

A Comprehensive Model of Perceived Risk of E-Commerce Transactions

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ABSTRACT: Perceived risk is an important construct in e-commerce research, but it has not been approached in a manner sufficiently systematic, comprehensive, or detailed to be understood along multiple dimensions instructive for information systems designers. This paper fills the gap by proposing a model of perceived risk based on a well-established marketing theory of risk. It identifies events that expose consumers to harm in e-commerce transactions and measures the dimensions of perceived risk with rigorously developed formative indicators that incorporate the almost unlimited range of unwanted events of potential concern to consumers. This risk construct is placed in a nomological network and tested through an on-line field study of 411 participants aggregated with structural equation modeling. Test results show that the construct e-commerce transaction perceived risk is an aggregate factor with three dimensions: risk of functionality inefficiency, risk of information misuse, and risk of failure to gain product benefit.

KEY WORDS AND PHRASES: B2C commerce, consumer risks, perceived risk, risk dimensions, risk events, risk measures, risk-reducing IT, transaction risk.

According to a U.S. Department of Commerce press release, business-to-consumer (B2C) e-commerce in the United States has grown in recent years, expanding at an annual rate of 8 percent from 2006 to 2009 [64]. However, this growth predominantly mirrors the growth of the overall retail market, which had an annual rate of 6 percent over the same period—from 2006 to 2009, the proportion of Internet retail sales grew only slightly, from 3.4 percent to 3.9 percent [64]. The underachievement of the retail e-commerce sales channel has prompted researchers in management information systems (MIS) and other areas to investigate the factors that encourage consumers to buy on the Web as well as the factors that may be preventing them from doing so.

Much research addressing these issues has focused on how to increase consumer trust in order to influence willingness to transact using e-commerce (e.g., [2, 22]), rather than on how to reduce the perceived risk that makes a high level of trust necessary in the first place. One reason for the relative lack of attention to perceived risk might be the difficulty of untangling its many compounded aspects—the risks attendant upon the purchase of any product or service are compounded with the risks of conducting an on-line transaction, and of making the purchase through electronic means over a public network [24]. However, it would be well worth the effort for information systems (IS) researchers to untangle these complexities and understand consumers' risk beliefs because some perceived risks may be unique to or exacerbated by the context of a B2C e-commerce transaction and highly influential to consumer behavior. These risk beliefs may explain the reluctance of some consumers

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to buy on the Web and also offer an opportunity for the use of information technology (IT) tools and other, non-IT interventions to reduce the perceived risks [5, 6, 45].

This paper develops a risk framework that IS researchers can utilize to conduct research on (1) the types of risks that concern prospective customers and thus need to be alleviated in order for e-commerce to prosper and (2) what IT tools need to be provided on the Web and how consumers can use them to reduce their perceived B2C e-commerce transaction risks. Guided by strong theory from seminal marketing research on perceived risk, the study applies a detailed methodological and comprehensive approach to derive the full range of risks in the e-commerce context [14].

The Case for a New Risk Model: Prior Research on Perceived Risk

Perspectives on Perceived Risk

Both early marketing studies and current research on the nature of perceived risk make a clear distinction between objective risk as it exists in the real world and risk as it is subjectively understood by the consumer. Bauer differentiates the two, defining *perceived risk* as an appropriate focus for consumer behavior researchers because consumers can only respond to risks they perceive subjectively. In contrast, while *objective risk* certainly exists for consumers, they cannot respond to what they do not perceive [4].

Perceived risk is commonly regarded as a person's perception of the uncertain and adverse consequences of engaging in an activity [18, 27]. Other researchers have described perceived risk in the e-commerce context as the extent to which a user believes that using the Web is unsafe or may have negative consequences [25, 40]. Both conceptualizations echo Bauer's definition of perceived risk as a consumer's expectation that purchasing actions could have unwanted consequences [4]. However, the study of perceived risk in B2C e-commerce differs from that in traditional marketing in that it also considers concerns associated with the on-line channel and point of purchase, rather than just the risks that arise from the product itself [28, 58]. Therefore, the present research paraphrases Bauer by defining B2C e-commerce transaction perceived risk as a consumer's expectation that the actions entailed in purchasing a good or a service from a B2C e-commerce site could have unwanted outcomes [4]. While there is some perceived risk in the purchase of a product at a physical store, the risks may be exacerbated in an e-commerce situation. For example, in an e-commerce transaction, the exchange occurs over a public network, the consumer may not be able to test the product, and the range of products available for purchase may be very large.

