

Modelling the consumer decision-making process to identify key drivers and bottlenecks in the adoption of environmentally friendly products

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Abstract

This paper empirically identifies the attitude-behaviour gap phenomenon, which has been witnessed frequently in environmentally friendly products, by suggesting a general and flexible Bayesian multivariate model and applying it to survey data. Since cognitive, affective and conative stages, which are closely related to the attitude-behaviour gap, are successive stages in the consumer decision-making process, these must be considered simultaneously in empirical analysis. For this reason, a recursive multivariate probit model is proposed. According to the empirical analysis, the affective stage (interest and preference) does not lead to the conative stage (intention to use and intention to purchase) in an analysis of eco-friendly detergent. By contrast, in an electric vehicle analysis, the affective stage partially influences the conative stage through the relationship between preference and usage intention, and through the relationship between interest and purchase intention. It was also found that high compatibility and low complexity must be emphasized in eco-friendly detergent, and that high relative advantage and compatibility must be emphasized for an electric vehicle in order to bridge the attitude-behaviour gap successfully.

KEYWORDS

attitude-behaviour gap, consumer decision-making process, diffusion of innovation theory, environmentally friendly products, recursive multivariate probit model

1 | INTRODUCTION

A variety of countries across the world have been expanding their investment in public procurement of green products in order to stimulate market demand for eco-friendly products (Ho, Dickinson, & Chan, 2010). While the public sector has rigorously participated in purchasing eco-friendly products, demand in the private sector has remained sluggish (Young, Hwang, McDonald, & Oates, 2010). However, it has been widely accepted by researchers and practitioners that an increase in business to government (B2G) transactions through public procurement can be the initial seed to set up the market, but this approach has limitations. Demand in the private sector must be the main driver to vitalize the eco-friendly product market (Appolloni, Sun, Jia, & Li, 2014; Testa, Iraldo, Frey, & Daddi, 2012). Policy tools

and marketing communications for promoting the purchase of eco-friendly products have been advanced over the last few years to stimulate consumption of environmentally friendly products (Kim, Kim, & Chae, 2014; Mathews, 2012). For instance, the investment was used not only to implement a labelling programme for identifying eco-friendly products, but also to educate people on the social and individual benefits of purchasing eco-friendly products (Coddington, 1993; Jeong & Kim, 2015). This effort was designed to stimulate individuals to have an interest in environmental protection, health and ecology and purchase eco-friendly products, but the amount of increased consumption was not significant. For example, the green credit card policy implemented by the Korean government was intended to vitalize eco-friendly product consumption, but the policy has been largely unsuccessful. In fact, the proportion of consumers who used a green credit



card remained constant at 10.7% (Hwang, Park, & Kim, 2016). Thus, it appears that programmes for increasing the sales of green products were effective to boost consumer knowledge and encourage consumer belief that their actions can positively affect the environment, but such programmes did not help to bridge the gap between interest and actual purchasing behaviour.

Not surprisingly, some consumers are willing to pay more for eco-friendly products, whereas others are not. However, the real problem is that, although the majority of consumers indicate that they are environmentalists, this mindset does not necessarily translate into pro-environmental behaviour such as purchasing eco-friendly products (Royne, Levy, & Martinez, 2011). In other words, in spite of consumers' expressed concern for the environment and the growing awareness of green products on retail shelves, consumers seldom purchase green products with any expected regularity (Gleim, Smith, Andrews, & Cronin Jr., 2013). In short, there is a significant gap between consumers' environmental concerns and their willingness to pay for eco-friendly products. Kaiser, Wölfling, and Fuhrer (1999) called this difference the attitude-behaviour gap or attitude-behaviour inconsistency. This topic has received significant attention from academics (Joshi & Rahman, 2015).

Another research stream on green product purchasing has focused on purchasing behaviour itself – adoption or non-adoption – in a dichotomous way (Bhate & Lawler, 1997; Janssen & Jager, 2002; Nath, Kumar, Agrawal, Gautam, & Sharma, 2013). In this framework, a lot of research pays attention to who is willing to pay more for eco-friendly products and what makes them choose such behaviour. Although these studies provide intuitive explanation about green purchasing behaviour, observation of only adoption or non-adoption purchasing behaviour is not able to explain the main bottlenecks consumers face in the decision-making process. From the attitude-behaviour gap perspective, the interest of consumers in eco-friendly products but their lack of willingness to purchase them indicates that consumers get stuck in the decision-making stage due to perceived barriers or bottlenecks. Accordingly, only observing buying decisions in the final stage of the decision-making process cannot provide an appropriate answer to this question. In order to stimulate the consumption of eco-friendly products, consumers must advance to the next decision-making stage by overcoming the perceived barriers. However, few studies have addressed the attitude-behaviour gap from a decision-making perspective.

In summary, huge amounts of effort and investment in promoting the consumption of eco-friendly products have enabled consumers to gain knowledge of and an interest in eco-friendly products, but have ultimately failed to persuade them to purchase these products. This is an attitude-behaviour gap and has been noted by many scholars. Academically, since the cognitive stage (awareness/knowledge), affective stages (interest/preference), and final purchase decision stage (usage intention/buying intention) are successive stages of the buying process, they should be considered simultaneously. This study attempts to model the consumer decision-making process in environmentally friendly products by considering endogeneity and simultaneity. Therefore, the main objective of this research is to propose an econometric model that is able to capture the consumer decision-making process in the eco-friendly product market without

endogeneity. The proposed model is fitted to a survey data set intended to investigate consumers' cognitive, affective, and conative responses to eco-friendly products. To this end, the empirical analysis applying the proposed model reveals key drivers or bottlenecks in the adoption of eco-friendly products and suggests a strategy to bridge the attitude-behaviour gap.

This study makes a couple of contributions to the existing literature. First, it analyses the attitude-behaviour gap using a consumer decision-making process theory. According to the review on factors affecting green purchase behaviour by Joshi and Rahman (2015), the majority of previous studies have investigated factors that influence an attitude-behaviour gap, have identified various prevalent motives, facilitators and barriers affecting the gap regarding green products, and have provided possible explanations for reported inconsistencies. Based on previous findings, this study extends the attitude-behaviour gap study to the decision-making process. The key idea behind this approach is that building knowledge, gaining interest and deciding to purchase green products are sequential and successive stages that should be considered simultaneously without endogeneity in the research model. Second, from a methodology perspective, this study proposes a general and flexible Bayesian multivariate regression model. Specifically, a recursive multivariate probit model is suggested for capturing the effects of product or decision-maker characteristics on each decision-making stage simultaneously, successfully estimating the proposed model with a survey data set. The proposed econometric model can be extended and applied to any product or service category that involves similar attitude-behaviour gap problems.

The remainder of this study is organized as follows. The next section introduces the previous papers that studied consumer behaviour related to the consumption of eco-friendly products and refers to the hierarchy of the effect model to set up a theoretical model. Section 3 briefly explains the methodology covering the estimation process. Section 4 describes the data and discusses the empirical results. The final section summarizes and concludes this study.

