Managing green brand equity: the perspective of perceived risk theory

Ching-Hsun Chang · Yu-Shan Chen

Abstract This paper applies perceived risk theory to explore the relationships among green perceived quality, green brand awareness, green perceived risk, and green brand equity. The research object of this study focuses on Taiwanese consumers who have the purchase experience of information and electronics products in Taiwan. The empirical results show that green perceived quality and green brand awareness would positively affect green brand equity. Furthermore, this study demonstrates that green perceived risk which is negatively influenced by green perceived quality and green brand awareness would negatively affect green brand equity. The positive relationships between green brand equity and its two antecedents—green perceived quality and green brand awareness—are partially mediated by green perceived risk. Hence, investing resources in the increase of green perceived quality and green brand awareness and the decrease of green perceived risk is helpful to enhance green brand equity.

Keywords Green brand equity · Green perceived quality · Green brand awareness · Green perceived risk · Green marketing · Perceived risk theory

1 Introduction

Because of the disastrous environmental pollution resulted directly from industrial manufacturing in the world, the society has increasingly noticed environmental issues (Chen 2008a; Chen and Chang 2013a). Therefore, more companies are willing to accept environment protection as their social responsibility (Chen et al. 2006; Chen 2011). Recently, environmental concern has rapidly emerged as a mainstream notion due to global warming, so foresighted companies are planning to seize the green opportunity (Chen and Chang 2013b; Lee et al.

C.-H. Chang (✉)
Department of Business Administration, Tamkang University, 151 Ying-zhuan Road Tamsui, New Taipei City 25137, Taiwan
e-mail: dr.chang.ch@gmail.com

Y.-S. Chen
Department of Business Administration, National Taipei University, New Taipei City, Taiwan

Springer

2013). Under this context, green marketing has received more attention in some industries, such as the information and electronics industry (Chen et al. 2006; Chen 2008b). Nevertheless, not all companies have enough capabilities to undertake green marketing activities. For companies, green marketing should be integrated into all aspects of routine marketing elements and concepts (Ottman 1992).

Companies should seek to apply green marketing activities to achieve superior brand differentiation and obtain competitive advantage, as well as enhance their environmental perceived quality and brand awareness in the market. As green products become more popular, so do the green marketing companies. Green marketing involves developing and promoting products and services that gratify customers' environmental wants and needs without a detrimental impact on the environment. If companies would like to launch green products, green marketing campaigns are important for them to determine how much benefit they can earn. Green marketing can change marketing practices in the world, and further make a difference by building customer needs for green products (Chen et al. 2012). Consequently, consumers are more likely to buy products from a company that is socially and environmentally responsible (Chen and Chang 2013c; Chang and Chen 2012). In order to reduce customers' perceived risk, companies must allow consumers to obtain enough information that enables them to compare with other products on the basis of the environmental concern (Chen et al. 2009). This necessarily requires more disclosure information not just for claiming 'greenness'. Without uniform disclosure information, it is a difficult and expensive task for green marketers to educate consumers about their products; moreover, customers may be mistrustful of their green claims.

There are five motives for companies to undertake green marketing: compliance with environmental trends, improving competitive advantage, enhancing corporate images, seeking green opportunities, and increasing product value (Chen 2010). Furthermore, adopting green marketing can raise intangible brand equity in practice. This study would like to fill the following two research gaps. First, although previous research has paid attention to explore the relevant issues about perceived quality, brand awareness, and perceived risk, none explores them about green or environmental issues. This study proposes two novel constructs, green perceived quality and green brand awareness, and incorporates the concepts of green brand equity and green perceived risk proposed by Chen (2010) and Chen and Chang (2012) into an integral framework to further discuss their implications in the field of green marketing. Second, 'perceived risk theory' argues that consumers' first priority is often to minimize their anticipated risk rather than to maximize their expected utility. Although Chen (2010) developed the concept of green brand equity, this study utilizes 'perceived risk theory' to develop a new research framework which can help companies enhance their green brand equity via its three determinants: green perceived quality, green brand awareness, and green perceived risk.

This study summarizes the literature on green marketing and branding management into a new managerial framework from the perspective of perceived risk theory. Therefore, the main contribution of this paper is to propose the two novel constructs—green perceived quality and green brand awareness—to extend green brand equity research into a new framework. In addition, this study would further undertake an empirical test to verify the relationships among green perceived quality, green brand awareness, green perceived risk, and green brand equity. This paper would like to propose correct viewpoints and to evaluate for new concepts of green marketing in compliance with these environmental trends to help companies enhance their green brand equity. The structure of this study is as follows. A literature review is discussed in Sect. 2, and five hypotheses are also proposed in this section. In Sect. 3, this study describes the methodology, the sample and data collection, and the measurements of the constructs.

Next, the descriptive statistics, reliability of the measurement, factor analysis, correlation coefficients between constructs, discriminant validity, convergent validity, and the results of structural equation modeling (SEM) are shown in Sect. 4. In the end, this study mentions the discussions about the findings and implications, and possible directions for future research in Sect. 5.

2 Literature review and hypothesis development

2.1 Green marketing

Because the rise of environmental protection activities and the impact of industrial disasters are revealed to the public, consumer environmentalism becomes more popular when consumers are aware of the environmental problems in the market (Mclntosh 1991). Therefore, consumers are eager to purchase green products which are more environmental friendly (Krause 1993). The environmentalism is impossible to ignore, so companies should develop business models that can comply with the green trend which is more prevalent nowadays. Green marketing is an emerging area in the marketing field, and its concept has been widely developed in recent years in practice. Companies can apply the notion of green marketing to facilitate their differentiation strategy intended to gratify customers' environmental needs or desires (Polonsky 1994). Green marketing is defined as 'a much broader concept which encompasses all marketing activities that are developed to stimulate and to sustain consumers' environmental friendly attitudes and behaviors' (Jain and Kaur 2004). Previous research suggests companies should develop green marketing activities to identify customers' green attitudes and behaviors, to evaluate the market of green products, to segment the green market into different niches based on the consumers' needs, to formulate green positioning strategies, and to adopt a green marketing mix program (Jain and Kaur 2004). There are more customers with responsible and environmental beliefs since the early 1990s who are more prone to purchase green products which generate a minimum detrimental influence on the environment, when the society becomes more concerned with the environment. As a result, companies are forced to change their business models to comply with the society's environmental concern (Vandermerwe and Oliff 1990; Ottman 1992; Peattie 1992, 1995). Hence, companies should embody the concept of green marketing in their products to obtain their differentiation advantages from their green products (Peattie 1992; Porter and Linde 1995; Chen et al. 2006).

