Signaling Effect of Website Usability on Repurchase Intention

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Abstract

After-sale service quality is a key to differentiating an online seller from numerous others and attracting returning customers. However, new customers cannot readily discern the quality of unfamiliar sellers. Sellers often try to reduce the information asymmetry and signal their quality by ensuring good website interface usability, considering that the website is the main point of contact with online shoppers. Most research on signaling has focused on its pre-purchase effects. Although researchers have argued that signaling could affect future purchase decisions, *how* signaling influences repurchase intention has not been detailed. This study proposes a model of the influence based on the signaling theory and expectation-confirmation model. The model posits that a signal influences an online shopper's expectation and the expectation-confirmation subsequently determines repurchase intention. The model was tested with pre-purchase and post-purchase data collected in a two-stage survey and analyzed with structural equation modeling. Findings indicate that signaling goes beyond the pre-purchase stage of initial purchase to influence *repurchase* intention. This indicates that signaling has longer-term effect than that typically examined in signaling research and further research on the effect is needed. For practice, the findings indicate that online sellers need to send realistic signals to attract *returning* customers.

Keywords: Website usability; signaling; online shopping; repurchase intention; information need

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Introduction

To ensure continual profitability, online sellers must acquire new customers and convert them into repeat, repurchasing customers (Kim, Ferrin, & Rao, 2009; Shin, Chung, Oh, & Lee, 2013). The number of consumers shopping online in the United States is forecasted to grow to 270 million in 2020. This is expected to lead to online sales amounting to $523 billion, which is a 56 percent increase from that in 2015 (Forrester Research Incorporated, 2015). While the increase in online shoppers presents great opportunities, acquiring and retaining new customers remain challenging for many online sellers (Fang, Wen, George, & Prybutok, 2016; Shin et al., 2013).

A key challenge in acquiring new customers is overcoming information asymmetry, which is the situation in which one party has less information than the other in a transaction (Mavlanova, Benbunan-Fich, & Koufaris, 2012). When shoppers encounter an unfamiliar online seller, they tend to lack information to accurately assess the seller's qualities and they are more hesitant to purchase (Schlosser, White, & Lloyd, 2006). This is further exacerbated by the fact that online shopping is fully mediated by websites and there is often a greater time lag between order and fulfillment compared to offline shopping. Online shoppers can only fully assess the qualities of an unfamiliar seller after they commit to pay and experience how their order is fulfilled. For example, prior to making a purchase, a shopper cannot accurately evaluate sellers' after-sale service quality. To avoid the risk of running into a poor-quality seller and bad experience, the shopper may decide not to purchase. To mitigate this, sellers often try to reduce the information asymmetry by conveying information about their qualities.

Signaling is an effective way for conveying information and reducing the information asymmetry between online sellers and their new customers (Li, Fang, Wang, Lim, & Liang, 2015). Signals are observable, extrinsic cues that can convey credible information regarding sellers' unobservable qualities (Schlosser et al., 2006; Wells, Valacich, & Hess, 2011). Signals

commonly used in online stores include those related to observable aspects of a website, reputation, and warranty (Li et al., 2015; Mavlanova, Benbunan-Fich, & Lang, 2016; Zhang, Li, Yan, & Johnston, 2017). These signals seek to assure new customers (i.e., the less-informed party) that the seller is of good quality. They are expected to influence new customers' beliefs and purchase decisions. Among them, website-interface-related signals, such as website quality, website design investments, and comprehensiveness of information (Li et al., 2015), are technology artifacts that are of particular interest to electronic commerce and information systems research. Therefore, we focus on website-interface-related signals in this study.

The focus of signaling research has been on signals' effects on pre-purchase beliefs (e.g., *expected* seller quality; review detailed in section 0) but researchers have argued that signaling could go beyond the pre-purchase stage to influence future purchase decisions, such as repurchase intention. Besharat (2010, p. 1242) argued that "signal acts as an indicator that reduces the likelihood of a bad outcome for the buyer...Otherwise, consumers will punish the brand by choosing not to *repurchase*". Dutta and Biswas (2005, p. 76) stated that "signal default might lower consumer *repurchase* intention". Kirmani and Rao (2000, p. 70) argued that "*repeat* purchase is likely to occur only if the claims about unobservable quality are true". At the same time, the expectation-confirmation theory (Parasuraman, Zeithaml, & Berry, 1985) indicates that pre-purchase *expectation* of sellers' service quality influences satisfaction and subsequently *repurchase* intention, depending on whether the expectation is met (i.e., confirmed). Accordingly, we propose that a possible theoretical mechanism through which signaling affects online shoppers' repurchase intention is website-interface-related signal → expectation of sellers' service quality → expectation confirmation → satisfaction → repurchase intention.

It is important for online sellers to signal their service quality to new customers because service quality affects online shoppers' willingness to purchase (Lee & Lin, 2005; Udo, Bagchi, & Kirs, 2010). Service quality is also an important determinant of *repurchase* decisions in that it helps a seller differentiates itself from other competitors. Sellers' service quality refers to the adequacy of after-sale service and support (e.g., order processing, delivery, security, convenience; Chiu, Wang, Fang, & Huang, 2014). Exemplary service is the next sale in the making and service quality can be a more important order winner than product quality (Abby, Simon, & Matthew, 1994). In online shopping, shoppers can compare the offerings of competing stores instantaneously with little effort and competitors are only a few clicks away (Srinivasan, Anderson, & Ponnavolu, 2002). There has been a trend of commoditizing

products, which emphasizes cost reduction over brand differentiation (Mathwick, Malhotra, & Rigdon, 2001). Given that product quality and price are relatively easy to imitate by competitors in electronic commerce, signaling service quality may be more fruitful for attracting new customers, fostering strong relationships, and turning them into repeating customers.

Since signaling seeks to convey information to online shoppers (Schlosser et al., 2006; Wells et al., 2011), it is important to account for shoppers' information need when studying the effect of signaling. Shoppers who have a greater need for information are likely to be more strongly affected by signals. Research on consumers' information seeking behavior shows that shoppers' information need is mainly determined by the perceived risk of a purchase and their prior online shopping experience (Aljukhadar & Senecal, 2016; Grant, Clarke, & Kyriazis, 2007; Mitra, Reiss, & Capella, 1999; Murray, 1991; Park & Stoel, 2005; Schmidt & Spreng, 1996; Shin et al., 2013). Similarly, in a study of signaling, Wells et al. (2011) suggests that information asymmetry, characterized by pre-purchase information scarcity and post-purchase information clarity, can vary depending on the extent to which the shopper is experienced. Therefore, in the proposed model, we consider the moderating effect of online shoppers' information need in terms of their perceived risk of a purchase and prior online shopping experience.

In sum, this study looks beyond the pre-purchase effects of signaling and our objective is to model and assess the effect of signaling on *repurchase* intention. We hypothesize that website interface usability signals service quality and the signaling effect is moderated by shoppers' information need. The resultant service quality expectation should influence repurchase intention, to the extent that it is confirmed and shoppers are satisfied, as posited by the expectation-confirmation theory. We assessed the proposed model with data collected in a longitudinal, two-stage survey of 213 online shoppers and found strong empirical support. This study contributes to research by (1) revealing that signaling has a longer-term effect than that typically examined in signaling research, (2) explaining the theoretical mechanism through which signaling affects repurchase intention, and (3) identifying website usability as a significant and manageable factor influencing the formation of service quality expectation in online shopping. For practice, this study shows that signaling is more important than expected in that it affects the initial purchase as well as future purchases. This study's contributions to research and practice are summarized in Table 1.

Table 1. Preview of Study Contributions

State of the Literature and Practice	This Study's Contribution	Relevance	
		Theory/ Empirics	Practice
Website-interface-related signals influence *pre-purchase* beliefs such as expected company (i.e., seller) quality, expected product quality, trust, and purchase intention (Li et al., 2015; Wells et al., 2011)	- Signals have significant influence *beyond the pre-purchase stage,* on repurchase intention - The effect can be explained in terms of the expectation-confirmation theory	✓	✓
Signaling effects have been empirically assessed in cross-sectional studies, focusing on the pre-purchase stage (Li et al., 2015; Wells et al., 2011)	The proposed model was empirically assessed with longitudinal data collected in a two-stage survey (before and after a purchase)	✓	
Expected service quality is compared vis-à-vis actual service quality to determine satisfaction and subsequently repurchase intention	The formation of expected service quality is affected by website usability (an observable aspect of websites), through signaling	✓	✓

Conceptual Background

In this section, we first explain the nature of signals and how they convey unobservable information and influence shopper' expectation in the pre-purchase stage, based on the signaling theory. This is followed by a discussion of website usability as a website-interface-related signal in online shopping. The information need of online shoppers is then described. We also provide an overview of the expectation-confirmation theory, which is useful for explaining how repurchase intention is formed based on pre-purchase expectation.

Signaling Theory

The signaling theory posits that signals can help to reduce information asymmetry between sellers and buyers in the *pre-purchase* stage of a transaction (Kirmani & Rao, 2000). Buyers often lack information to accurately assess unfamiliar sellers' quality prior to making a purchase. Signals are observable cues that can convey information about sellers' true quality to buyers. Signals are generally extrinsic and can be confidently assessed by potential buyers (Richardson, Dick, & Jain, 1994). Extrinsic cues are related but not inherent to the quality being signaled. For example, to signal after-sale service quality, the ease of use of a website and depth of product information provided would be extrinsic cues, while the size of customer service staff would be an intrinsic cue. The latter is intrinsic because altering it will change after-sale service quality directly. A signal with high confidence value is one that can be used and judged by shoppers easily and accurately. The size of customer service staff may be a strong predictor

of after-sale service quality, but buyers typically have less confidence in determining what the appropriate size is. In comparison, the ease of use of a website can be more readily recognized and evaluated by shoppers navigating the website.

A signal is useful for reducing information asymmetry when it is profitable for high-quality sellers to send, but unprofitable for low-quality sellers. When high-quality sellers have an incentive (i.e., tradeoff between cost and revenue) to send a signal and low-quality sellers have disincentive to choose the same signal, use of the signal leads to a *separating equilibrium* (Boulding & Kirmani, 1993). Shoppers can use the signal to separate (distinguish) the unobservable type of sellers. To illustrate, the ease of use of website is a signal that is costly to send because upfront investments are necessary to design and build an easy-to-use website. High-quality sellers can expect to recoup the investments from future sales, while low-quality sellers have little incentive to invest in the signal because their true qualities would soon be known and sales would deteriorate quickly as customers do not return and negative words of mouth spread exponentially in the online world (Wells et al., 2011). Assuming that sellers are rational, they are likely to honor the level of quality conveyed through the signal because not doing so is likely to be economically detrimental.