2 | PREVIOUS RESEARCH

In section 2.1, previous literature related to the attitude-behaviour gap in the fields of environmental economics and marketing is summarized. Section 2.2 briefly reviews the theory related to the consumer decision-making process with new product adoption in order to advance understanding of the attitude-behaviour gap from a marketing perspective.

2.1 | The attitude-behaviour gap in green consumer behaviour

In environmental economics literature, researchers began witnessing a curious paradox in the early 1990s. There was a situation in which surveyed consumers said that environmental problems and sustainability were important to them and that they were interested in the ecological function and quality of environmentally friendly products, but that they were reluctant to buy such environmentally friendly products.

For instance, in one survey targeting British people in 1992, 69% of the respondents agreed that pollution and environmental damage were affecting their daily lives, and 60% answered that they fully understood environmental matters (Worcester, 1993). However, over the same period, eco-friendly products represented a small portion of the market share, and many green products achieved disappointingly low levels of market sales (Charter, 1992). This curious paradox was defined academically as the attitude-behaviour gap by Wong, Turner, and Stoneman (1996), and they described this ironic behaviour as a much smaller than expected consumer adoption of green products compared to that indicated by public attitudes towards eco-friendly consumption (Wong et al., 1996). This behaviour can also be interpreted intuitively as people having positive attitudes towards eco-friendly products, and knowledge about their impact on environment protection, but not demonstrating these attitudes in their purchasing intentions.

In this context, marketers and policy-makers began to recognize the attitude-behaviour gap as a serious problem or barrier preventing green consumption (Intel, 1995; Wong et al., 1996). Along with the emergence of this curious behaviour, scholars also paid attention to this incongruence between environmental concerns and purchasing behaviour, and they discussed the issue in depth. De Pelsmacker, Driesen, and Rayp (2005) conducted a survey of 808 Belgian respondents that intended to measure actual willingness to pay for fairtrade coffee, and they found that consumer buying behaviour was not consistent with their positive attitudes towards ethical products. In 2008, Finisterra do Paço and Raposo (2010) conducted a survey of 887 respondents in Portugal and identified three types of green consumers: (i) the uncommitted (36%), (ii) the green activists (35%), and (iii) the undefined (29%). They found that the uncommitted was the most important segment, composed mainly of young people with knowledge about environmental issues but negative positions towards green purchasing behaviour.

In the same vein, Vringer, Aalbers, and Blok (2007) found no relationship between the strength of consumer attitudes towards sustainability issues such as climate change, and their actual energy consumption behaviour. Interestingly, Boulstridge and Carrigan (2000) found a similar attitude-behaviour gap phenomenon in their corporate social responsibility study. They reported that, although consumers express willingness to make ethical purchases linked to corporate social activities, the reality is more likely to be that responsible corporate behaviour is not the most dominant criterion in their purchasing decisions. A more elaborate example is that, while 85% of respondents stated that they had a more positive attitude towards corporations that supported causes they cared about, only 51% said they would be more likely to pay for products or services related to such companies, and only 20% said that they had actually bought a product or service in the past 12 months because it was associated with a cause (Simon, 1995). These studies imply lack of a causal effect between a positive attitude towards corporate social responsibility and consumer intention to favour that company in their purchases. Furthermore, findings of previous studies suggest that it is easy for this to happen when people consider social values but do not recognize the individual benefits of these products such as price, quality, and convenience during purchasing.

Many scholars have studied the enhancement of green purchasing intention by overcoming this gap. Schlegelmilch, Bohlen, and Diamantopoulos (1996) argued that specific measures of environmental consciousness are closely linked to environmentally responsible purchasing behaviour. Green consumer understanding of the consequences of their actions and their environmental knowledge can explain their green purchasing behaviour. Blake (1999) identified three barriers in the process from environmental concern to action: individuality, responsibility, and practicality. Individual barriers are those present within the person, having to do with attitude and temperament and including laziness and lack of interest. Responsibility represents a situation where people do not act pro-environmentally because they believe that they cannot influence environmental reform. Lastly, practicality is linked to social and institutional constraints that prevent people from acting pro-environmentally regardless of their attitudes or intentions. Such constraints can be lack of time, money, or information. Recently, Claudy, Peterson, and O'Driscoll (2013) empirically showed that behavioural reasoning theory (BRT), the key premise of which is that people use different and distinct psychological processes when making behavioural decisions, can successfully explain consumer behaviour in regard to the adoption of renewable energy and overcoming the attitude-behaviour gap. Vringer, Vollebergh, van Soest, van der Heijden, and Dietz (2015) designed and conducted a quasi-experiment to test the attitude-behaviour gap for two familiar products with two distinct sustainability problems: animal welfare in relation to meat and poverty in relation to chocolate. Their analysis of the results suggested that this gap could be overcome by sharing the fact that others buy sustainable products, because people are more inclined to buy sustainable product varieties if they think others are buying them, too.

In summary, as the attitude-behaviour gap phenomenon has been witnessed frequently across product categories and countries in eco-friendly product purchasing, it was essential to examine why environmental attitudes have a weak influence on green purchase behaviour. Consequently, various green consumer profiles and typologies have been identified to help advance understanding of green consumption and the green consumer. However, studies have limited their research inquiries to specific aspects of consumer behaviour or consumer consciousness rather than investigating them from within the broader consumption picture. Therefore, in this study, a decision-making model in which consumers progress from unawareness of green products to having a purchase intention is posited, and, based on this model, the proposed model is used to identify the factors blocking adoption.

2.2 | The hierarchy response model in the consumer decision-making process

In order to examine the attitude-behaviour gap in broader consumption and bridge the gap, understanding how consumers arrive at their buying decisions is important. In this framework, the consumer purchasing decision-making process is addressed because consumers in the real world do not immediately decide whether or not to purchase a new product when encountering it or obtaining information about it (Wei, Chiang, Kou, & Lee, 2017). Rather, they experience a series of

hierarchical and sequential stages before reaching a decision. Intuitively, the decision-making process depicts a very general situation in which a group of consumers may be aware of a new product but may not be interested in it. A group of consumers may also be interested in a product but unwilling to buy it. In this context, many theoretical models have been developed to explain such a hierarchical decision-making process or attitude formation process, and empirical analysis has been conducted applying such a theoretical model (Shim, Kim, & Altmann, 2016). These models are very similar in that they explicitly provide three key constructs of decision making and suggest the concept as a sequential process.

In marketing literature, two similar theoretical models on the consumer purchasing decision-making process were developed for different reasons, but they both depict how people react to information delivered by the advertising of a new product. First, the Attention-Interest-Desire-Action (AIDA) model was developed to represent the stages a salesperson must go through in the personal selling process (Belch & Belch, 2003). This model depicts the buyer as passing successively through attention, interest, desire, and action. Second, the hierarchy of effect model proposed by Lavidge and Steiner (2000) was designed to show the process by which advertising works. The hierarchy of effect model expresses the accumulated effect of advertising on consumer purchasing decision-making. The model involves sequential stages, beginning with the product's arrival in target customer awareness, passing through purchase intention, and terminating with the actual purchase.