2.2 The negative effect of green perceived quality on green perceived risk

Consumers expect quality today more than ever before, so quality is a powerful competitive weapon (Parasuraman et al. 1985). Perceived quality has attracted the interest of practitioners and researchers because of a belief in its beneficial effects on marketing performance (Sweeney et al. 1999). Perceived quality provides value to customers by providing them with a reason to buy and by differentiating the brand from competing brands (Zeithaml 1988; Aaker 1996; Dyson et al. 1996; Keller 1993). Because environmental consciousness is more popular nowadays, this study proposes a novel construct, 'green perceived quality', and refers to Zeithaml (1988) to define it as 'the customer's judgment about a brand's (or a product's) overall environmental excellence or superiority'. On the other hand, perceived risk is defined as 'a combination of uncertainty and negative consequences' (Bauer 1967; Peter and Ryan 1976; Stone and Gronhaug 1993; Rindfleisch and Crockett 1999). Perceived risk is

a multidimensional construct which includes physical, financial, psychological, performance, and social risk (Roselius 1971; Jacoby and Kaplan 1972). A purchase decision involves risk when the consequences are uncertain (MacCrimmon and Wehrung 1986; Rao et al. 2007). Perceived risk theory asserts that consumers are prone to minimize the perceived risk first, rather than to maximize the expected positive outcome (Sheth and Venkatesan 1968). Companies need to deliver messages that help to improve consumer perceptions of quality to reduce consumer perceived risk. In some markets the messages are central to successful marketing results, and marketers can achieve success by focusing on consumer perceptions of quality (Aaker 1991). The theory of information economics argues that markets are characterized by imperfect and asymmetrical information (Spence 1974). Because the consequences of purchases cannot be entirely anticipated, customers are uncertain about product quality and therefore perceive their decisions are risky (Mitchell 1992). Based on this view, perceived quality may function as an important cue of product performance. Thus, perceived risk theory postulates that perceived quality can mitigate perceived risk because of the decrease of uncertainty of consumer purchase process (Aaker 1991). Under the rising environmental trends, customers have more environmental concern which would increase their perceived risk. Thus, Chen and Chang (2012) propose the concept of 'green perceived risk' and define it as 'the expectation of negative environmental consequences associated with purchase behavior'. Previous research posits that there is a negative relationship between perceived quality and perceived risk (Clow et al. 1998; Sweeney et al. 1999; Snoj et al. 2004; Chen and Chang 2005). Therefore, this study argues that green perceived quality would negatively affect green perceived risk and proposes the following hypothesis:

- **Hypothesis 1** (*H₁*). Green perceived quality is negatively associated with green perceived risk.

2.3 The negative effect of green brand awareness on green perceived risk

Brand awareness is the likelihood that consumers recognize the existence and availability of a brand (Rossiter and Percy 1987). Two constituents express brand awareness: brand recognition and brand recall (Rossiter and Percy 1987; Keller 1993; Yoo and Donthu 2001; Dew and Kwon 2010). Brand recognition reflects customer's ability to recognize a brand from abstract hints, and brand recall is a higher format of brand recognition, when a customer is able to allocate a brand to a specific class of products (Kwun and Oh 2007). Brand awareness is a multidimensional construct which includes brand recognition, brand recall, top-of-mind awareness, and brand knowledge (Aaker 1996). Brand awareness can influence consumers' perceived risk assessment and their confidence in the purchase decision due to familiarity with the brand (Aaker 1996). Customers are sometimes uncertain about product quality and therefore perceive their decisions as risky. Based on the theory of information economics, brand awareness can decrease buyer perceived risk because it can reduce buyer information costs (Erdem and Swait 1998), so it may function as an important cue which can reduce information costs for the buying firm (Aaker 1991). More specifically, brand awareness acts as a strong signal of outstanding reputation (Hoyer and Brown 1990). Perceived risk is a subjective estimation by consumers connected with possible consequences of wrong decisions (Roselius 1971; Peter and Ryan 1976). In the presence of uncomfortable levels of perceived risk, consumers can apply risk reduction strategies, such as reliance on personal recommendations (Cunningham et al. 2004), seeking additional information (Beatty and Smith 1987), a preference for well-known brands (Locander and Herman 1979), and the security of warranties (Dowling and Staelin 1994). Information economics theory asserts

that markets are characterized by imperfect and asymmetrical information (Spence 1974). Consumers often perceive their purchases are risky because they are unsure about product quality. In this context, brand awareness is an important signal of brand value. Perceived risk theory argues that brand awareness can alleviate perceived risk due to the reduction of uncertainty of consumer buying process through more sufficient information (Aaker 1991). Hence, brand awareness reduces the perceived risk of consumers in the purchase process (Mitchell 1995). Consumers may well assume that the brands they know well are likely to be purchased by many other consumers (Aaker 1991). Thus, purchasing high-awareness brands is associated with reduced risk for the consumers. This study proposes a novel construct, 'green brand awareness', and refers to Aaker (1991) to define it as 'the ability for a buyer to recognize and to recall that a brand is environmental friendly'. This study argues green brand awareness can reduce customers' green perceived risk and implies the following hypothesis:

- **Hypothesis 2** (H_2). Green brand awareness is negatively associated with green perceived risk.