Website Usability as a Signal in Online Shopping

Usability is critical to the success of online shopping websites, affecting shoppers' purchase-related perceptions and decisions (e.g., Chen & Macredie, 2005; Flavián, Guinalíu, & Gurrea, 2006; Gould & Lewis, 1985; Green & Pearson, 2011; Marie, Olivier, & Benoit, 2001; Palmer, 2002). Usability research focuses on users' perception of the functional and instrumental qualities related to a website's controllability and effectiveness, and highlights navigability and organization of information to be the key aspects (Palmer, 2002). Usability refers to "the perceived ease of navigating the site or making purchases through the Internet" (Flavián et al., 2006, p. 2). Usability research distinguishes usability from website aesthetics, which reflects non-instrumental qualities related to visual appearance and beauty (Thüring & Mahlke, 2007). Human and computer interaction researchers acknowledge that usability and aesthetic do not always coincide, as an overemphasis on aesthetic elements could degrade usability (Tractinsky, 1997).

Table 2. Website-Interface-Related Signals Examined in Online Shopping Studies

Study	Signal studied	Signal measure	Signal outcome
Ahrholdt (2011)	Product pictures, layout, technical quality	Perception based, e.g., "I have the impression that the website offers a customer-friendly product presentation with large product pictures and/or a three-dimensional representation"	Trust-based intention to transact
Chen and Teng (2013)	**Ease of use of website***	Perception based, e.g., "Please answer the following questions according to the online travel store: hard to use – easy to use"	Trust
Gregg and Walczak (2008)	E-image (**amount of product information** and presence of aesthetic feature)	Perception based, e.g., "The information in this auction listing is sufficiently detailed"	Willingness to transact
Kim, Xu, and Koh (2004)	Website **ease of navigation**, visual attractiveness; **Information relevance, reliability, and adequacy**	Perception based, e.g., "This Web site is easy to use", "This Web site is easy to navigate"	Trust
Li et al. (2015)	Visual appeal, **information quality**	Objective, e.g., Deployment status of two features: luxurious website and detailed pictures (scale of 0 to 2)	Sales
Mavlanova (2015)	Website amateurism, website **content quality**	Objective, e.g., Presence of broken links, typographical errors, relevant information	Purchase intention
Riasanow, Ye, and Goswami (2015)	Review content	Perception-based, e.g., "Indicate the extent to which you think the reviewers' opinions about the hotel were positive"	Willingness to purchase
Schlosser et al. (2006)	Sophisticated website technology and visual design elements	Perception-based, e.g., "The amount of effort devoted to developing this website seems to be very little – a great deal"	Trust and purchase intention
Wells et al. (2011)	**Navigability**, download delay, visual appeal	Perception-based, e.g., "Navigating these web pages is easy for me"	Perceived product quality prior to purchase

* Signals related to navigability and organization of information are in bold

In this study, we choose to focus on the signaling effect of website usability for several reasons. First, the key aspects of website usability, website navigability and organization of information (Palmer, 2002), are commonly identified as relevant website-interface-related signals in prior studies of online shopping (see Table 2). Prior studies show that both aspects have significant signaling effect and they send positive signals about a website. Since our objective is to study the effect of signaling on repurchase intention rather than the significance of specific signals, we focus on salient signals identified in prior studies.

Second, website usability qualifies as a signal because it can be directly observed and confidently judged by online shoppers. By definition, usability focuses on users and their tasks/goals, and users constitute the primary source of information about the usability of a website (Gould & Lewis, 1985). The design of usability involves understanding what matters to users, while the evaluation of usability is mainly informed by users' performance, thoughts, and attitudes as they carry out important tasks (Gould & Lewis, 1985). Usability is therefore user-centered, noticeable and observable by users, and is best evaluated by users.

Third, as a signal, website usability is extrinsic to sellers' after-sale service quality, which is the unobservable information to be signaled in this study. As discussed earlier, changes in website navigability and information organization would not directly alter actual after-sale service quality. After-sale customer service quality can be conceptually distinguished from website usability in that service goes beyond the website interface (Wolfinbarger & Gilly, 2003).

Fourth, ensuring website usability requires upfront investments by sellers (e.g., fee, time, effort) to provide good navigability and information organization, and rational sellers seek to recoup this investment through future sales (Wells et al., 2011). Therefore, a separating equilibrium exists as shoppers can discern between websites of good and poor usability, and infer that sellers sending a false signal would lose credence and not survive in the long term.

Like most prior studies of website (see the third column of Table 2), we focus on the perception of a signal rather than whether a signal is sent by sellers or objectively exists. Recall that observability, the extent to which shoppers are able to notice a signal, is one of the important characteristics of efficacious signals (Boulding, Kalra, Staelin, & Zeithaml, 1993; Connelly, Certo, Ireland, & Reutzel, 2011). If actions sellers take are not readily observed by shoppers, it is difficult to use those actions to communicate information to shoppers (Connelly et al., 2011). This suggests that when studying a signal and assessing its effect, it is more important to focus on the extent to which customers observed and perceived it. In the context of online shopping websites, this means that it is more appropriate to focus on users' perception of website usability after interacting with the website, compared to whether the certain elements objectively exist on a website.

Focusing on the perception of website usability is also in line with our research objective, which is to model and empirically assess the effect of signaling on repurchase intention. Repurchase intention is perception-based/ idiosyncratic rather than objective.

Therefore, we expect repurchase intention to be more strongly affected by users' perceptions of a website than by the objective existence of certain website elements. An aspect that is not perceived by shoppers is unlikely to affect perceptions about related issues, such as repurchase intention. A website might have been designed following a certain set of website design guidelines, but this is unlikely to affect repurchase intention if the shopper did not notice it. It is also unlikely to improve repurchase intention if the user did not perceive it favorably.

Our review also shows that prior research has focused on the effect of signals on outcomes in the pre-purchase stage (see Table 2), such as trust (Kim et al., 2004), perceived product quality prior to purchase (Wells et al., 2011), and willingness to purchase (Riasanow et al., 2015). Although the signaling theory recognizes post-purchase information clarity, that is, shoppers will have access to information for verifying pre-purchase signals by observing sellers' actual performance and behavior in fulfilling order (Connelly et al., 2011; Mavlanova et al., 2012; Wells et al., 2011), there has been a lack of empirical studies on the outcomes of verification. One exception is the study by Hu, Rabinovich, and Hou (2015), which focuses on product guarantee as a signal and found that signaling has a significant effect on online customer complaint intention. This study seeks to contribute to this line of inquiry by examining the signaling effect of website usability on repurchase intention, which is a critical outcome variable in online shopping research and practice.

Information Need of Online Shoppers

Since signaling seeks to reduce information asymmetry (Boulding & Kirmani, 1993), shoppers' use of signals to infer information about sellers is likely to be affected by their need for information in the pre-purchase stage. Therefore, our proposed model accounts for the effect of information need. Research on consumers' information seeking behavior shows that shoppers' need for information is mainly determined by the perceived risk of a purchase and their prior online shopping experience (Grant et al., 2007; Mitra et al., 1999; Murray, 1991; Park & Stoel, 2005; Schmidt & Spreng, 1996).

Perceived risk of a purchase is the extent to which the buyer believes that a purchase decision produces social or economic consequences that cannot be estimated with certainty (Conchar, Zinkhan, Peters, & Olavarrieta, 2004). Risks related to financial loss and product performance are frequently cited as reasons for not purchasing online (e.g., Forsythe & Shi, 2003). When perceived risk is high, buyers need more and better information to ensure that correct purchase decisions are made and any possible loss is minimized (Schmidt & Spreng,

1996). This suggests that buyers making high-risk purchases are likely to be more strongly affected by the information conveyed in signals.
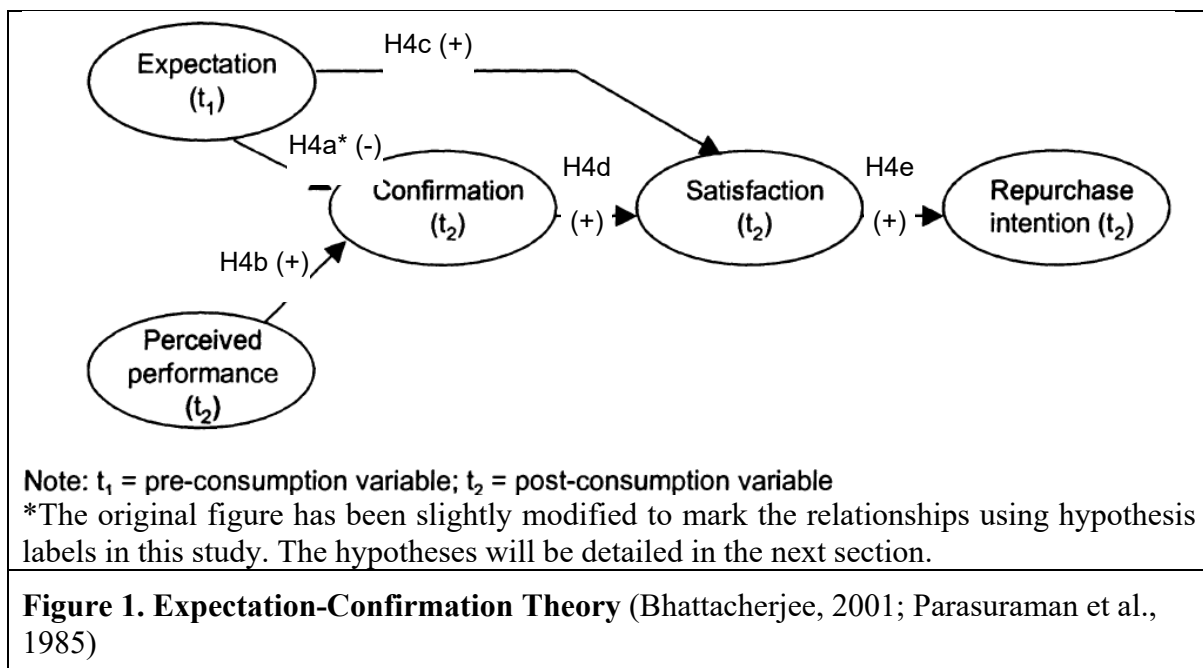
Prior experience with online shopping also affects the need for information. Accumulation of experience contributes towards the development of better knowledge structures or "schema" that are useful for future purchases (Rao & Monroe, 1988). Shoppers with strong prior experience tend to believe that they have the relevant knowledge stored in memory to evaluate purchases (Schmidt & Spreng, 1996) and this reduces their need to acquire information compared to less experienced shoppers. In support, Shim, Eastlick, Lotz, and Warrington (2001) noted that online shopping experience impacts the intention to search for information. This indicates that more experienced shoppers are likely to be less affected by the information conveyed in signals.

Expectation-Confirmation Theory

The expectation-confirmation theory explains how consumers form repurchase intention (Bhattacherjee, 2001; Parasuraman et al., 1985). The theory posits that consumers assess the pre-purchase expectation of service quality vis-à-vis the actual service performance after purchase to determine the extent to which the expectation is confirmed (see Figure 1). The higher the level of expectation, the more difficult it is to meet (i.e., confirm) the expectation. Consumers form a satisfaction, or affect, based on the confirmation level and the expectation on which that confirmation was based. Satisfied consumers form a stronger repurchase intention, while dissatisfied consumers avoid purchasing again. The theory also suggests that high-expectation consumers are likely to feel more satisfied than low-expectation consumers, because expectation provides the reference level for consumers to evaluate service quality. Based on the adaptation level theory, a high reference level or expectation tends to enhance one's attainable satisfaction (Bhattacherjee, 2001). Lower expectation and/or higher performance result in greater confirmation, which in turn positively influences satisfaction and repurchase intention. The reverse causes disconfirmation, dissatisfaction, and reduced repurchase intention.

