



What Predicts Intention to Purchase New Energy Vehicles Between Males and Females in China: Using Extended Theory of Planned Behavior

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Abstract. Drawing on the theory of planned behavior (TPB), the aim of this study is to explore affective attitude, cognitive attitude, subjective norms, and perceived behavioral control that affect the intention to purchase new energy vehicles (NEVs) and the moderating effect of gender on the relationship between attitudes and behavioral intention. A total of 706 participants were recruited to complete an online questionnaire on NEVs in China via the Sojump survey platform. The results indicate that cognitive attitude, subjective norms, and perceived behavioral control positively predicted the intention to buy a NEV, while affective attitude was negatively correlated to behavioral intention. In addition, the gender had a significant moderating effect on the relationship between affective attitude and intention to buy a NEV. Theoretical contributions and practical contributions are discussed as well.

Keywords: Theory of planned behavior · new energy vehicles · affective attitude · gender

1 Introduction

Global warming has become a severe climate issue that has caused serious environmental and health problems in recent years, such as slowed tree growth, destroyed biodiversity, and the spread of infectious diseases [1–3]. Among many factors, exhaust gas released by traditional motor vehicles is the first to be blamed for global warming [4, 5]. According to the World Meteorological Organization's WMO Greenhouse Gas Bulletin, the global average of greenhouse gases (i.e., surface carbon dioxide, methane, and nitrous oxide) has reached a high level [6]. The combustion of fossil fuels has also been proved to lead to more carbon dioxide emissions [7, 8].

Given the serious situation, promoting the widespread usage of new energy vehicles (NEVs) could be an effective way to reduce carbon emissions [9]. In China, governments have implemented several policies to encourage the use of NEV, such as the “comprehensive work plan for energy conservation and emission reduction in the 14th five-year

plan,” “management measures for average fuel consumption of passenger vehicle enterprises and new energy vehicle credits,” and “fuel consumption limits for passenger cars” [10–12].

As one of the largest consumer markets in the automotive field, however, electric vehicle registrations in China declined by 9% in 2020 [13]. It is therefore particularly important to investigate antecedents of Chinese consumers’ intention to purchase NEVs. Previous literature (e.g., [14–16]) identified the theory of planned behavior as one of the most powerful theoretical frameworks to predict people’s intention to purchase NEVs. As such, we adopted the theory of planned behavior as our theoretical framework.

The theory of planned behavior (TPB) posits that individuals’ attitudes, subjective norms, and perceived behavioral control positively influence individuals’ behavioral intentions. However, the original theory did not adequately account for affective values in the formation of behavioral decisions [17, 18]. While most TPB studies have only considered measured behavioral attitudes in ways that involve cognitive attitudes, limited studies explored an affective component in their attitudinal measurements. As such, this study examined an extended TPB to explore consumers’ behavioral intentions to purchase NEVs. Specifically, the attitude was subdivided into affective and cognitive attitudes.

In addition to investigating different attitudes, we also explored the moderating role of gender in the context of this study. Previous studies determined that females and males behave differently, especially in product purchasing [19]. However, few studies have explored how gender affects individuals’ purchasing intention. In this regard, the study seeks to explore the moderating effect of gender on the relationship between (a) the cognitive attitude and (b) the affective attitude and behavioral intention.

2 Literature Review

2.1 Theory of Planned Behavior

The TPB is an extension of the theory of reasoned action (TRA), which indicates that attitude and subjective norms affect behavioral intention. Behavioral intentions “are motivational factors that influence a behavior” [20], which is treated as the most important determinant of behavior. Compared to the TRA, the TPB adds a new variable, perceived behavioral control, to the theoretical framework, which affects behavioral intention together with subjective norms and attitude [21]. Because TPB is influential and effectively predicts people’s behavior and explains determinants of people’s decisions, it has been used in many fields, such as to predict e-commerce websites usage intention, organic food purchase intention, and vaccination intention [22–24].