2.4 The negative effect of green perceived risk on green brand equity

Perceived risk is a subjective expectation of a loss (Engel et al. 1986). Perceived risk has a negative impact on a customer's purchase process (Murphy and Enis 1986), so it would influence customer behavior (Bauer 1960; Bettman 1973; Cunningham 1967; Mitchell 1999; Murray and Schlacter 1990). Brand equity is one kind of intangible brand property inherent in a brand name (Yasin et al. 2007). Previous research defines brand equity from two perspectives: the value of a brand to the firm from the financial perspective (Simon and Sullivan 1993); the value of a brand to the customers from the consumer perspective (Aaker 1991; Keller 1993). Recent branding research has expanded brand equity to include a broad set of attributes that favor customer relationship (Yoo et al. 2000). Aaker (1991) and Keller (1993) discuss brand equity from the consumer perspective based on consumers' memory-based brand associations. Perceived risk theory provides a comprehensive explanation of why consumers often tend to avoid negative aspects than to seek positive payoffs (Mitchell 1999). High level of perceived risk often causes a consumer to avoid a purchase (Mitchell 1995). It is likely that consumers prefer to buy a brand associated with low level of perceived risk such that the brand possesses better brand reputation and brand equity (Mitchell 1999). Thus, low-level perceived risk about a brand may raise its brand equity (Mitchell 1995). Under the rising environmental era, Chen (2010) proposes a novel construct, 'green brand equity', and defines it as "a set of brand assets and liabilities about green commitments and environmental concerns linked to a brand, its name and symbol that add to or subtract from the value provided by a product or service". Green brand equity is more important for enterprises especially under the rise of prevalent customer environmentalism and strict international environmental regulations. Because past research demonstrates that risk reduction leads to the rise of purchase probability (Wood and Scheer 1996), decreasing perceived risk is beneficial for the increase of brand equity (Faircloth et al. 2001). Therefore, this paper asserts that green perceived risk affects green brand equity negatively and proposes the following hypothesis:

- **Hypothesis 3** (H_3). Green perceived risk is negatively associated with green brand equity.

2.5 The positive effect of green perceived quality on green brand equity

Perceived quality is a set of attributes contributing to the perception of a brand's or a product's quality (Aaker 1991; Sweeney et al. 1999), so it can reduce the costs of managing customers, increase purchase volumes, make it possible to charge a higher price, and create a positive word-of-mouth effect (Qualls and Rosa 1995; Danaher and Roland 1996). Brand equity can precisely represent the preference, attitude, and purchase behavior of customers for a brand (Yasin et al. 2007). Besides, brand equity is a set of the associations developed between the attributes of a brand and the benefits perceived from its customers (Keller 1993; Zaichkowsky et al. 2010). Perceived risk theory argues that customers are usually uncertain about product quality and thereby think their purchases are probably risky since the results of the purchases cannot be completely anticipated (Mitchell 1999). High level of perceived quality acts as a strong cue of high level of product value and functionality (Hoyer and Brown 1990). Thus, perceived quality can reduce the perceived risk of consumers in the purchase process (Aaker 1991; Mitchell 1995). Based on this point, perceived quality drives market performance through two mechanisms: it reduces consumer information cost and perceived risk (Erdem and Swait 1998). Therefore, purchasing a high-quality brand is associated with increased brand equity for consumers. Hence, there exists a positive relationship between perceived quality and brand equity (Pappu and Quester 2006; Kim et al. 2008). Because some companies promote their new products which embody misleading and confusing green claims, and exaggerate the environmental quality of their products, customers are not willing to buy their products any more (Kalafatis and Pollard 1999). Thus, green perceived quality is more important in the environmental era nowadays. Because green perceived quality is crucial to green brand equity, this study implies the following hypothesis:

- **Hypothesis 4** (H_4). Green perceived quality is positively associated with green brand equity.

2.6 The positive effect of green brand awareness on green brand equity

One of the main functions of a brand from the consumer perspective is to minimize the perceived purchasing risk which thereby helps cultivate a trust-based relationship (Mitchell 1999). Brand awareness can influence consumers' perceived risk in the purchase decision due to familiarity with the brand and its characteristics (Aaker 1996). Based on the theory of perceived risk, high level of brand awareness causes better market performance (Erdem and Swait 1998). Consumers have reasons to expect that the purchase of a well-known brand will result in better utility (Aaker 1996). Brand awareness can deliver an important signal regarding the commitment of brand owners (Aaker 1991). In addition, brand awareness can reduce the perceived risk of the consumers (Mitchell 1995). It is likely that consumers prefer to buy a brand associated with high awareness levels such that the brand has higher brand equity. Besides, brand awareness influences customer purchase process through the strength of this brand association (Keller 1993; Erdem and Swait 1998). Raising brand awareness can increase the strength of this brand association (Aaker 1996). Besides, brand awareness can positively affect perceived value about this brand in the consideration set. Consumers often decide to buy only familiar and well-known brands (Aaker 1996). High levels of brand awareness could increase the probability of brand choice, as well as produce greater customer loyalty (Keller 1993). Thus, the creation of brand awareness is a key element of branding strategy for firms (Munoz and Kumar 2004). It is likely that brand awareness plays a special role in driving brand equity (Davis et al. 2008). The relationship between brand equity
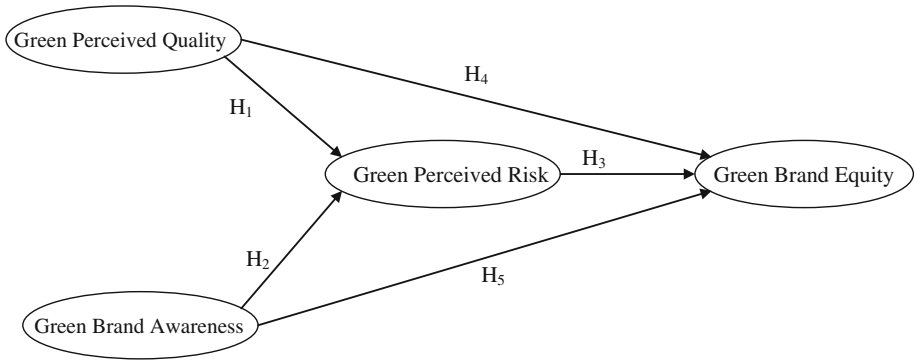
Fig. 1 Research framework

and brand awareness has been an important area in extant literature (Keller 1993; Aaker 1991, 1996; Yoo 2000; Srinivasan et al. 2005). Brand awareness has significant influence on marketing activities related to a brand, so it is one of the fundamental dimensions of brand equity (Keller 1993). It is widely accepted that brand awareness is positively related to brand equity (Keller 1993; Kim et al. 2008). Connecting the concept of brand awareness to brand equity in the environmental context, this study proposes the following hypothesis:

- **Hypothesis 5** (H_5). Green brand awareness is positively associated with green brand equity.

