# CONSUMERS' INTENTIONS TO BUY ENERGY-EFFICIENT HOUSEHOLD APPLIANCES IN CHINA

Bing Zhu[1,*] and John Thøgersen[2]

**Abstract**

This study investigates the intentions of Chinese consumers to buy electrical household products labeled as highly energy-efficient, using induction cookers as a case study. Data were collected from June to August 2019 using an online survey among Chinese residents (N = 189) recruited through convenience sampling. The SEM analysis revealed that consumers' intentions to buy an energy-efficient induction cooker are primarily driven by their attitudes towards doing so, while perceived control also played a role. In addition, multi-group analysis revealed that paying attention to energy labels moderates relationships in the model. For Chinese consumers who do *not*, in general, pay attention to energy labels, the intention to buy an energy-efficient induction cooker is weakly related to the antecedents proposed by the TPB, and only the attitude towards doing so is significant. However, for consumers who generally pay attention to energy labels, relationships in the model are strong, with all three TPB antecedents being significant and jointly accounting for substantial variation in purchase intentions. This suggests that clear and sufficient information on energy-efficient products and energy labeling is necessary to convince consumers that it is worthwhile to choose energy-efficient products.

Keywords: Energy label, Electric home appliances, Theory of planned behavior, Structural equation modeling, Moderation analysis

## 1. INTRODUCTION

The continued burning of fossil fuels to cover the demand for and consumption of energy have resulted in pressing environmental problems (Nguyen et al., 2017), including global warming (Bulunga & Thondhlana, 2018). Consequently, the international community is determined to take action to reduce global warming and protect

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the planet (Dwyer, 2009), including more sparing use of energy as one of the key elements of sustainable energy development (Meng et al., 2018; Rafique & Rehman, 2017). One of the critical instruments in facilitating energy-saving consumer choices is energy efficiency labeling (Kuhn et al., 2022; Linares & Labandeira, 2010), which has been implemented in more than 40 countries and regions around the world (Abas & Mahlia, 2018). Energy efficiency labeling provides essential energy-saving information for household appliances at the point of purchase and enhances consumers' knowledge about energy conservation (Hua & Wang, 2019). This fosters the choice of energy-efficient appliances (Kuhn et al., 2022) and the reduction of household energy consumption (Gram-Hanssen, 2004).

Clearly, consumers play a crucial role in reshaping energy consumption to be more sustainable (Ali et al., 2019). The increasing consumer demand for energy-efficient products has contributed to the transition and upgrading of the home appliance industry (Wang et al., 2004). Studies on energy-efficient consumer behavior have been carried out in countries such as Denmark (Thøgersen, 2017), Germany (Grealis et al., 2019), the UK (Pothitou et al., 2016), Australia (Gadenne et al., 2011), and Sweden (Martinsson et al., 2011). However, overall, research on the impact of energy-efficiency labeling on consumer purchases is still limited (Galarraga et al., 2020; Zhou & Bukenya, 2016). In addition, most of this research was carried out in WEIRD (Western, educated, industrialized, rich, and democratic) countries (Henrich et al., 2010), leaving energy-conserving consumer behavior in emerging economies under-researched (Bhutto et al., 2019; Biswas & Roy, 2015). Studies in emerging economies in Asia suggest that the effectiveness of energy labeling in this context is constrained due to difficulties in comprehending complex information (Yu et al., 2017) and monetary concerns (Weng et al., 2016).

Due to its size and importance in the world economy, knowledge of the situation in China is particularly important. China''s economy is growing rapidly, but the outstanding achievements come at considerable costs regarding resource consumption and environmental degradation (The Telegraph, 2019). The ever-increasing energy consumption in the residential sector amplifies these problems (Wang et al., 2014; Yu et al., 2012). Hence, strengthening energy conservation is urgently needed to cope with environmental, economic, and societal problems (Wang et al., 2014). In this regard, it is essential to remove unnecessary electricity use and reduce household energy consumption, among other things, by changing to the most energy-efficient household appliances (Alam et al., 2019; Ali et al., 2019). For this purpose, energy-efficiency labeling of household appliances is an essential tool, considered a critical practice to achieve "energy efficiency and climate policy targets" (Tan et al., 2017, p. 459).

