

The Effect of Perceived Risk on Information Search for Innovative Products and Services: The Moderating Role of Innate Consumer Innovativeness

Abstract

Purpose - The purpose of the study is to explore the effects of two dimensions of perceived risk (functional and emotional risk) on two types of consumer information search (ongoing and pre-purchase search) in the context of innovative products and services, and examine the moderating effect of innate consumer innovativeness.

Design/methodology/approach – The findings in this study are generated with a quantitative design using multiple linear regression model and residual centering method on data collected survey responses related to tablet PC adoption in an online community and laboratory experiment on online bike-renting services.

Findings - The results show that functional and emotional risk influence on-going and pre-purchase search differently in innovative products and services context. On the one hand, functional risk affects on-going search negatively, whereas emotional risk affects on-going search positively; on the other hand, the effect of functional risk on pre-purchase search is not significant, and the effect of emotional risk on pre-purchase search is positive. Furthermore, these relationships are moderated by innate consumer innovativeness. For on-going search, consumer innovativeness moderates the negative effect of functional risk negatively and moderates the positive effect of emotional risk positively; for pre-purchase search, consumer innovativeness moderates negatively the positive effect of emotional risk on pre-purchase search.

Originality/value - Unlike established products and services, innovative products and services possess some elements that are unfamiliar to consumers. Companies typically pre-release innovative products and services long before officially launching them on the market, enabling consumers to assess potential risks and seek information in advance, thereby priming the market. Since innovative products and services are becoming more ubiquitous, research on the impact of perceived risk on information search is crucial for marketers. The present work is designed to be the first to consider the effects of two dimensions of perceived risk (functional and emotional risk) on two types of consumer information search (ongoing and pre-purchase search), and the moderating effect of innate consumer innovativeness. The present research is therefore intended to make contributions to the literature on perceived risk, information search and innovation management.

Keywords Perceived risk, Ongoing search, Pre-purchase search, Innate consumer innovativeness, Innovative products and services

Paper type Research paper

Introduction

As Freeman (1982) wrote in his famous study of the economics of innovation, "...not to innovate is to die", innovation is the survival and development foundation for the present enterprise. Customer-oriented marketing concept is driving a growing number of companies to produce the innovative products and services based on customers' perceived values. Currently, both radical innovation and incremental innovation are receiving more attention than ever before (Barczak, 2012; Kotler and Keller, 2012). Since innovative products and services differ somewhat from established products in terms of function, appearance, etc. (Chakravarti and Xie, 2006), consumers typically engage far more in information search activities to understand how such products could be used and their potential benefits. At the same time, different consumers can perceive different uncertainty about the usefulness, ease-of-use and applicability of such products. This perceived risk is central to consumers' purchase decisions about innovative products and services. Therefore, research on the effect of perceived risk on information search is critically important, to both control perceived risk and understand purchasing behavior in the context of innovative products and services.

Information search is a process whereby consumers make inquiries in the social environment and access appropriate data so they can make reasonable decisions (Solomon, 2012). Information search is a persistent process behavior based on a collection of selection sets (Pham and Chang, 2010; Dellaert and Häubl, 2012; Levav *et al.*, 2012), and is driven not only by a consumer's desire to purchase a particular product, but also by her own interests and habits before the purchase demand is generated (Bloch *et al.*, 1986). Therefore, there are two distinct types of information search: pre-purchase search and ongoing search (Bloch *et*

al., 1986; Dholakia, 1998). Pre-purchase search refers to a consumer's search for specific information in response to purchase demands, while ongoing search refers to a consumer's broader information-seeking behaviors aimed at maintaining and upgrading personal knowledge. Most prior research on information search was conducted in the non-innovative product context, and thus focused on pre-purchase search (Bloch *et al.*, 1986). However, advances in information technology and the Internet have enabled companies to stimulate market interest before products are officially launched. The time interval between pre-release and official launch for new products continues to increase (Iyer and Davenport, 2008). This new marketing strategy, which has become highly popular for innovative products and services, creates more opportunities for consumers to engage in ongoing search activities. For example, in the car industry, some firms will make an early presentation of new models (or innovation to be implemented on cars) before offering them on large market. BMW, the giant in car industry, releases its 2021 plan of autonomous vehicles solution in July, 2016, and people who are interested can do solid information search to keep an eye on new product development (BMW.com, 2016). And this practice is also true with Apple. The company would release the product-related information formally through the launch event. Also, they would informally release potential improvements on the forthcoming series months before the next launch event. For example, Apple launched iPhone 6s in September 2015, and showed its intention to release iPhone 7 in November 2015, but didn't formally launch the product until late September 2016 (Apple.com, 2016). The long period between does leave loyal customers plenty time for on-going research. Therefore, the impact of ongoing search is considered to be a potentially crucial factor in the marketing of innovative products and

services.

In addition, an individual trait called innate consumer innovativeness plays an important role in understanding the adoption of innovative products and services (Lee *et al.*, 2013; Hirunyawipada and Paswan, 2006; Vandecasteele and Geuens, 2010). Individuals have different preferences and tendencies to make innovative decisions or use innovative products and services (Hauser and Toubia, 2005; Midgley and Dowling, 1978). Innate consumer innovativeness refers to an inherent and unobservable characteristic that reflects an individual's tendency to innovate (Hirschman, 1980; Hoffman *et al.*, 2010). When applied in the specific domain of innovative products and services, innate consumer innovativeness represents a psychological trait that determines the degree to which a person will embrace newly released innovative products and services (Goldsmith and Hofacker, 1991). Therefore, it is worth exploring whether the relationship between perceived risk and information search is affected by the degree of innate consumer innovativeness.

Two major research objectives frame this study. First, we aim to explore the different effects of two dimensions of consumer perceived risk (functional risk and emotional risk) on two kinds of information search (ongoing search and pre-purchase search) in the context of innovative products and services. Second, we seek to investigate the effect of innate consumer innovativeness on the above-mentioned relationships. The rest of this article is organized as follows. First, we thoroughly review prior research related to these concepts, and create hypotheses based on previously published results and theorization. We then conduct two empirical studies, and analyze our results. Finally, we discuss managerial implications and opportunities for future research.

Theoretical background

Innovative products and services

According to the concept of innovation proposed by Kotler and Keller (2012), innovative products and services encompass a wide range of items, from real products, service, concept to idea, as long as people consider it innovative, it is called the innovative product. At present, service innovation, global innovation, social innovation, open innovation and radical innovation are gaining more attention (Barczak, 2012).