This study asserts that green perceived quality and green brand awareness positively affect green brand equity. In addition, this study argues that the positive relationships between green brand equity and its two determinants—green perceived quality and green brand awareness— are partially mediated by green perceived risk based on perceived risk theory. The antecedents of the research framework are green perceived quality and green brand awareness and the consequent is green brand equity, while green perceived risk is a partial mediator. The research framework is shown in Fig. 1.

3 Methodology and measurement

3.1 Data collection and the sample

The unit of analysis in this study is the consumer level. This study applies the questionnaire survey to verify the hypotheses and research framework. The research object of this study focuses on Taiwanese consumers who have the purchase experience of information and electronics products in Taiwan. The questionnaires were randomly mailed to consumers who had the purchase experience of information and electronics products. The sample was randomly selected from "Yellow Book of Taiwan". The research assistants called to each randomly selected consumer to confirm he or she must have the purchase experience of information and electronics products. If he or she has the purchase experience of information and electronics products, the research assistants would undertake the subsequent procedures. However, if he or she has no the purchase experience of information and electronics products, the research assistants wouldn't undertake the subsequent procedures. The study refers to previous research to design questionnaire items. Prior to the questionnaire mailing, six

experts and scholars were asked to modify the questionnaire in the first pretest. Subsequently, this study invites ten managers whose companies have the purchase experience of information and electronics products to fill in the questionnaire and to identify ambiguities in terms, meanings, and issues in the second pretest. Therefore, the questionnaire of this study has a high level of content validity. High content validity is a necessary requisition for the questionnaire survey in this study. After the second pretest, the sample was randomly selected from "Yellow Book of Taiwan". To heighten the valid survey response rate, the research assistants called to each randomly selected consumer who had the purchase experience of information and electronics products, explained the objectives of the study and the questionnaire contents, and confirmed the names and addresses of the respondents prior to questionnaire mailing. The respondents were asked to return the completed questionnaires within 2 weeks through mailing. Information and electronics products are regulated by the highly strict international environmental laws or regulations, such as Montreal Convention, Kyoto Protocol, Restriction of the Use of Certain Hazardous Substances in EEE (RoHS), and Waste Electronics and Electrical Equipment (WEEE), so that consumers need to purchase information and electronics products which are environmental friendly to satisfy their environmental needs (Chen et al. 2006). This study asked every respondent to point out a specific brand of information and electronics products which is the most impressive for her or him. Then, every respondent was requested to regard this brand as the focal one to fill in the questionnaire. There are three reasons to focus on Taiwanese consumers who have the purchase experience of information and electronics products in this study. First, Taiwan is a highly export-oriented country which has intense interaction with both of the West and the East. Hence, this research conducted in Taiwanese consumers can provide a valuable reference for practitioners and researchers. Second, Taiwan is one of key manufacturing bases for information and electronics products in the world. It is quite common that Taiwanese consumers are familiar with the environmental trends with respect to information and electronics products. Hence, it is interesting to conduct this study in Taiwanese consumers with regard to the experience of information and electronics products. Third, Taiwan is one of famous emerging markets in the world. This research resulting from Taiwanese consumers can contribute to other emerging markets as valuable reference. This study sent 750 questionnaires to the randomly sampled consumers. There are 248 valid questionnaires and the effective response rate is 33.1%.

3.2 The measurement of the constructs

The measurement of the questionnaire items is by use of "five-point Likert scale from 1 to 5" rating from strongly disagreement to strongly agreement. This study asked every respondent to point out a specific brand of information and electronics products which is the most impressive for her or him. Then, every respondent was requested to regard this brand as the focal one to fill in the questionnaire. The measurement of the constructs in this study is in the following:

3.2.1 Green perceived quality

This study proposes 'green perceived quality' and refers to Zeithaml (1988) to define it as 'the customer's judgment about a brand's (or a product's) overall environmental excellence or superiority'. Besides, this paper refers to Dodds et al. (1991), Sweeney et al. (1999) and Yoo and Donthu (2001) to measure green perceived quality and its measurement includes five

items: (1) The quality of the brand's products is regarded as the best benchmark with respect to environmental concern; (2) The quality of the brand's products is reliable with respect to environmental consideration; (3) The quality of the brand's products is durable with respect to environmental performance; (4) The quality of the brand's products is excellent with respect to environmental image; (5) The quality of the brand's products is professional with respect to environmental reputation.

3.2.2 Green brand awareness

This study proposes 'green brand awareness' and refers to Aaker (1991) to define it as 'the ability for a buyer to recognize and to recall that a brand is environmental friendly'. In addition, this paper refers to Rossiter and Percy (1987), Keller (1993), Aaker (1996), and Yoo and Donthu (2001) to measure green brand awareness and its measurement includes five items: (1) You can recognize this brand among other competing brands because of its environmental commitments; (2) You are aware of this brand because of its environmental reputation; (3) Some environmental characteristics of this brand come to the top-of-mind in your consideration set quickly; (4) You can quickly recall the green image of this brand; (5) You can easily figure out this brand because of its environmental concern.

3.2.3 Green perceived risk

Chen and Chang (2012) define 'green perceived risk' as 'the expectation of negative environmental consequences associated with purchase behavior'. Furthermore, this paper refers to Chen and Chang (2012) to measure green perceived risk, and its measurement includes five items: (1) There is a chance that there will be something wrong with the environmental performance of the brand's products; (2) There is a chance that the brand's products will not work properly with respect to its environmental design; (3) There is a chance that you would get environmental penalty or loss if you use the brand's products; (4) There is a chance that using the brand's products will negatively affect the way others think of you with respect to green image; (5) The brand's products would damage your green reputation.

3.2.4 Green brand equity

Chen (2010) defines 'green brand equity' is 'a set of brand assets and liabilities about green commitments and environmental concerns linked to a brand, its name and symbol that add to or subtract from the value provided by a product or service'. This study refers to Chen (2010) to measure green brand equity and its measurement includes four items: (1) It makes sense to buy this brand instead of other brands because of its environmental commitments, even if they are the same; (2) Even if another brand has the same environmental features as this brand, you would prefer to buy this brand; (3) If there is another brand's environmental performance as good as this brand's, you prefer to buy this brand; (4) If the environmental concern of another brand is not different from that of this brand in any way, it seems smarter to purchase this brand.