The China Energy Label is a categorical energy-efficiency label based on the EU Energy Label (Zeng et al., 2014; Zhang et al., 2021). China implemented a voluntary energy-saving product certification system in 1998 (Li et al., 2006) to certify energy-saving, water-saving, and environmentally friendly products (People.cn, 2005). Later, a mandatory energy labeling implementation plan – "Energy-Efficiency Label Management Approach" (No. 17) – became effective in 2005 (Zhang et al., 2021, p. 2), which covered a limited number of the most energy-consuming appliances, including refrigerators and air conditioners (Li et al., 2006). Further, an update to the "Energy-Efficiency Label Management Approach" (No. 35) was implemented in 2016 (Zhang et al., 2021, p. 3), expanding the coverage to different appliances and promoting the use of energy-saving appliances (Zhang et al., 2021). As of 2020, there have been 15 batches of Energy Efficiency Standards (EES), with the associated labeling system covering over 73 types of product, and including standards for 42 household, industrial, and commercial categories (Li and Cao, 2021; Charter, et al., 2021).

Since 2005, the Chinese energy-efficiency classification system has undergone two stages of development. Before 2009, a 5-grades system was employed (Figure 1) (Zhang et al., 2021). But, in 2009 the system was changed to a 3-grades system with stricter energy-efficiency management, in which grade 1 was the highest energy efficiency, grade 2 referred to the average level and grade 3 was the lowest acceptable level (Figure 2) (Zhang et al., 2021).

In addition, an energy efficiency "Top Runner" System (in Chinese: Lin Pao Zhe) was implemented in China (China Energy Portal, 2014) (Figure 3), inspired by a similar program in Japan (Huang et al., 2016; Lopes et al., 2005).

The "Top Runner" program is used in combination with the China Energy Efficiency Label system (Figure 4), with only household appliances reaching the highest level of energy efficiency being allowed to use the Top Runner Label (Zhang et al., 2021).

The "Top Runner" program further improved the energy efficiency standards of China's energy labeling (Nie et al., 2018) and provided consumers with more energy efficiency information to further promote energy-saving products (Zhang et al., 2021).

After more than 15 years of Energy Labelling in China, consumer awareness of the value and significance of energy-efficient products and energy-saving technologies still requires improvement (HuBei.gov.cn, 2018).

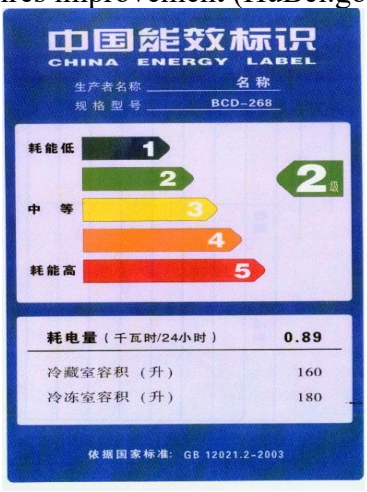


**Figure 1**. 5-Grade System

Source: http://www.gov.cn/ztzl/2006-07/01/content_324564.htm


**Figure 2**. 3-Grade System

Source: https://www.zhufaner.com/s-uhm4bsvonvwkio.html


**Figure 3**. Top Runner (Lin Pao Zhe)

Source: https://chinaenergyportal.org/plan-of-implementation-for-a-energy-efficiency-leader-system/


**Figure 4.** The Energy-Efficiency "Top Runner" Label Added to the China Energy Label

Source: http://www.jobinhe.net/news/20190227/3746.html

Part of the problem can be attributed to inconsistent management and implementation of the labeling. In the latest 2022 national supervision and spot check on the product quality of induction stove tops, a total of 19 items were tested, of which 11 items found problems such as substandard thermal efficiency, unlicensed production, and counterfeiting (National Quality News Network, 2022). This further underscores the importance of strengthening the implementation and management of energy efficiency rating labels (National Quality News Network, 2022).

Still, Chinese consumers have had the opportunity to familiarize themselves with and become accustomed to using energy labels as a reference, at least when buying certain household appliances (lyxinwen.com, 2009). However, the market share and consumer adoption rate of energy-efficient household appliances are still relatively low, especially for small appliances (Hua & Wang, 2019; Weng et al., 2016), while consumers' knowledge and understanding of the energy label are still limited (Zha et al., 2020). In this context, it is a problem that research on consumer responses to energy labeling in China is still limited (Ma et al., 2013) and insufficient to effectively develop appropriate market strategies and policies to promote consumer adoption of energy-efficient appliances (Yao et al., 2014). Hence, there is a need for further research on the attitudes and behaviors of Chinese consumers regarding energy-efficient appliances (Ma et al., 2011, 2013). Mainly, it is critical to investigate how consumers' buying decisions for energy-saving appliances are shaped by external (e.g., subjective norms) and internal (e.g., label cognition, individual perception, attitude) mechanisms (Guo et al., 2021).