Booz and Hamilton (1982) classify the innovative products and services into 6 categories based on two dimensions, newness to the company and newness to the market. The 6 categories are: new-to-the-world products, new product lines, additions to existing product lines, improvements to existing products, repositionings and cost reductions. The innovative products and services put forward by Product Development and Management Association includes two types (PDMA, 2016). The first one is radical innovation, which refers to the really-new products that generally involve new technology and are able to significantly change consumer behavior and consumption paradigm in the market. Radical innovation corresponds to the first type of innovative product raised by Booz and Hamilton (1982), new-to-the-world products. The other is incremental innovation products, which improve the conveyance of a currently delivered benefit, but they produce neither the behavior change nor the change in consumption. Incremental innovation products cover the rest 5 categories of innovative products and services by Booz and Hamilton (1982). This study adopts the definition and categorization by PDMA and focuses on the incremental innovation products

to conduct further analysis.

Perceived risk

The definition of perceived risk was initially extended from psychology by Bauer in 1960. He believes that uncertainty is implied in consumer making purchasing decisions, which is the initial concept of risk. As can be seen from this definition, perceived risk includes two factors. The first one is the uncertainty of decision outcomes, and the second is the consequences of making wrong decisions, that is, the importance of possible loss (Taylor, 1974). Consequently, perceived risk can be defined as consumers' perception of uncertainty and adverse consequences when they purchase products or services (Dowling and Staelin, 1994). Cox (1967) further defines perceived risk as the function containing two factors. The first factor is the perceived adverse consequences of the purchase before the consumer makes the purchase, namely, the level of risk consumers undertake in advance. The second factor is the subjectively perceived size of loss when the purchase outcome is unfavorable. Cunningham (1967) modifies the definition raised by Cox and conducted empirical research to demonstrate that when consumers are faced with uncertainty and consequences arising from making purchasing decisions, the higher degree of importance consumers attach on uncertainty and consequence, the higher level of perceived risk consumers can detect. Furthermore, Khan and Kupor (2016) show that the value of a risky option decrease upon addition of risky prospects of the same valence.

Many scholars have conducted researches on the dimensions of perceived risk, which suggest that perceived risk is a multidimensional concept (e.g., Biswas and Biswas, 2004;

Kaplan *et al.*, 1974; Roselius, 1971). Roselius (1971) believes that consumers bear the risk of loss when making purchasing decisions, time loss, hazard loss, ego loss and money loss.

When examining the different effects of signals on perceived risks in both online and offline situations, Biswas and Biswas (2004) focus on three dimensions of risks: performance risk, financial risk and transaction risk; this study has shown great concern over perceived risks in the new technology era, Kaplan *et al.* (1974) use regression analysis to determine the relationship between five components (physical risk, psychological risk, social risk, financial risk and performance risk) of risks and overall perceived risk across 12 products. The study found that these five components can explain 74% of the variance of the overall risk.

Thereafter, Murray and Schlacter (1990) conduct further research on the perceived risk.

Financial risk is associated with money and risk capital; physical risk refers to physical, health, and energy aspects of loss; performance risk arises when products deliver functions and meet the needs of customers; social risk relates to the possible loss of respect and friendship with others when purchasing or using the products; psychosocial risks refers to the potential damage of self-image in the process of the product purchase or product. Chaudhuri (2000) conducts principal component analysis on these five aspects of perceived risk, and extracted two factors, that is, functional risk and emotional risk. Specifically speaking, functional risk relates to financial risk, performance risk and physical risk, and emotional risk reflects the social and psychological risks. This study will adopt the concepts of the two dimensions of perceived risk, that is, functional risk and emotional risk, to analyze the impact of the perceived risk on information search of innovative products and services.

The measurement method of perceived risk was first proposed by Cunningham (1967),

where he uses ordinal scale to directly ask respondents the feelings of danger and uncertainty, and the value of perceived risk is then obtained by multiplying the respondents the feelings of danger and uncertainty. Barach (1969) asks respondents to order a series of products in accordance with the products' importance, as a measure of perceived risk. Dowling and Staelin (1994) propose to measure the overall perceived risk via totaling product-category risk and product-specific risk. When the product specific risk is greater than the risk acceptable to consumers, consumers will not use the product. By summarizing the measurement of perceived risk mentioned above, the measurement methods can be broadly divided into two categories. The first category is to directly ask consumers' perception of risk, and the other one is to use the facets of perceived risk, and multiply the possibility of loss and weight attaching on the loss to represent consumers' perceived risk.

Information search

Information search refers to the process that consumers conduct investigation in the social environment and get access to appropriate data to make reasonable decisions (Solomon, 2012). From the information sources, consumer information search can be divided into internal search and external search. Specifically, internal search is scanning the memory bank to gather information of different optional brands, and external search obtains information from advertising, friends, or simple observation of others. Other categorization criteria of information search include such as the range of information search, where information search can be divided into global search and local search (Pham and Chang, 2010). Also, academics have paid great attention to different key drivers and thus different search behaviors through

online and offline channels in the web era (Biswas, 2004). Biswas (2004) proposes that search costs are neutralized with the easy accessibility to information through online channel, and information overload began playing a major role in the new century, instead. Information search is a persistent process behavior based on a collection of selection sets (Dellaert and Häubl, 2012; Levav *et al.*, 2012). Information search not only includes the purchase-oriented information search after consumers recognize their purchase demand, but also the search driven by their own hobbies and habits before purchase demand is generated (Bloch *et al.*, 1986). Therefore, viewing from the phase of information search, the external search can be further divided into pre-purchase search and on-going search (Dholakia, 1998). Pre-purchase search refers to consumers' search for specific information in the market after consumer identify their demands, while the purpose of consumer conducting on-going search lies in maintaining and upgrading their knowledge level, which contains broader information obtaining behaviors, such as reading magazines. Both of the two types of information search can increase consumer product knowledge. Punjgn's (1983) study mentions that consumers' prior knowledge has at least two special components, specific product knowledge and general product-class knowledge. Pre-purchase search aims to make better purchasing decisions, which results in the increasing of consumer's specific product and market knowledge and then bring about higher purchase decision satisfaction. In the continuous process of information search, the knowledge consumers obtain is mainly general product-class knowledge.