This model has also been effectively used to explore and predict people’s green consumption behavior, including their NEV purchasing behavior [25, 26]. Extended TPB models to investigate the purchasing intentions for NEVs have been frequently used in prior studies (e.g., [27]). Wang et al. added “personal moral norm” as a new variable into the research model to predict the intention to adopt NEVs; social norm, collective efficacy, experience, and environmental effect were selected as added antecedents, and the result showed that technology and policy factors positively influence the purchase intention of NEVs [28]. While several previous studies (e.g., [29, 30]) have proven that

it is feasible to apply TPB theory in the area of NEV purchasing behavior, the emotional component of attitude has not been addressed; in this study, we therefore divided attitude into cognitive and affective attitudes to examine the influence of attitude on the intention to buy NEVs in greater detail.

2.2 Affective and Cognitive Attitudes

Attitude is “the evaluation of an object, concept, or behavior along a dimension of favor or disfavor, good or bad, like or dislike” [31]; and the significant effect thereof on intention has been confirmed in a large number of previous studies (e.g., [32, 33]). Liu et al. demonstrated that attitude plays the most important role in predicting green purchase intentions in China [34]; Alam and Sayuti concluded that attitude positively influences halal food purchasing intention [35]; Teo and Lee found that attitude toward technology usage was a significant predictor of intention to use technology [36].

Previous literature differentiated two types of attitudes and separately examined their respective impacts to gain a deeper understanding of the impact of different attitudes (e.g., [37]). For instance, Lawton et al. subdivided attitude into cognitive and affective attitudes in the area of predicting health behaviors [38]. An affective attitude is the expression of feelings and emotions about mental objects or behaviors, and a cognitive attitude is the expression of behavioral beliefs through cognitive objects and experiences [39]; both types of attitudes are vital antecedents that influence behavioral intentions [37, 40]. Compared to the traditional TPB variables, affective attitudes explain an additional 11% variance in physical activity behaviors [41]. For cognitive attitude, Lorenz et al. found that the cognitive attitude has a significantly positive impact on behavioral intention [42].

When people have affective and cognitive beliefs that they agree with or will like something, they will have a positive intention to act on it [43, 44]. Tailoring cognitive attitude and affective attitude to the NEV context, when buying a NEV, consumers who know more about the benefits of these vehicles and emotionally love them more have a more positive intention to buy a NEV.

As such, we put forth the following hypotheses:

H1: Affective attitude toward NEVs is positively related to the intention to purchase NEVs.

H2: Cognitive attitude toward NEVs is positively related to the intention to purchase NEVs.

2.3 Subjective Norms and Perceived Behavioral Control

Subjective norms are perceptions of the extent to which an individual’s significant other expects them to perform a certain behavior, and these can be used to predict NEV purchase intention [45, 46]. The greater the degree to which an individual believes that others think they should do something, the greater likelihood that the individual will have the intention to achieve that behavior [47].

In addition to subjective norms, perceived behavioral control also plays an essential role in predicting NEV purchase intention [48]. Huang and Ge suggested that perceived

behavioral control and attitude are significantly and positively related to the willingness of Beijing consumers to purchase NEVs [49].

Consequently, we posit the following hypotheses:

H3: Subjective norm is positively related to the intention to purchase NEVs.

H4: Perceived behavioral control is positively related to the intention to purchase NEVs.

2.4 Gender as a Moderator

In terms of driving a car, there has always been a focus on gender-related differences. Regarding the safety aspect of cars, younger males did not consider this feature important, but older females highly rated it [50]. Similarly, Aldred et al. reported that females were more concerned about risk when cycling than males were [51]. González Iglesias et al. also found that compared to females, males are more likely to violate traffic regulations and are angrier at police presence [52].

Gender-induced disparities are also of interest to scholars in the area of NEVs. Kong et al. suggested that females are better suited to drive electric vehicles because of the relatively short distances this gender drives [53]. Sovacool et al. conducted a survey, interviews, and focus groups and discerned a significant relationship between car ownership, miles driven, experience with electric vehicles, and gender, albeit with a predominance of men [54].