The traditional hierarchy response models including AIDA and hierarchy of effect have been discussed in the marketing literature for more than a century, and little has changed in the AIDA model essentials, which have been used since 1898. The basic premise of these two models is that advertising effects occur over a period of time, and advertising communication may not lead to an immediate behavioural response or purchase. Rather, a series of effects must occur, with each step fulfilled before the consumer can move to the next stage in the

hierarchy. Therefore, the traditional hierarchy framework asserts that consumers respond to advertising messages in a very ordered way.

In innovation literature, researchers have developed a similar decision-making model related to the adoption of an innovative product in the market (Rogers, 2003). Rogers named this model the innovation-decision process and explained that the innovation-decision process is the "process through which individuals pass from gaining initial knowledge of an innovation, to forming an attitude about the innovation, to making a decision to adopt or reject, to implementation of the new idea and to confirmation of this decision process" (Rogers, 2003, p. 168). The first three stages were named the knowledge, persuasion and decision stages. At the knowledge stage, the individual becomes aware of and acquires basic information about a new product. At the persuasion stage, the individual forms a favourable or unfavourable attitude towards the new product. Finally, at the decision stage, people represent their intention to adopt or reject the new product. The validity of the innovation-decision process was first demonstrated by an Iowa study (Beal & Rogers, 1960), in which most respondents recognized that they had passed through a series of stages, from awareness and knowledge gain to an adoption decision. The previous theories regarding the consumer decision-making process are summarized in Figure 1.

In summary, the hierarchy response models discussed describe the sequential decision-making process for the purchase of a product, and embrace the effects of advertising or other marketing communication strategies as the communication processes that attract customer attention. The models are based on the different stages involved, from a new product first arriving in the target customer's awareness, to having a purchase intention or making the actual purchase. Therefore, this study includes three explicit main dimensions: the cognitive dimension of a person's response (thinking), the affective dimension of a person's response (feeling), and the conative dimension of a person's response (behaviour). The essence of this conceptual model is that it provides a means to understand how people process information, form attitudes,

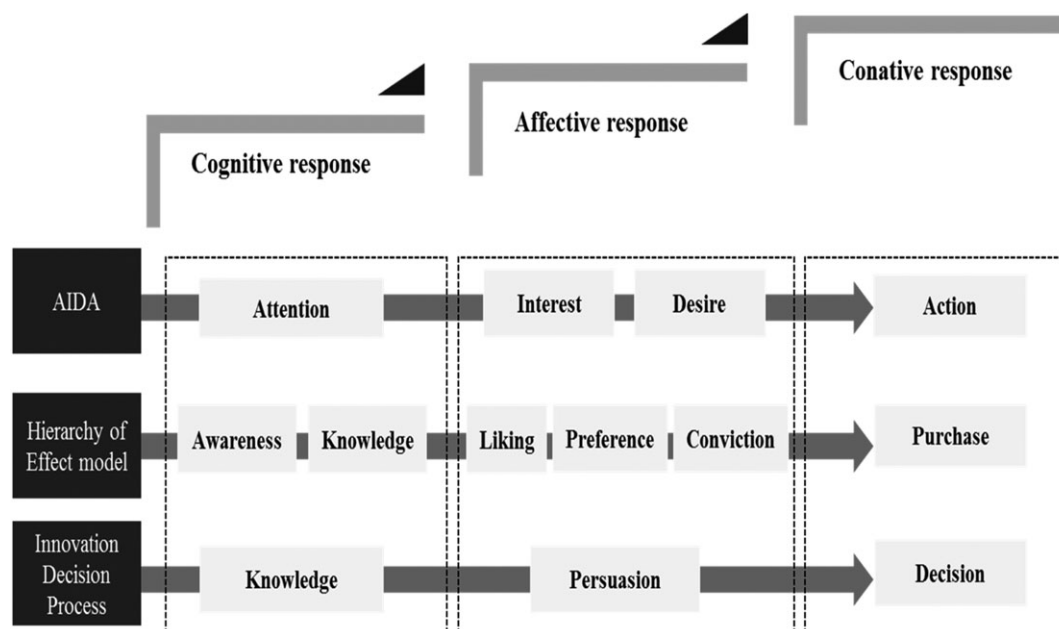


FIGURE 1 Comparison of previous theories about the consumer decision-making process

and behave as a direct result of the information processed and the attitudes formed.

3 | METHODOLOGY

3.1 | Model specification

In order to achieve the research objective, an econometric model for capturing the individual decision-making process associated with new product adoption was proposed. Previous studies mainly used a structure equation model and discrete choice model to analyse the consumer decision-making process. However, the structure equation model has several shortcomings, including specification of model structure, omitted variables and choice of measurement variables (Tomarket & Waller, 2015). Also, it does not adhere to utility maximization behaviour. With the discrete choice model, most studies did not consider a sequential decision process of consumer behaviour, but only focused on the purchase/adoption stage. On the other hand, hierarchy response models clearly state that purchase decision-making does not occur immediately after encountering a new product. Rather, consumers experience a series of decision-making stages. Undoubtedly, this process also applies to eco-friendly product purchases. Guided by hierarchy response theory, the research framework is described as shown in Figure 2.

In order to reflect the proposed research framework in an econometric model, the econometric model must satisfy the following

conditions. First, the econometric model must be able to reflect the attitude-behaviour gap phenomenon and show if such a gap actually exists or not in an empirical analysis. Second, the model must be able to identify factors to bridge this gap efficiently. These factors may be bottlenecks or drivers.

The recursive multivariate probit model successfully satisfies these two conditions and allows bottlenecks or drivers that prevent or stimulate green consumption based on survey data to be empirically identified. Basically, the recursive multivariate probit model is based on the multivariate probit model (Chib & Greenberg, 1998). Consider a multivariate probit model with J choices allowed for the i^{th} consumer. In this case, a J -dimensional multivariate regression model can be described as follows:

$$W_i = Z_i\alpha + v_i \quad (1)$$

where

$$W_i = (W_{i1}, \dots, W_{ij}, \dots, W_{iJ})', \quad v_i = (v_{i1}, \dots, v_{ij}, \dots, v_{iJ})', \quad \text{and } Z_i = (z'_{i1}I_J) = \begin{pmatrix} z'_{i1} & 0 & \dots & 0 \\ 0 & z'_{i2} & \dots & 0 \\ \vdots & \vdots & z'_{ij} & \vdots \\ 0 & 0 & \dots & z'_{iJ} \end{pmatrix}$$

and W_i represents the utility set of the i^{th} consumer, Z_i describes the independent variables, α is the coefficient of each variable, and v_i is the error term which is assumed to follow a multivariate normal distribution. The choice for the j^{th} alternative of the i^{th} consumer is described as:

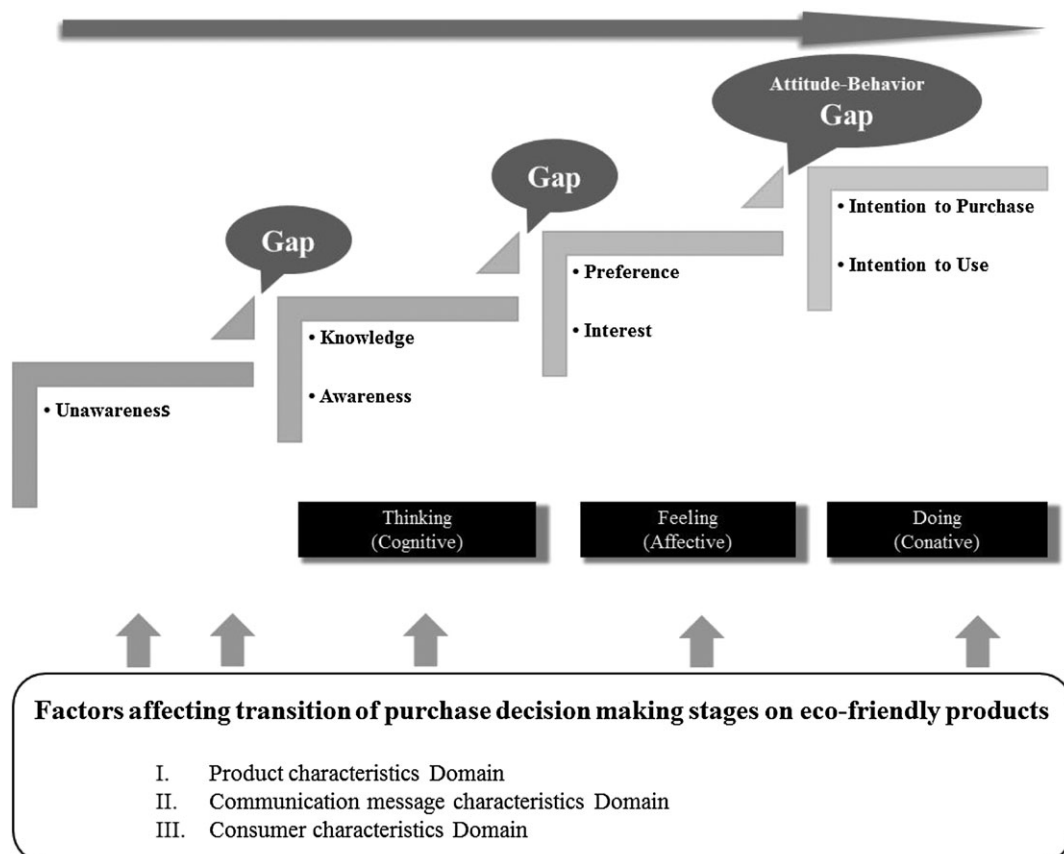


FIGURE 2 Research framework

$$y_{ij} = \begin{cases} 1, & \text{if } W_{ij} > 0 \\ 0, & \text{otherwise} \end{cases} \quad (2)$$

Then, the recursive multivariate probit is an extension of the multivariate probit model in that it considers the two stages of multivariate choice jointly, and that the outcomes of the first stage influence the second stage choice. Therefore, the second stage of the multivariate probit model among L alternatives can be represented similarly as follows:

$$V_i = E_i\theta + R_i\delta + \rho_i \quad (3)$$

$$h_{ij} = \begin{cases} 1, & \text{if } V_{ij} > 0 \\ 0, & \text{otherwise} \end{cases} \quad (4)$$

where V_i represents the utility set of the i^{th} consumer in the second stage, E_i and R_i are the independent variables, θ and δ are coefficients of each variable, and ρ_i is an error term which is assumed to follow a multivariate normal distribution. $R_i = [(d_{i1}, d_{ij}, d_{iL}) \otimes I]$ and d_{ij} are dummy variables defined as 1 if agent i selects j alternatives in the first choice but otherwise zero, capturing the systematic effects of the first choices on the second choices. The choice in the second stage for the i^{th} alternative of the i^{th} consumer is described as h_{ij} .

In this study, the first choice occasion among J alternatives corresponds to the cognitive stage response: if one is aware of a new product and if one has knowledge about it. Similarly, the second choice occasion corresponds to the affective stage response: if one is interested in and supportive of a new product. In this manner, a third stage choice that covers the conative stage response can be considered. In particular, $R_i\delta$ is able to systematically identify the attitude-behaviour gap in this study.

3.2 | Model estimation

To consider two multivariate choices jointly, the two equations are combined as follows:

$$U_i = X_i\beta + \varepsilon_i, \quad (5)$$

$$\text{where } U_i = \begin{bmatrix} W_i \\ V_i \end{bmatrix}, X_i = \begin{bmatrix} Z_i \\ E_i \quad R_i \end{bmatrix}, \beta = \begin{bmatrix} \alpha \\ \theta \\ \delta \end{bmatrix}, \varepsilon_i = \begin{bmatrix} v_i \\ \rho_i \end{bmatrix}, \varepsilon_i \sim N(0, \Sigma).$$

In order to estimate the parameter (β, Σ) , the Bayesian approach allows inclusion of a probability density function about parameters (i.e. the posterior distributions) that is conditional on the sample (i.e. the likelihood function) and prior information (i.e. the prior distributions) based on Bayes' rule. A model structure can be constructed by applying Bayes' rule for the above multivariate regression model, and thus obtaining the following equation:

$$P(\beta, \Sigma^{-1} | U) \propto P(\beta, \Sigma^{-1}) P(U | \beta, \Sigma^{-1}) \quad (6)$$

where $P(\beta, \Sigma^{-1} | U)$ represents the posterior distributions of parameters, $P(\beta, \Sigma^{-1})$ is the prior distributions of parameters, and $P(U | \beta, \Sigma^{-1})$ is the likelihood function. Further details regarding posterior distribution, prior distribution and the likelihood function are described in the Appendix.

Since the posterior density is not analytically tractable, it is impossible to directly compute from the closed form formula. In this situation, the Markov Chain Monte Carlo (MCMC) method is very useful for estimating the parameters in the posterior distribution. A Markov chain is one generating a sequence of random variables with a conditional distribution that depends only on the one step ahead, i.e. $\theta_{r+1} | \theta_r \sim F(\theta_r)$. The state of the chain after a number of steps is then used as a sample of the desired posterior distribution. Thus, there is no direct sampling from the posterior distribution itself. Rather, samples are simulated by sweeping through all the posterior conditionals, one random variable at a time.

As one of the MCMC methods, Gibbs sampling formulates a Markov chain obtained by iterative sampling from conditional distributions of m sets of parameters, i.e. $\theta' = (\theta_1, \theta_2, \dots, \theta_m)$. Through the iterative process, the samples approximate the joint distribution of all variables, and the marginal distribution of any subset of variables can be approximated by simply considering the samples for that subset of variables.