Consumer innovativeness

The important role of consumer innovativeness in the stage of product diffusion and acceptance has been proven by previous researches (Gatignon and Robertson, 1991). Those who have high consumer innovativeness often exist in the group of early adopters of innovative products (Rogers, 1995). However, currently, no uniform definition of consumer innovativeness exists in academia. Midgley and Dowling (1978) define consumer innovativeness as the degree that individuals make innovative decisions without sharing experiences with others, and further categorized consumer innovativeness into actualized and innate. Actualized consumer innovativeness is new product adoption behavior, which refers to the extent that individuals adopt innovative products earlier than others in the social system (Rogers and Shoemaker, 1971). Innate consumer innovativeness refers to an innate and unobservable personality, which reflects individuals' innate tendency to innovate, traits and cognitive styles (Hirschman, 1980; Hoffman *et al.*, 2010). This concept is also known as innovative tendency, which is related to the consumers' innate or acquired characteristics and learning history (Midgley and Dowling, 1993). If applied in the specific product areas, the innate consumer innovativeness represents as a psychological trait of potential acceptance of new products. This psychological trait exists in many product categories, known as domain specific innovativeness (Goldsmith and Hofacker, 1991). Further, Steenkamp *et al.* (1999) regard innovative as the tendency of consumers being attracted by innovative products. Following this logic, Hauser and Toubia (2005) further define consumer innovativeness as the tendency and preferences of using innovative products. The present study is mainly based on the innate consumer innovativeness of the specific products for analysis, which reflects the individual's inherent innovative personality, cognitive style and behavioral tendencies.

Since consumer innovativeness is a potential personality trait, that is, the consumers' desire for new and different experience. And this desire can drive individuals to seek new and different stimulus deep in their heart. However, for those consumers who seek to pursue excitement, their motives and motivation induced thought and physical activity are not the same. Several studies have identified the different experiential activities of innovative consumers, including pursuing optimal stimulation, seeking to diversify, experiencing novelty, searching for information and getting access to cognition (Hirunyawipada and Paswan, 2006). Obviously, different activities have various psychological drive sources and destinations. Some activities are derived from the consumers' underlying perception trait, whose purpose is to obtain diversified perceived needs. Others come from the underlying cognitive trait, whose purpose is to meet the curiosity in the cognitive psychology (Wood and Swait, 2002). Vandecasteele and Geuens (2010) further propose the four dimensions of Motivated Consumer Innovativeness (MCI), including functional, hedonic, social and cognitive.

Research hypotheses

Previous studies have proven that perceived risk is a multidimensional construct (e.g., Kaplan *et al.*, 1974; Murray and Schlacter, 1990; Roselius, 1971). Kaplan *et al.* (1974) find that 74% of the variance of overall risk could be explained by five components: physical risk, psychological risk, social risk, financial risk and performance risk. Chaudhuri (2000) further categorizes the five types of risk into functional risk and emotional risk. Specifically, physical, financial and performance risks are types of functional risk, and psychological and social risks are types of emotional risk. Different dimensions of perceived risk affect information

search in different ways. For example, Lutz and Reilly (1973) find that social risks do not significantly impact consumer information search. Moreover, Dholakia (2001) suggests that performance risk has a positive influence on information search, and psychological risk has no significant effect on information search through the intermediary role of social risk.

Information search not only includes pre-purchase information search related to specific product demands, but also ongoing information search driven by consumers' personal interests and habits before purchase demand is generated (Bloch *et al.*, 1986). Yet in prior studies, most researchers considered only pre-purchase search. Consumers conduct pre-purchase information search in order to increase product knowledge, which enables them to make better purchasing decisions, which results in higher satisfaction with those decisions. On the other hand, by continuously engaging in ongoing information search, consumers gain general product knowledge. Are seemingly aimless information search behaviors influenced by perceived risk?

Moreover, findings from previous studies indicate that innovative products and services differ from ordinary products and services in terms of functionality or appearance, which makes it difficult for consumers to determine whether they are useful and how to use them (Chakravarti and Xie, 2006). Hence, innovative products and services are associated with higher perceived risk. When consumers believe the risk associated with purchasing innovative products and services is high, their purchase intentions decrease (Cox, 1967; Stone and Gronhaug, 1993). In the context of innovative products and services, does perceived risk affect information search behaviors?

Synthesizing the results of previous studies, here we divide perceived risk into

functional risk and emotional risk (Chaudhuri, 2000), and information search into pre-purchase search and ongoing search (Bloch *et al.*, 1986). Next, we explore the various effects of different dimensions of perceived risk on information search behavior.

Effect of perceived risk on ongoing Search

Consumers adopt different decision modes based on context. A consumer's cognitive style and decision-making mode will change with the decision-making environment; therefore, different dimensions of perceived risk will have different effects on information search behaviors (Mitchell, 1999).

Ongoing information search is not related to purchases. Rather, a consumer engages in ongoing search when he/she does not have specific purchase demands. The purpose of ongoing search is not to make better immediate purchasing decisions, but to make future purchasing decisions more enjoyable, to satisfy personal interests and to gain product knowledge. In other words, ongoing search is related to entertainment or recreation in the present, and generates product knowledge that can be used by themselves or others in future decision-making situations.

When consumers engage in ongoing information search related to recently launched innovative products and services, they know little functional information (e.g., price, application). By engaging in ongoing information search, consumers access not only detailed product (service) information, but also opinions about product (service) features, price, and safety issues. Thus, accessing more information may actually have the effect of increasing consumers' perceived risk rather than reducing it. According to Goldman and Johansson

(1978), there are diminishing returns to continued search. In the new web-era, the search costs is not the top consideration any more while the information overload is (Biswas, 2004), which may help explain the problem of cognitive dissonance. Mitchell (1999) believes that consumers deliberately avoid information that may bring cognitive dissonance, and this avoidance behavior is more likely to occur in ongoing information search, which is not related to decision making. Because consumers engage in ongoing information search for pleasure or to satisfy personal curiosity, such information searching behavior is not obligatory. Since innovative products and services differ from existing products and services in function or appearance, the higher the level of products (services) innovativeness, it may be more difficult for consumers to discern how to use them and whether they are helpful. When the functional risks of innovative products and services create excessive anxiety, consumers will choose not to learn more about the products since they are not inclined to make immediate buying decisions. This will lead to reduced information search. Therefore, we propose the following hypothesis:

H1: Functional risk produces a negative effect on ongoing information search.

Compared with general products, innovative products and services don't provide a great deal of detailed information of products (services)' features, price, etc., consumers tend to perceive the risks of innovative products (services) from the emotional perspective in the process of information search, such as what will be others' evaluation towards me if I use this product, whether the use of the product will bring me some burden, etc. Emotional risk is the main issue that consumers want to solve by on-going search, and thus emotional risk may promote consumers' on-going search behavior. Therefore, we propose:

H2: Emotional risk produces a positive effect on ongoing information search.