4 Empirical results

This study utilizes structural equation modeling (SEM) to verify the research framework and hypotheses, and applies AMOS 17.0 to obtain the empirical results. SEM of this study

Table 1 Means, standard deviations, and correlations of the constructs

Constructs	Mean	Standard deviation	A.	B.	C.	D.
A. Green perceived quality	3.721	0.586				
B. Green brand awareness	3.843	0.561	0.361*			
C. Green perceived risk	2.427	0.575	−0.368*	−0.380*		
D. Green brand equity	3.905	0.590	0.409**	0.369*	−0.359*	

$* \, p < 0.05, ** \, p < 0.01$

examines the two levels of analysis, the measurement model and the structure model, and their results are shown in the following.

4.1 The results of the measurement model

The means, standard deviations, and correlation matrix are shown in Table 1. In Table 1, there are positive correlations among green perceived quality, green brand awareness, and green brand equity, while there are negative correlations between green perceived risk and the other constructs. The factor analysis of the four constructs is shown in Table 2. Every construct in this study can be classified into only one factor. The study refers to the prior research to design questionnaire items. Before mailing to the respondents, this study employs two pretests for the questionnaire revision. Therefore, the measurement of this study is acceptable in content validity. Besides, there are several measures to confirm the reliability and validity of the constructs. On one hand, one measure of the reliability is to examine the loadings of each constructs' individual items. With respect to the quality of the measurement model, the loadings (λ) of all items of the four constructs listed in Table 3 are significant. On the other hand, Cronbach's α is the other measure of the reliability. Table 3 lists Cronbach's α for the constructs. In general, the minimum requirement of Cronbach's α coefficient is 0.7 (Hair et al. 1998). In Table 3, the Cronbach's α coefficient of "green perceived quality" is 0.851; that of "green brand awareness" is 0.842; that of "green perceived risk" is 0.847; that of "green brand equity" is 0.905. Because the Cronbach's α coefficients of all constructs are more than 0.7, the measurement of this study is acceptable in reliability.

In addition, it is also important to verify whether the validity of the measurement in this study is acceptable. This study applies Fornell and Larcker's measure of average variance extracted (AVE) to access the discriminant validity of the measurement (Fornell and Larcker 1981). The AVE measures the amount of variance captured by the construct through its items relative to the amount of variance due to the measurement error. To satisfy the requirement of the discriminant validity, the square root of a construct's AVE must be greater than the correlations between the construct and other constructs in the model. For example, the square roots of the AVEs for the two constructs, green perceived quality and green brand equity, are 0.857 and 0.858 in Table 3 which are more than the correlation, 0.409, between them in Table 1. It demonstrates that there is adequate discriminant validity between the two constructs. The square roots of all constructs' AVEs in Table 3 of this study are all more than the correlations among all constructs in Table 1. Therefore, the discriminant validity of the measurement is acceptable. Besides, if the AVE of a construct is higher than 0.5, it means that there is convergent validity for the construct. As shown in Table 3, the AVEs of the four constructs are 0.734, 0.741, 0.730, and 0.737, which are all higher than 0.5. It indicates that the convergent validity of the measurement is acceptable. According to the above results, the reliability and validity in this study are adequate.

Table 2 Factor analysis of this study

Constructs	Number of items	Number of factors	Accumulation percentage of explained variance (%)
Green perceived quality	5	1	57.0
Green brand awareness	5	1	57.9
Green perceived risk	5	1	56.3
Green brand equity	4	1	61.3

Table 3 The items' loadings (λ) and the constructs' Cronbach's α coefficients and AVEs

Constructs	Items	λ	Cronbach's α	AVE	The square root of AVE
A. Green Perceived Quality	GPQ1	0.824**	0.851	0.734	0.857
	GPQ2	0.831**			
	GPQ3	0.842**			
	GPQ4	0.819**			
	GPQ5	0.873**			
B. Green Brand Awareness	GBA1	0.851**	0.842	0.741	0.861
	GBA2	0.870**			
	GBA3	0.862**			
	GBA4	0.913**			
	GBA5	0.924**			
C. Green Perceived Risk	GPR1	0.855**	0.847	0.730	0.854
	GPR2	0.869**			
	GPR3	0.843**			
	GPR4	0.872**			
	GPR5	0.908**			
D. Green Brand Equity	GBE1	0.848**	0.905	0.737	0.858
	GBE2	0.890**			
	GBE3	0.901**			
	GBE4	0.914**			

**$p < 0.01$

4.2 The results of the structural model

Table 4 shows the results of the structural model in this study. The overall fit measures of the full model in the SEM indicates that the fit of the model is acceptable (Degree of freedom = 147, Chi-square = 295.78, GFI = 0.887, RMSEA = 0.051, NFI = 0.902, CFI = 0.906). All of the paths estimated are significant, and all hypotheses are supported in this study. Adding more paths in this research framework would not significantly improve the fit. The residuals of the covariance are small and center near 0. The results of the full model in this study are shown in Fig. 2. All five paths estimated are significant. Therefore, H_1, H_2, H_3, H_4, and H_5 are all supported in this study. This study finds out that the increase of green perceived quality and green brand awareness can not only meet the strict international environmental regulations and the popular environmentalism of consumers, but also enhance green brand equity. Besides, the results figure out that green perceived risk

Table 4 The results of the structural model

Hypothesis	Proposed effect	Path coefficient	Results
H_1	−	−0.327**	H_1 is supported
H_2	−	−0.303*	H_2 is supported
H_3	−	−0.284*	H_3 is supported
H_4	+	0.316*	H_4 is supported
H_5	+	0.283*	H_5 is supported

