nanning

This section evaluates the stages of consumers' purchase intention for plug-in hybrid electric vehicles (PHEVs) in Nanning::

Understanding Needs: Questions assessing consumers' awareness of their transportation needs and how PHEVs might fulfill them such as environmental concerns, cost savings.

Information Search: Questions gauging the consumers' enthusiasm for understanding information about PHEVs.

Evaluation and Comparison: Questions measuring how consumers compare PHEVs with traditional vehicles or other NEVs such as price, performance, charging infrastructure.

3.4. Validity analysis

Validity ensures that the questionnaire accurately measures what it is intended to measure. Content validity was assessed through 3 experts evaluation, and the Index of Item Objective Congruence (IOC) was computed for the survey questionnaire.

IOC Calculation: The IOC index ranges from +1 to -1, with three possible ratings for each item: +1: Experts strongly agree that the item measures the objective. 0: Experts are neutral about whether the item measures the objective. -1: Experts strongly disagree that the item measures the objective.

The total score for each item is divided by the number of experts. The resulting value must be equal to or above 0.50 to indicate acceptable validity^[17].

3.5. Reliability analysis

Reliability analysis measures the consistency and stability of the questionnaire by repeatedly measuring the same object using the same method and obtaining consistent results. Cronbach's Alpha is the most commonly used reliability measurement method.

Criteria: A reliability coefficient above 0.8 indicates better scale reliability. Between 0.7 and 0.8 is acceptable. Between 0.6 and 0.7 is barely acceptable. Below 0.6 means the scale needs modification^[18].

In this study, Cronbach's Alpha will be calculated for each dimension (price, performance, government policy) to ensure internal consistency. If the Cronbach's Alpha value falls below 0.7, the items within the respective dimension will be reviewed and revised for improvement.

4. Results

4.1. Validity and Reliability Analysis Results

By inviting three experts to evaluate the effectiveness of the content and calculating the Item Objective Consistency Index (IOC) of the survey questionnaire, it can be concluded that the overall questionnaire has an average IOC of 0.868, which is greater than 0.5, indicating that all item objectives of the questionnaire are consistent. Therefore, the questionnaire in this study has good validity

Using 30 test questionnaires, calculate the Cronbach's Alpha coefficient. The Cronbach's Alpha coefficient for the three dimensions of the questionnaire (price, performance, government policy), with a Cronbach's Alpha coefficient of 0.804 for price, 0.832 for performance, and 0.842 for government policy. The three dimensions of the questionnaire and the overall Cronbach's Alpha coefficient all exceed 0.8, indicating that the literature in this study has good reliability.

Therefore, The questionnaire demonstrates good validity and reliability and is suitable for data collection.

Table 1. Validity Results

Measurement items	Items	Item-Objective Congruence (IOC) Average Score of 3 Experts	Corrected Item- Total Correlation (CITC)	Cronbach's Alpha if Item Deleted	Cronbach's Alpha coefficient
Perceptions of consumers in Nanning PHEVs		1.00			
		1.00			
		0.67			
		0.67			
		0.67			
Price		1.00	0.644	0.750	0.804
		1.00	0.655	0.766	
		0.67	0.632	0.755	
		1.00	0.715	0.779	
		0.67	0.590	0.780	
Performance		1.00	0.587	0.810	0.832
		1.00	0.678	0.786	
		1.00	0.558	0.819	
		0.67	0.734	0.768	
		1.00	0.608	0.806	
Government policy		1.00	0.738	0.822	0.842
		1.00	0.804	0.769	
		1.00	0.437	0.877	
		1.00	0.736	0.785	
		0.67	0.726	0.788	
Purchase intention of PHEVs in Nanning		0.67			
		1.00			
		1.00			
		0.67			
		0.67			

4.2. Descriptive Statistical Analysis

Table 2. Descriptive Statistical Analysis

Demographic	Categories	Quantity	Percentage
Gender	Male	205	51.25
	Female	195	48.75
Age	18–25	63	15.75
	26–35	124	31.00
	36–45	116	29.00
	46–55	53	13.25
	56–60	44	11.00
Educational Level	High school or below	105	26.25
	Associate degree	128	32.00
	Bachelor's degree	109	27.25
	Master's degree or above	58	14.50
Monthly Income Level (RMB)	Below 4,000	62	15.50
	4,001–8,000	105	26.25
	8,001–12,000	104	26.00
	12,001–16,000	80	20.00
	Above 16,000	49	12.25

The table describes the demographic data of gender, age, educational level and monthly income level (RMB).

In the sample, the proportion of men was slightly higher (51.25%), age was mainly 26-35 years old (31.00%), associate degree was the most (32.00%), and monthly income level was the most in the range of 4001-8000 RMB (26.25%).