The expectation-confirmation theory has been widely applied in electronic commerce and information systems research (Hossain & Quaddus, 2012; Kalia, 2016; McKinney, Yoon, & Zahedi, 2002; Qazi, Tamjidyamcholo, Raj, Hardaker, & Standing, 2017; Valvi & West, 2013; Wu & Huang, 2015) and detailed in several seminal articles (e.g., Bhattacherjee, 2001; Parasuraman et al., 1985). Here, we illustrate the theory with an example of shopping online.

Prior to making a purchase (t_1 in Figure 1), a shopper first forms an (ex-ante) expectation of the online seller's after-sale service quality ("expectation" in Figure 1). Second, after the purchase is fulfilled (t_2 in Figure 1), the consumer forms a perception of the seller's performance based on the seller's actual service quality (i.e., "perceived performance" in Figure 1). Third, this perceived performance is compared with the pre-purchase expectation to determine whether the expectation is confirmed (i.e., "confirmation" in Figure 1). There is confirmation when the perceived performance meets or exceeds expectation. The better the perceived performance, the greater the level of confirmation (i.e., positive relationship). However, the higher the level of expectation, the more difficult it is for the expectation to be met and confirmed (i.e., negative relationship). Fourth, the shopper is likely to be more satisfied when the expectation is exceeded (i.e., level of confirmation is higher). Fifth, the level of attainable satisfaction is also higher for consumers with a higher expectation, as suggested by the adaptation theory (i.e., positive relationship). Sixth, higher level of satisfaction with service quality should increase repurchase intention (i.e., positive relationship).

Note: t_1 = pre-consumption variable; t_2 = post-consumption variable
*The original figure has been slightly modified to mark the relationships using hypothesis labels in this study. The hypotheses will be detailed in the next section.

Figure 1. Expectation-Confirmation Theory (Bhattacherjee, 2001; Parasuraman et al., 1985)

Development of Research Model and Hypotheses

We draw on the signaling theory and expectation-confirmation theory to develop a model that explains the signaling effect of website usability on repurchase intention. Based on the signaling theory, we hypothesize that website usability signals after-sale service quality and influences expected service quality (see Figure 2). Since signaling conveys information to shoppers, the effect of signaling is likely to depend on shoppers' information need. Therefore,

we account for the moderating effects of perceived risk of a purchase and prior experience with online shopping when modeling the signaling effect of website usability. Examining the subsequent effects of expected service quality allows us to understand how signaling influences repurchase intention. Based on the expectation-confirmation theory, expected service quality is hypothesized to influence confirmation (of expectation) when it is assessed vis-à-vis actual service quality perceived by shoppers. Confirmation is hypothesized to influence satisfaction and subsequently repurchase intention. These hypotheses are justified next. In analyzing the model, we also controlled for the direct effect of website usability on repurchase intention to assess whether expectation confirmation fully mediates the effect of website usability, and controlled for the effect of demographic variables such as age and gender.
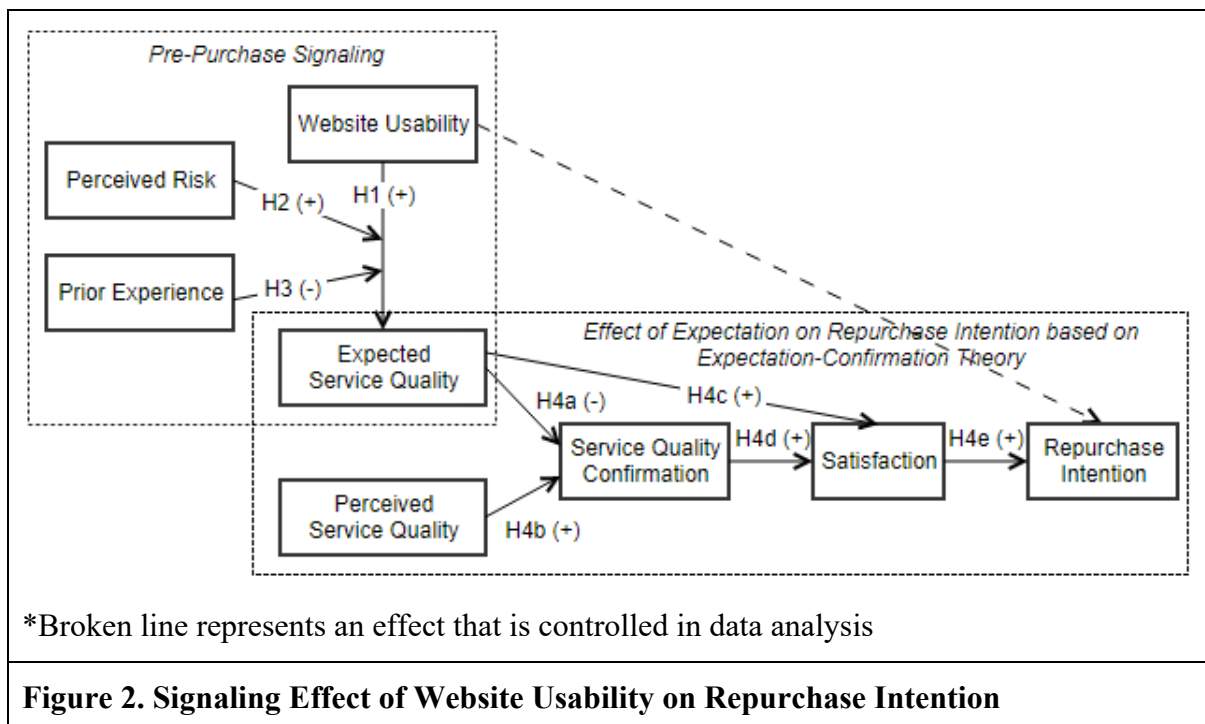

*Broken line represents an effect that is controlled in data analysis

Figure 2. Signaling Effect of Website Usability on Repurchase Intention

Pre-Purchase Signaling Effect of Website Usability on Service Quality

As discussed in the previous section, website usability is a directly observable aspect of the website interface that can be readily evaluated by users with a high degree of confidence. It is also extrinsic in that changes in website usability do not directly alter after-sale service quality. Website usability also generates a separating equilibrium as low-quality sellers have little incentive to incur the upfront costs involved.

Website usability may serve as a pre-purchase signal of after-sale service quality similar to how the physical store environment serves as a signal in offline shopping (Baker, Grewal, & Parasuraman, 1994). A carefully designed website demonstrates to shoppers that the seller

has incurred expenditure on the website and expects to recover it through future and repeat sales (Mavlanova et al., 2012). The seller is therefore more likely to excel in after-sale service to ensure customer satisfaction and repeat business. The focus on ease of navigation indicates the seller's customer orientation, especially the concern for customers' comfort and efficiency. A good organization of product information signals the seller's concern for shoppers' shopping efficiency and effectiveness. In support, Xu, Benbasat, and Cenfetelli (2013) suggest that customers are likely to draw on their perception of system quality in their mental schema when considering service quality, such that when they perceive a higher quality of content and delivery in a website, their perceived service quality will also be higher. Accordingly, we hypothesize that website usability influences online shoppers' expected after-sale service quality.

The notion that signals affect pre-purchase expectation is also supported by prior studies. Hong and Pavlou (2012) argue that consumers "expect a higher service level if the provider transmits a signal indicating that he is of higher quality" (p. 5). Dutta, Biswas, and Grewal (2007) explained that a guarantee default (i.e., signaled quality not honored) "represents a disconfirmation between the expectation … and the postpurchase discovery of inaccuracy of such expectation" (p. 78). In addition, prior studies have measure signal outcomes in terms of expectation (e.g., Srivastava & Lurie, 2004). Therefore, we propose the following hypothesis:

H1: Perceived website usability is positively related to service quality expectation.

Moderating Effects of Perceived Risk and Prior Experience with Online Shopping

As discussed before, perceived risk of a purchase increases the need for information to ensure that the correct purchase decision is made and any possible loss is minimized (Schmidt & Spreng, 1996). As perceived risk increases, shoppers tend to allocate more attention and cognitive resources to acquire, comprehend, and process information before making purchases (Dholakia, 2001). The information can help shoppers reduce perceived risk to at least an acceptable level by modifying the alternatives in the choice set, identifying mechanisms to insure against adverse consequences, or altering purchase goals (Dowling & Staelin, 1994). Information about service quality is important in this respect as service quality is directly related to the potential of recovering from problems after a purchase (e.g., after-sale support, exchange, return, refund). When perceived risk is high, shoppers are more concerned about loss and they are therefore likely to be more sensitive to signs of inadequacies in website

usability. Hence, we hypothesize that the signaling effect of website usability is stronger when perceived risk is high.

H2: The signaling effect of website usability is stronger when perceived risk of a purchase is high.

Prior experience can dilute the effect of information obtained through signaling. Experienced shoppers are likely to rely less on website usability as a signal cuing information about after-sale service quality, since they have more experiential information to draw on. They may therefore weigh website usability less in their purchase decisions compared to inexperienced shoppers. Similarly, Jin and Park (2006) suggest that experienced shoppers tend to rely less on cues such as website design and promotion. They concluded that these cues have less influence on the trust of experienced online shoppers. Chiagouris and Ray (2010) suggest that less experienced online shoppers may process stimuli in a more peripheral manner and rely more on peripheral cues and symbols in evaluating a website due to the lack of knowledge compared to experienced online shoppers. They found that online shopping experience moderates the effects of advertising and reputation such that less experienced shoppers focus more on these attributes. Similarly, Dahlen (2001) examined the impact of banner advertisements on brand familiarity and observed that inexperienced Internet users are more affected by banners than experienced users.

Experienced shoppers may still need to obtain store-specific information when they shop in unfamiliar stores. However, compared to inexperienced shoppers, they tend to be better at acquiring information for making purchase decisions (Ward & Lee, 2000), by supplementing with their experiential information and information provided and signaled by online stores with information from other sources such as third-party review websites, peer online shoppers, and offline sources (Klein & Ford, 2003). This is likely to reduce experienced shoppers' reliance on the signal of website usability. In support, it has been found that as users gain more experience with the Internet, their proficiency in searching and evaluating information increases (Hernández, Jiménez, & Martín, 2010). Overall, prior research suggests that the signaling effect is stronger for shoppers with less prior shopping experience, such that they rely more on the readily available signal of website usability compared to experienced shoppers:

H3: The signaling effect of website usability is stronger for users with less prior experience with online shopping.

Expectation Confirmation of Service Quality and Repurchase Intention

According to the expectation-confirmation theory discussed in section 0, we hypothesize that pre-purchase expectation of service quality is negatively related to the confirmation of service quality because high expectations are more difficult to meet, while perceived service quality (based on actual service quality) is positively related. Expectation is positively related to satisfaction since a higher expectation sets a higher reference level for determining the attainable satisfaction (Bhattacherjee, 2001). Assessing the effect of expectation on confirmation requires a study that measures them at different times, thus many cross-sectional studies had only examined the effect of confirmation and excluded expectation (e.g., Bhattacherjee, 2001; Lankton & McKnight, 2012; Limayem, Hirt, & Cheung, 2007; Premkumar & Bhattacherjee, 2008). Only a few studies had assessed the effects of expectation (Brown, Venkatesh, & Goyal, 2012; Kim et al., 2009). Therefore, an additional benefit of testing them in this study is providing further empirical evidence.