4 | EMPIRICAL STUDY

4.1 | Data

A survey was used to conduct an empirical analysis using the proposed recursive MVP model designed for investigating the attitude-behaviour gap. Since the two main objectives of this study are to show the attitude-behaviour gap phenomenon empirically and identify drivers or bottlenecks affecting transitions between decision-making stages, a survey is the ideal methodology to collect the research data because it can successfully capture constructs related to the consumer decision-making process and factors influencing the adoption of eco-friendly products. Therefore, the survey consisted of two parts. The first part was designed to capture respondents' current decision-making stage, and the second part was designed to capture factors affecting the transitions between decision-making stages in new product adoption. As a result, data were collected through a structured survey questionnaire using a scale with single and multiple items to measure the constructs of the proposed research framework.

During the months of September and October 2016, a national survey was conducted among South Korean adults aged 20 years or older. While using the quota sampling method with subgroups categorized by gender, age and residential area (17 provinces in South Korea), a pilot test was conducted to improve the internal consistency of multi-attribute measurements by calculating the Cronbach's alpha of multiple items. The demographic distribution of respondents in the main survey is shown in Table 1.

It was expected that the level of consumer involvement and the consumer attitude formation process according to the level of involvement would be very different depending on the product category (Krugman, 1966; Zajonc, 1980), and that consumer purchasing behaviour would vary according to the product category (Flannery, 2010). Thus, two different product categories were considered for the empirical analysis: housewares with a short purchase cycle and low price, and automobiles with a long purchase cycle and high price. Specifically, eco-friendly detergent was selected in the housewares category,

TABLE 1 Demographic distribution of respondents

Total		Number of respondents 1533	Component ratio (%)100.0
Gender	Male	830	54.1
	Female	703	45.9
Age	20–29	327	21.3
	30–39	471	30.7
	40–49	438	28.6
	50–59	253	16.5
	60–64	44	2.9
Income level [10 000 Korean won (KRW ¹)]	< 299	377	24.6
	300–399	308	20.1
	400–499	312	20.4
	500–699	361	23.5
	> 700	175	11.4

¹ 1 US \$ = 1150 KRW on 19 February, 2017.

and an electric vehicle in the automobile category. Not surprisingly, these two product categories have totally different price ranges and purchase cycles. For these reasons, it was expected that the analysis of the two different product categories would allow meaningful policy implications and managerial strategies to be drawn depending on the category, because previous studies consistently argued that the level of consumer involvement and product category influence the consumer purchasing decision-making process.

4.2 | Variables

The majority of eco-friendly products are based on technological innovation in the product development process (Demirel & Kesidou, 2011; Kesidou & Demirel, 2012). They are frequently regarded as innovative products in the market. For instance, electrification is the main focus for most car manufacturers today and results in large changes, both in terms of the vehicle itself, including technology and integrated systems, as well as usage in the market (Aggeri, Elmquist, & Pohl, 2009). In this way, some functionalities of eco-friendly products are very novel to potential buyers and difficult to observe.

With this background, innovation adoption theories provide a useful framework for analysing consumer adoption behaviour of eco-friendly products. Several theoretical models have been presented in the field of innovation adoption: the technology acceptance model (TAM), its extension, TAM2, and the unified theory of acceptance and use of technology (UTAUT). Among them, Rogers' (2003) Diffusion of Innovation Theory (DIT) is the most popular and has been frequently cited since 1960. Its main argument is that certain attributes of an innovation influence potential buyers' opinions of the innovation prior to adoption: relative advantage, compatibility, complexity, observability, and triability. Additionally, Rogers (2003) and his successors argued that not only product attributes, but also consumer characteristics and communication channels, are important factors for predicting adoption behaviour.

Following the innovation literature, there are three types of independent variables in this study: product domain characteristics, communication message characteristics, and consumer characteristics. First, product domain characteristics reflect the perceived attributes of innovation. Second, communication message characteristics reflect the type and credibility of the message. Lastly, consumer

characteristics reflect consumers' innovativeness in multiple dimensions. Table 2 presents the independent variables included in the empirical analysis and shows their operational definitions. Accordingly, the questionnaire was designed and included in the survey to capture these variables. However, it is worth noting that the variables included in the product domain and communication message domain were measured with multi-attribute items and, more importantly, were operationalized again in the survey in order to apply them separately to both product categories: eco-friendly detergent and electric vehicles.

The dependent variables capture the consumer decision-making process as a binary variable that consists of three stages and six steps: the cognitive, affective and conative stages, which are part of the research framework. The cognitive stage is divided into awareness and knowledge steps. The affective stage is divided into interest and preference steps. The conative stage is divided into usage intention and purchase intention steps.

4.3 | Results

4.3.1 | Eco-friendly detergent

By applying the proposed recursive MVP model, the consumer decision-making process for eco-friendly detergent was analysed and the attitude-behaviour gap was identified (Table 3).

Remarkably, the attitude-behaviour gap was identified empirically in the case of eco-friendly detergent, which means that interest in eco-friendly detergent did not impact usage intention or purchase intention. Similarly, having a preference for eco-friendly detergent did not significantly influence usage intention or purchasing intention. This result implies that the affective stage did not lead to the conative stage, which strongly supports the attitude-behaviour gap in eco-friendly detergent-purchasing. The following results associated with the product, consumer and communication message domains provide insights into how to overcome this attitude-behaviour gap efficiently.

The results from the product domain, which considers the five main factors from Rogers (2003), show that relative advantage did not have a significant effect on any step of the consumer decision-making process. However, compatibility had a significantly positive effect on the affective and conative stages, and complexity had a significantly negative effect on all stages of the consumer decision-making process. Observability had a significantly positive effect on the cognitive and affective stages, but not on the conative stage. Interestingly, triability had a significantly negative effect on purchasing intention in the conative stage. According to Rogers (2003), greater triability increases the adoption of innovations. However, when consumers have an opportunity to use eco-friendly detergent before their purchase, this experience may decrease their purchasing intention.