$*p < 0.05, **p < 0.01$
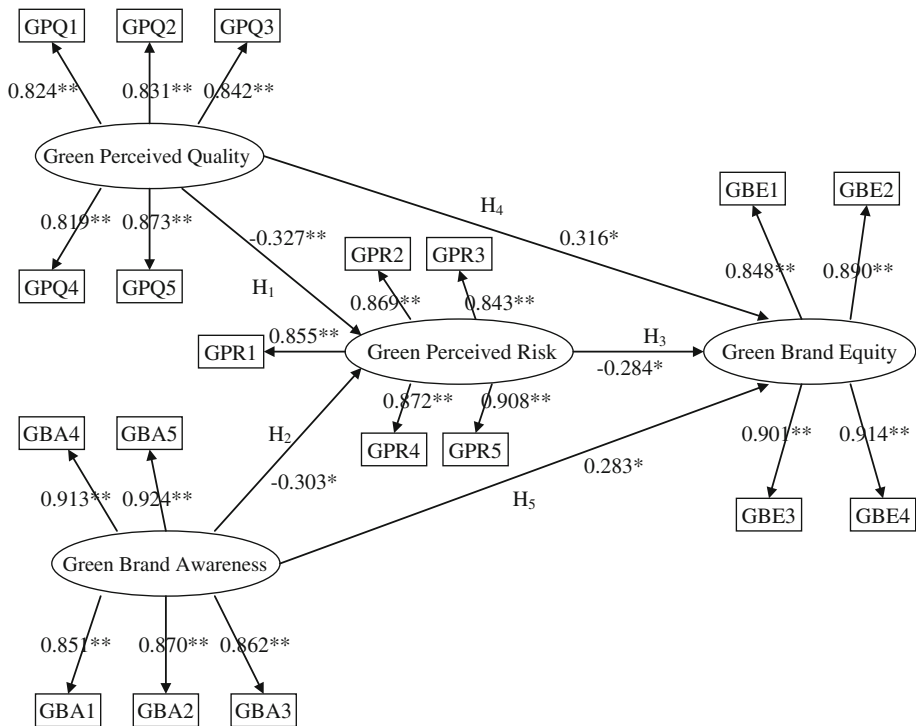
Fig. 2 The results of the full model. Degree of freedom = 147, Chi-square = 295.78, GFI = 0.887, RMSEA = 0.051, NFI = 0.902, CFI = 0.906. $*p < 0.05, **p < 0.01$

which is negatively related to green perceived quality and green brand awareness is negatively associated with green brand equity. Therefore, this study verifies that green perceived risk partially mediates the positive relationships between green brand equity and its two antecedents—green perceived quality and green brand awareness. As a result, companies should raise their green perceived quality and green brand awareness and reduce green perceived risk to enhance their green brand equity to gratify their customers' environmental needs.

5 Conclusions and implications

This study proposes two original constructs—green perceived quality and green brand awareness—and develops a research framework to further discuss their relationships with green brand equity from the perspective of perceived risk theory. The empirical results show that green perceived quality and green brand awareness are positively related to green brand equity. In addition, this study indicates that green perceived risk which is negatively influenced by green perceived quality and green brand awareness would negatively affect green brand equity. Thus, this study finds out that the positive relationships between green brand equity and its two determinants—green perceived quality and green brand awareness—are partially mediated by green perceived risk. All hypotheses proposed in this study are supported in this study. Therefore, investment resources in the increase of green perceived quality and green brand awareness and the decrease of green perceived risk is helpful to enhance green brand equity. Consumers usually possess imperfect and asymmetrical information in the markets, so it is not easy for them to distinguish product quality. Therefore, green perceived quality and green brand awareness play an important role which is a strong signal that can reduce green perceived risk and raise green brand equity from the perspective of perceived risk theory.

The main purpose of this paper is to demonstrate the positive relationships between green brand equity and its two antecedents— green perceived quality and green brand awareness and to identify the partial mediation effect of green perceived risk. Companies must increase their green perceived quality and green brand awareness or to reduce their green perceived risk in order to enhance their green brand equity in the environmental era. Nowadays, green marketing can become a way of brand positioning, so companies should exploit popular concerns about environmental issues to position their brands in order to seize new green markets. Although some companies try to formulate long-term strategies to carry out their green marketing, the huge challenge for them is incorporating their environmental vision into their corporate strategies rather than seeking to promote their green brands alone. This paper extends brand equity research into the environmental context and verifies that green perceived quality and green brand awareness are positively related to green brand equity. This study demonstrates that investing resources in improving firms' green perceived quality and green brand awareness can not only decrease their green perceived risk, but also enable them to enhance their green brand equity. If companies would like to enhance their green brand equity, they should incorporate the ideas of green perceived quality, green brand awareness, and green perceived risk into their long-term environmental strategies in the stage of strategy-planning.

In more sophisticated marketing context, retailers are regarded as important mediation agents to delivery messages between consumers and manufacturers. Hence, retailers' professional knowledge and services play a particularly crucial role in increasing both of green quality perceptions and green brand awareness and in decreasing green risk perceptions. This occurs largely through the offering of favorable product knowledge and services that can raise green quality perceptions and green brand awareness and reduce green risk perceptions. Besides, retailers exercise an influence by reassuring customers that products of a particular brand possess prestigious environmental awareness and outstanding environmental quality in the long term. With the trend towards a more sophisticated marketing context, educating experienced retailers as an effective information channel between consumers and manufacturers to increase both of green quality perceptions and green brand awareness and to decrease green risk perceptions is more convincing in practice. Additional effective strategies may include money back guarantees and green quality guarantees. Customers may be willing

to take green perceived risk if they're sure that the brand owner stands behind their green products. Finally brand managers need to develop and to deliver messages to consumers that help to improve their green perceived quality, green brand awareness, and green perceived risk. In some markets these messages are central to successful green marketing techniques, methods, and strategies which can enhance green brand equity.

There are four directions about future research in the study. First, this study concentrates on the purchase experience of information and electronics products. Future research can focus on the purchase experience of other products and compare with this study. Second, this study concentrates on Taiwanese consumers. Future research can focus on other consumers in other countries and compare with this study. Third, this study verifies the hypotheses by means of questionnaire survey which only provides cross-sectional data so that this study can't observe the dynamic change of green perceived quality, green brand awareness, green perceived risk, and green brand equity in the different stages through longitudinal data. Therefore, future research can set forth toward the longitudinal study to find out the differences of green perceived quality, green brand awareness, green perceived risk, and green brand equity in the different stages. Fourth, future research can focus on business-to-business context and compare with this study. Finally, this study hopes that the research results are helpful to practitioners, researchers, or policy makers, and contribute to future researches as reference.