In order to make the case that researchers and practitioners will benefit from a new model of e-commerce perceived risk, it is necessary to first examine the existing models. Two fundamental methods of conceptualizing perceived risk are commonly found in the e-commerce literature:

1. The first method operationalizes perceived risk as a unidimensional whole [22, 25, 27, 31, 47, 49]. For example, Jarvenpaa, and Tractinsky developed and tested a model of the relationship of perceived risk, trust, attitude, and willingness to buy [27]. Perceived risk, measured as a unidimensional whole, was found to act as an antecedent of attitude and a mediator of the effect of trust on willingness to buy. More recently, Kim, Ferrin, and Rao included a unidimensional construct of perceived risk in their longitudinal trust-satisfaction model [30].

Although the unidimensional conceptualization of perceived risk has been shown to be meaningful in e-commerce and has demonstrated that perceived risk and trust are separate (though related) constructs, it does not provide researchers and practitioners with the finer granularity of information required to design specifically IT-based and non-IT-based interventions. In order to determine how researchers and practitioners can influence consumer perceived risk to support e-commerce, it is necessary to examine the underlying structure of perceived risk in more detail.

2. The second method operationalizes multiple dimensions (or attributes, or facets) of perceived risk. Spiekermann and Paraschiv suggested a breakdown of overall perceived risk into the attributes of social/psychological risk, functional risk, financial risk, and level of delivery risk [55]. The model of perceived risk proposed by Park, Lee, and Ahn posited that it has two attributes: perceived risk of the transaction, using items that reflect security, privacy, and nonrepudiation (deniability of the transaction); and perceived risk of the product/service, using items that reflect functional loss, financial loss, time loss, opportunity loss, and overall perceived risk with product/service [46]. Featherman and Pavlou found that performance risk (the risk that an e-service system will not perform as expected) is an antecedent to perceived risk and distinct from the types of harm that might occur (financial, privacy, psychological, and time) [20]. Pavlou, Liang, and Xue applied agency theory to study perceived uncertainty in e-commerce adoption, finding that fears of seller opportunism and perceived information asymmetry form perceived uncertainty, along with the additional constructs of information privacy concerns and information security concerns [48]. Crespo, del Bosque, and de los Salmones applied perceived risk using the dimensions of the types of harm experienced by consumers (financial loss, time loss, psychological harm, social harm, physical harm) to determine their effects on e-commerce user intentions [15].

However, the various dimensions of risk already identified and researched are not sufficient. To explain why this might be the case, past perceived risk research in e-commerce was examined through the lens of a model of risk that used a three-stage process to describe how a consumer could experience harm from a transaction [63]: (1) some phenomenon or actor is the *source* of the risk; (2) a consumer will only suffer harm from that phenomenon if an *event* exposing the consumer to harm occurs; and (3) this event may result in one or more *types of harm* to the consumer. Each stage of this process provides a perspective for the investigation of perceived risk in e-commerce, resulting in three perspectives, as shown in Figure 1. Existing e-commerce perceived risk

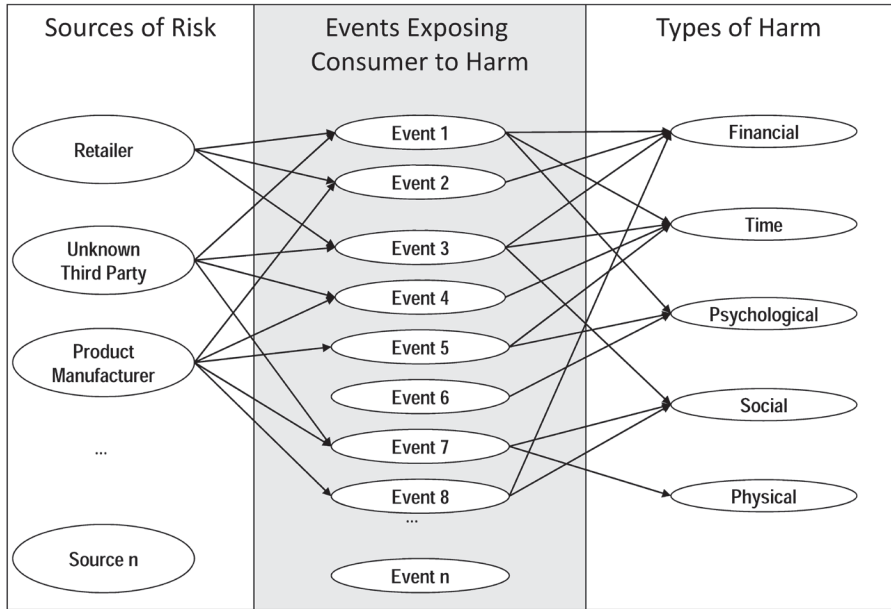


Figure 1. Three Perspectives on Perceived Risk

research was analyzed using this lens. Appendix A summarizes the findings from selected multidimensional studies, the dimensions of perceived risk identified, and the perspectives taken.