As for the results from the communication message domain, objective information about a product and service had a significantly positive effect only on the cognitive stage. Transformation, including consumers' subjective evaluations of their usage experience, had a significantly positive effect on purchasing intention in the conative stage. Nowadays, many new products are released, so it is difficult for consumers to compare every newly released product. Park et al. (2007) mentioned that online consumer reviews of the usage experience

TABLE 2 Explanation of explanatory variables

Variable (number of items)	Mean (SD) Eco-friendly detergent/electric vehicle	Operational definition	Source
Product domain characteristics			
Relative advantage (3)	2.90 (1.00) /2.66 (1.00)	The perceived benefit of using the eco-friendly product compared with the costs in relation to alternatives The extent to which purchasing and usage of eco-friendly products is based on existing ways of doing things and standard cultural norms The perceived difficulty involved in using the eco-friendly product The extent to which eco-friendly products are observable to everyone The extent to which an eco-friendly product can be tried on a limited basis	Ozaki (2011); Rogers (2003)
Compatibility (2)	2.52 (0.76) /3.09 (1.02)		
Complexity (2)	3.08 (0.86) /2.65 (0.91)		
Observability (2)	2.96 (0.93) /3.47 (1.03)		
Triability (2)	3.25 (1.00) /3.37 (1.03)		
Communication message domain characteristics			
Type of message	Information (1) Transformation (1)	The message logically conveys information about the identity of an eco-friendly product The message conveys experimental and sentimental information about using an eco-friendly product	Chen, Shen, and Chiu (2007)
Credibility of message	Expertise (1) Trust (2)	The source that conveys the message has knowledge of evaluating eco-friendly products The source of the message is reliable	McGinnies and Ward (1980)
Consumer domain characteristics			
Innovativeness	Functional (4)	Self-reported consumer innovativeness motivated by the functional performance of innovation and accomplishment improvement	Vandecasteele and Geuens (2010)
	Hedonic (4)	Self-reported consumer innovativeness motivated by affective or sensory stimulation and gratification	
	Social (4)	Self-reported consumer innovativeness motivated by the self-assertive social need for differentiation	
	Cognitive (4)	Self-reported consumer innovativeness motivated by the need for mental stimulation	

SD, standard deviation.

TABLE 3 The estimation results for eco-friendly detergent

	Product domain					Communication message domain					Consumer domain					Cognitive stage			Affective stage	
	RA	Compa	Compl	Obs	Tri	Infor	Trans	Expert	Trust	Func	Hedonic	Social	Cogni	Gender	Age	Income	Aware	Know	Interest	Prefer
Awareness	0.126	-0.106	-0.370*	0.309*	-0.063	0.176*	0.078	0.041	-0.089	0.036	-0.088	-0.004	0.147*	-0.227*	-0.004	0.003				
Knowledge	0.095	-0.010	-0.187*	0.175*	-0.082	0.159*	0.034	0.009	-0.030	0.053	-0.047	-0.113	0.192*	-0.234*	-0.010*	-0.002				
Interest	0.050	0.224*	-0.286*	0.116*	-0.055	0.103	0.045	0.086	0.010	-0.113	0.180*	-0.049	0.056	-0.302*	-0.007*	0.001	-0.500*	-0.510*		
Preference	0.147	0.239*	-0.311*	0.155*	-0.003	0.042	0.044	0.121*	-0.020	0.044	0.141*	-0.121*	-0.021	-0.266*	-0.010*	-0.014	-0.587*	-0.625*		
Usage intention	0.051	0.513*	-0.280*	0.029	-0.157*	-0.029	0.053	0.002	0.146*	-0.205*	0.186*	-0.102	-0.044	-0.323*	-0.004	0.013			0.050	0.424
Purchasing intention	0.016	0.337*	-0.273*	0.107	-0.076	-0.090	0.171*	0.020	0.018	-0.175*	0.216*	-0.006	-0.182*	-0.362*	-0.003	0.022			0.378	0.278

*10% significance level.

RA, Compa, Compl, Obs and Tri describe relative advantage, compatibility, complexity, observability and triability, respectively.

Infor, Trans, Expert, and Trust mean Information, Transformation, Expertise and Trust messages, respectively.

Func, Hedonic, Social, and Cogni represent Functional, Hedonic, Social and Cognitive motivations, respectively.

Aware, Know, Interest, and Prefer represent awareness, knowledge, interest and preference steps, respectively.

are important in the decision-making process. In this context, it is expected that information from consumer reviews affects consumer purchasing behaviour positively. In addition, expert messages provide a significantly positive effect only on consumer preference in the affective stage, and trusted messages provide a significantly positive effect only on purchasing intention in the conative stage.

The results from the consumer domain showed that consumer functional motivation had a significantly negative effect in the conative stage. In other words, eco-friendly detergent did not satisfy consumers' expectations in terms of functionality when compared with other detergent products. Consumer hedonic motivation showed a significantly positive effect in the affective and conative stages. This means that hedonic innovation from eco-friendly detergent had a positive effect on pro-environmental consumption behaviour. In addition, consumer social motivation had a significantly negative effect on preference in the affective stage. Consumer cognitive motivation showed a significantly positive effect in the cognitive stage but a significantly negative effect on purchasing intention in the conative stage. This means that, even if consumers have a cognitive motivation to purchase green products, the attitude-behaviour gap is not overcome.

As for the socio-demographic variables, being a woman had a significantly positive effect in the cognitive, affective and conative stages for eco-friendly detergent, and being a younger consumer had a significantly positive effect in the cognitive and affective stages for eco-friendly detergent. However, this study was unable to determine different impacts according to consumer income levels in the eco-friendly detergent analysis, which is a relatively low-price product compared with electric vehicles.

Finally, it should be emphasized that a significant negative effect of the cognitive stage on the following affective stage in the consumer decision-making process was found. In other words, both cognitive response types (awareness and knowledge) significantly negatively affected consumer affective stages (interest and preference). This means that, although consumers have a high awareness and amount of knowledge on eco-friendly detergent, they have a lower interest in and preference for eco-friendly detergent. It is believed that this result is implicitly linked to the greenwashing phenomenon. According to the survey results for trust in the environmental mark on the label, consumers reported that the reliability of the environment mark was 58.6% when this mark was certified by the Government. However, when the environment mark was provided for products by private companies, the reliability of the environment mark decreased to 38.6%. The main reason for the low reliability of the environment mark was greenwashing, false or exaggerated statements or expressions about the products of private companies being environmentally friendly (Delmas & Burbano, 2011). This result is understandable because greenwashing allows consumer cognition regarding eco-friendly detergent to influence the affective stage in a negative direction. Therefore, to encourage pro-environmental consumption, the Government should start with methods to improve consumer cognition of greenwashing.

4.3.2 | Electric vehicle

The proposed recursive MVP model was also applied to an electric vehicle, which is regarded as a higher involvement, higher priced, and

long-term purchase cycle product than eco-friendly detergent, and thus it was expected that the analysis would show different results in terms of the attitude-behaviour gap. Similar to the analysis for eco-friendly detergent, the consumer decision-making process for the electric vehicle was divided into three stages and six steps (Table 4).

It is important to pay attention to the attitude-behaviour gap for the electric vehicle. In the relationship between the affective stage and conative stage, preference in the affective stage significantly affected usage intention, but not purchasing intention. Also, interest in the affective stage significantly influenced purchase intention but not usage intention. Consequently, since the affective stage did not perfectly lead to the conative stage, it can be stated that the attitude-behaviour gap still exists in the decision-making process for buying an electric vehicle. As with eco-friendly detergent, the following results related to the product, consumer and communication message domains provide insights into how to bridge this attitude-behaviour gap efficiently in the purchase of an electric vehicle.