This paper aims to contribute to filling this knowledge gap and the somewhat wider gap regarding how consumers in emerging markets respond to energy labeling on appliances by studying Chinese consumers' responses to energy-efficiency labeling on a popular type of kitchen appliance, the induction cooker. At the same time, it is also hoped that the results of this study will enable manufacturers and marketers of energy-saving products to better understand consumers in emerging economy countries (especially consumers in the same cultural background, such as collectivism), helping them to bring energy-saving products to the market more effectively. Energy-efficiency labeling was applied to induction cookers in China in 2009. However, induction cookers without an energy label were still commonly sold in the Chinese market, especially on e-commerce platforms, a decade later. Specifically, the objective of this study is to understand Chinese consumers' intentions to buy energy-efficient induction cookers and the extent to which the energy label affects their buying decision. The primary research question is whether Chinese consumers consider the energy label when buying an induction cooker.

It is supposed that Chinese consumers' motivation to buy an energy-efficient induction cooker is similar to what was previously found in an emerging economy context. Theoretically, as suggested, for example, by the theory of planned behavior (TPB), consumers' intentions to buy an energy-efficient induction cooker are assumed to be partly based on their assessment of costs and benefits, which is reflected in the attitude toward buying an energy-efficient induction cooker, but also partly by perceived social pressure from family members and others and by how easy or difficult buying it, is perceived to be (i.e., perceived behavioral control). Hence, the study will involve Chinese consumers'

1) attitudes towards buying an energy-efficient induction cooker,

2) perceived social pressure to buy an energy-efficient induction cooker and

3) perceived behavioral control regarding buying an energy-efficient induction cooker, in addition to the relative weights of each of these factors on consumers' intentions to buy an energy-efficient induction cooker.

In addition, the study will investigate how much paying attention to the energy efficiency labeling influences Chinese

consumers' intentions to buy an energy-efficient induction cooker.

## 2. THEORETICAL FRAMEWORK AND LITERATURE REVIEW

### 2.1. A Reasoned Action Approach

As electric appliances are infrequently bought and at a relatively high cost, they are likely perceived as somewhat risky purchases. As the novelty of an energy-efficient appliance may further magnify the perceived risk, it is unlikely that many consumers will buy them without deliberate and extensive reasoning (Thøgersen & Ebsen, 2019). Hence, it is assumed that the decision to buy an energy-efficient appliance is typically characterized by a relatively high degree of involvement and deliberation (Fazio & Towles-Schwen, 1999). In line with this assumption, a reasoned action framework (Fishbein & Ajzen, 2009) is often applied to study the antecedents of buying intentions for appliances (e.g., Hua & Wang, 2019; Tan et al., 2017; Zhang et al., 2020). Reasoned action theory emphasizes intentional behaviors, i.e., behaviors that are preceded by a conscious intention (Fishbein & Ajzen, 2009). When the perceived risk is high, as is assumed to be the case here, consumers usually form intentions based on deliberate reasoning aiming at making an optimal decision (Fazio & Towles-Schwen, 1999). This deliberately constructed intention is the tendency or readiness to actualize a behavior, which is assumed to be the immediate psychological antecedent and the best predictor of behavior (Ajzen, 2002; Paul et al., 2016). Therefore, it makes sense to focus on understanding or explaining intentions to buy rather than actual buying in this case (Thøgersen & Ebsen, 2019).

The most widely used reasoned action theory is the Theory of Planned Behavior (TPB) (Icek Ajzen, 1991), which has been used in fields such as psychology, healthcare, communication, public relations, and consumer behavior (Alam et al., 2019), in addition to studies of pro-environmental behavior, such as choosing a "green" hotel (Chen & Tung, 2014; Wang et al., 2017), energy-saving (Wang et al., 2015; Zhang et al., 2014), or buying energy-efficient appliances (Hua & Wang, 2019; Tan et al., 2017; Zhang et al., 2020). Rivis et al. (2009, p.2985) judged that "the TPB is perhaps the most influential theory in the prediction of social and health behavior" (see also Hsu et al., 2017).