The first perspective focuses on the source of the risk: the environment, object, or actor responsible for an event that causes harm to the e-commerce consumer. For example, Tung et al. suggest that risk in e-commerce may come about from the choice of product or vendor, while Miyazaki and Fernandez identified security risk as arising from either of two sources, the Web retailer and third parties [42, 59]. Unfortunately, the identification of the source of a perceived risk may not provide enough information regarding what precisely the consumer fears from that source, and therefore such a conceptualization of perceived risk may not help in designing relevant IT tools.

The second perspective focuses on the various types of harm the consumer may experience: financial loss, time loss, psychological harm, social harm, and physical harm. This perspective on consumer perceived risk is widely used by marketing researchers and more recently has been adopted by e-commerce researchers [15, 32, 41]. However, measuring each type of harm provides little indication of how an IT tool might be used to change this risk or its perception because it does not focus upon the *source of harm* or the *event* that exposed the consumer to this *type of harm*. For example, knowing that a consumer fears both financial loss and loss of time in a Web transaction does not inform the practitioner of the steps to take or the IT tool to employ to reduce the perceived risk.

The third perspective focuses on events in the course of an e-commerce transaction that expose the consumer to harm. For example, Featherman and

Pavlou found that the harm perceived by the user of e-services arose from the event in which the service failed to perform as designed and advertised, and failed to deliver the desired benefits (an event that causes harm) [20]. Miyazaki and Fernandez also adopted the event perspective (in combination with the source perspective) to identify privacy risk and the inconveniences of on-line shopping as events that may occur while shopping on-line [42]. Although this perspective on risk seems to offer the greatest potential for IT-based interventions, the research to date has not methodically generated the full range of events that consumers may perceive as causing them harm. Further, perspectives regarding the dimensions of perceived risk are sometimes considered in combination. For example, the types of harm perspective was adapted to an e-services setting by Featherman and Pavlou, along with the perspective of the events that could cause the harm [20]. Their research, finding that performance risk (an event) was an antecedent to the types of harm that could occur, provides support for the model in Figure 1.

Based on the preceding discussion, it is here argued that a focus on events that expose a consumer to harm and an approach that accounts for the full breadth and depth of possible detrimental events are the best way to inform practitioners about how to design IT tools that will alleviate consumers' perceived risks. However, since the extraordinary range of events possible in an e-commerce transaction is limited only by the creativity of wrongdoers and the imagination of consumers, the goal here is to develop a model of e-commerce perceived risk that is both comprehensive and usable.

Development of the Research Model

Dimensions of E-Commerce Transaction Perceived Risk

According to the theory of reasoned action (TRA), one's behavior is influenced by one's attitude toward the behavior (along with one's beliefs regarding the subjective norm regarding the behavior) [1]. Attitude toward a behavior is influenced by one's beliefs regarding the events resulting from that behavior, both negative and positive. The behavior that the present research seeks to understand (and that practitioners seek to influence) is the behavior of buying on the Web. Thus this study on risk aims to understand a set of negative beliefs that consumers might hold regarding events that could occur when they buy on the Web. Since the range of such events is vast, however, the researcher must categorize them in a set of dimensions that group together those that harm consumers in similar ways. To do this, a theoretical framework is needed that expresses the full range of ways consumers may experience harm in a transaction.

Fortunately, marketing researchers studying perceived risk have provided a theory-driven starting point for identifying the causes of e-commerce transaction perceived risk. In his foundational book on the structure of perceived risk, Cox expressed risk from the perspective of the consumer in order to identify the range of perceived risks that could harm consumers [13, p. 37]. The model Cox proposed is still cited today to explain consumer perceived

risk (e.g., [36]). Cox identified three overarching ways in which consumers are exposed to harm in a transaction: (1) they may not gain the benefit they are seeking, (2) they may have to pay a penalty for trying to make the gain, and (3) they may lose the resources they hoped to gain. Writing in 1967, Cox was obviously not considering risks that might occur as a result of transacting over the Internet. Nevertheless, the general risk types he proposed may also apply to Internet consumers.