Table 3. Descriptive Statistics of Research Variables

Variables	Mean	Standard Deviation	Interpret	Ranking
Price	3.00	0.781	Moderate	2
Performance	2.89	0.723	Moderate	3
Government Policy	3.11	0.797	Moderate	1

Government policy (Mean=3.11, SD=0.797) scored the highest and ranked first, indicating that respondents generally believe that government related policies have a relatively positive impact on promoting their consideration of purchasing PHEVs. Its standard deviation is 0.797, slightly higher than the other two variables, indicating that there are some differences in the degree of recognition of this factor among individuals, which may be due to different expectations of policy sustainability or actual benefits.

The price (Mean=3.00, SD=0.781) score is 3.00, ranking second, reflecting consumers' neutral attitude towards the purchase cost, usage economy, and long-term maintenance costs of PHEVs. The standard deviation is 0.781, indicating a relatively concentrated distribution of opinions, and most people have not formed a strong judgment on the reasonableness of its price.

The performance score (Mean=2.89, SD=0.723) is the lowest, ranking third, indicating that consumers have weak confidence in PHEV's technical performance such as range, charging convenience, power performance, and battery reliability. Its standard deviation is 0.723, which is the smallest among the three variables, indicating that the respondents have the most consistent views on performance issues and generally have doubts.

In summary, among the three major factors that affect the purchase intention of PHEVs consumers in Nanning, the perceived influence of government policy is the strongest, the price factor is in the middle, and the perceived evaluation of performance factors is the lowest.

4.3. Results Related to Research Objective 1

Objective 1 : To study price, performance, and government policy in relation to consumers' purchase intentions regarding plug-in hybrid electric vehicles (PHEVs) in Nanning, through Pearson correlation analysis to determine the direction and strength of the relationship between the variables (price, performance, government policy) and the purchase intention. Shown in Table 4, there is a significant positive correlation between each factor and purchase intention ($p < .001$). There is a significant median high correlation between price, performance and government policy ($p < .001$).

The Pearson correlation coefficient between price and government policy was 0.686 ($p < .001$), which was the strongest among the three. The correlation coefficient between price and performance is 0.629 ($p < .001$), showing a significant positive correlation. The correlation coefficient between performance and government policy was 0.624 ($p < .001$), which also reached a significant level.

Therefore, these three main influencing factors are not isolated, but show highly correlated structural characteristics. This shows that consumers consider price, performance and government policy when have purchase intention.

Table 4. Correlation Analysis

	Price	Performance	Government policy	Purchase intention
Price	1			
Performance	0.629	1		
Government policy	0.686	0.624	1	
Purchase intention	0.632	0.556	0.661	1

Note: $p < 0.001$

4.4. Results Related to Research Objective 2

Objective 2 : To analyze the effects of price, performance, and government policy on consumers' purchase intentions regarding plug-in hybrid electric vehicles (PHEVs) in Nanning. The regression analysis confirms that Price, Performance, and Government Policy collectively have a significant effect on purchase intention ($p < .001$).

The following regression equation (prediction equation) can be derived from the table:

$$Y = 0.509 + 0.276(H1) + 0.173(H2) + 0.362(H3)$$

Y: Represents the dependent variable, which is the predicted value of consumers' PHEVs purchase intentions. H1: represents the standardization or scale score of the independent variable Price. H2: Standardization or scale score representing the independent variable Performance. H3: Represents the standardized or scale score of the independent variable Government Policy.

The regression model explains 51.1% of the variance in purchase intention ($R^2 = 0.511$), indicating a good fit. Three factors have a significant impact on consumer purchase intention. Government Policy has the strongest effect on purchase intention (Beta = 0.371), making it the most significant driver. Price is the second most influential factor (Beta = 0.277). Performance also has a significant effect, although it is the weakest of the three factors (Beta = 0.160). These results clearly show that while all factors have a significant impact on consumer purchase intention, government policy and price are the primary determinants of PHEV consumer purchase intention in Nanning.

Table 5. Multiple Regression analysis

Variables	Estimate	Std.Error	Beta	t	p
Intercept	0.509	0.1255		4.05	<.001
Price (H1)	0.276	0.0514	0.277	5.36	<.001
Performance (H2)	0.173	0.0517	0.160	3.34	<.001
Government policy (H3)	0.362	0.0502	0.371	7.23	<.001

$R^2 = 0.511$ Adjusted $R^2 = 0.508$ a constant = 0.509 N = 400

5. Conclusion

This study reveals that government policy are the strongest factor influencing PHEVs consumers' purchase intention, with their influence surpassing price and performance. This discovery indicates that in developing regions such as Nanning where charging infrastructure is not yet complete, consumers have a strong risk aversion towards purchasing PHEVs, and they rely more on government policy to reduce perceived risks and ownership costs. Price comes second, reflecting consumers' high level of economic rationality and concern for the cost effectiveness of the entire lifecycle of vehicles. In contrast, performance has the weakest impact on purchase intention, indicating that abstract technical parameters are difficult to directly translate into consumer purchasing confidence in the absence of actual user experience and unresolved charging anxiety.