H4a: Service quality expectation is negatively related to service quality confirmation.

H4b: Perceived service quality is positively related to service quality confirmation.

H4c: Service quality expectation is positively related to satisfaction.

According to the expectation-confirmation theory, when online shoppers' service quality expectation is confirmed (i.e., actual service quality meets or exceeds expected service quality), they are likely to feel contended and satisfied. This in turn increases their intention to return and willingness to purchase again (Parasuraman et al., 1985). In support, prior studies have showed that confirmation is positively related to satisfaction (e.g., Bhattacherjee, 2001; Bhattacherjee & Premkumar, 2004; Kim et al., 2009; Lankton & McKnight, 2012; Limayem et al., 2007; Premkumar & Bhattacherjee, 2008; Susarla, Barua, & Whinston, 2003), and satisfaction is positively related to repurchase intention (e.g., Wen, Prybutok, & Xu, 2011; Yen & Lu, 2008). In this study, we model their effects to understand how service quality expectation formed based on the signal of website usability influences repurchase intention.

H4d: Service quality confirmation is positively related to satisfaction.

H4e: Satisfaction is positively related to repurchase intention.

Research Method

To assess the proposed model and hypotheses, data were collected in a two-stage survey of online shoppers. This section describes the survey instrument, data collection procedure, and

sample demography.

Survey Instrument

Constructs in the proposed model were measured with items adapted from existing scales as much as possible (see Appendix A). Website usability emphasizes navigability and organization of information (Palmer, 2002). Since website usability and service quality are distinct constructs in our model, it is important to ensure that their operationalization does not overlap. Wolfinbarger and Gilly (2003) developed a set of scales that conceptually distinguished between website usability aspects (i.e., ease of use, informativeness measuring depth of information, selection measuring breadth of information, and experiential/atmospheric; see p. 188) and service quality aspects (e.g., customer service, fulfillment). It therefore serves as an appropriate basis for operationalizing website usability in our study. Among the four significant usability aspects identified by Wolfinbarger and Gilly (2003), the experiential/atmospheric aspect reflects website aesthetic, which usability researchers consider to be outside the conceptual scope of website usability (Thüring & Mahlke, 2007; Tractinsky, 1997). Therefore, we excluded the experiential/atmospheric aspect and security and measured website usability in terms of ease of navigation, depth of product information (informativeness), and breadth of product information (selection).

After-sale service quality was measured in terms of efficiency in transaction processing (e.g., order, payment, delivery), security, and convenience (Chiu et al., 2014). Pre-purchase service quality expectation, post-purchase service quality perception, and post-purchase confirmation were measured with commensurate items having the same content (Edwards, 2002). This is required to ensure that they are consistent and comparable before and after purchase. Perceived risk of a purchase was measured in terms of product risk, financial risk, and an item capturing overall risk (Bhatnagar, Misra, & Rao, 2000; Kim, Ferrin, & Rao, 2008). Satisfaction was measured with the semantic differential scale developed by Spreng, MacKenzie, and Olshavsky (1996). Repurchase intention was measured following Khalifa and Liu (2007).

Data Collection

To test the proposed model, we needed to collect data about online shoppers' first purchase from an unfamiliar online seller (i.e., one that they had not purchased from before). Data on website usability, expected service quality, perceived risk, and prior online shopping experience should be collected after a shopper has navigated the website of the unfamiliar

seller, but before a purchase is made, while data on perceived (actual) service quality, service quality confirmation, satisfaction, and repurchase intention should be collected after a shopper has purchased from the unfamiliar seller. Accordingly, we designed a two-stage survey to collect data.

Figure 3. Approach to Data Collection
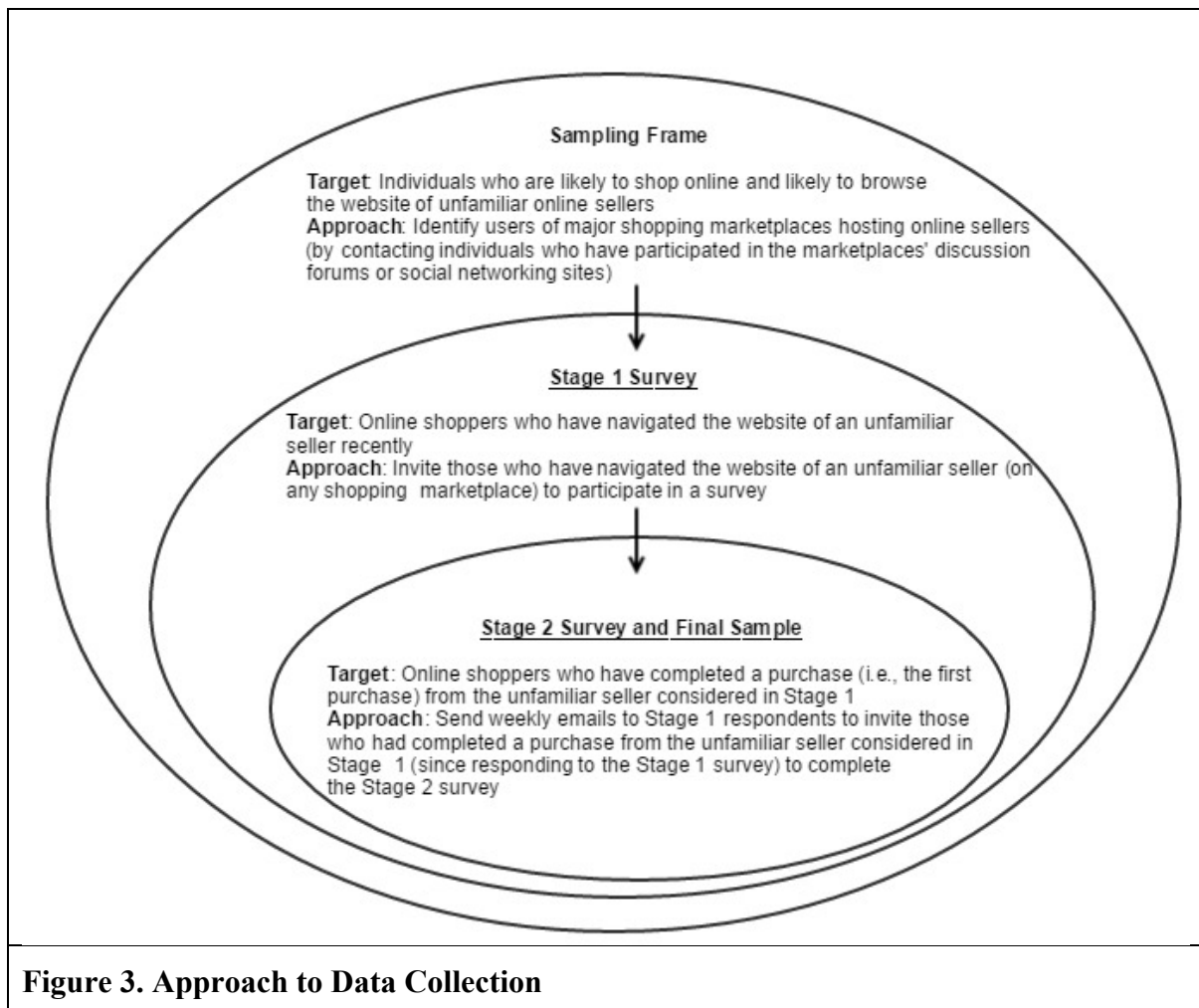
To recruit respondents for the first stage, that is, individuals who had browsed the website of an unfamiliar seller but not yet made a purchase, we turned to major online marketplaces in Taiwan, such as PCHome, Yahoo! Shopping, PayEasy, and MomoShop. Together, these online marketplaces accounted for more than 30 percent share of the fragmented online retail market in Taiwan (Euromonitor International, 2017). These online marketplaces hosted a large number of online sellers and users often encountered unfamiliar sellers while shopping. Due to the lack of access to the list of all users, we identified active users by observing these marketplaces' discussion forums or social networking sites[1]. A total of 711 users who had posted or

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[1] In the discussion forums or social network sites, users often share information about products that they have purchased recently or recommend products they have come across to friends in their social network

commented were contacted and asked whether they had recently browsed the website of an unfamiliar seller (i.e., had never completed a purchase from the seller) (see Figure 3). If so, they were invited to participate in the stage 1 survey and answer the survey based on the unfamiliar seller (see Figure 3).

A total of 244 users completed the stage 1 survey. After that, they received a weekly email asking whether they had completed a purchase from the seller considered in stage 1. They were invited to complete the stage 2 survey if they had made a purchase since responding to the stage 1 survey. As an incentive for participating in the stage 2 survey, respondents were offered a chance to participate in a lucky draw for a smartphone and a tablet computer. A total 213 users completed the stage 2 survey. To assess whether sample attritions was due to non-random effects that could potentially result in biased estimates, we compared the means of website usability, perceived risk, prior experience, and expected service quality in the attrited sample with those in the remaining sample (Lohse, Bellman, & Johnson, 2000). The result indicated that the attrited sample did not differ significantly from the remaining sample.

Even though the online sellers considered by the respondents in our sample were from several major online marketplaces and their websites were created using the tools provided by the marketplaces, we expect adequate variance in different seller's website usability (i.e., ease of navigation, depth of information, breadth of information). Usability is likely to vary as each seller must determine how to present their products using the tools provided. For example, a low-quality seller that is not concerned with usability might not bother to use the tools provided to create a navigation menu that allows shoppers to browse products based on categories; a low-quality seller might choose to reduce effort by providing only minimal product information, even when the tools provided by the marketplace permits detailed product information. Having access to the tools provided by online marketplaces does not guarantee that a seller's website would have good usability. Website usability is likely to be more of a result of design choices made by the seller rather than by the marketplace that hosts the seller. In support, our analysis of constructs (detailed later) showed that our data on perceived website usability ranged from 1 (lowest level in the scale) to 7 (highest level in the scale) and had a standard deviation of 0.97.

It is also important to control for differences in website layout and seller's reputation, since we collected data from shoppers purchasing from different websites and sellers. At the individual level of analysis, layout has been found to influence navigability (e.g., Palmer, 2002).

We measured individuals' perceived navigability as part of the construct website usability (see Appendix A item PWU1), which is an independent variable in our structural model. Reputation has been found to be an affect-based antecedent of trust that influences perceived risk (e.g., Kim et al., 2008) at the individual level. Perceived risk is a moderator in our study (and modeled as an independent variable in the proposed model, as part of the moderating analysis).

Sample Demography

As summarized in Table 3, there were more male (62.4 percent) than female respondents. The majority was between 20 to 35 years old (93.4 percent) and held a bachelor degree (69.5 percent). Most of the respondents had more than four years of experience using the Internet (96.7 percent). These demographic variables were controlled for in data analysis because previous literature suggests that they might affect purchases on the Internet (e.g., Fang et al., 2014).