Effect of perceived risk on pre-purchase search

The goal of both pre-purchase search and ongoing search is to obtain information. However, pre-purchase search is based on improving satisfaction with a specific purchase. That is, when consumers have already considered purchasing a product, pre-purchase information search improves satisfaction by reducing perceived risk. The accumulated information obtained through ongoing search can make future pre-purchase information search and purchase behavior more efficient (Bettman, 1979). Thus consumers will use information search to reduce perceived functional risks.

Unlike established products, the product knowledge accumulated through ongoing information search for innovative products and services is quite limited, especially information that may address functional risks. In addition, some research has shown that individuals who are knowledgeable or unknowledgeable engage less in information search than somewhat-knowledgeable individuals (Bettman and Park, 1980). Therefore, in the context of pre-purchase information search, even consumers who perceive a comparatively higher level of functional risk may not engage more in information search activities. Furthermore, information overload can be a severe problem concerning people in their search experience (Biswas, 2004), thus posing a contradicting effect on the amount of search. The information one can get before purchase usually seems abundant but similar, making consumers confused to screen out the real informative ones. So it is possible that such individuals may engage less in information search activities in an attempt to avoid cognitive

dissonance.

Although the purpose of pre-purchase information search is to increase satisfaction with purchase decisions, Bloch *et al.* (1986) find that information obtained via pre-purchase search alone is insufficient to ensure satisfactory purchase outcomes. Inevitably, consumers must bear the pressure of this psychological risk. In order to maintain cognitive consistency, consumers may adopt a heuristic decision model. Specifically, consumers may actively seek to decrease psychological burden by avoiding dissonant information in order to improve satisfaction with their decisions.

However, emotional risk is primarily reduced by soliciting the opinions of others and social media, which is generally unrelated to knowledge level. Consumers who engage in pre-purchase information search activities have already decided to purchase (and therefore to accept social and psychological risks associated with) innovative products and services. Since social risk is external as opposed to internal, even if a consumer is able to avoid information that conflicts with his self-concept, he cannot change others' evaluations of him once he uses the product. Therefore, a consumer may seek more information and opinions about an innovative product to minimize the conflict between the product and his self-concept. As the increasingly technological/digital context, more pressure from social media leads to information search. Based on the above analysis, we propose Hypotheses 3 and 4:

H3: Functional risk produces a negative effect on pre-purchase information search.

H4: Emotional risk produces a positive effect on pre-purchase information search.

Moderating effects of innate consumer innovativeness

Innate consumer innovativeness is an essential factor that affects consumer decision making about innovative products (Im *et al.*, 2003). For instance, highly innovative consumers have low levels of perceived risk and high levels of purchasing willingness. Bloch *et al.* (1986) find that individuals who engage more in ongoing information search are more likely to be opinion leaders; likewise, opinion leaders tend to be more innovative. According to Kirton's (1976) definition of innovativeness, highly innovative individuals prefer variation and are more inclined to accept new things. Ongoing information search enables people to access more new information, which is consistent with innovative consumers' demands for novelty. Therefore, compared to consumers with low levels of innovativeness, those with high levels of innovativeness will be less likely to curtail information search due to perceived functional risk. That is to say, the negative effects of functional risk on ongoing search can be weakened when the level of innate consumer innovativeness is high. Accordingly, we propose

Hypothesis 5:

H5: Innate consumer innovativeness plays a negative moderating role for the negative effects of functional risk on ongoing search.

As Cowart *et al.*'s (2008) study on consumer innovativeness and self-consistency **show**, consumer innovativeness and perceived risk have a positive relationship with behavioral intention. The authors concluded that self-consistency between consumers and innovative products would affect their behavioral intentions toward innovative products. On the other hand, innovative consumers prefer adventures and are more open to new experiences, so their self-concepts adjust more easily to change. That is, consumer innovativeness has positive effect on perceived self-consistency. Ongoing information search is mainly based on

consumers' personal preferences and interests, and is highly related to personality. As an innovative individual's self-concept adjusts, her perceived self-concept related to emotional risk will be influenced. Hence, in the process of ongoing information search, the positive effect of emotional risk on ongoing search will be greater for individuals with high levels of consumer innovativeness than for those with low levels of consumer innovativeness.

Therefore, we propose Hypothesis 6:

H6: Innate consumer innovativeness plays a positive moderating role for the positive effects of emotional risk on ongoing information search.

Brucks (1985) suggests that consumers who make innovative decisions need relatively little information. Since highly innovative consumers are more likely to accept new things and are more receptive to innovative products, they require less information than others to make satisfactory decisions about innovative products. Therefore, the motivation to obtain information through pre-purchase search is also lower for highly innovative consumers than for consumers with low levels of innovativeness, thereby decreasing the effect of perceived risk on information search. Therefore, we propose Hypotheses 7 and 8:

H7: Innate consumer innovativeness plays a positive moderating role for the negative effects of functional risk on pre-purchase information search.

H8: Innate consumer innovativeness plays a negative moderating role for the positive effects of emotional risk on pre-purchase information search.

The theoretical framework and major hypotheses are shown in Figure 1.

~Insert Figure 1 about Here~

To test the proposed hypotheses, we used a survey method to collect data on information

search behaviors related to innovative products and services. Specifically, we explored how consumers' perceived functional risk and emotional risk affect their ongoing search and pre-purchase search behaviors, and we further analyzed the moderating effect of innate consumer innovativeness.

We conducted two studies. In Study 1, we used tablet PC as a stimulus to test the hypothesis with innovative products. In Study 2, we used online bike-renting service as the stimulus and proved the conclusion reached in Study 1 also applied to innovative services. A pretest was conducted beforehand for measurement validity and reliability.

Pilot test

Method

Participants in this study were early adopters of innovative products and services. Early adopters have comparatively positive attitudes towards innovative products and services and greatly help companies to understand their markets; hence, they are a consumer segment of great concern to companies. We conducted a pilot test with 120 valid samples of university students. We used the questionnaire to be used in the main study and tried to make improvements based on the response.

Measures

To verify the hypotheses, we needed to measure consumers' perceived risks associated with innovative products and services and the levels of ongoing and pre-purchase information search driven by the perceived risks. We also measured innate consumer innovativeness to

assess its moderating effect. Based on knowledge obtained through in-depth interviews and our literature review, we modified existing scales to the innovative products and services context. Survey items are provided in the appendix (Using tablet PC as an example). We used 5-point Likert-type scales in this study, ranging from 1 (totally disagree) to 5 (totally agree).