The TPB – an extension of the theory of reasoned action (TRA) (Ajzen & Fishbein, 1980; see also Hackman & Knowlden, 2014) – posits that behavioral intentions are co-determined by attitudes towards the behavior, perceived social pressure or subjective norms, and perceived behavioral control, all of which account for influential factors beyond the individual's control (Ajzen, 1991; Fishbein, 1967; Montaño & Kasprzyk, 2015). Perceived behavioral control refers to how difficult or easy people find it is to perform the behavior (Choo et al., 2016). Hence, it reflects people's self-confidence when engaging in a behavior (see also Bandura et al., 1980; Nguyen et al., 2017). According to the TPB, attitudes toward the behavior, subjective norms, and perceived behavioral control, all derive from a person's beliefs (Hsu et al., 2017; Paul et al., 2016) and co-determine the individual's behavioral intentions (Yadav & Pathak, 2017).

This study hypothesizes that Chinese consumers' intentions to buy an energy-efficient product are co-determined by their attitudes towards doing so, perceived social pressures, and perceived behavioral control. First, several studies have found a positive relationship between energy-saving attitudes and behavioral intentions (Greaves et al., 2013; Zhang et al., 2014). For instance, Ha and Janda (2012) found a strong influence of attitude on consumers' decisions to buy energy-efficient products in South Korea. Hence, it is hypothesized that:

*H1. The attitude toward buying an energy-efficient induction cooker positively affects the intention to buy one.*

Second, results regarding "the perceived social pressure to perform or not to perform a

behavior" (Icek Ajzen, 1991) (i.e., subjective norms, SN) are mixed. Although many studies find that SN strongly influence "green" consumer behavior in collectivist cultures, such as Bangladesh (Taufique & slam, 2021), China (Zhao et al., 2014), Malaysia (Alam et al., 2019), and Turkey (Emekci, 2019), others have found no significant influence, such as a study on young consumers' pro-environmental behavior in India (Taufique & Vaithianathan, 2018). Importantly, Hua and Wang (2019) found that SN significantly affected consumers' intentions to buy an energy-efficient appliance in China. Consequently, it is hypothesized that:
*H2. Perceived social pressure positively affects the intention to buy an energy-efficient induction cooker.*

Third, consumers with the relevant resources and opportunities are more likely to buy energy-efficient appliances (Hua & Wang, 2019). Affordability and complexity are essential for whether or not consumers buy an energy-efficient appliance. It is likely that individuals will have higher purchase intentions for an energy-efficient appliance if their relevant resources and opportunities endow them with a sufficient level of controllability concerning this behavior (Chen & Tung, 2014; Hua & Wang, 2019). Hence, it is hypothesized that:
*H3. Perceived behavioral control positively affects intentions to buy an energy-efficient induction cooker.*

Eco-labels are only meaningful if consumers pay attention to them while shopping (Thøgersen, 2000). Provided that consumers pay attention to energy labels, such a label might strengthen the consumer's reasoning and decision-making and, thereby, the impact of all three antecedents – attitudes, subjective norms, and perceived behavioral control – on purchase intentions. Hence, it is hypothesized that:
*H4. The impact of the three antecedents, attitudes, social pressure, and perceived behavioral control, on intentions to buy an energy-efficient induction cooker is moderated by consumer attention to energy labels.*

## 3. RESEARCH METHODOLOGY

A two-step survey study was conducted in China from August 2018 to August 2019. In a first step pre-study, 15 Chinese residents participated in in-depth interviews to better understand Chinese consumers' buying decisions regarding an (energy-labeled) induction cooker. Snowball sampling was used to reach consumers who had bought an induction cooker with an energy label. These interviews provided input to design the questionnaire used in the second step.

The second step was an online survey with a broad convenience sample of Chinese residents conducted from June to August 2019 via WeChat, a popular messaging and social media app. To determine the minimum sample size for the study, we employed several, different procedures and guidelines. A power analysis (Hair et al., 2018; Kline, 2016) via G* Power (Faul et al., 2007) suggested a minimum sample size of 77 with an expected effect size of 0.15, power at 0.80, and alpha at 0.05. A-prior sample size (Soper, 2020), which is "a popular application among users of 2nd generation multivariate data analysis techniques" (Memon et al., 2020, p. v), suggested a minimum sample size of 166 for this study, with a medium effect size for the structural equation model and a statistical power of 0.8. Kline (2005) recommends a sample size between 100 and 200 as the minimum for structural equation modeling (Memon et al., 2020). Finally, Bentler and Chou (1987) suggested, as a rule of thumb, that the minimum recommended ratio of sample size to number of parameters to be estimated in a SEM should be at least 5:1. The number of distinct parameters to be estimated by the SEM model of this study is 32, yielding a minimum sample size of 160. Based on all these criteria, the final sample of this study (189 participants, after data cleaning, who delivered completed questionnaires containing the necessary information for the planned analyses) surpasses the minimum threshold.