In e-commerce, consumers attempt to purchase a product that best meets their needs, with the least expenditure of time and effort, and avoiding harm. Adapting Cox's general risks to the context of an e-commerce transaction, the general risk categories facing e-commerce consumers are: (1) the product purchased on the Web might not deliver the expected product-related benefits (benefits sought through the purchase are not gained); (2) the consumer will face ancillary harm when buying on the Web, such as loss of privacy (paying a penalty for trying to make the gain); and (3) the consumer will waste time, money, or effort in making the purchase on the Web (losing the resources with which the consumer hoped to make the gain).

The dimensions of perceived risk in prior research discussed above are subsumed within the three general risk categories now proposed. First, consumers are concerned that the product or service they buy on the Web might not deliver the expected benefits [20]. This is true whether the problem results from the product, the retailer, the transaction, or the fact that the product was not delivered as expected [39, 46, 55, 59]. While the same risk also exists in a purchase from a physical store, it is exacerbated in a purchase over the Web, and this justifies its inclusion as a dimension of e-commerce transaction perceived risk. This general risk is labeled as failure to gain product benefit risk.

Second, consumers fear that they may face ancillary harm by buying a product on the Web. This might stem, for instance, from the need for the consumer to provide personal and financial information over a public network, often to a retailer whose use of the information cannot be predicted or controlled. Privacy and information security have been identified as very important concerns for e-commerce users [20, 35, 42, 48]. Malhotra, Kim, and Agarwal found that Internet user information privacy concerns were related to consumers' perceived risk [37]. Similarly, Van Slyke et al. observed that consumer concerns about information privacy were related to their perceived risks [61]. This general risk is labeled as information misuse risk.

Third, consumers fear that they may lose the resources they hoped to gain. Although the possible wastage of time, money, and effort is not limited to transactions on the Internet, the risk is exacerbated in e-commerce transactions [13]. While the functionality offered in an e-commerce Web site exists to enhance or facilitate the identification, purchase, delivery, and maintenance of a core product offering, the e-commerce transaction process is primarily a self-serve process and therefore requires an investment of time, effort, know-how, and (perhaps) money on the part of the consumer to make use of the function [7]. This phenomenon is similar to the "minimizing time" fundamental objectives identified by Keeney [28] and the "inconveniences of online shopping" identified by Miyazaki and Fernandez [42]. For example, the use of an on-line

product-recommendation agent in a purchase may require time and effort to specify detailed preferences for a number of product attributes [66]. Using this functionality may require more investment than the consumer cares to make. The risk of wasting the time, effort, and money expended in making a purchase transaction on the Web from which the consumer hoped to make a gain is labeled as the functionality inefficiency risk.

The proposed e-commerce transaction perceived risk construct is modeled as an aggregate factor of these three dimensions—information misuse, failure to gain product benefit, and functionality inefficiency risks—consistent with the work of Petter, Straub, and Rai [50] and of Diamantopolous and Winklhofer [16] because the dimensions are viewed as causing, rather than being caused by, the construct.

Development of the Formative Measures

Each of the three dimensions identified above is a complex construct in itself, formed by a number of beliefs that consumers hold regarding specific events that may cause harm. This meets the definition of a formative or aggregate construct by Petter et al. (i.e., a composite of multiple measures) [50]. Therefore, each dimension may best be assessed with formative measures that express the range of events that concern consumers [50]. Edwards's recommendation for the measurement of an aggregate multidimensional construct suggests that the dimensions of the aggregate construct be treated as latent variables and their measures as manifest variables [19]. That is the approach adopted in the present research.

Researchers developing formative measures for aggregate constructs need to be concerned with two key issues prior to empirical validation of the measure: content specification and indicator specification [16]. For content specification, the range of events that may cause harm to consumers was identified from Cox's seminal theory. For indicator specification, a systematic process to identify and summarize the events of concern to consumers was conducted. The measures were developed using the following processes:

- A panel of e-commerce researchers and consumers elicited the events that consumers perceive might result in unwanted outcomes, based on the three perspectives recommended by Lewis, Templeton, and Byrd [33].
- A procedure similar to Keeney's [28] was used to group the elicited events, which were then grouped in nine emergent measures of the three general risk categories derived from Cox [13], based on the way the events expose the consumer to harm.
- The nine measures were validated as representing the consensus of the panel through q-sorts of the events using subgroups of the participants in step 1.
- Semantically differential items were developed for each of the measures.