Perceived risk

To measure perceived risk, we based our survey items on those used by Stone and Gronhaug (1993) (e.g., “If I bought this product, I feel that it would be a bad way to spend my money”). Following the method used by Chaudhuri (2000), we used principal component analysis to analyze the five dimensions of perceived risk. Two factors, functional risk and emotional risk, were extracted with a total explained variance of 70.5%. The rotated component matrix is shown in Table I . In subsequent analyses, we used the factor scores to represent functional risk and emotional risk.

~Insert Table I about Here~

Information search

We measured consumers’ ongoing and pre-purchase information search behaviors. We adapted items used by Claxton *et al.* (1974) (e.g., “Before purchasing, I will consider alternate brands”) to measure pre-purchase information search behavior, and items used by Bloch *et al.* (1986) (e.g., “I often visit computer malls, just to look around or get information, rather than to make a specific purchase”) to measure ongoing information search behavior.

Innate consumer innovativeness

We adapted the DSI (Domain-Specific Innovativeness) Scale developed by Goldsmith and Hofacker (1991) to measure consumer innovativeness (e.g., “In general, I am the first in my

circle of friends to know the functions of the latest tablet PC”). The descriptive statistics for each variable are shown in Table II .

~Insert Table II about Here~

Validity and reliability

The reliability results of each variable are shown in Table III. We used KMO and Bartlett’s test of sphericity to test the construct validity. A reliability coefficient above 0.70 is preferable, with a minimum acceptable reliability range of 0.65 to 0.70 (DeVellis, 2003). As Table 3 shows, each Cronbach's α is above 0.70 in this study. Moreover, the $KMO > 0.5$ and Bartlett’s test of sphericity are both significant.

~Insert Table III about Here~

Based on the feedback, we revised and finalized the research stimulus and response scales to be used in the further study.

Study 1: Innovative products

Method

Participants in Study 1 were early adopters of latest tablet PC. We conducted survey with participants in an online research community. The participants were first asked to read a paragraph with a detailed description of the new tablet PC and answer a screening question indicating whether they thought the tablet PC was an innovative product to satisfy the external validation of the status of innovation. Then, respondents answered survey questions related to perceived risk, pre-purchase information search, ongoing information search,

consumer innovativeness and demographic information.

In total, 360 participants took the survey and there were 321 valid responses, yielding a response rate of 89.2%. Responses from participants who did not pass the screening test (i.e., those who thought the tablet PC was not an innovative product) were eliminated from further analysis. The final data set included responses from 216 participants (118 males and 98 females; mean age = 28.7). The participants thought they were quite knowledgeable about computers and, on average owned 2.97 computers each.

To examine whether the sample had a self-selection bias, we compared the demographic information of the two groups: the final data set with 216 valid responses, and the excluded data set with 105 responses. No significant differences were found. Finally, according to the interviews with an online community manager, the highly educated participants in this study adequately represented early adopters of innovative products and services. Therefore, we believe that the sample we used in this research is representative for studying innovative products.

Hypothesis testing

In order to verify the effect of perceived risk on information search and the moderating effect of consumer innovativeness, we constructed the following two sets of multiple linear regression models.

Models 1 and 2:

$$OIS = \beta_{00} + \beta_{01} \times FPR + \beta_{02} \times EPR + \beta_{03} \times CI + d_{OIS} \quad (1)$$

$$OIS = \beta_{00} + \beta_{01} \times FPR + \beta_{02} \times EPR + \beta_{03} \times CI + \beta_{04} \times I_{FPR \times CI} + \beta_{05} \times I_{EPR \times CI} + d_{OIS} \quad (2)$$

Models 3 and 4:

$$PIS = \beta_{P0} + \beta_{P1} \times FPR + \beta_{P2} \times EPR + \beta_{P3} \times CI + d_{PIS} \quad (3)$$

$$PIS = \beta_{P0} + \beta_{P1} \times FPR + \beta_{P2} \times EPR + \beta_{P3} \times CI + \beta_{P4} \times I_{FPR \times CI} + \beta_{P5} \times I_{EPR \times CI} + d_{PIS} \quad (4)$$

where *OIS* represents ongoing search, *PIS* represents pre-purchase search, *FPR* is functional risk, *EPR* is emotional risk, and *CI* is consumer innovativeness. The interaction effect of functional risk and consumer innovativeness is captured by $I_{FPR \times CI}$, and the interaction effect of emotional risk and consumer innovativeness is captured by $I_{EPR \times CI}$. Residual errors are d_{OIS} and d_{PIS} .

Models (2) and (4) use an interaction term approach to validate the moderating role of consumer innovativeness on the relationship between perceived risk and ongoing search. A common problem with this method is the high correlation between the interaction terms and the independent variables (Table IV). This may create a multicollinearity problem in which the interaction effect and the main effects will be confused. We put the five independent variables directly into Model 1 to conduct regression analysis, and we obtained a condition index greater than 30 with VIF above 10, which indicates a serious multicollinearity problem (Hair *et al.*, 1998).

~Insert Table IV about Here~

To address this problem, we used the residual centering method proposed by Lance (1988). First, the interaction term was used as the dependent variable, and the corresponding main effects were used as independent variables for regression:

$$I_{FPR \times CI} = \alpha_1 FPR + \alpha_2 CI + D_{FPR \times CI} \quad (5)$$

The residuals of the interaction terms are as follows:

$$D_{FPR \times CI} = I_{FPR \times CI} - \hat{I}_{FPR \times CI} = I_{FPR \times CI} - (\hat{\alpha}_1 FPR + \hat{\alpha}_2 CI) \quad (6)$$

As the standardized form of $D_{FPR \times CI}$, $d_{FPR \times CI}$ is used to replace the original interaction term, and then put into a complete regression model. For the interaction term $I_{EPR \times CI}$, we also used the residual centering method to replace the original interaction term with the standardized interaction residuals. Thus, models (7) and (8) replace models (3) and (4), respectively, for analysis purposes.

Models 7 and 8:

$$OIS = \beta_{00} + \beta_{01} \times FPR + \beta_{02} \times EPR + \beta_{03} \times CI + \beta_{04} \times d_{FPR \times CI} + \beta_{05} \times d_{EPR \times CI} + d_{OIS} \quad (7)$$

$$PIS = \beta_{p0} + \beta_{p1} \times FPR + \beta_{p2} \times EPR + \beta_{p3} \times CI + \beta_{p4} \times d_{FPR \times CI} + \beta_{p5} \times d_{EPR \times CI} + d_{PIS} \quad (8)$$

First, we examined the effects of functional risk and emotional risk on ongoing information search (Table V). Regression analysis results show that ongoing information search and functional risk are linearly correlated ($R^2 = 0.10$, $F = 12.17$, $p = 0.00$), which shows that perceived risk has a significant influence on ongoing information search. For ongoing information search, 10% of the variance can be explained by functional and emotional risk. According to Guo's (2001) study, the fitness of this model can be considered preferable. Many other factors that influence information search exist, such as marketing environment, situational variables, potential returns, product importance, knowledge and experience, individual differences, conflict and conflict resolution strategies, and search costs; perceived risk is only a variable of the third category. Functional risk has a significant negative impact on ongoing information search, and emotional risk has a significant positive influence on ongoing information search, confirming Hypotheses 1 and 2.