Thus, the sample size is assessed to be sufficient for the planned data analyses.

SPSS 24 was used for descriptive analysis and reliability testing, while Amos 24 was used for confirmatory factor analysis and structural equation modeling (SEM). The questionnaire was designed to capture buying intentions, attitudes, subjective norms, and perceived behavioral control, regarding the target behavior. The measurement items were adapted from Ajzen's TPB questionnaire (original version available at https://people.umass.edu/aizen/), with a five-point Likert scale being employed for all items, but with varying endpoints. Participants' socio-demographic characteristics were also obtained. Finally, a multi-group analysis was used to investigate to what extent attention to energy labels moderates the impact of consumers' attitudes, perceived social pressure, and perceived behavioral control on purchase intentions for an energy-efficient induction cooker. For this purpose, the question asked was "to what extent do you take the Chinese Energy Label into account when you shop?". Consumers who answered that they always or sometimes consider the Chinese Energy Label (N=92) were compared to consumers who answered that they do not consider the energy labeling (N=97).

## 4. RESULTS

### 4.1. Demographic Profile of Respondents

Most of the respondents were male consumers aged between 31 and 35 years old. Many held college diplomas and were employed in public institutions (e.g., education, hospitals) with a monthly salary between 2000 and 4000 Yuan. More than half of the respondents bought an induction cooker by themselves (*N=108, 57.1%*), while the remainder reported that others bought their induction cooker (typically a family member) *(N= 81, 42.9%)*. Of those who bought an induction cooker by themselves, 21.3 percent reported that their induction cooker carried the China Energy Label. The top three factors that they considered most when choosing an induction cooker were warranty (27.8 percent), power level (26.9 percent), and word-of-mouth (18.5 percent).

### 4.2. Correlations and Convergent Validity

Table 1 presents the correlations among latent variables and convergent validity tests, including composite reliability (CR) and average variance extracted (AVE). First, purchase intentions were positively correlated with attitudes towards buying the product (r=.759) but were not correlated with subjective norms or perceived behavioral control (r's <.02, ns). Perceived behavioral control was positively correlated with attitudes (r=.184) and subjective norms (r=.152). Subjective norms were also not significantly correlated with attitudes (r=-.024, ns). The CR varies from 0.732 to 0.904, surpassing the recommended threshold of 0.7 (Hair et al., 2009). Regarding the AVE, all except the subjective norm (0.477) exceed the threshold value of 0.5 (Hair et al., 2009). However, as Lam (2012) suggested, if the CR exceeds the acceptable level, it is still acceptable to have an AVE value lower than 0.5. Thus, the AVE of the subjective norms is acceptable for this

**Table 1** Bivariate Correlations and Convergent Validity (N=189)

| | Composite Reliability | Average Variance Extracted | Purchase intentions | Attitudes | Perceived Behavioral Control | Subjective Norms |
|---|---|---|---|---|---|---|
| Purchase Intentions | 0.751 | 0.503 | 1 | | | |
| Attitudes | 0.904 | 0.759 | .759 | 1 | | |
| Perceived Behavioral Control | 0.799 | 0.506 | -0.018 | .184 | 1 | |
| Subjective Norms | 0.732 | 0.477 | 0.019 | -.024 | .152 | 1 |

study.

### 4.3. DISCRIMINANT VALIDITY

The heterotrait-monotrait ratio of correlations (HTMT) analysis, an emerging and more robust technique was applied to assess discriminant validity. All constructs possess HTMT values less than 0.85 as recommended by Voorhees et al. (2016) (Table 2). Thus, discriminant validity was confirmed for all constructs.

### 4.4. Structural Equation Modelling Analysis

In the structural equation model (SEM), the exogenous constructs were attitudes, subjective norms, and perceived behavioral control, while the only endogenous construct was purchase intentions. The estimated structural model, including standardized path coefficients, is presented in Figure 5, with the total model being shown in Table 3. The significant chi-square shows that the model does not fit the data perfectly, but the commonly recommended relative model fit indices (Bagozzi & Yi, 2012): RMSEA, TLI, CFI, and SRMR, all suggest an acceptable fit.