References

Aaker, D.A.: Managing brand equity: capitalizing on the value of a brand name. The Free Press, New York (1991)

Aaker, D.A.: Building Strong Brands. The Free Press, New York (1996)

Bauer, R.A.: Consumer behavior as risk taking. In: Hancock, R.S. (ed.) Dynamic Marketing for a Changing World. Proceedings of the 43rd Conference, American Marketing Association, Chicago, IL, pp. 389–398 (1960).

Bauer, R.: Consumer behavior as risk taking. In: Cox, D. (ed.) Risk Taking and Information Handling in Consumer Behavior, pp. 82–264. Harvard University Press, Cambridge (1967)

Beatty, S.E., Smith, S.M.: External search effort: an investigation across several product categories. J. Consum. Res. **14**, 83–95 (1987)

Bettman, J.R.: Perceived risk and its components. J. Mark. Res. **10**, 84–90 (1973)

Chang, C.H., Chen, Y.S.: The determinants of green intellectual capital. Manag. Decis. **50**(1), 74–94 (2012)

Chen, Y.S.: The driver of green innovation and green image–green core competence. J. Bus. Ethics **81**(3), 531–543 (2008a)

Chen, Y.S.: The positive effect of green intellectual capital on competitive advantages of firms. J. Bus. Ethics **77**(3), 271–286 (2008b)

Chen, Y.S.: The drivers of green brand equity: green brand image, green satisfaction, and green trust. J. Bus. Ethics **93**(2), 307–319 (2010)

Chen, Y.S.: Green organizational identity: sources and consequence. Manag. Decis. **49**(3), 384–404 (2011)

Chen, Y.S., Chang, C.H.: Enhance green purchase intentions: the roles of green perceived value, green perceived risk, and green trust. Manage. Decis. **50**(3), 502–520 (2012)

Chen, Y.S., Chang, C.H.: Enhance environmental commitments and green intangible assets toward green competitive advantages: an analysis of structural equation modeling (SEM). Qual. Quant. **47**(1), 529–543 (2013a)

Chen, Y.S., Chang, C.H.: Utilize structural equation modeling (SEM) to explore the influence of corporate environmental ethics: the mediation effect of green human capital. Qual. Quant. **47**(1), 79–95 (2013b)

Chen, Y.S., Chang, K.C.: The nonlinear effect of green innovation on the corporate competitive advantage. Qual. Quant. **47**(1), 271–286 (2013c)

Chen, T.Y., Chang, H.S.: Reducing consumers' perceived risk through banking service quality cues in Taiwan. J. Bus. Psychol. **19**(4), 521–540 (2005)

Chen, Y.S., Lai, S.B., Wen, C.T.: The influence of green innovation performance on corporate advantage in Taiwan. J. Bus. Ethics **67**(4), 331–339 (2006)

Chen, Y.S., Lin, M.J.J., Chang, C.H.: The positive effects of relationship learning and absorptive capacity on innovation performance and competitive advantage in industrial markets. Ind. Mark. Manag. **38**(2), 152–158 (2009)

Chen, Y.S., Chang, C.H., Wu, F.S.: Origins of green innovations: the differences between proactive and reactive green innovations. Manage. Decis. **50**(3), 368–398 (2012)

Clow, K.E., Baack, D., Fogliasso, C.: Reducing perceived risk through advertising service quality cues. J. Prof. Serv. Mark. **16**(2), 151–162 (1998)

Cunningham, S.: The major dimensions of perceived risk. In: Cox, D. (ed.) Risk Taking and Information Handling in Consumer Behavior, pp. 82–108. Harvard University Press, Cambridge (1967)

Cunningham, L.F., Gerlach, J., Harper, M.D.: Assessing perceived risk of consumers in internet airline reservations services. J. Air Transp. **9**(1), 21–35 (2004)

Danaher, P.J., Roland, T.R.: Indirect financial benefits from service quality. Qual. Manag. J. **3**(2), 63–75 (1996)

Davis, D.F., Golicic, S.L., Marquardt, A.J.: Branding a B2B service: does a brand differentiate a logistics service provider? Ind. Mark. Manag. **37**(2), 218–227 (2008)

Dew, L., Kwon, W.: Exploration of apparel brand knowledge, brand awareness, brand association and brand category structure. Cloth. Textiles Res. J. **28**(1), 3–18 (2010)

Dodds, W.B., Monroe, K.B., Grewal, D.: Effects of price, brand and store information on buyers' product evaluations. J. Mark. Res. **28**(3), 307–319 (1991)

Dowling, G., Staelin, R.: A model of perceived risk and intended risk-handling activity. J. Consum. Res. **21**(1), 119–134 (1994)

Dyson, P., Farr, A., Hollis, N.S.: Understanding, measuring, and using brand equity. J. Advert. Res. **36**(6), 9–21 (1996)

Engel, J.F., Blackwell, R.D., Miniard, P.W.: Consumer Behavior. The Dryden Press, Chicago (1986)

Erdem, T., Swait, J.: Brand equity as a signaling phenomenon. J. Consum. Psychol. **7**(2), 131–157 (1998)

Faircloth, J.B., Capella, L.M., Alford, B.L.: The effect of brand attitude and brand image on brand equity. J. Mark. Theory Pract. **9**(3), 61–75 (2001)

Fornell, C., Larcker, D.F.: Evaluating structural equation models with unobservable variables and measurement error. J. Mark. Res. **18**(1), 39–50 (1981)

Hair, J.F., Anderson, R.E., Tatham, R.L., Black, W.C.: Multivariate Data Analysis. Prentice-Hall, Inc., Upper Saddle River (1998)

Hoyer, W.D., Brown, S.P.: Effects of brand awareness on choice for a common, repeat-purchase product. J. Consum. Res. **17**(2), 141–148 (1990)

Jacoby, J., Kaplan, L.B.: The components of perceived risk. In: Venkatesan, M. (ed.) Proceedings of the Third Annual Conference. Association for Consumer Research, Iowa City, Iowa (1972)

Jain, S.K., Kaur, G.: Green marketing: an Indian perspective. Decision **31**(2), 168–209 (2004)

Kalafatis, S.P., Pollard, M.: Green marketing and Ajzen's theory of planned behaviour: a cross-market examination. J. Consum. Mark. **16**(4/5), 441–460 (1999)

Keller, K.L.: Conceptualizing, measuring, and managing customer-based brand equity. J. Mark. **57**(1), 1–22 (1993)