- The items were validated through another q-sort of the items using subgroups of the participants in step 1 in different combinations than step 3.

The members of the panel, which was made up of 10 e-commerce researchers and graduate students at a public university, were surveyed individually to elicit the unwanted events that could cause them harm as consumers during an e-commerce transaction. In order to identify events resulting from as many aspects of an e-commerce transaction as possible, three steps were used, as recommended in the development of measures for IS research by Lewis et al. [33]. Panel members were surveyed to elicit harmful events using perspectives of the stages of the transaction as represented by the e-commerce Customer Service Life Cycle (ECSLC) [7], the possible participants in the transaction, and the characteristics of an e-commerce transaction.

As a result of the above process, the panel identified 104 unique unwanted e-commerce events. Keeney's approach (grouping concerns about the Internet according to their "bottom line consequences") was then used to group the events according to the way the event exposed the consumer to harm [28]. The three general risks discussed by Cox were used as a framework of the ways the events expose consumers to harm, grouping the 104 unwanted events under these three general risks [13]. The events were grouped into nine emergent *subdimensions* under the general risks, thereby identifying the formative measures of the three general risks. For example, a consumer may express a concern regarding a particular event: "Someone may intercept my personal information during an e-commerce transaction." Another consumer may be concerned with other events: "The Web site may not secure my personal information well," or "The Internet site may sell my personal information to another company." Each of these events causes harm to the consumer when information is misused—specifically, when personal information is misused. Thus, these statements can be categorized together by the way they expose the consumer to harm: in this case, the misuse of personal information. As a result, the misuse of personal information was identified as a subdimension and a formative measure of the general risk of the misuse of information.

Consistent with Diamantopoulos and Winklhofer, the formative measures should represent a census of the dimensions of the construct being measured [16]. As a result, the next step was a test of whether the preliminary set of nine proposed measures of the three general risks identified by the researchers represented all the ways a consumer might be exposed to harm in an e-commerce transaction. If this were the case, each of the 104 events elicited from the panel could be placed in one of the nine proposed measures. To verify this and refine the measures, a card-sort exercise was conducted using the e-commerce panel that had helped identify the potential events, following the approach of Moore and Benbasat [43]. Because the process required multiple iterations, subsets of four panel members were used for judging. The composition of the subset of judges was changed for each iteration in order to reduce participant fatigue. The panel members were given a spreadsheet listing the 104 elicited events in a random order along with descriptions of the nine proposed measures for

the events. Respondents were asked to identify: (1) the measure with which a particular event was most associated, (2) whether the event was associated equally well with more than one measure, or (3) whether the event was not associated with any measure. This activity was conducted iteratively, with the wording of the dimension descriptions or number dimensions changed to overcome difficulties identified by the participants in each previous card-sort. The refinement process of the categories was concluded when less than 5 percent of the events remained unassigned by more than one judge (or, put another way, when 95% of the events were assigned by three of four judges), providing an indication that the measures captured the full range of events identified by the panel.

Based on this, the final nine risk measures (discussed below) were judged to represent a census of the events that could cause harm to the consumer and were adopted as the formative indicators for the three general risks adapted from Cox [13, 50]. The three risk dimensions and their associated nine measures are:

- Risk Dimension 1: Information Misuse Risk
 - Measure 1: personal information revealed when buying from a Web retailer will be misused.
 - Measure 2: financial information revealed when buying from a Web retailer will be misused.
- Risk Dimension 2: Failure to Gain Product Benefit Risk
 - Measure 3: something bought from a Web retailer will not meet the needs of the buyer.
 - Measure 4: something bought from a Web retailer will arrive late or not at all.
- Risk Dimension 3: Functionality Inefficiency Risk
 - Measure 5: finding and choosing something to buy from a Web retailer will be too difficult or time consuming.
 - Measure 6: ordering and paying for something bought from a Web retailer will be too difficult or time consuming.
 - Measure 7: receiving something bought from a Web retailer will be too difficult or time consuming.
 - Measure 8: returning or exchanging something bought from a Web retailer will be too difficult or time consuming.
 - Measure 9: maintaining something bought from a Web retailer will be too difficult or time consuming.

Appendix B lists the risk dimensions and measures, along with the events.