Table 3. Demographic Analysis		Frequency	Percentage	Cumulative Percentage
Gender	Female	80	37.6	37.6
	Male	133	62.4	100.0
Age	Less than 20 years old	6	2.8	2.8
	20-35 years old	199	93.4	96.2
	36-50 years old	3	1.4	97.7
	More than 50 years old	5	2.4	100.0
Education	High school	2	0.9	0.9
	Bachelor degree	148	69.5	70.4
	Postgraduate degree	63	29.6	100.0
Experience Using the Internet	1 – 2 years	2	0.9	0.9
	3 – 4 years	5	2.4	3.3
	More than 4 years	206	96.7	100.0

Data Analysis

The proposed model was assessed with Partial Least Squares (PLS), a structural equation modeling approach that simultaneously assesses all constructs and relationships in a research model. PLS is variance-based and is more suitable than covariance-based approaches for causal-predictive analysis where theory is less established (Wetzels, Odekerken-Schroder, & Van Oppen, 2009). It is appropriate for our purpose since this is one of the first to model and assess the signaling effect of website usability on repurchase intention. PLS can analyze reflective and formative constructs jointly occurring in a single model (Wetzels et al., 2009).

Formative constructs are measured using items that tap into different themes and they are neither interchangeable nor expected to covary. For instance, ease of navigation (PWU1) may not necessarily covary with informativeness (PWU2). In this study, the formative constructs are perceived website usability, service quality expectation, perceived service quality, and service quality confirmation. The other constructs are reflective. PLS analysis involves testing the measurement model and the structural model, as detailed next.

Analysis of Measurement Model

For the reflective constructs, the measurement model was assessed in terms of reliability, convergent validity, and discriminant validity (Wetzels et al., 2009). Cronbach's alpha and composite reliability were calculated to evaluate reliability (see Table 4). We found that all values exceeded the requirement of 0.70. Convergent validity was assessed by calculating average variance extracted (AVE). All AVEs exceeded the recommended value of 0.50. Discriminant validity was assessed by examining the square root of AVEs. For all the constructs, the square root of AVE (italic, diagonal entries in Table 5) exceeded corresponding correlations with other constructs (non-diagonal entries in Table 5). Additional support for discriminant validity comes through inspection of the cross loadings, which were low compared with the loadings. We also assessed multicollinearity by calculating variance inflation factors and the values were all below 3.33 (see Table 5), indicating that the threat was low (Cenfetelli & Bassellier, 2009).

For the formative constructs, these tests were not applicable. Instead, significance of item weight was examined to determine the contribution of items constituting the construct. The results were favorable, with all the item weights significant at $p < 0.05$. Multi-collinearity among items was assessed using variance inflation factor (VIF). All exogenous constructs had VIF that was less than 3.3, below the recommended threshold (Petter & Rai, 2007). Overall, the measurement model was satisfactory.

Common method bias was assessed with three tests, considering that all data were collected using survey. In the one-factor test, all items were entered into an unrotated principal components factor analysis to check if a) a single factor emerged and b) a single factor accounted for more than 50% of the variance. Neither of these was observed and we therefore concluded that common method bias was unlikely. In the test of goodness-of-fit measures for PLS (Wetzels et al., 2009), we found that the one-factor model had considerably worse fit than the multi-factor model ($GOF_{one-factor} = 0.39$ vs. $GOF_{multi-factor} = 0.44$). This further supported the conclusion that common method bias was not significant. Using the "controlling for the effects

of an unmeasured latent methods factor" technique suggested by Podsakoff, MacKenzie, Lee, and Podsakoff (2003), we tested whether the addition of a method factor to the structural model significantly improved its fit over the model with only the latent constructs specification, and whether the factor loadings continue to be significant. We observed that the fit of the model did not improve significantly and factor loadings remained significant. We concluded that the threat of common method bias was not significant.

Table 4. Assessment of Reliability and Validity					
Construct	**Item**	**Loading***	**Construct**	**Item**	**Weight#**
Perceived Risk α=0.80; CR=0.88; AVE=0.71	PR1	0.85	Perceived Website Usability (formative)	PWU1	0.51
	PR2	0.79		PWU2	0.27
	PR3	0.89		PWU3	0.43
Prior Experience α=0.92; CR=0.95; AVE=0.86	PE1	0.92	Service Quality Expectation (formative)	SQE1	0.27
	PE2	0.92		SQE2	0.35
	PE3	0.94		SQE3	0.21
Satisfaction α=0.96; CR=0.97; AVE=0.90	ST1	0.95		SQE4	0.25
	ST2	0.96	Perceived Service Quality (formative)	PSQ1	0.35
	ST3	0.94		PSQ2	0.32
	ST4	0.96		PSQ3	0.23
Repurchase Intention α=0.96; CR=0.97; AVE=0.93	RI1	0.96		PSQ4	0.26
	RI2	0.97	Service Quality Confirmation (formative)	SQC1	0.25
	RI3	0.95		SQC2	0.37
α: Cronbach's Alpha; CR: Composite Reliability; AVE: Average Variance Extracted; * All item loadings were significant at p<0.001 # All item weights were significant at p<0.05				SQC3	0.23
				SQC4	0.34

Table 5. Correlations among Constructs and Square Root of AVE												
Construct	Min*	Max*	Mean	SD*	VIF*	PWU	SQE	PR	PE	PSQ	SQC	ST	RI
PWU	1	7	5.42	0.97	1.14	*N.A.*							
SQE	1	7	5.31	0.88	2.54	0.47	*N.A.*						
PR	1	7	3.58	1.36	1.10	-0.17	-0.56	*0.84*					
PE	1	7	5.40	1.24	1.25	0.40	0.68	-0.25	*0.93*				
PSQ	1	7	5.42	0.88	1.14	0.18	-0.27	0.21	-0.19	*N.A.*			
SQC	1	7	5.23	0.91	1.80	0.40	-0.53	-0.10	0.41	0.07	*N.A.*		
ST	3	7	5.49	0.92	1.00	0.47	0.49	-0.05	0.40	0.10	0.64	*0.95*	
RI	1	7	5.49	1.00	N.A.*	0.32	0.45	-0.29	0.42	0.27	0.30	0.29	*0.96*
*Min: minimum; Max: maximum; SD: standard deviation; VIF: variance inflation factor; N.A.: not applicable													

In addition to ex-post statistical assessment, we employed several ex-ante strategies

suggested by Podsakoff et al. (2003) to minimize common method bias. First, the predictor and criterion variables were measured separately, before and after a purchase. The time lag introduces a temporal separation. Second, the survey questions were measured using only positive values rather than bipolar values (e.g., -3 to +3) to avoid acquiescence bias. Third, respondents were assured of their anonymity and instructed to select the responses that best described their perceptions rather than the "correct" response. Combining multiple statistical and methodological strategies can help to minimize common method bias more effectively (Craighead, Ketchen, Dunn, & Hult, 2011).

Analysis of Structural Model

The proposed model was assessed in two steps. First, a model with control variables and main effects was evaluated (i.e., the main-effects model). In the next step, the hypothesized moderating effects were added (i.e., the moderating-effects model). The moderating effects were modeled using the product indicator approach (Henseler & Fassott, 2010), where product terms were created using mean-centered indicators of the latent independent variable and mean-centered indicators of the latent moderator variable. These product terms served as indicators of the moderators.

Table 6. Path Coefficients and Result of Hypothesis Testing

Relationship	Result	Main-Effects Model		Moderating-Effects Model	
		Path	T Statistic	Path	T Statistic
Perceived website usability → Service quality expectation	H1 is supported	0.66***	16.44	0.67***	16.24
Perceived risk * Perceived website usability → Service quality expectation	H2 is supported			0.10*	1.97
Prior experience * Perceived website usability → Service quality expectation	H3 is supported			-0.10*	2.09
Perceived risk → Service quality expectation		-0.46***	11.23	-0.45***	9.57
Prior experience → Service quality expectation		0.10*	2.60	0.09*	2.38
Service quality expectation → Service quality confirmation	H4a is supported	-0.32***	3.78	-0.32***	3.48
Perceived service quality → Service quality confirmation	H4b is supported	0.46***	5.40	0.46***	5.03
Service quality expectation → Satisfaction	H4c is supported	0.19*	2.04	0.19*	2.03
Service quality confirmation → Satisfaction	H4d is supported	0.44***	5.17	0.45***	5.43
Satisfaction → Repurchase intention	H4e is supported	0.41***	5.11	0.41***	5.33
Perceived website usability → Repurchase intention	Control effect is significant	0.36***	4.65	0.36***	4.64
*p<0.05; **p<0.01; ***p<0.001					