Based on previous research by Bradley et al., females are more emotionally responsive than males [55]. When faced with choices, Mills et al. [56] found that females experience more conflict than males. Since the affective experience has been shown to be one of the useful predictors of attitude along with cognitive experience, Allen concluded that it makes sense to explore the effect of gender on affective and cognitive attitudes [57]. Prieto and Caemmerer demonstrated that gender has an effect on purchase intentions, specifically that males are more likely to buy premium cars and larger vehicles [58]. Notably, however, the question of whether gender can moderate the relationship between attitude and intention has not yet been answered in the extant literature.

We, therefore, pose the following research questions:

RQ1: How does the relationship between affective attitudes and purchase behavioral intention differ between males and females?

RQ2: How does the relationship between cognitive attitudes and purchase behavioral intention differ between males and females?

3 Method

Data were collected in China from a national online survey during February 2022. The convenience-sampling technique was employed to recruit respondents on Sojump, one of the most popular survey companies in China. A total of 735 respondents completed questionnaires; of these, 29 respondents were excluded for choosing not to agree to participate in our study in the informed consent section. A total of 706 questionnaires were ultimately obtained for this study.

3.1 Measures

3.1.1 Demographic Variables

Demographic variables in this study included age, gender, education, and monthly household income. Of the 706 participants, 58.4% were males; the respondents' ages ranged from 17 to 57 years of age, with an average age of 41.41 years; approximately 33.3% had a bachelor's degree; and the median monthly household income was 5,000–8000 yuan.

3.1.2 Affective Attitude

The affective attitude was adapted from previous research by Shi and Wang et al. [59, 60]. The affective attitude was measured by asking participants to indicate their feelings and emotions related to purchasing a NEV on a 7-point Likert scale (1 = strongly disagree, 7 = strongly agree). Five items were used to measure affective attitude ($M = 3.77$, $SD = 1.36$, Cronbach's $\alpha = 0.83$); for example, participants were asked to indicate their agreement with the statements "purchasing a new energy vehicle makes me uneasy" and "the performance of a new energy vehicle elicits my anxiety."

3.1.3 Cognitive Attitude

The cognitive attitude was measured with four items adapted from Zhao et al. [61]. Respondents rated their attitude toward the behavior of purchasing a NEV on a bipolar Likert scale in the following dimensions: (a) good/bad; (b) pleasant/unpleasant; (c) useful/useless; and (d) attractive/unattractive. These items were then averaged and combined into a composite variable ($M = 5.23$, $SD = 1.20$, Cronbach's $\alpha = 0.86$).

3.1.4 Subjective Norms

Subjective norms were adapted from previous research by Schifter and Ajzen [62]. Participants were asked whether their parents, friends, or relatives thought they would buy a NEV. A 7-point scale (1 = strongly disagree, 7 = strongly agree) was used to measure subjective norms ($M = 4.99$, $SD = 1.12$, Cronbach's $\alpha = 0.83$); an example item was "most of my friends think I will buy a new energy vehicle."

3.1.5 Perceived Behavioral Control

Based on the prior study by Xiao and Wong, participants' perceived difficulties toward purchasing NEVs were assessed on a 7-point scale (1 = strongly disagree, 7 = strongly agree), and two items were used to measure perceived behavioral control ($M = 5.14$, $SD = 1.21$, $r = 0.35$, $p < 0.000$); an example item was "If I want to, I can buy a new energy vehicle in the future" [63].

3.1.6 Purchase Intention

The purchase intention was adapted from research conducted by Wang et al. [64]. Two items were used to measure purchase intention ($M = 5.10$, $SD = 1.27$, $r = 0.52$, $p <$

Table 1. OLS Hierarchical Regression Analysis Predicting the Intention to Purchase NEVs

| | Model 1 | Model 2 |
|-------------------------------------|-----------------|-----------------|
| Block 1 | | |
| Age | -.160*** | -.089*** |
| Educational level | .051 | .019 |
| Monthly income | -.008 | -.019 |
| Incremental R²(%) | 3.4% | |
| Block 2 | | |
| Affective attitude | | -.049* |
| Cognitive attitude | | .157*** |
| Subjective norms | | .507*** |
| Perceived behavioral control | | .215*** |
| Incremental R²(%) | 56% | |

0.000); and participants were asked to rate the following statements on a 7-point scale (1 = strongly disagree, 7 = strongly agree): “I am willing to buy a NEV in the future” and “I will buy a NEV for my second car.”