Items were then developed for the formative measures. Consistent with the recommendations of Ajzen and Fishbein, semantic differential items were used to measure the perceived likelihood and perceived severity of consequence of each measure [1]. For each formative measure, three items of perceived probability were cross-multiplied with three items of perceived consequence (each on a 7-point semantic differential scale) to create nine indicators of each measure. This multiplicative model of “probability times severity of

consequences" was identified by Mitchell as the most common model in component-based measures of perceived risk [41]. A summary of the items is included in Appendix C.

Content validity of the measures was established through the process of generating, categorizing, and validating the events; and by an electronic q-sort of the items to test the convergent and discriminant validity of the measurement items [43]. A subset of the panel of e-commerce researchers and consumers described above was able to sort the items correctly into one of the nine formative measures with 97 percent accuracy.

Development of the Nomological Network

To validate the operationalization of e-commerce transaction perceived risk as proposed above, the construct must be placed in a research model that describes its relationships with associated constructs [16]. The present research adapts and paraphrases Bauer by defining e-commerce transaction perceived risk as a consumer's expectation that the actions entailed in purchasing a good or a service from a B2C e-commerce site could have unwanted outcomes [4]. This implies that consumers have a preexisting set of general beliefs regarding the outcomes of the behavior of buying on the Web and consider these beliefs before they make a purchase from a specific retailer. As a result, this research proposes a nomological network of relationships between e-commerce transaction perceived risk and general constructs of buying on the Web: attitude toward buying on the Web, trust in Web retailers, and intention to buy on the Web.

According to TRA, one's behavior is influenced by one's attitude toward any given behavior (along with one's beliefs regarding the subjective norm regarding the behavior) [1]. One's attitude toward the behavior is influenced by one's beliefs regarding the events resulting from that behavior, both negative and positive. The present study, as discussed above, identified a negative subset of consumer beliefs regarding the events that result from the behavior of buying from a Web retailer. This construct of negative beliefs regarding buying on the Web (i.e., e-commerce transaction perceived risk) negatively influences attitude toward buying on the Web, consistent with TRA. The set of positive beliefs that would also influence attitude are not included because the nomological network addresses only the relationship between e-commerce transaction perceived risk and attitude, and is not attempting to explain the maximum amount of the variance in attitude.

Nomological Relationship 1 (NR1): Higher e-commerce transaction perceived risk will lead to a less favorable attitude toward buying on the Web.

Behavioral intention is influenced by a person's attitude toward the behavior, as specified in TRA [1]. Applied to the context of this research, intention to buy on the Web is determined by attitude toward buying on the Web.

Nomological Relationship 2 (NR2): A more favorable attitude toward buying on the Web will lead to greater intention to buy on the Web.

Trust and perceived risk have been modeled together in a number of e-commerce studies, and both have been found to influence consumer attitudes. In general, e-commerce research had modeled trust as influencing perceived risk, rather than perceived risk as influencing trust. For example, in a cross-cultural study of the effects of retailer reputation, Jarvenpaa and Tractinsky modeled trust as an antecedent of perceived risk [27]. Kimery and McCord, studying the effect of third-party seals on trust, included perceived risk as influenced by trust [31]. Pavlou, examining the integration of trust and perceived risk in the context of the Technology Acceptance Model (TAM), modeled trust as influencing perceived risk [49]. Pavlou and Gefen, in their research on trust and risk in the context of a community of sellers, modeled trust as preceding perceived risk [47]. So did Nicolaou and McKnight in examining the effects of information quality as did Van der Heijden et al. in examining trust and on-line purchasing [44, 60]. Recent fMRI brain research on trust has provided some neurological support for this view, finding that untrustworthy stimulus activates the insular cortex, which has uncertainty and risk-signaling functions [52]. As a result, in the proposed nomological network, it is hypothesized that trust in Web retailers influences perceived risk.

For purposes of the present study, trust in Web retailers in general, rather than trust in a specific Web retailer, was chosen as the trust target most consistent with the general constructs of perceived risk of buying on the Web and attitude toward buying on the Web. Therefore, the risk construct represents the consumer's belief in the competence, integrity, and reliability of Web retailers in general. A consumer who has a positive belief in the competence, integrity, and benevolence of Web retailers in general (resulting in a high level of trust in Web retailers) is likely to perceive a lower risk of unwanted events from buying on the Web. Rather than acting on the latent construct of e-commerce transaction perceived risk directly, however, *trust in Web retailers* will influence each of the dimensions of the risk construct differently. For example, some aspects of *perceived information misuse risk* and *perceived failure to gain product benefits risk* are under the control of the Web retailer, while others are not, leading to a different relationship between trust and those dimensions than between trust and the dimension of *perceived functionality inefficiency risk*. As a result, the nomological associations describe the relationship of *trust in Web retailers* with each of the three dimensions of e-commerce transaction perceived risk. Petter et al. discuss a similar "decomposition" approach to the modeling of formative constructs and warn of a risk to the parsimony of the model [50]. However, the theoretically differential relationship of the dimensions of risk to trust in the nomological network supports the decomposition in this case.