Path coefficients of the proposed model are shown in Table 6 and Figure 4. As hypothesized, perceived website usability strongly influenced service quality expectation and the relationship was stronger in high-risk purchases and for online shoppers with less prior experience with online shopping (see Figure 5). None of the control variables had a significant effect, indicating that service quality expectation and repurchase intention were not significantly affected by age, gender, or education. Although our sample had a larger proportion of male respondents, it is unlikely to bias the findings, as we statistically controlled for the effect of gender found that it did not have a significant effect. The effects of service quality expectation on confirmation and subsequently satisfaction and repurchase intention were significant and consistent with the expectation-confirmation theory. The direct effect of website usability on repurchase intention was significant, indicating that expectation confirmation is not the only mechanism mediating the effect of website usability. The model accounted for 49% of the variance in repurchase intention ($r^2=0.49$), 34.2% of the variance in satisfaction ($r^2=0.34$), and 79% of variance in expected service quality ($r^2=0.79$).
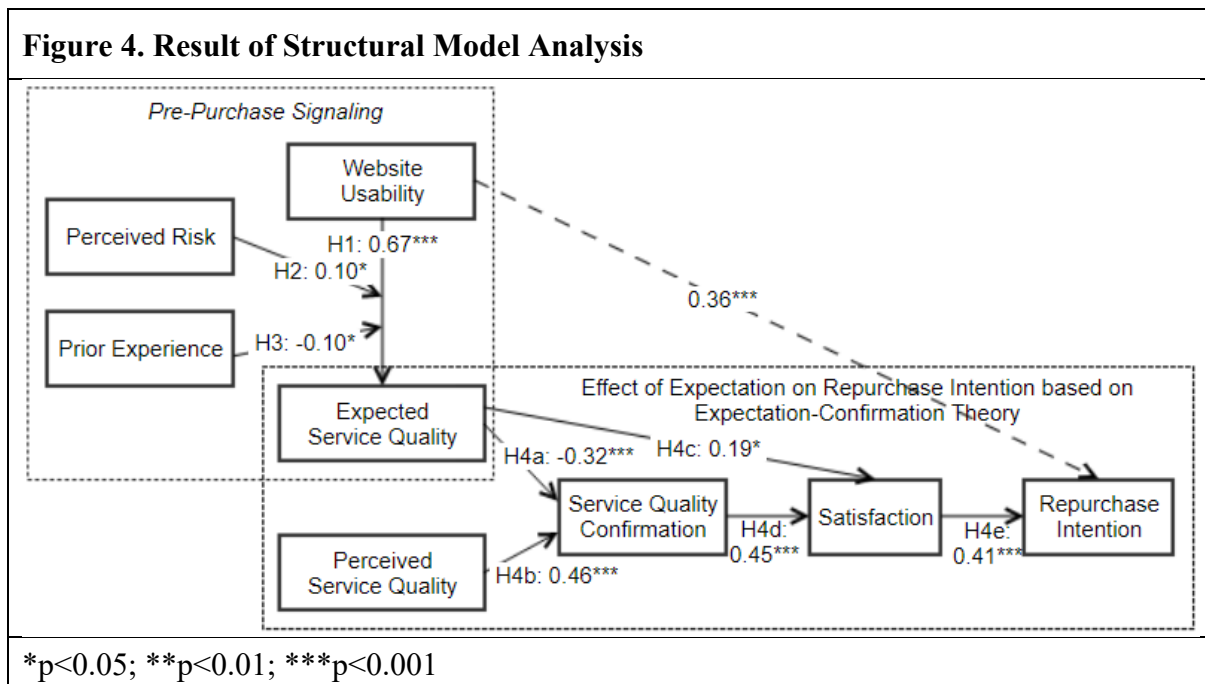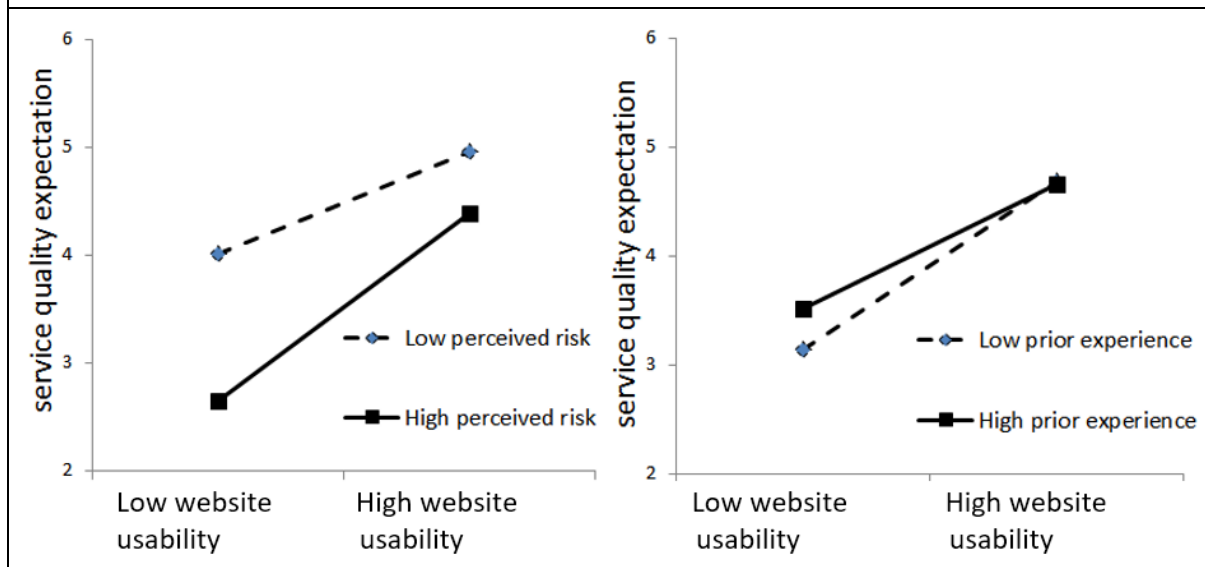

Figure 4. Result of Structural Model Analysis

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

Figure 5. Plot of Interaction Effects

Discussion and Implications

We will first discuss the key findings and their implications for research and theoretical development, followed by a consideration of the study's limitations and suggestions for further research. We will then discuss how the findings inform the practical management of online shopping websites.

Implications for Research and Theoretical Development

One of the key findings is that the signaling effect of website usability goes beyond the pre-purchase stage to influence repurchase intention in the post-purchase stage. This enhances our understanding of the effect of signaling by revealing its longer-term effect and extends existing research, which has mainly focused on the pre-purchase outcomes of signaling (Kim et al., 2004; Riasanow et al., 2015; Wells et al., 2011). This study is among the earliest to assess whether signaling affects repurchase intention, which is a critical outcome variable in online shopping research. The finding provides empirical support for researchers' argument that "repeat purchase is likely to occur only if the claims about unobservable quality are true" (Kirmani & Rao, 2000, p. 70). More importantly, it pinpoints a new topic for further investigation: does signaling influence other post-purchase attitudes or behaviors, such as regret and word of mouth? Further research can also identify whether signals conveyed by other observable aspects of a website, such as aesthetics, have a long-term effect on repurchase intention.

This study has also identified a theoretical mechanism through which signaling affects

repurchase intention. The proposed model depicts how website usability affects expected service quality through signaling, and how the confirmation of expected service quality influences satisfaction and subsequently repurchase intention. This sheds light into the black box of signaling's long-term effect and contributes towards a more comprehensive theoretical understanding of the concept. Notwithstanding, our finding that expectation confirmation partially mediated the effect of signaling on repurchase intention indicates that other mediating mechanisms may be at work. Our review of studies on signaling suggests that trust-related mechanism may be a likely candidate. Further research may study expectation confirmation alongside trust-related mechanisms to determine whether they fully mediate the effect of website usability, though it should be noted that the large and longitudinal model might require much research resources.

The proposed model was tested with data collected in a two-stage study, allowing us to conclude the causal effects more confidently. The pre-purchase signaling effect was measured separately from evaluations of after-sale service quality, satisfaction, and repurchase intention. The data accounted for the temporal order between pre-purchase signaling and repurchase intention. The temporal separation also has the additional advantage of controlling for common method bias. Reducing the cognitive accessibility of responses to predictors collected at an earlier time limits the likelihood that earlier responses influence subsequent responses to outcome variables (Podsakoff et al., 2003).

We have also identified how the effect of signaling varies depending on online shoppers' information need. We found that the signaling effect of website usability is significantly stronger when the perceived risk of a purchase is high and for less experienced shoppers. Examining these moderators clarify the different informational conditions under which signaling is used by online shoppers. Further research studying signaling should consider other moderators capturing information needs, such as personality traits (e.g., trust propensity, need for cognition), to better delineate the boundary conditions of the signaling effect. Interestingly, in this study, we observed that the signaling effect is significant even when perceived risk is low and for experienced online shoppers, though the effect is significantly weaker (see Figure 3). This highlights the prominence of website usability's signaling role for all shoppers.

The proposed model also enriches our understanding of the expectation-confirmation theory by identifying website usability to be a significant antecedent of online shoppers'

expectation. Prior research has mostly focused on the effects of expectation rather than its formation (e.g., Brown et al., 2012; Kim et al., 2009). Our findings indicate that examining the factors influencing online shoppers' expectation may be a fruitful topic for further research, considering that the theory's validity in online shopping has been strongly established (e.g., Bhattacherjee, 2001; Lankton & McKnight, 2012; Limayem et al., 2007; Premkumar & Bhattacherjee, 2008).

Limitations and Suggestions for Future Research

This study's results should be interpreted in light of several limitations. The first six are related to the study's design. First, data were collected from a sample of online shoppers in Taiwan who uses shopping forums/social networking sites and generalizability of our findings is therefore limited. The robustness and generalizability of our findings need to be further established by studying other samples. Second, the shoppers in our sample were users of several major online shopping marketplaces. Although we observed adequate variance in the perceived website usability of different sellers within these marketplaces, our findings can be further validated by studying shoppers browsing business-to-consumer, direct-sale websites. Third, we collected data from users of shopping forums or social networking sites. It is possible for them to gather second-hand information about the service quality of an unfamiliar seller through the forum/social networking sites. The information might influence their pre-purchase expectation of service quality. Future studies might consider controlling for the effect of second-hand information to rule out alternative explanations. Fourth, this study focused on websites selling physical products. The findings may not apply to websites selling digital products (e.g., online gaming, information). We expect the proposed model to be applicable to contexts where after-sale service quality and repurchase intention are important. The proposed model needs to be further ascertained with data collected from these contexts. Fifth, we did not distinguish among product categories. While repurchase intention and the expectation-confirmation theory have been found to be useful for understanding many different product categories in online shopping research, the signaling effect of website usability may be influenced by product category. For example, the signaling effect may be stronger for luxury, expensive products compared to undifferentiated, low-cost products. While this is partly accounted for in the proposed model by the perceived risk construct, accounting for the effect of product category might improve the explanatory power of the proposed model. Sixth, we recruited respondents by inviting those who had browsed the website of an unfamiliar seller (i.e., never purchased a product from the seller before) to participate in the stage 1 survey,

considering that our focus is on the first purchase from an unfamiliar seller. In retrospect, it might be useful to measure familiarity with a seller and control for its effect statistically in data analysis.

There are several limitations related to the proposed model. First, since signaling is used to address information asymmetry, we focused on the moderators influencing shoppers' cognitive information needs (i.e., perceived risk and prior experience). It has been suggested that both cognition and affect may have significant influence in consumer decision making (Shiv & Fedorikhin, 1999). Thus, an opportunity exists to extend the proposed model by accounting for the potential influence of affect. For example, it may be worthwhile to investigate whether the use of signaling is moderated by online shoppers' hedonic shopping motivation. Second, as explained earlier, we focused on the perception of website usability rather than objective usability. A few studies had measured signals objectively and found significant effect (see Table 2). It might be interesting to compare perception-based and objective measures of website signals to determine whether they have the similar signaling effect. Third, website usability encompasses ease of navigation and informativeness. Given our finding of the long-term effect of signaling, there is potential in studying signals at a more specific level to achieve a more detailed understanding of how each website element can be configured to signal service quality. Fourth, the comprehensiveness of the proposed model could be improved by modeling more control variables affecting repurchase intention, such as review rating (Gauri, Bhatnagar, & Rao, 2008).

Implications for Practice

This study shows that signaling after-sale service quality through improving website usability significantly affects online shoppers' repurchase intention through expectation confirmation. Website usability can be directly managed by online sellers, and our findings suggest that it is important to match website usability with the actual level of service quality so that shoppers' expectation is confirmed. Poor website usability is likely to put off new customers, while usability design that raises shoppers' expectation for service quality excessively will lead to dissatisfaction and eventually reduces repurchase intention, thwarting sellers' effort to turn new customers into returning customers. For example, a website that is very easy and efficient to navigate (i.e., good usability) is likely to lead the shopper to expect efficient after-sale order fulfilment (i.e., signaling after-sale service quality). To increase repurchase intention, the seller should ensure that the after-sale service quality indeed matches the expectation set (i.e., expectation is confirmed) and shoppers are satisfied. It does not pay for a low-service-quality

seller to focus excessively on website usability and generate an unrealistic expectation of after-sale service quality (i.e., send an inaccurate pre-purchase signal), since the expectation will soon be disconfirmed and shoppers are unlikely to have strong repurchase intention, threatening the online seller's long-term survival.