After adding the interaction term of innate consumer innovativeness, the regression

model is significant with good model fitness ($R^2 = 0.50$, $F = 40.95$, $p = 0.00$). Moreover, by adding the interaction term, the variance explaining the change in R^2 equals 0.02, and the change in F is significant ($p = 0.01$), indicating that innate consumer innovativeness plays a significant moderating role in the relationship between perceived risk and ongoing information search. Specifically, innate consumer innovativeness plays a negative moderating role for the negative effects of functional risk on ongoing information search, and it plays a positive moderating role for the positive effects of emotional risk on ongoing information search, confirming Hypotheses 5 and 6.

~Insert Table V about Here~

Second, Table VI shows the results of the effects of emotional risk and functional risk on pre-purchase information search. Regression analysis results reveal that ongoing search and functional risk are linearly correlated ($R^2 = 0.19$, $F = 24.57$, $p = 0.00$). Further, 19.3% of the variance associated with pre-purchase information search is determined by functional risk, and the model fitness is preferable. Therefore, emotional risk has a significant positive effect on pre-purchase information search, confirming Hypothesis 4. However, the effect of functional risk on pre-purchase information search is not significant; thus, Hypothesis 3 is not verified.

The model becomes significant with good model fitness after adding the interaction term ($R^2 = 0.40$, $F = 26.35$, $p = 0.00$), and the variance explaining the change in R^2 is 0.14 with a significant change in F ($p = 0.00$), indicating that innate consumer innovativeness is a significant moderator of the relationship between perceived risk and pre-purchase information search. Further analysis confirms Hypothesis 8, that innate consumer

innovativeness plays a negative moderating role for the positive effects of emotional risk on pre-purchase information search. However, innate consumer innovativeness is not a significant moderator for the effect of functional risk on pre-purchase information search, and thus Hypothesis 7 is not supported.

~Insert Table VI about Here~

Study 2 Innovative service

Method

We conducted Study 2 in the laboratory. Each student was paid 20 RMB for participating in the experiment. As in Study 1, the participants were first asked to read a paragraph with a detailed description of online bike-renting service and answer a screening question indicating whether they thought online bike-renting service was an innovative product. Then, respondents answered survey questions related to perceived risk, pre-purchase information search, ongoing information search, consumer innovativeness and demographic information.

Online bike renting service was selected as the research stimulus to represent an innovative service. It became available through apps installed on mobile devices or online websites early in early 2015 and went popular throughout China in 2016. Compared to traditional bike renting service, this concept of online renting indicates the idea of “sharing economy”. With a mobile device at hand connected to wifi, people can search for bikes available nearby at any time and rent one by scanning the code on bike. When finishing the riding journey, one can easily return the bike at public area through the online channel and pay through electronic wallet like Alipay.

In total, 348 participants took the survey and there were 323 valid responses, yielding a response rate of 92.8%. Responses from participants who did not pass the screening test (i.e., those who thought the online bike renting service was not an innovative product) were eliminated from further analysis. The final data set included responses from 169 participants (55 males and 114 females; mean age = 19.34). 98.2% of the participants thought they were quite knowledgeable about online services and, on average had 7.5 apps installed on mobile phones. To examine whether the sample had a self-selection bias, we compared the demographic information of the two groups: the final data set with 169 valid responses, and the excluded data set with 154 responses. No significant differences were found.

Hypothesis testing

As in Study 1, we used model (1) and model (7) to examine the effects of functional risk and emotional risk on ongoing information search, and used model (2) and model (8) to examine the effects of functional risk and emotional risk on pre-purchase information search.

Results from Table VII show that ongoing information search and functional risk are linearly correlated ($R^2 = 0.06$, $F = 4.91$, $p < 0.05$), which shows the significant influence perceived risk has on ongoing information search also holds true for innovative services. For ongoing information search, 6 % of the variance can be explained by functional and emotional risk, so the fitness of this model can be considered preferable (Guo, 2001). Functional risk has a significant negative impact on ongoing information search, and emotional risk has a significant positive influence on ongoing information search, confirming Hypotheses 1 and 2 also applies to innovative services.

After adding the interaction term of innate consumer innovativeness, the regression model is significant with good model fitness ($R^2 = 0.21$, $F = 15.88$, $p < 0.05$). Furthermore, the variance explaining the change in R^2 equals 0.16, and the change in F is significant ($p < 0.05$), again, proving that innate consumer innovativeness plays a significant moderating role in the relationship between perceived risk and ongoing information search. Specifically, innate consumer innovativeness plays a negative moderating role for the negative effects of functional risk on ongoing information search, and it plays a positive moderating role for the positive effects of emotional risk on ongoing information search, confirming Hypotheses 5 and 6 once again.

~Insert Table VII about Here~

Meanwhile, Table VIII shows the results of the effects of emotional risk and functional risk on pre-purchase information search. Regression analysis results reveal that ongoing search and functional risk are linearly correlated ($R^2 = 0.12$, $F = 11.02$, $p < 0.05$); 12% of the variance associated with pre-purchase information search is determined by functional risk, and the model fitness is preferable. Therefore, emotional risk has a significant positive effect on pre-purchase information search, confirming Hypothesis 4. Again, the effect of functional risk on pre-purchase information search is not significant in Study 2 and fails to prove Hypothesis 3.

The model becomes significant with good model fitness after adding the interaction term ($R^2 = 0.17$, $F = 14.27$, $p < 0.05$), and the variance explaining the change in R^2 is 0.05 with a significant change in F ($p < 0.05$), indicating the moderation effect of innate consumer innovativeness between perceived risk and pre-purchase information search. is also significant

when the product is service. Hypothesis 8 is also proved for services, showing the negative moderating role of innate consumer innovativeness between emotional risk and pre-purchase information search. However, just as in Study 1, we find no significant moderation effect of innate consumer innovativeness between functional risk and pre-purchase information search. Thus Hypothesis 7 is not supported by Study 2.

~Insert Table VIII about Here~

General discussion

Theoretical implications

We conducted two studies to analyze the relationship of perceived risk and information search in the context of innovative products and services in a more detailed fashion by dividing perceived risk and information search into different dimensions.