Most aspects of an e-commerce transaction that may lead to a misuse of information are under the control of the Web retailer: for example, whether personal information is captured; how it is transmitted, stored, and safeguarded; whether transaction information is used to market additional products or sold to other organizations. As a result:

Nomological Relationship 3a (NR3a): *Higher trust in Web retailers will lead to reduced perceived information misuse risk.*

Web retailers do not control all aspects of an e-commerce transaction that could lead to a failure to deliver product benefits. For example, the consumer may simply not choose the appropriate product, or a courier company may fail to deliver the product. However, the consumer will regard the Web retailer as playing the most important role in this dimension of e-commerce transaction perceived risk because the retailer chooses the products and the brands to offer, provides the consumer with information and assistance, and selects companies to provide ancillary services such as delivery. As a result:

Nomological Relationship 3b (NR3b): Higher trust in Web retailers will lead to a perceived reduction of failure to gain product benefit risk.

Because Web retailers control the functions available on the retail Web site, they will be regarded as responsible for most of the aspects of an e-commerce transaction that may make buying something on the Web difficult or time consuming. As a result:

Nomological Relationship 3c (NR3c): Higher trust in Web retailers will lead to a perceived reduction of functionality inefficiency risk.

The resulting measurement model and its nomological network are shown in Figure 2.

Control Variables

Additional variables were identified to control for other antecedents of consumer attitude toward buying on the Web. *Perceived ease of use* and *perceived usefulness* have been identified as important positive antecedents of attitude and intent in many studies utilizing the TAM in e-commerce [23, 49, 62, 65]. As a result, they were included as control variables, consistent with their treatment by Pavlou et al. [48]. *Number of Web purchases in the past year*, *dollar amount of Web purchases in the past year*, *average Web purchase*, *Web experience*, and *level of Web usage* were included as controls because these variables might explain variations in the levels of attitude toward buying on the Web [27]. *Propensity to trust* was included because it has been cited as an antecedent to trust and perceived risk. *Age* was included because differences in age among participants may result in differing comfort levels with the technology of the Web and therefore attitudes toward it. Because the field survey was designed to measure the perceived risk of buying on the Web in general, rather than the perceived risk of purchasing a specific product or product class on the Web, control variables of product class, specific Web retailer, or a specific transaction were not included.

Test of the Research Model

Description of the Field Study

The measurement model was tested with a field study conducted using an on-line questionnaire completed by participants contacted through an Internet

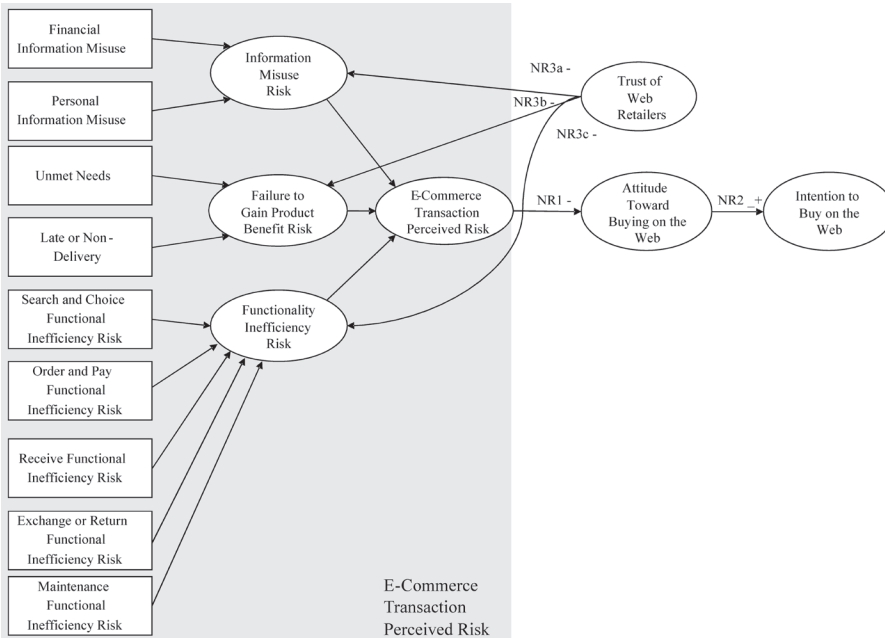


Figure 2. E-Commerce Transaction Perceived Risk Measurement Model and Nomological Network