The results from the product domain show that relative importance had a significantly positive effect on all stages in the consumer decision-making process. Interestingly, compatibility negatively affected consumers' cognitive stage but positively affected their conative stage at a significant level. In addition, complexity had a significantly negative effect on consumer interest in an electric vehicle in the affective stage. Observability had a significantly negative effect on purchasing intention in the conative stage. One possible interpretation of this finding is that, because consumers are more likely to witness the inconvenience of charging an electric vehicle, observability has a negative effect. According to Kim and Huh (2016), the number of charging stations for electric vehicles in Korea was 337 (2.38%) in 2016, compared to 14 135 fuel stations. In addition, the accessibility of charging stations positively affects the consumer purchasing decision (Byun, Shin, & Lee, 2018; Shin, Hong, Jeong, & Lee, 2012; Shin, Lim, Kim, & Choi, 2018). Therefore, the Government should increase the number of charging stations for electric vehicles. Triability did not have a significant effect on the consumer decision-making process.

The results from the communication message domain show that information about a product or service had a significantly positive effect on consumer awareness of electric vehicles in the cognitive stage, and had a significantly negative effect on purchasing intention in the conative stage. The reason for the negative effect on purchasing intention was increased awareness of electric vehicle charging infrastructure and the price of an electric vehicle. Transformation had a significantly positive effect on the cognitive and affective stages, which is consistent with the findings of Park et al. (2007), but the expertise of the message did not have a significant effect on the consumer decision-making process. Trust in the message had a significantly positive effect at all stages. Therefore, based on the results from the communication message domain, trust in the message is especially important to encourage the purchase of electric vehicles.

As for the results from the consumer domain, functional motivation had a significantly negative effect in all stages of the consumer decision-making process. This means that the performance of electric vehicles did not satisfy consumers' expectations compared with other vehicles such as gasoline, diesel and hybrid vehicles. A hedonic motivation had a significantly positive effect on consumer preference in

TABLE 4 The estimation results for electric vehicles

	Product domain					Communication message domain					Consumer domain					Cognitive stage			Affective stage	
	RA	Comp	Compl	Obs	Tri	Infor	Trans	Expert	Trust	Func	Hedonic	Social	Cogni	Gender	Age	Income	Aware	Know	Interest	Prefer
Awareness	0.353*	-0.226*	-0.013	0.043	0.005	0.263*	0.018	-0.014	0.19*	-0.23*	-0.072	-0.043	-0.49*	0.519*	0.010*	0.052*				
Knowledge	0.515*	-0.248*	0.029	0.065	-0.058	0.006	0.123*	0.055	0.21*	-0.27*	-0.022	-0.083	-0.55*	0.412*	0.010*	0.032				
Interest	0.550*	-0.057	-0.161*	-0.055	-0.036	-0.078	0.053	0.092	0.30*	-0.177*	0.035	-0.003	-0.571*	0.225*	0.003	0.028	-0.215	0.113		
Preference	0.620*	0.124	-0.020	0.086	-0.077	0.027	0.108*	0.085	0.15*	-0.390*	0.17*	-0.146*	-0.74*	0.139	0.003	-0.033	-0.297	-0.079		
Usage intention	0.558*	0.251*	-0.048	-0.144*	-0.127	-0.171*	-0.038	-0.018	0.42*	-0.381*	0.102	-0.208*	-0.650*	0.196*	0.008	0.060*			0.350	1.052*
Purchasing intention	0.335*	0.182*	-0.082	-0.031	0.068	-0.078	0.063	-0.021	0.17*	-0.610*	0.141	-0.095	-0.703*	0.093	0.010*	0.064*			0.899*	0.633

*10% significance level.

RA, Compa, Compl, Obs, and Tri describe relative advantage, compatibility, complexity, observability and triability, respectively.

Infor, Trans, Expert, and Trust mean Information, Transformation, Expertise and Trust messages, respectively.

Func, Hedonic, Social, and Cogni represent Functional, Hedonic, Social and Cognitive motivations, respectively.

Aware, Know, Interest, and Prefer represent awareness, knowledge, interest, and preference steps, respectively.

the affective stage. In addition, social motivation provided a significantly negative effect in the conative stage. In other words, although consumers purchased an electric vehicle, they did not receive a social reputation as green consumers. Woo et al. (2017) showed that greenhouse gas emissions from electric vehicles in Korea were higher than the global average. Therefore, it was expected that consumers in Korea did not receive a social reputation by purchasing electric vehicles. A cognitive motivation had a significantly negative effect for all stages of the consumer decision-making process.

As for the results of the socio-demographic variables, being a man had a significantly positive effect in the cognitive, affective and conative stages for electric vehicles. In other words, men showed higher cognitive, affective and conative responses for electric vehicles than women. In addition, older consumers showed higher cognitive and conative responses for electric vehicles than younger consumers. Because an electric vehicle is a higher priced product, consumers having a higher income level had relatively higher cognition and conation responses for electric vehicles.

Regarding the impact of the cognitive stage on the affective stage, no meaningful relationship was found in the case of electric vehicles. This means that a gap exists between the cognitive and affective stages. However, consumer affective stage affected the conative stage. In particular, if consumers had a higher interest in an electric vehicle in the affective stage, they had a higher purchasing intention for an electric vehicle. In addition, if consumers had a higher preference for an electric vehicle in the affective stage, they had a higher usage intention for an electric vehicle.

5 | CONCLUSIONS

The purpose of this paper was to identify the attitude-behaviour gap empirically by proposing an applied econometric model and to examine bottlenecks or drivers to bridge this gap. Therefore, a recursive MVP model was constructed and applied to survey data on eco-friendly detergent and electric vehicles. Guided by hierarchy response theories and diffusion of innovation theory, empirical models were specified and the results were estimated using those models. As predicted, it was found that the attitude-behaviour gap exists during the purchase decision-making process of eco-friendly products. Furthermore, drivers or bottlenecks in each decision-making stage were identified. In this regard, the implications of the empirical analysis can be summarized as follows.

In the eco-friendly detergent analysis, the results demonstrate that the affective stage did not lead to the conative stage, which strongly supports the presence of an attitude-behaviour gap. Specifically, interest in eco-friendly detergent did not affect usage intention or purchasing intention. Similarly, a preference for eco-friendly detergent did not significantly influence usage intention or purchasing intention. In contrast, in the electric vehicle analysis, the affective stage partially led to the conative stage. That is, it was found that preference significantly influenced usage intention and interest affected purchasing intention. However, it can be stated that the attitude-behaviour gap still exists in the purchase decision-making for an electric vehicle.

As mentioned earlier, the attitude-behaviour gap existed in eco-friendly detergent through every relationship between the affective stage and conative stage, whereas the gap only partially existed for the electric vehicle. Such a difference in the attitude-behaviour gap between detergent and electric vehicles implies that the existence of this gap is heavily affected by the product category. In other words, a product category with a high level of involvement, price, and purchase cycle, is likely to display higher attitude-behaviour consistency compared to a product category with a low level of involvement, price, and purchase cycle. When interpreting this result, it is difficult to assume that an electric vehicle always produces higher involvement than detergent because the level of involvement is affected by several factors, including the product category. However, given that the price of an electric vehicle is much greater than that of detergent and that the purchase cycle of an electric vehicle is longer than that of detergent, it is reasonable to interpret these results as a high level of involvement displaying a higher level of attitude-behaviour consistency in the realm of the environmentally friendly product category.