When engaging in ongoing information search in the context of innovative products and services, consumers are influenced by both functional risk and emotional risk, where functional risk has a negative influence on ongoing information search, and emotional risk has a positive influence on ongoing information search. Individuals with low levels of consumer innovativeness tend to feel uncomfortable when functional information about a new product is relatively limited. Hence, when such a consumer perceives potential risks associated with innovative products and services, she may limit her information searches to specific products in order to avoid dissonance with her self-concept. However, highly innovative consumers are adventurous and easily accept new things; thus, they engage more in ongoing information search than consumers with low levels of innovativeness. Therefore,

in general, consumer innovativeness moderates the effect of perceived risk on ongoing search.

For pre-purchase information search, emotional risk has a positive impact, whereas functional risk has no significant impact. Since information about innovative products and services is limited, the majority of customers lack functional knowledge about features and prices. Consumers are more inclined to learn about innovative products and services through perceptual cognition, hence the perceived functional risk is relatively vague for consumers. Moreover, since consumers lack experience using innovative products and services, it is possible that consumers will engage more in pre-purchase information search to reduce perceived risks, while engaging less in pre-purchase information search to avoid negative emotions. These conflicting motivations lead to the insignificant effect of functional risk on pre-purchase information search, and further result in the insignificant moderating role of consumer innovativeness. However, the effect of emotional risk is more prominent, because emotional risk is reduced primarily through social channels (such as asking friends) without being affected by the level of innovative product knowledge. Hence, emotional risk has a positive effect on pre-purchase information search. Further, consumers with high levels of consumer innovativeness require less information to make decisions, so consumer innovativeness plays a negative moderating role for the effects of emotional risk on pre-purchase information search.

Practical implications

Since perceived risk is an important factor influencing consumer purchasing decisions,

studying how perceived risk affects consumers' information search behaviors in the context of innovative products and services has strong practical significance. Moreover, because individuals with different levels of consumer innovativeness will be influenced differently by information about innovative products and services, companies should provide targeted information to consumers with different levels consumer innovativeness. According to the innovative product diffusion curve, the innovativeness levels of early adopters and subsequent users are not the same. Therefore, companies should focus on tailoring the information provided in marketing campaigns at various diffusion stages for innovative products and services. Compared to consumers with low levels of consumer innovativeness, highly innovative consumers engage more in ongoing information search, and have weaker perceptions of functional risk, so emphasizing product functions can be more impactful during the pre-launch stage. However, consumers who engage in pre-purchase information search mainly seek to mitigate emotional risk. Therefore, after a product or service has been launched, companies should focus on providing information that reduces emotional risk, rather than emphasizing functional information such as price.

Limitations and directions for future research

In two studies, we employed survey methods, which may not reflect actual marketing situations. In the future, researchers could conduct similar studies using observational methods or process tracking tests to overcome this limitation. In addition, for various types of innovative products and services, consumers' perceived risks will differ, and along with them, the effect of perceived risks on information search. In two studies, we adopted the DSI scale

to examine innate consumer innovativeness based on a specific product; however, consumer innovativeness and its moderating effect may vary with the type of product. Finally, we used a tablet PC as the research stimulus for innovative products and online bike-renting service as the research stimulus for innovative services. We encourage researchers to use other types of products and services as stimuli in future studies.

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Appendix: Construct Measures and Sources

Perceived risk (Adapted from Stone and Gronhaug 1993)

- If I bought this product, I feel that it would be a bad way to spend my money.
- If I bought this product, I would be concerned that the financial investment I would make would not be wise.
- If I bought a tablet PC, I would be concerned that I really would not get my money's worth from this product.
- I worry that the product will really not perform as well as it is supposed to.
- I am concerned that the product will not provide the level of benefits that I would be expecting.
- I am concerned that the product will not really be dependable and reliable.
- I worry about potential physical risks associated with this product.
- I am concerned that the product could lead to some uncomfortable physical side-effects (such as radiation).
- I am concerned that the product could lead to some uncomfortable physical side-effects (such as radiation) for those around me.
- If I bought this product, some friends would think I was just being a show-off.

- If I bought this product, I would be thought of as being foolish by some people whose opinions I value.
- If I bought this product, people around me would think I was impulsive.
- The thought of using a tablet PC makes me feel psychologically uncomfortable.
- The thought of using a tablet PC gives me a feeling of unwanted anxiety.
- The thought of using a tablet PC causes me to experience unnecessary tension.

Pre-purchase information search (Adapted from claxton *et al.* 1974)

- Before purchasing, I will consider alternate uses of money.
- Before purchasing, I will consider alternate brands.
- Before purchasing, I will consider alternate price levels.
- Before purchasing, I will consider friends as a source of information.
- Before purchasing, I will consider salespeople as a source of information.
- Before purchasing, I will consider stores as a source of information.
- Before purchasing, I will consider advertisements as a source of information.
- Before purchasing, I will consider family members as a source of information.
- Before purchasing, I will consider style as an important feature.
- Before purchasing, I will consider quality as an important feature.
- Before purchasing, I will consider size as an important feature.
- Before purchasing, I will consider visiting more than three stores.
- Before purchasing, I will deliberate for a long time.

Ongoing information search (Adapted from Bloch *et al.* 1986)

- I often visit computer malls, just to look around or get information, rather than to make a specific purchase.
- I often browse through PC book sections at bookstores.
- I often read PC magazines.
- I often talk to friends and acquaintances to obtain information or advice concerning PCs.
- I often browse PC-related websites and apps.

Innate consumer innovativeness (Adapted from Goldsmith and Hofacker 1991)

- If I heard that a new tablet PC was available, I would be interested enough to buy it when economic conditions permitted.
- Compared to my friends, I own a lot of tablet PCs.
- If a friend had a new tablet PC, I would ask to try it.
- In general, I am the first in my circle of friends to know the functions of the latest tablet PC.
- If a new tablet PC was released, I would want to know.
- I know the models of new tablet PCs before other people do.
- I am always very interested in new tablet PCs.

Figure 1.