Kim, K.H., Kim, K.S., Kim, D.Y., Kim, J.H., Kang, S.H.: Brand equity in hospital marketing. J. Bus. Res. **61**(1), 75–82 (2008)

Krause, D.: Environmental consciousness: an empirical study. J. Environ. Behav. **25**(1), 126–142 (1993)

Kwun, D.J.W., Oh, H.: Consumers' evaluation of brand portfolios. Hosp. Manag. **26**(1), 81–97 (2007)

Lee, Y.I., Chang, C.H., Chen, Y.S.: The influence of novelty, flexibility, and synergy of package tours on tourist satisfaction: an analysis of structural equation modeling (SEM). Qual. Quant. **47**(4), 1869–1882 (2013)

Locander, W., Herman, P.: The effect of self-confidence and anxiety on information seeking in consumer risk reduction. J. Mark. Res. **16**, 268–274 (1979)

MacCrimmon, K.R., Wehrung, D.A.: Taking Risks: The Management of Uncertainty. The Free Press, New York (1986)

Mclntosh, A.: The impact of environmental issues on marketing and politics in the 1990s. J. Mark. Res. Soc. **33**(3), 205–217 (1991)

Mitchell, V.W.: Understanding consumers' behavior: can perceived risk theory help? Manag. Decis. **30**(3), 26–31 (1992)

Mitchell, V.W.: Organizational risk perception and reduction: a literature review. Brit. J. Manag. **6**(2), 115–133 (1995)

Mitchell, V.W.: Consumer perceived risk: conceptualizations and models. Eur. J. Mark. **33**(1), 163–195 (1999)

Munoz, T., Kumar, S.: Brand metrics: gauging and linking brands with business performance. J. Brand Manag. **11**(5), 381–387 (2004)

Murphy, P.E., Enis, B.M.: Classifying products strategically. J. Mark. **50**, 24–42 (1986)

Murray, K.B., Schlacter, J.L.: The impact of services versus goods on consumers' assessment of perceived risk. J. Acad. Mark. Sci. **18**(1), 51–65 (1990)

Ottman, J.A.: Green Marketing. NTC Business Books, Chicago (1992)

Pappu, R., Quester, P.: Does customer satisfaction lead to improved brand equity? An empirical examination of two categories of retail brands. J. Prod. Brand Manage. **15**(1), 4–14 (2006)

Parasuraman, A., Zeithaml, V.A., Berry, L.L.: A conceptual model of service quality and its implications for future research. J. Mark. **49**(4), 41–50 (1985)

Peter, J.P., Ryan, M.J.: An investigation of perceived risk at the brand level. J. Mark. Res. **13**(2), 184–189 (1976)

Peattie, K.: Environmental Marketing Management. Pitman Publishing Corp, London (1995)

Peattie, K.: Green Marketing. Pitman Publishing Corp, London (1992)

Polonsky, M.J.: Green marketing regulation in the US and Australia: the Australian checklist. Greener Manag. Int. **5**, 44–53 (1994)

Porter, M.E., van der Linde, C.: Green and competitive. Harvard Bus. Rev. **73**(5), 120–134 (1995)

Qualls, W.J., Rosa, J.: Assessing industrial buyers' perceptions of quality and their effects on satisfaction. Ind. Mark. Manag. **24**(5), 359–368 (1995)

Rao, S.S., Truong, D., Senecal, S., Le, T.T.: How buyers' expected benefits, perceived risks, and e-business readiness influence their e-marketplace usage. Ind. Mark. Manag. **36**(8), 1035–1045 (2007)

Rindfleisch, A., Crockett, D.X.: Cigarette smoking and perceived risk: a multidimensional investigation. J. Public Policy Mark. **18**(2), 159–171 (1999)

Roselius, T.: Consumer ranking of risk reduction methods. J. Mark. **35**, 56–61 (1971)

Rossiter, J.R., Percy, L.: Advertising Promotion Management. McGraw-Hill, New York (1987)

Sheth, J.N., Venkatesan, M.: Risk-reduction process in repetitive consumer behavior. J. Mark. Res. **5**(3), 307–310 (1968)

Simon, C.J., Sullivan, M.W.: The measurement and determinants of brand equity: a financial approach. Mark. Sci. **12**(1), 28–52 (1993)

Snoj, B., Korda, A.P., Mumel, A.: The relationships perceived quality, perceived risk and perceived product value. J. Prod. Brand Manag. **13**(3), 156–167 (2004)

Spence, M.: Market Signaling: Informational Transfer in Hiring and Related Screening Processes. Harvard University Press, Cambridge (1974)

Srinivasan, V., Park, C.S., Chang, D.R.: An approach to the measurement, analysis and prediction of brand equity and its sources. J. Manage. Sci. **51**(9), 1433–1448 (2005)

Stone, R.N., Gronhaug, K.: Perceived risk: further considerations for the marketing discipline. Eur. J. Mark. **27**(3), 39–50 (1993)

Sweeney, J.C., Soutar, G.N., Johnson, L.W.: The role of perceived risk in the quality-value relationship: a study in a retail environment. J. Retail **75**(1), 77–105 (1999)

Vandermerwe, S., Oliff, M.D.: Customers drive corporations green. Long Range Plan. **23**(6), 10–16 (1990)

Wood, C.M., Scheer, L.K.: Incorporating perceived risk into models of consumer deal assessment and purchase intent. Adv. Consum. Res. **23**, 399–406 (1996)

Yasin, N.M., Noor, M.N., Mohamad, O.: Does image of country-of-origin matter to brand equity? J. Prod. Brand Manag. **16**(1), 38–48 (2007)

Yoo, B., Donthu, N.: Developing and validating a multidimensional consumer-based brand equity scale. Journal of Business Research **52**(1), 1–14 (2001)

Yoo, B., Donthu, N., Lee, S.: An examination of selected marketing mix elements and brand equity. J. Acad. Mark. Sci. **28**(2), 195–211 (2000)

Zaichkowsky, J.L., Parlee, M., Hill, J.: Managing industrial brand equity: Developing tangible benefits for intangible assets. Industrial Marketing Management **39**(5), 776–783 (2010)

Zeithaml, V.A.: Consumer perceptions of price, quality, and value: a means-end model and synthesis of evidence. Journal of Marketing **52**, 2–22 (1988)