The findings related to moderating effects show that the information signaled by website usability remains significant even for customers making low-risk purchases, and matters for experienced online shoppers. These suggest that website usability is important for low-risk as well as high-risk products. It will also continue to have a dominant influence even as electronic commerce becomes more prevalent and online shoppers in general become more experienced.

Conclusion

As the primary point of contact between shoppers and online sellers, website usability serves as a signal that has a long-term effect, in that it influences not just the initial purchase but also repurchase intention. To attract new and returning customers, websites should be designed to send an accurate signal of the online seller's actual after-sale service quality. The findings of this study point towards new avenues of research on the post-purchase and long-term effects of signaling, while also offering pragmatic suggestions for online sellers.

References

Abby, G., Simon, S., & Matthew, J. (1994). Service Quality: Concepts and Models. *International Journal of Quality & Reliability Management, 11*(9), 43-66.

Ahrholdt, D. C. (2011). Empirical Identification of Success-Enhancing Web Site Signals in E-Tailing: An Analysis Base d on Known E-Tailers and the Theory of Reasoned Action. *Journal of Marketing Theory and Practice, 19*(4), 441-458.

Aljukhadar, M., & Senecal, S. (2016). The user multifaceted expertise: Divergent effects of the website versus e-commerce expertise. *International Journal of Information Management, 36*(3), 322-332.

Baker, J., Grewal, D., & Parasuraman, A. (1994). The influence of store environment on quality inferences and store image. *Journal of the Academy of Marketing Science, 22*(4), 328-339.

Bauer, H. H., Falk, T., & Hammerschmidt, M. (2006). eTransQual: A transaction process-based approach for capturing service quality in online shopping. *Journal of Business Research, 59*(7), 866-875.

Besharat, A. (2010). How co-branding versus brand extensions drive consumers' evaluations of new products: A brand equity approach. *Industrial Marketing Management, 39*(8), 1240-1249.

Bhatnagar, A., Misra, S., & Rao, H. R. (2000). On risk, convenience, and Internet shopping behavior. *Communications of the ACM, 43*(11), 98-105.

Bhattacherjee, A. (2001). Understanding Information Systems Continuance: An Expectation-Confirmation Model. *MIS Quarterly, 25*(3), 351-370.

Bhattacherjee, A., & Premkumar, G. (2004). Understanding Changes in Belief and Attitude toward Information Technology Usage: A Theoretical Model and Longitudinal Test. *MIS Quarterly, 28*(2), 229-254.

Boulding, W., Kalra, A., Staelin, R., & Zeithaml, V. A. (1993). A dynamic process model of service quality: from expectations to behavioral intentions. *Journal of Marketing Research, 30*(1), 7-27.

Boulding, W., & Kirmani, A. (1993). A consumer-side experimental examination of signaling theory: do consumers perceive warranties as signals of quality? *Journal of Consumer Research* (Vol. 20, pp. 111-123).

Brown, S. A., Venkatesh, V., & Goyal, S. (2012). Expectation Confirmation in Technology Use. *Information Systems Research, 23*(2), 474-487.

Cenfetelli, R. T., & Bassellier, G. (2009). Interpretation of Formative Measurement in Information Systems Research. *MIS Quarterly, 33*(4), 689-708.

Chen, M.-Y., & Teng, C.-I. (2013). A comprehensive model of the effects of online store image on purchase intention in an e-commerce environment. *Electronic Commerce Research, 13*(1), 1-23.

Chen, S. Y., & Macredie, R. D. (2005). The assessment of usability of electronic shopping: A heuristic evaluation. *International Journal of Information Management, 25*(6), 516-532.

Chiagouris, L., & Ray, I. (2010). Customers on the web are not all created equal: the moderating role of internet shopping experience. *The International Review of Retail, Distribution and Consumer Research, 20*(2), 251-271.

Chiu, C.-M., Wang, E. T. G., Fang, Y.-H., & Huang, H.-Y. (2014). Understanding customers' repeat purchase intentions in B2C e-commerce: the roles of utilitarian value, hedonic value and perceived risk. *Information Systems Journal, 24*(1), 85-114.

Conchar, M. P., Zinkhan, G. M., Peters, C., & Olavarrieta, S. (2004). An integrated framework for the conceptualization of consumers' perceived-risk processing. *Journal of the Academy of Marketing Science, 32*(4), 418-436.

Connelly, B. L., Certo, S. T., Ireland, R. D., & Reutzel, C. R. (2011). Signaling theory: A review and assessment. *Journal of Management, 37*(1), 39-67.

Craighead, C. W., Ketchen, D., Dunn, K. S., & Hult, G. (2011). Addressing common method variance: guidelines for survey research on information technology, operations, and supply chain management. *IEEE Transactions on Engineering Management, 58*(3), 578-588.

Dahlen, M. (2001). Banner advertisements through a new lens. *Journal of Advertising Research, 41*(4), 23-30.

Dholakia, U. M. (2001). A motivational process model of product involvement and consumer risk perception. *European Journal of Marketing, 35*(11/12), 1340-1362.

Dowling, G. R., & Staelin, R. (1994). A Model of Perceived Risk and Intended Risk-Handling Activity. *The Journal of Consumer Research, 21*(1), 119-134.

Dutta, S., & Biswas, A. (2005). Effects of low price guarantees on consumer post-purchase search intention: The moderating roles of value consciousness and penalty level. *Journal of Retailing, 81*(4), 283-291.

Dutta, S., Biswas, A., & Grewal, D. (2007). Low price signal default: an empirical investigation of its consequences. *Journal of the Academy of Marketing Science, 35*(1), 76-88.

Edwards, J. R. (2002). Alternatives to difference scores: Polynomial regression and response surface methodology. In F. Drasgow & N. Schmitt (Eds.), *Measuring and analyzing behavior in organizations: Advances in measurement and data analysis* (pp. 350-400). San Francisco: Jossey-Bass.

Euromonitor International. (2017). Internet Retailing in Taiwan. Retrieved from http://www.euromonitor.com/internet-retailing-in-taiwan/report

Fang, J., Wen, C., George, B., & Prybutok, V. R. (2016). CONSUMER HETEROGENEITY, PERCEIVED VALUE, AND REPURCHASE DECISION-MAKING IN ONLINE SHOPPING: THE ROLE OF GENDER, AGE, AND SHOPPING MOTIVES. *Journal of Electronic Commerce Research, 17*(2), 116.

Fang, Y., Qureshi, I., Sun, H., McCole, P., Ramsey, E., & Lim, K. H. (2014). Trust, Satisfaction, and Online Repurchase Intention: The Moderating Role of Perceived Effectiveness of E-Commerce Institutional Mechanisms. *MIS Quarterly, 38*(2), 407-427.

Flavián, C., Guinalíu, M., & Gurrea, R. (2006). The role played by perceived usability, satisfaction and consumer trust on website loyalty. *Information & Management, 43*(1), 1-14.

Forrester Research Incorporated. (2015). Forrester Research Online Retail Forecast, 2015 To 2020 (US). Retrieved from https://www.forrester.com/report/Forrester+Research+Online+Retail+Forecast+2015+To+2020+US/-/E-RES125161

Forsythe, S. M., & Shi, B. (2003). Consumer patronage and risk perceptions in Internet shopping. *Journal of Business Research, 56*(11), 867-875.

Gauri, D. K., Bhatnagar, A., & Rao, R. (2008). Role of word of mouth in online store loyalty. *Communications of the ACM, 51*(3), 89-91.

Gould, J. D., & Lewis, C. (1985). Designing for usability: key principles and what designers think. *Commun. ACM, 28*(3), 300-311.

Grant, R., Clarke, R. J., & Kyriazis, E. (2007). A review of factors affecting online consumer search behaviour from an information value perspective. *Journal of Marketing Management, 23*(5-6), 519-533.

Green, D. T., & Pearson, J. M. (2011). Integrating website usability with the electronic commerce acceptance model. *Behaviour & Information Technology, 30*(2), 181-199.

Gregg, D. G., & Walczak, S. (2008). Dressing Your Online Auction Business for Success: An Experiment Comparing Two eBay Businesses. *MIS Quarterly, 32*(3), 653-670.

Henseler, J., & Fassott, G. (2010). Testing Moderating Effects in PLS Path Models: An Illustration of Available Procedures. In E. V. Vinzi, W. W. Chin, J. Henseler, & H. Wang (Eds.), *Handbook of Partial Least Squares* (pp. 713-735): Springer Berlin Heidelberg.

Hernández, B., Jiménez, J., & Martín, M. J. (2010). Customer behavior in electronic commerce: The moderating effect of e-purchasing experience. *Journal of Business Research, 63*(9-10), 964-971.

Hong, Y., & Pavlou, P. A. (2012). *An empirical investigation on provider pricing in online crowdsourcing markets for IT services.* Paper presented at the International Conference on Information Systems, ICIS 2012.

Hossain, M. A., & Quaddus, M. (2012). Expectation-confirmation Theory in Information System Research: A Review and Analysis. In Yogesh K. Dwivedi, Michael R. Wade, & S. L. Schneberger (Eds.), *Information Systems Theory* (Vol. 28, pp. 441-469). New York: Springer.

Hu, M., Rabinovich, E., & Hou, H. (2015). Customers Complaints in Online Shopping: The Role of Signal Credibility. *Journal of Electronic Commerce Research, 16*(2), 95.

Jin, B., & Park, J. Y. (2006). The moderating effect of online purchase experience on the evaluation of online store attributes and the subsequent impact on market response outcomes. *Advances in Consumer Research, 33*, 203-211.

Kalia, P. (2016). E-service quality, consumer satisfaction and future purchase intentions in e-retail. *e-Service Journal, 10*(1), 24.

Khalifa, M., & Liu, V. (2007). Online consumer retention: contingent effects of online shopping habit and online shopping experience. *European Journal of Information Systems, 16*(6), 780-792.

Kim, D. J., Ferrin, D. L., & Rao, H. R. (2008). A trust-based consumer decision-making model in electronic commerce: The role of trust, perceived risk, and their antecedents. *Decision Support Systems, 44*(2), 544-564.

Kim, D. J., Ferrin, D. L., & Rao, H. R. (2009). Trust and Satisfaction, Two Stepping Stones for Successful E-Commerce Relationships: A Longitudinal Exploration. *Information Systems Research, 20*(2), 237-257.

Kim, H.-W., Xu, Y., & Koh, J. (2004). A comparison of online trust building factors between potential customers and repeat customers. *Journal of the Association for Information Systems, 5*(10), 13.

Kirmani, A., & Rao, A. R. (2000). No pain, no gain: A critical review of the literature on signaling unobservable product quality. *Journal of Marketing, 64*(2), 66-79.

Klein, L. R., & Ford, G. T. (2003). Consumer search for information in the digital age: An empirical study of prepurchase search for automobiles. *Journal of Interactive Marketing, 17*(3), 29-49.

Ladhari, R. (2010). Developing e-service quality scales: A literature review. *Journal of Retailing and Consumer Services, 17*(6), 464-477.

Lankton, N. K., & McKnight, H. D. (2012). Examining Two Expectation Disconfirmation Theory Models: Assimilation and Asymmetry Effects. *Journal of the Association for Information Systems, 13*(2), 88-115.