**Table 2** The Heterotrait-Monotrait Ratio of Correlations (HTMT) Analysis

| | Attitudes | Subjective norms | Perceived behavioral control | Purchase intentions |
|---|---|---|---|---|
| Attitudes | | | | |
| Subjective norms | 0.028 | | | |
| Perceived behavioral control | 0.187 | 0.201 | | |
| Purchase intentions | 0.777 | 0.032 | 0.018 | |

**Table 3** Hypothesis Tests and Structural Equation Model Estimates (N=189, $R^2$ =.606)

| Hypothesis & model | B | S.E. | $\beta$ | $t$ | $p$ | Conclusion |
|---|---|---|---|---|---|---|
| H1: Attitudes -> BI | 0.57 | .07 | .79 | 7.851 | <.001 | Supported |
| H2: Subjective norms -> BI | 0.08 | .09 | .07 | 0.883 | .337 | Not Supported |
| H3: Perceived behavioral control -> BI | -0.25 | .11 | -.17 | -2.252 | .024 | Supported |
| *Measurement model* | | | | | | |
| AT3 <- Attitudes | 1.00 | | .87 | | | |
| AT2 <- Attitudes | 0.98 | .06 | .89 | 15.895 | <.001 | |
| AT1 <- Attitudes | 0.92 | .06 | .85 | 14.845 | <.001 | |
| SN3 <- Subjective norms | 1.00 | | .68 | | | |
| SN2 <- Subjective norms | 0.85 | .13 | .70 | 6.429 | <.001 | |
| SN1 <- Subjective norms | 0.94 | .15 | .69 | 6.432 | <.001 | |
| PB4 <- Perceived behavioral control | 1.00 | | .56 | | | |
| PB3 <- Perceived behavioral control | 1.30 | .18 | .83 | 7.292 | <.001 | |
| PB2 <- Perceived behavioral control | 1.23 | .17 | .83 | 7.292 | <.001 | |
| PB1 <- Perceived behavioral control | 0.95 | .16 | .59 | 6.126 | <.001 | |
| INT3 <- BI | 1.00 | | .67 | | | |
| INT2 <- BI | 1.24 | .15 | .78 | 8.223 | <.001 | |
| INT1 <- BI | 0.98 | .13 | .67 | 7.503 | <.001 | |

Note: BI = Purchase intentions. Chi-square = 107.214, 59 df., p <.001, TLI = .935, CFI = .951 RMSEA = .066, SRMR = .047.

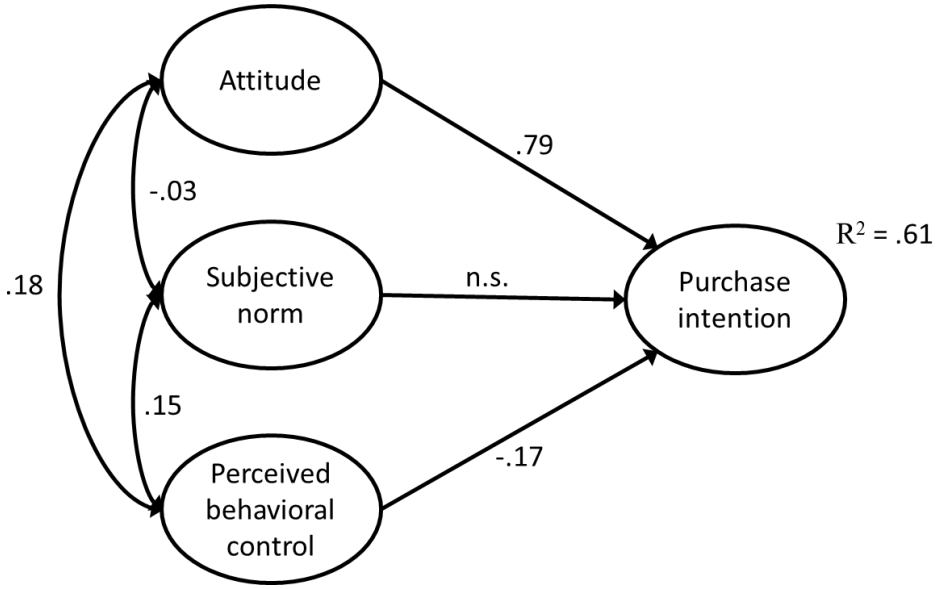


**Figure 5**. Structural Equation Model

The path coefficients confirm hypotheses H1 and H3 (significant at the 95 and 99 percent levels), but not H2 (Table 3). The size of the regression weights shows that the intention to buy an energy-labeled induction cooker primarily depends on the consumer's attitude toward doing so, while perceived lack of control has a smaller, negative effect on intentions. In contrast, perceived social pressure (i.e., subjective norms) appears to be unimportant.