3.2 Data Analysis Strategy

To address the hypotheses and research questions, ordinary least squares (OLS) regression and PROCESS 4.0 were used for data analysis. Demographic variables (i.e., age, education level, monthly household income) were entered into the first block, and TPB-related variables (i.e., affective attitude, cognitive attitude, subjective norms, perceived behavioral control) were entered into the second block; the intention to purchase NEV served as the dependent variable in the regression.

PROCESS Macro 4.0 Model 1 was used in the present study to examine the moderating effect of gender on the relationship between (a) the affective attitude and the purchase intention and (b) the cognitive attitude and the purchase intention.

4 Results

Table 1 delineates the standardized coefficients in the OLS regression analysis that predicted the respondents’ intentions to purchase a NEV.

H1 and H2 predicted a positive association between different attitudes (i.e., affective and cognitive attitudes) and purchase intention. The results demonstrated that the affective attitude was negatively related to the purchase intention ($\beta = -0.05$, $p < 0.05$), and the cognitive attitude was positively related to the purchase intention ($\beta = 0.16$, $p < 0.000$); H1 and H2 were therefore supported. Whereas participants with a positive affective attitude were less likely to purchase a NEV, participants with a positive cognitive attitude were more likely to purchase a NEV.

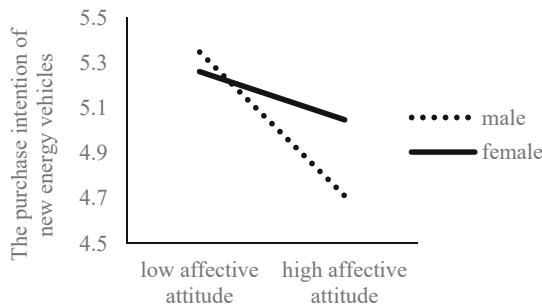


Fig. 1. Effects of affective attitude and gender on the intention to purchase NEVs.

H3 and H4 predicted a positive association between subjective norms and purchase intention and between perceived behavioral control and purchase intention. The results indicated that both subjective norms ($\beta = 0.50$, $p < 0.000$) and perceived behavioral control ($\beta = 0.22$, $p < 0.000$) are positively related to the purchase intention; thus, H3 and H4 were supported. Participants with a higher degree of subjective norms and perceived behavioral control were more likely to become NEV owners. Notably, the independent block explained 56% of the variances in the purchase intention ($p < 0.000$).

To answer RQ1 and RQ2, the ways in which gender moderates the relationship between (a) the affective attitude and the purchase intention and (b) the cognitive attitude and the purchase intention were examined. While the results indicated that gender did not significantly moderate the relationship between the cognitive attitude and intention to purchase a NEV ($\beta = -0.12$, $p = 0.089$), gender strengthened the relationship between the affective attitude and intention to purchase NEVs ($\beta = 0.17$, $p < 0.01$).

The influence of affective attitude on the intention to purchase a NEV among female and male participants was plotted (see Fig. 1). From the right half part, we can conclude that when holding a high affective attitude, females are more likely to purchase NEVs than males. From the left half part, the figure demonstrates that when holding a low affective attitude, males are more likely to purchase NEVs than females.

A simple slope was administered to regress the interaction effects of gender and the affective attitude on the purchase intention by exploring the effect of the affective attitude on the intention among male and female participants. While the relationship between affective attitude and purchase intention was significantly negative among male participants ($\beta = -0.15$, $p < 0.001$, 95% CI [-0.24, -0.06]), the relationship between affective attitude and intention was not significantly correlated for the female participants ($\beta = 0.03$, $p = 0.61$, 95% CI [-0.08, 0.13]); this indicates that males are less likely to buy a NEV when their affective attitude is positive.