Lee, G.-G., & Lin, H.-F. (2005). Customer perceptions of e-service quality in online shopping. *International Journal of Retail & Distribution Management, 33*(2), 161-176.

Li, H., Fang, Y., Wang, Y., Lim, K. H., & Liang, L. (2015). Are all signals equal? Investigating the differential effects of online signals on the sales performance of e-marketplace sellers. *Information Technology & People, 28*(3), 699-723.

Limayem, M., Hirt, S. G., & Cheung, C. M. K. (2007). How Habit Limits the Predictive Power of Intention: The Case of Information Systems Continuance. *MIS Quarterly, 31*(4), 705-737.

Lohse, G. L., Bellman, S., & Johnson, E. J. (2000). Consumer buying behavior on the Internet: Findings from panel data. *Journal of Interactive Marketing, 14*(1), 15-29.

Marie, C. R., Olivier, D., & Benoit, A. A. (2001). The impact of interface usability on trust in web retailers. *Internet Research, 11*(5), 388-398.

Mathwick, C., Malhotra, N., & Rigdon, E. (2001). Experiential value: conceptualization, measurement and application in the catalog and Internet shopping environment☆. *Journal of Retailing, 77*(1), 39-56.

Mavlanova, T. (2015). The Effect of Positive and Negative Signals on Perceived Deceptiveness of Websites in Online Markets. *Journal of theoretical and applied electronic commerce research, 10*(1), 19.

Mavlanova, T., Benbunan-Fich, R., & Koufaris, M. (2012). Signaling theory and information asymmetry in online commerce. *Information & Management, 49*(5), 240-247.

Mavlanova, T., Benbunan-Fich, R., & Lang, G. (2016). The role of external and internal signals in E-commerce. *Decision Support Systems, 87*(Supplement C), 59-68.

McKinney, V., Yoon, K., & Zahedi, F. M. (2002). The Measurement of Web-Customer Satisfaction: An Expectation and Disconfirmation Approach. *Information Systems Research, 13*(3), 296-315.

Mitra, K., Reiss, M. C., & Capella, L. M. (1999). An examination of perceived risk, information search and behavioral intentions in search, experience and credence services. *Journal of Services Marketing, 13*(3), 208-228.

Murray, K. B. (1991). A test of services marketing theory: consumer information acquisition activities. *The Journal of Marketing, 55*(1), 10-25.

Palmer, J. W. (2002). Web Site Usability, Design, and Performance Metrics. *Information Systems Research, 13*(2), 151-167.

Parasuraman, A., Zeithaml, V. A., & Berry, L. L. (1985). A Conceptual Model of Service Quality and Its Implications for Future Research. *Journal of Marketing, 49*(4), 41-50.

Park, J., & Stoel, L. (2005). Effect of brand familiarity, experience and information on online apparel purchase. *International Journal of Retail & Distribution Management, 33*(2), 148-160.

Petter, S., D. Straub, & Rai, A. (2007). Specifying Formative Constructs in Information Systems Sesearch. *MIS Quarterly, 31*(4), 623-656.

Podsakoff, P. M., MacKenzie, S. B., Lee, J.-Y., & Podsakoff, N. P. (2003). Common Method Biases in Behavioral Research: A Critical Review of the Literature and Recommended Remedies. *Journal of Applied Psychology, 88*(5), 879-903.

Premkumar, G., & Bhattacherjee, A. (2008). Explaining information technology usage: A test of competing models. *Omega, 36*(1), 64-75.

Qazi, A., Tamjidyamcholo, A., Raj, R. G., Hardaker, G., & Standing, C. (2017). Assessing consumers' satisfaction and expectations through online opinions: Expectation and disconfirmation approach. *Computers in Human Behavior, 75*(Supplement C), 450-460.

Rao, A. R., & Monroe, K. B. (1988). The Moderating Effect of Prior Knowledge on Cue Utilization in Product Evaluations. *Journal of Consumer Research, 15*(2), 253-264.

Riasanow, T., Ye, H. J., & Goswami, S. (2015, 5-8 Jan. 2015). *Generating Trust in Online Consumer Reviews through Signaling: An Experimental Study.* Paper presented at the 48th Hawaii International Conference on System Sciences.

Richardson, P. S., Dick, A. S., & Jain, A. K. (1994). Extrinsic and intrinsic cue effects on perceptions of store brand quality. *The Journal of Marketing, 58*(4), 28-36.

Schlosser, A. E., White, T. B., & Lloyd, S. M. (2006). Converting Web Site Visitors into Buyers: How Web Site Investment Increases Consumer Trusting Beliefs and Online Purchase Intentions. *Journal of Marketing, 70*(2), 133-148.

Schmidt, J., & Spreng, R. (1996). A proposed model of external consumer information search. *Journal of the Academy of Marketing Science, 24*(3), 246-256.

Shim, S., Eastlick, M. A., Lotz, S. L., & Warrington, P. (2001). An online prepurchase intentions model: The role of intention to search. *Journal of Retailing, 77*(3), 397-416.

Shin, J. I., Chung, K. H., Oh, J. S., & Lee, C. W. (2013). The effect of site quality on repurchase intention in Internet shopping through mediating variables: The case of university students in South Korea. *International Journal of Information Management, 33*(3), 453-463.

Shiv, B., & Fedorikhin, A. (1999). Heart and mind in conflict: The interplay of affect and cognition in consumer decision making. *Journal of Consumer Research, 26*(3), 278-292.

Spreng, R. A., MacKenzie, S. B., & Olshavsky, R. W. (1996). A Reexamination of the Determinants of Consumer Satisfaction. *Journal of Marketing, 60*(3), 15-32.

Srinivasan, S. S., Anderson, R., & Ponnavolu, K. (2002). Customer loyalty in e-commerce: an exploration of its antecedents and consequences. *Journal of Retailing, 78*(1), 41-50.

Srivastava, J., & Lurie, N. H. (2004). Price-matching guarantees as signals of low store prices: survey and experimental evidence. *Journal of Retailing, 80*(2), 117-128.

Susarla, A., Barua, A., & Whinston, A. B. (2003). Understanding the service component of application service provision: empirical analysis of satisfaction with ASP services. *MIS Quarterly, 27*(1), 91-123.

Thüring, M., & Mahlke, S. (2007). Usability, aesthetics and emotions in human-technology interaction. *International Journal of Psychology, 42*(4), 253-264.

Tractinsky, N. (1997). *Aesthetics and apparent usability: empirically assessing cultural and methodological issues.* Paper presented at the Proceedings of the ACM SIGCHI Conference on Human factors in computing systems.

Udo, G. J., Bagchi, K. K., & Kirs, P. J. (2010). An assessment of customers' e-service quality perception, satisfaction and intention. *International Journal of Information Management, 30*(6), 481-492.

Valvi, A. C., & West, D. C. (2013). E-loyalty is not all about trust, price also matters: extending expectation-confirmation theory in bookselling websites. *Journal of Electronic Commerce Research, 14*(1), 99.

Ward, M. R., & Lee, M. J. (2000). Internet shopping, consumer search and product branding. *Journal of Product & Brand Management, 9*(1), 6-20.

Wells, J. D., Valacich, J. S., & Hess, T. J. (2011). What Signals Are You Sending? How Website Quality Influences Perceptions of Product Quality and Purchase Intentions. *MIS Quarterly, 35*(2), 373-396.

Wen, C., Prybutok, V. R., & Xu, C. (2011). An integrated model for customer online repurchase intention. *Journal of Computer Information Systems, 52*(1), 14-23.

Wetzels, M., Odekerken-Schroder, G., & Van Oppen, C. (2009). Using PLS path modeling for assessing hierarchical construct models: guidelines and empirical illustration. *MIS Quarterly, 33*(1), 177-195.

Wolfinbarger, M., & Gilly, M. C. (2003). eTailQ: dimensionalizing, measuring and predicting etail quality. *Journal of Retailing, 79*(3), 183-198.

Wu, I.-L., & Huang, C.-Y. (2015). Analysing complaint intentions in online shopping: the antecedents of justice and technology use and the mediator of customer satisfaction. *Behaviour & Information Technology, 34*(1), 69-80.

Xu, J. D., Benbasat, I., & Cenfetelli, R. T. (2013). Integrating service quality with system and information quality: An empirical test in the e-service context. *Management Information Systems Quarterly, 37*(3), 777-794.

Yen, C. H., & Lu, H. P. (2008). Factors influencing online auction repurchase intention. *Internet Research, 18*(1), 7-25.

Zhang, J., Li, H., Yan, R., & Johnston, C. (2017). Examining the Signaling Effect of E-tailers' Return Policies. *Journal of Computer Information Systems, 57*(3), 191-200.

Appendix A. Survey Instrument

Survey Instrument		
Construct and Definition	**Item[a]**	**Reference**
Perceived Website Usability (PWU; Pre-purchase)	PWU1 (ease of navigation): This online store is easy to navigate. PWU2 (informativeness): This online store provides informative product description. PWU3 (selection): I am able to find the product I want in this online store.	Wolfinbarger and Gilly (2003)
Service Quality Expectation (SQE; Pre-purchase)	SQE1: I expect to get good after-sale service from this online store. SQE2: I expect this online store to process transactions efficiently (e.g., order, payment processing, delivery). SQE3: I expect purchasing from this online store to be secured. SQE4: I expect purchasing from this online store to be convenient.	Bauer, Falk, and Hammerschmidt (2006); Ladhari (2010)
Perceived Service Quality (PSQ)	PSQ1: I got good after-sale service from this online store. PSQ2: This online store processed transactions efficiently (e.g., order, payment processing, delivery). PSQ3: Purchasing from this online store was secured. PSQ4: Purchasing from this online store was convenient.	
Service Quality Confirmation (SQC)	SQC1: The after-sale service by this online store was better than expected. SQC2: This online store processed transactions more efficiently (e.g., order, payment processing, delivery) than expected. SQC3: Purchasing from this online store was more secured than expected SQC4: Purchasing from this online store was more convenient than expected.	
Perceived Risk (PR; Pre-purchase)	PR1 (overall risk): There is little risk that my purchase will go wrong (reverse coded). PR2 (financial risk): The price I pay is high. PR3 (product risk): I am confident that the product I purchase will be correct (reverse coded).	Bhatnagar et al. (2000); Kim et al. (2008)
Prior Experience with Online Shopping (PE; Pre-purchase)	PE1: I have shopped online extensively. PE2: I have used the Internet to shop for a long time. PE3: I shop online frequently.	Khalifa and Liu (2007)
Satisfaction (ST)	How do you feel about this purchase? ST1: Very dissatisfied – Very satisfied ST2: Very displeased – Very pleased ST3: Very frustrated – Very contented ST4: Absolutely terrible – Absolutely delighted (measured with seven-point semantic differential scales)	Spreng et al. (1996)
Repurchase Intention (RI)	RI1: I anticipate to repurchase from this online store in the near future RI2: It is likely that I will repurchase from this online store in the near future RI3: I expect to repurchase from this online store in the near future	Khalifa and Liu (2007)
[a] All items were measured with a seven-point Likert scale except for those measuring satisfaction.		