### 4.5. The Moderating Effect of Attention

To test the moderating effect of paying attention to the energy label, multi-group analysis was employed (always or sometimes paying attention to the label vs. never pays attention to the label). A chi-square difference test was conducted to compare a baseline model where measurement weights and intercepts were assumed to be identical and everything else was allowed to vary between groups (chi-square = 201.413, df=137), and a model where equality constraints were added for the three structural regression weights (chi-square = 219.731, df=140). The difference in fit between the two models was statistically significant (Δchi-square = 18.318, df=3, p<.001). Hence, it can be concluded that the three predictors proposed by the TPB do not predict intentions to buy an energy-labeled cooker in the same way across the two groups. A test of differences in latent means refutes the possibility that the reason is a difference in attitudes (ΔM=-.235, t=-1.855, p=.064), perceived social pressure (ΔM=.092, t=1.053, p=.292) or perceived behavioral control (ΔM=-.036, t=-0.534, p=.593) between the groups.

Table 4 shows the separate structural models for consumers who take the energy label into account and consumers who do not consider the energy label. For those consumers who generally do *not* consider the energy label, the regression weights are considerably lower, and only one of the predictors, attitude, is significantly related to purchase intentions. However, for those who pay attention to the energy label, all three predictors are significantly related to purchase intentions. Consistent with this, Table 4 also reports that the explained variance in buying intentions is substantially higher among those that pay attention to the energy label ($R^2$=.888 vs $R^2$=.269). Note that attitude is the strongest of the three predictors in both groups. However, the impact of attitude is considerably stronger when the consumer pays attention to the energy label with the difference in the regression weights of attitudes being highly significant (Δchi-square = 15.838, df=1, p<.001). It also appears that among those who pay attention to

the energy label, intentions to buy an energy-labeled induction cooker are further boosted by perceived social pressure and dampened by a perceived lack of control.

## 5. DISCUSSION AND CONCLUSIONS

This study investigates Chinese consumers' attention to energy labeling and intentions to buy an energy-labeled household appliance, an induction cooker. Since this kind of purchase is made infrequently, attending to aspects such as energy labeling and energy efficiency, demanding reasoning from the consumer, the Theory of Planned behavior (TPB) model was applied.

The hypothesis test employing structural equation modeling (SEM) revealed that the intention to buy an energy-labeled induction cooker primarily and strongly depends on the personal attitude towards doing so, that is, the consumer's evaluation of perceived costs and benefits. This finding is consistent with prior studies in other contexts (e.g., Ali et al., 2019; Cazacu et al., 2014). In these studies, the consumer's attitude is the factor that most strongly shapes purchase intentions for more sustainable products (e.g., energy-saving and green products). In the present study, this finding is qualified by a significant moderation effect from whether or not the consumer, in general, pays attention to energy labeling. Compared to consumers who do not routinely pay attention to energy labels, the attitudes of consumers who do are significantly more predictive of intentions. An obvious interpretation is that paying attention reflects one or more well-known attitude strength variables, such as personal importance of the issue, experience, and/or attitude accessibility (Howe & Krosnick, 2017). Consumers that generally pay attention to energy labeling are also more influenced by what they think others expect and by how easy or difficult they believe it is to take the energy label into account. As expected, perceived social pressure positively and lack of behavioral control negatively impact purchase intentions, which is consistent with logic and prior findings (e.g., Ali et al., 2019; Yadav & Pathak, 2017). The finding that none of these predictors are significant among consumers who ignore energy labeling further implies a lack of attention. Consequently, this reflects that the issue is not essential to these consumers, or not important enough to them to consider others' expectations or how difficult it might be to take energy efficiency into account when contemplating the purchase of a small appliance, like an induction cooker. The low personal importance of this issue could be due to a lack of understanding of the energy label, low trust in the energy label (Weng et al., 2016), or a strong focus on other aspects, such as the price (Hua & Wang, 2019).