Research framework

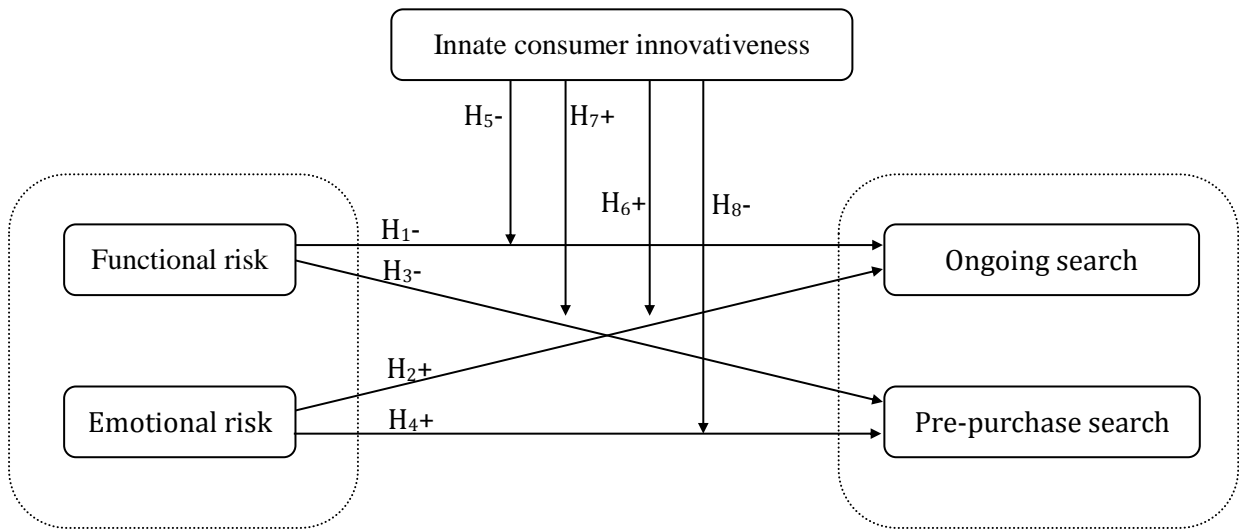


Table I .

Factor analysis results for perceived risk

		Factor 1	Factor 2
Functional risk	Financial risk	0.73	
	Performance risk	0.80	
	Physical risk	0.70	
Emotional risk	Social risk		0.73
	Psychological risk		0.67

Table II .

Standard deviations and pearson correlation coefficients

	Standard deviation	Functional risk	Emotional risk	Ongoing search	Pre-purchase search	Innate consumer innovativeness
Functional risk	0.62	2.76				
Emotional risk	0.66	0.73 ^{**}	2.71			
Ongoing search	0.81	-0.28 ^{**}	- 0.08	3.50		
Pre-purchase search	0.60	0.03	0.16 [*]	0.13	3.84	
Innate consumer innovativeness	0.77	-0.33 ^{**}	- 0.16 [*]	0.68 ^{**}	0.09	3.24

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

Table III.

Scale reliability and validity

	Cronbach's α	Bartlett's test of sphericity			
		KMO	χ^2	Degrees of freedom	Sig.
Functional risk	0.85	0.67	290.15	10	0.00
Emotional risk	0.79				
Ongoing search	0.89	0.82	753.24	10	0.00
Pre-purchase search	0.76	0.78	343.08	21	0.00
Innate consumer innovativeness	0.85	0.83	651.50	21	0.00

Table IV.

Correlation coefficients of main effects and interaction effects

	FPR	EPR	CI
$I_{FPR \times CI}$	0.56 ^{**}		0.57 ^{**}
$I_{EPR \times CI}$		0.67 ^{**}	0.59 ^{**}

^{**} $p < 0.01$

Table V.

Study1. The moderating effect of innate consumer innovativeness - the effect of functional risk and emotional risk on ongoing search

Variables	Hypotheses	Model (1)		Model (7)	
		Non-standardized regression coefficients (β)	Standard error (s.e.)	Non-standardized regression coefficients (β)	Standard error (s.e.)
Intercept		4.38***	0.24	1.52***	0.33
Functional risk	H1	-0.56***	0.12	-0.23**	0.10
Emotional risk	H2	0.26**	0.11	0.17*	0.09
Innate consumer innovativeness				0.67***	0.05
Functional risk \times innate consumer innovativeness	H5			-0.26***	0.10
Emotional risk \times innate consumer innovativeness	H6			0.26***	0.10
R^2		0.10		0.50	
F -value		12.17***		40.95***	
R^2 change				0.02*	

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Table VI.

Study1. The moderating effect of innate consumer innovativeness-the effect of functional risk and emotional risk on pre-purchase search

Variables	Hypotheses	Model (2)		Model (8)	
		Non-standardized regression coefficients (β)	Standard error (s.e.)	Non-standardized regression coefficients (β)	Standard error (s.e.)
Intercept		2.90***	0.17	2.13***	0.21
Functional risk	H3	0.07	0.09	0.16**	0.08
Emotional risk	H4	0.33***	0.08	0.34***	0.07
Innate consumer innovativeness				0.15**	0.04
Functional risk \times innate consumer innovativeness	H7			-0.09	0.08
Emotional risk \times innate consumer innovativeness	H8			-0.24***	0.07
R^2		0.19		0.40	
F -value		24.57***		26.35***	
R^2 change				0.14***	

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Table VII.

Study 2. The moderating effect of innate consumer innovativeness - the effect of functional risk and emotional risk on ongoing search

Variables	Hypotheses	Model (1)		Model (7)	
		Non-standardized regression coefficients (β)	Standard error (s.e.)	Non-standardized regression coefficients (β)	Standard error (s.e.)
Intercept		8.44**	0.18	6.42**	0.46
Functional risk	H1	-0.37**	0.18	-0.35**	0.16
Emotional risk	H2	0.42**	0.17	0.42*	0.16
Innate consumer innovativeness				0.78**	0.16
Functional risk \times innate consumer innovativeness	H5			-0.27*	0.16
Emotional risk \times innate consumer innovativeness	H6			0.46**	0.15
R^2		0.06		0.21	
F -value		4.91**		15.88**	
R^2 change				0.16**	

* $p < 0.1$; ** $p < 0.05$

Table VIII.

Study 2. The moderating effect of innate consumer innovativeness-the effect of functional risk and emotional risk on pre-purchase search

Variables	Hypotheses	Model (2)		Model (8)	
		Non-standardized regression coefficients (β)	Standard error (s.e.)	Non-standardized regression coefficients (β)	Standard error (s.e.)
Intercept		3.72**	0.08	3.35**	0.20
Functional risk	H3	-0.01	0.07	0.01	0.07
Emotional risk	H4	0.34**	0.07	0.34**	0.07
Innate consumer innovativeness				0.14**	0.07
Functional risk \times innate consumer innovativeness	H7			-0.09	0.07
Emotional risk \times innate consumer innovativeness	H8			-0.13*	0.06
R^2		0.12		0.17	
F -value		11.02**		14.27**	
R^2 change				0.05**	

* $p < 0.1$; ** $p < 0.05$