5 Discussion

In this study, we examined the extended TPB model in the context of NEV purchasing. Specifically, we investigated how cognitive attitude, affective attitude, subjective norms, and perceived behavioral control influence the behavioral intention. We then explored

the moderating effect of gender on the relationship between the attitudes (i.e., cognitive and affective attitudes) and the purchase intention.

The results demonstrated that affective and cognitive attitudes were both significantly related to purchase intention; and affective and cognitive attitudes as two dimensions of attitude served as antecedents of behavioral intention. We concluded that a consumer with a more positive cognitive attitude is more willing to buy a NEV; even if a consumer possesses a positive affective attitude, however, they are less likely to buy a NEV. This phenomenon is not difficult to understand. A positive cognitive attitude indicates that an individual fully understands and recognizes the benefits of NEVs and is therefore more likely to buy one of these vehicles. However, even though individuals demonstrate a positive affective attitude toward NEVs, they will not buy one of these vehicles due to a series of concerns that can deter them from this purchase; for example, customers are worried about the safety of NEVs for everyday driving [66].

Furthermore, the study results supported the original variables of the TPB theory (i.e., H3 and H4). Specifically, subjective norms and perceived behavioral control were shown to be positively related to the purchase intention. While customers who developed a higher level of subjective norms about NEV purchasing behavior were more likely to become NEV owners for the sake of public censure and social acceptance, consumers who perceived that their ability to purchase a NEV was stronger were more willing to purchase one.

Finally, the study results reveal that gender is a significant moderator between affective attitude and behavior intention among male participants. Gender weakens the relationship between affective attitude and intention to purchase NEVs; males with more positive affective attitudes were less likely to buy a NEV. This can be explained by the barriers of using NEVs, such as inadequate and unreasonable charging piles distribution, and is the reason individuals holding a positive affective attitude are less likely to buy a NEV [26].

The theoretical contributions of this research are as follows: First, instead of examining a uni-dimensional attitude, the current research explored a bi-dimensional attitude (i.e., affective and cognitive); the findings suggest that these two dimensions of attitudes have the opposite effect on the intention to buy NEVs, which cannot be measured on one scale. Second, rather than investigating the extended TPB model, a significant moderator (i.e., gender) was also explored, and the moderating role of gender weakened the relationship between affective attitude and the intention to buy a NEV.

Practical implications of this study are as follows: The findings emphasized practical suggestions for campaign designers, and this study can aid campaigns seeking to convince people to purchase NEVs based on cognitive and affective aspects. Even though many advertisements attempt to build positive affective and cognitive attitudes toward NEVs, people do not buy these vehicles; for this reason, in addition to describing the benefits of NEVs in advertising and promotion, barriers should be removed from consumers' minds by stating that NEVs are mature, so consumers with a positive affective attitude will decide to purchase a NEV.

6 Conclusions

To investigate the factors that influence consumers' intention to purchase new energy vehicles, this paper divides attitudes into affective and cognitive dimensions based on the TPB model, with gender added as a moderating variable to explain changes in the relationship between attitudes and behavioral intentions. In this study, 706 valid questionnaires were collected through an online questionnaire survey. To summarize, the cognitive attitude, the affective attitude, subjective norms, and perceived behavioral control are strong determinants of the intention to purchase NEVs. The moderating effect of gender on the relationship between the affective attitude and intention to buy a NEV is significant, especially among males. Specifically, males with more positive affective attitudes were less likely to buy a NEV. Better understanding of these factors which influence the purchase intention can enable marketing professionals and policy makers to adjust their ongoing research and promotion and to make more effective incentives in China. The government and marketing professionals should focus on the affective and cognitive attitude of consumers and should remove barriers in the minds of consumers by explaining the maturity and sophistication of NEVs in addition to describing the benefits of NEVs in advertising and promotion.

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