The finding that more than half of the samples pay no attention to energy labels may reflect strong uncertainty avoidance in Chinese culture, according to Hofstede's cultural dimension, as labels may still be regarded as something unfamiliar by most Chinese consumers. Uncertainty avoidance makes consumers tend to avoid buying products that they are uncertain about. Chinese consumers tend to stick to traditions rather than using familiar products and adopting new ones.

However, the multi-group moderation analysis revealed that the more consumers get

**Table 4** Multi-Group Comparison Between Two Groups

| | Pays Attention to Label ($R^2$ = .888) | | | | | No Attention to Label ($R^2$ = .268) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Path | B | S.E. | $\beta$ | $t$ | $p$ | B | S.E. | $\beta$ | $t$ | $p$ |
| Attitudes -> BI | .67 | .09 | .97 | 7.818 | <.001 | .30 | .08 | .49 | 3.939 | <.001 |
| SN -> BI | .26 | .13 | .20 | 2.091 | .037 | -.06 | .11 | -.07 | -0.562 | .574 |
| PBC -> BI | -.36 | .14 | -.25 | -2.637 | .008 | -.21 | .15 | -.18 | -1.402 | .161 |

Note: Only the structural model, the measurement model can be acquired from the authors. BI = Purchase intention, SN = Subjective norm, PBC = Perceived behavioral control. Chi-square = 205.775, 140 df., p <.001, TLI = .927, CFI = .934, RMSEA = .050.

accustomed to the Chinese energy label, the more they will be inclined to transform a positive attitude towards buying labeled products with a known energy efficiency. This emphasizes the necessity of informing and educating consumers about the energy label. Higher familiarity, trust, and understanding, will increase purchases of energy-efficient appliances.

## 6. IMPLICATIONS

This study contributes to the existing literature in several ways. It further confirms the usefulness of the TPB model but also adds a critical boundary condition for the model's applicability to predicting pro-environmental consumer choices in an emerging economy context. At the more practical level, it extends understanding of Chinese consumers' motivation to choose energy-efficient appliances, contributing to contemporary energy conservation scenarios. Further, the study reveals new insights into the importance of energy labeling for motivating consumers to select an energy-efficient product. These findings also further solidify the notion that culture plays a critical role when it comes to consumer decisions regarding innovation adoption. The results suggest that the high uncertainty avoidance in Chinese culture matters for consumers' engagement with new products or product-related features as they are more likely to avoid products or features that they are unfamiliar with. Thus, campaigns advocating the use of energy-efficient products should be initiated, preferably all-over available media, to maximize the exposure of consumers to information about energy labeling and energy-efficient products. The government should authorize agents or offices to conduct effective education campaigns, educating the public on energy conservation and the official energy label, providing correct and sufficient knowledge about these matters, and shifting consumer mindsets to embrace sustainable consumption. These practices should be supplemented by producers and retailers providing clear and adequate information on energy-labeled, energy-efficient products to convince consumers that it is worthwhile to choose such products. In addition, manufacturers should try to develop energy-efficiency technologies and reduce production costs to make energy-efficient products more affordable. A strengthening of the supervision and control systems in online and offline settings is also needed to strengthen consumers' confidence in energy-efficient appliances.

## 7. LIMITATIONS

Like other studies, this study has several limitations. First, it is based on a sample of only 189 respondents from a single city in China. Such a study cannot claim to be representative of all Chinese consumers. Hence, to the extent that more precise and representative estimates are required, a large-scale, representative survey is recommended. In addition, the study's dependent variable is consumers' behavioral intentions, which captures their motivation and plans and is generally considered the immediate antecedent and best predictor of reasoned behavior. However, it is not actual behavior. Thus, the most valid approach requires field experiments involving retailers selling the products to test the impact of energy labeling and campaigns to promote the choice of energy-labeled products. Accordingly, future research on this topic using field experiments is strongly encouraged. Finally, the use of the HTMT ratio as a test of discriminant validity, which has become very popular since Henseler introduced it in 2015, has recently attracted critique (e.g., Rönkkö & Cho, 2022) and alternative techniques are applied in some studies (e.g., Chuchuen & Chanvarasuth, 2022; Fakfare et al., 2021; Suwannakul & Khetjenkarn, 2022). In the present case, the evidence for discriminant validity was judged to be strong enough to not be challenged by this critique, but the future will show which technique becomes the new standard for discriminant validity testing.

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