6. Discussions

The results show that the current potential consumers in Nanning are mainly the urban middle class, who have a certain technical understanding ability, but show a high degree of economic rationality and risk aversion awareness in car purchase decisions. Among the three influencing factors, government policy has proved to be the strongest driving force, which may be because the policy provides direct economic incentives, and government support may effectively reduce the perceived

risk of consumers. Sustained policy support maybe alleviates individual concerns about long-term ownership risks but also enhances behavioral feasibility through tangible benefits, such as reduced operating costs. This finding aligns with Zhang (2016), who identified government policy as the most powerful external variable explaining PHEVs purchase intention in a Chinese context. Similarly, Li and Guo (2022) demonstrated in their Wuhan-based study that policies directly reducing daily costs (e.g., free parking, toll exemptions) are more effective than abstract or symbolic incentives. Meanwhile, this may also be related to the unique regional characteristics of Nanning and the limitations of its charging infrastructure. As a rapidly developing provincial capital city, Nanning's private car ownership has surged, leading to severe traffic congestion and parking shortages. However, in some areas far from the city center, the construction of public charging facilities has not kept pace with this growth. This regional feature enhances the importance of specific policy measures. For example, the limitations of infrastructure have caused range anxiety, which cannot be alleviated solely by vehicle performance. On the contrary, consumers heavily rely on government led solutions, such as mandatory installation of chargers in new residential areas or prioritizing the use of public charging stations, to alleviate their actual concerns.

The price factor follows closely. Consumers' economic evaluation of PHEV is not only based on car purchase subsidies, but also extended to the consideration of the whole life cycle cost, including the comprehensive judgment of residual value, battery replacement cost and whether it can really save expenses in actual use. This resonates with Bi and Cao (2024) findings in Northeast China, where price remained the primary barrier to behavioral conversion despite strong pro-environmental attitudes. Yang (2016) similarly emphasized high upfront pricing as a key constraint on uneven market penetration of PHEVs in China. In contrast, the impact of performance factors is relatively weak, which reflects that in the absence of practical use experience, consumers' perceived usefulness of technical parameters is difficult to translate into actual purchasing power, and their focus is more on the long-term reliability of core components such as batteries. To sum up, consumers' purchase intention is not determined by a single factor, but the result of the joint action of price, performance and government policy.

7. Recommendations

7.1. Suggestions for Government

Research shows that non monetary convenience measures are more attractive to consumers. It is suggested that the government should prioritize the design and expansion of non-financial incentive policies while maintaining the existing subsidy system. For example, vigorously promoting measures such as free parking and reducing tolls that can directly reduce daily usage costs, as well as further lowering the threshold for car purchases through tax incentives. In response to consumers' range anxiety and concerns about inconvenient charging, it is recommended to strengthen the construction of charging networks. Systematically increase the coverage and reliability of charging stations in public areas and communities through urban planning guidance and financial support. For example, it is mandatory to require a certain proportion of charging facilities to be built in new residential and commercial areas, in order to eliminate consumers' concerns about the difficulty of charging.

7.2. Suggestions for Company

Consumers have doubts about the high purchase cost and long-term economic viability of PHEVs. It is suggested that the industry should develop transparent calculation tools to visually display the total cost of ownership comparison between PHEVs and traditional fuel vehicles throughout their entire lifecycle to consumers. To eliminate consumers' distrust of technical parameters, it is recommended that companies increase technical transparency and promote test drive activities and long-term deep experience plans. By allowing potential customers to personally

experience vehicle performance and transforming abstract technical indicators into concrete user experiences, confidence can be established. In response to consumers' biggest concerns about power performance and battery safety, it is recommended that companies increase their research and development investment. In marketing communication, emphasis should be placed on displaying real road test data, third-party authoritative certifications, and the reputation of real users, rather than empty environmental concepts, in order to rebuild consumers' trust in the reliability of PHEV performance.

7.3. Recommendations for Future Research

Incorporate more psychological and social influencing factors to gain a more comprehensive understanding of consumers' psychological motivations. Conducting longitudinal tracking research can more accurately capture the dynamic impact of various factors on purchase intention and derive stronger causal relationships by long-term tracking of changes in consumer attitudes. Suggest conducting comparative analysis between cities with different levels of development and policy environments. Adopting a mixed research approach to compensate for the insufficient explanatory power of a single quantitative analysis.

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