This study also delivers new insights for bridging this gap effectively and proposes a recursive MVP model that can be utilized to analyse multiple consumer decision-making processes. Based on the results, drivers or bottlenecks were identified as stimulating usage and purchasing intentions in eco-friendly detergent and electric vehicles. Regarding product characteristics, high relative advantage and low complexity were found to have a positive influence on the overall propensity for an individual to adopt eco-friendly detergent. Interestingly, complexity was identified as one of the main bottlenecks to prevent adoption in all six steps of all three stages of the decision-making process, whereas observability was a main driver influencing the cognitive and affective stages, but not the conative stage. The result regarding complexity in eco-friendly detergent implies that potential buyers have trouble understanding usage and are concerned about the difficulty of using eco-friendly detergent, which has a significant impact on purchasing behaviour. Therefore, it is very important to deliver a message guaranteeing ease of use, and marketers must explain the ease of use of eco-friendly detergent, with detailed instructions.

In the electric vehicle analysis, high relative advantage and high compatibility had a significant influence on usage intention and purchase intention. Compatibility indicates the fit of an electric vehicle with the driving habits of a consumer compared to a vehicle with an internal combustion engine. One possible explanation of this result is that people tend to think that they cannot drive an electric vehicle as comfortably as they can a non-electric vehicle. Charging stations for an electric vehicle are not as common as gas stations. This fact can seriously influence the perceived level of compatibility. In addition, a high relative advantage was found to affect all six steps of all three stages of the decision-making process. Indeed, consumers had serious doubts about the relative advantages of an electric vehicle with respect to costs and benefits such as maximum driving distance, battery-charging time, fuel cost, and automobile price. Therefore, policy-makers have to promote the perception that purchasing an electric vehicle brings about benefits in terms of monetary value and driving comfort.

This study concludes by acknowledging that there are several shortcomings in it that could be addressed in future research. First, it was assumed that consumers experience cognitive, affective and

behavioural stages sequentially, based on the theory of traditional consumer behaviour and innovation adoption literature. However, some researchers have pointed out that there is a possibility that consumers follow different decision-making paths when purchasing new products (Ratchford, 1987). For example, in impulse purchasing situations, consumers may initially experience a behavioural intention to purchase, and then subsequently experience the affective and cognitive stages. However, this study did not adopt such a heterogeneous decision-making path. Second, the five innovation characteristics suggested by Rogers (2003) were utilized when identifying drivers or bottlenecks affecting the adoption of eco-friendly products. Although numerous studies have been built upon Rogers' diffusion of innovation theory, it is difficult to correctly evaluate and explain consumer responses to eco-friendly products using this conceptual framework. In fact, an aesthetic value reflecting a green image may influence consumer decision-making. However, it was impossible to reflect these attributes in this study. Finally, based on the results of this study, it is concluded that the level of involvement, price and purchase cycle could affect the level of attitude-behaviour consistency. However, according to Gelman and Stern (2006), the significance of such results could change depending on the sample size. Thus, it is difficult to make conclusions based on the statistical results, and further research is needed to find more evidence of the factors affecting attitude-behaviour consistency. In summary, this study presents the initial steps for accounting for the attitude-behaviour gap when implementing policy and strategy to stimulate consumption of eco-friendly products. The authors hope that this encourages future researchers to address some of the unresolved issues raised here.

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APPENDIX A

Posterior distribution, prior distribution and likelihood function

Assuming β and Σ are priorly independent and that the prior density of β and Σ^{-1} follow the k -dimensional multivariate normal distribution and Wishart distribution, respectively, the prior distribution can be represented as follows:

$$\begin{aligned} P(\beta, \Sigma^{-1}) &= P(\beta)P(\Sigma^{-1}) \\ &= (2\pi)^{-\frac{k}{2}}|C|^{-\frac{1}{2}}\exp\left(-\frac{1}{2}(\beta-B)'C^{-1}(\beta-B)\right) \\ &\quad \times |\Sigma^{-1}|^{\frac{s-J-1}{2}}\text{etr}\left(-\frac{1}{2}\Sigma^{-1}V\right) \end{aligned} \quad (\text{A1})$$

where $\beta \sim N(B, C)$ and $\Sigma^{-1} \sim W(s, V)$.

The likelihood function for the multivariate probit model is given by

$$\begin{aligned} L(\beta, \Sigma^{-1}) &= P(U|\beta, \Sigma^{-1}) \\ &= \prod_{i=1}^N (2\pi)^{-\frac{1}{2}}|\Sigma|^{-\frac{1}{2}}\exp\left(-\frac{1}{2}(U_i-x_i'\beta)' \Sigma^{-1}(U_i-x_i'\beta)\right) \\ &= (2\pi)^{-\frac{N}{2}}|\Sigma|^{-\frac{N}{2}}\exp\left(-\frac{1}{2}\sum_{i=1}^N (U_i-x_i'\beta)' \Sigma^{-1}(U_i-x_i'\beta)\right). \end{aligned} \quad (\text{A2})$$

Then, the posterior distribution is expressed as follows:

$$\begin{aligned} P(\beta, \Sigma^{-1}|U) &\propto P(\beta)P(\Sigma^{-1})P(U|\beta, \Sigma^{-1}) \\ &= (2\pi)^{-\frac{k}{2}}|C|^{-\frac{1}{2}}\exp\left(-\frac{1}{2}(\beta-B)'C^{-1}(\beta-B)\right) \\ &\quad \times |\Sigma^{-1}|^{\frac{s-J-1}{2}}\text{etr}\left(-\frac{1}{2}\Sigma^{-1}V\right) \\ &\quad \times (2\pi)^{-\frac{N}{2}}|\Sigma|^{-\frac{N}{2}}\exp\left(-\frac{1}{2}\sum_{i=1}^N (U_i-x_i'\beta)' \Sigma^{-1}(U_i-x_i'\beta)\right) \\ &= |\Sigma^{-1}|^{\frac{s-J-1}{2}}\text{etr}\left(-\frac{1}{2}\Sigma^{-1}V\right) \\ &\quad \times (2\pi)^{-\frac{N}{2}-\frac{k}{2}}|C|^{-\frac{1}{2}}|\Sigma|^{-\frac{N}{2}}\exp\left(-\frac{1}{2}(\beta-\hat{\beta})' \Sigma_{\beta}^{-1}(\beta-\hat{\beta})\right) \end{aligned} \quad (\text{A3})$$

where $\Sigma_{\beta} = \left(\sum_{i=1}^N x_i x_i' \Sigma^{-1} + C^{-1}\right)$ and $\hat{\beta} = \Sigma_{\beta}^{-1} \left(\sum_{i=1}^N x_i x_i' \Sigma^{-1} U_i + C^{-1}B\right)$.

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