marketing research firm. The marketing firm sent an e-mail invitation to 2,700 randomly selected North American members of an e-commerce panel maintained for market research purposes. Of these 2,700 invitations, Web site log statistics indicate that 671 unique visits were made to the Web site described in the invitation. Of these visitors, 564 elected to participate, creating an effective participation rate of 21 percent (564/2,700).

The demographic profile of the sample reflected the way the participants were obtained. Participation in the research company's e-commerce panel requires that the respondents become aware of the opportunity and opt in to receive surveys through the marketing firm. This implies that the panel is made up of more experienced Internet users than the general U.S. Internet user population. The average age of the participants was 46 (compared to the average age of U.S. Internet users of 37 in analysis of 2007 U.S. Census Bureau data [10]), and 57 percent of the participants were female (compared to the proportion of 51% female American Internet users reported in U.S. Census Bureau 2007 data). A total of 80 percent of the participants reported having used the Internet for more than five years (compared to 73% in the Pew Internet & American Life Project [11]), 90 percent of the participants had used e-commerce to make a purchase in the past 12 months (compared to 67% of all Internet users in Pew), and 33 percent had made 10 or more purchases over the past 12 months. Because experienced Internet and e-commerce users are more likely to perceive less risk in buying on the Web than inexperienced users, the sample represents a conservative test of the model.

Since contaminated data are a greater problem in on-line surveys than in traditional pencil-and-paper surveys, the complete set of responses was examined prior to analysis [12, 26, 38]. This examination eliminated 153 data records (i.e., 27% of the 564 participants) as unusable, a percentage of problematic data that is common in on-line surveys [12, 54]. This resulted in a final sample size of 411 participants. To verify that the exclusion of the problematic data did not bias the results, the structural model was also analyzed post-testing using data that included *all* responses. The signs and significance of all relationships were unchanged.

Validation of the Measurement Model

Prior research suggested that each of the dimensions of an aggregate construct should be treated as a latent variable and its measures treated as a manifest variable [19]. Therefore, each of the formative dimensions for the e-commerce transaction perceived risk model shown in Figure 3 was measured using the multiple reflective items provided in Appendix C [50]. As a result, the procedures used to validate the reflective items were appropriate even though the items were combined as a formative measure [9]. Individual item reliability, item internal consistency, and item discriminant validity were all examined [3].

The loading of the individual items on their respective constructs indicated that all the loadings of the measures were above the threshold of 0.707 suggested by Barclay, Higgins, and Thompson [3]. All items loaded with a p -value of < 0.01 , satisfying the criteria suggested by Gefen and Straub for convergent validity [21]. Internal consistencies for each of the formative measures were well above 0.70, supporting the reliability of the measures. Discriminant validity is supported when the square root of the average value extracted (AVE) for each measure is larger than its correlations with other measures: All measures satisfied this requirement. Although a high correlation was present between *financial information misuse* and *personal information misuse* (0.83, variance inflation factor [VIF] = 3.2), between *finding and choosing functionality inefficiency risk* and *ordering and paying functionality inefficiency risk* (0.80, VIF = 2.8), between *receiving functionality inefficiency risk* and *finding and choosing functionality inefficiency risk* (0.74, VIF = 2.2), and between *receiving functionality inefficiency risk* and *ordering and paying functionality inefficiency risk* (0.76, VIF = 2.3), these VIF measures were well below the common threshold of 10 and below the threshold of 3.3 suggested for formative measures, indicating that multicollinearity of the measures was not a problem for testing the model [16, 50].

Finally, the cross-loading of items on other constructs supported the findings of previous tests. Gefen and Straub suggest that the loading of each of the indicators on its latent construct should be above a threshold of 0.60 and at least 0.10 greater than its loading on any other construct [21]. The examination of cross-loading showed that each of the indicators satisfied these criteria for discriminant validity. Taken in total, the tests of the measurement model supported the validity and reliability of the measures developed for this study as well as the validities and reliabilities of the measures adapted from prior

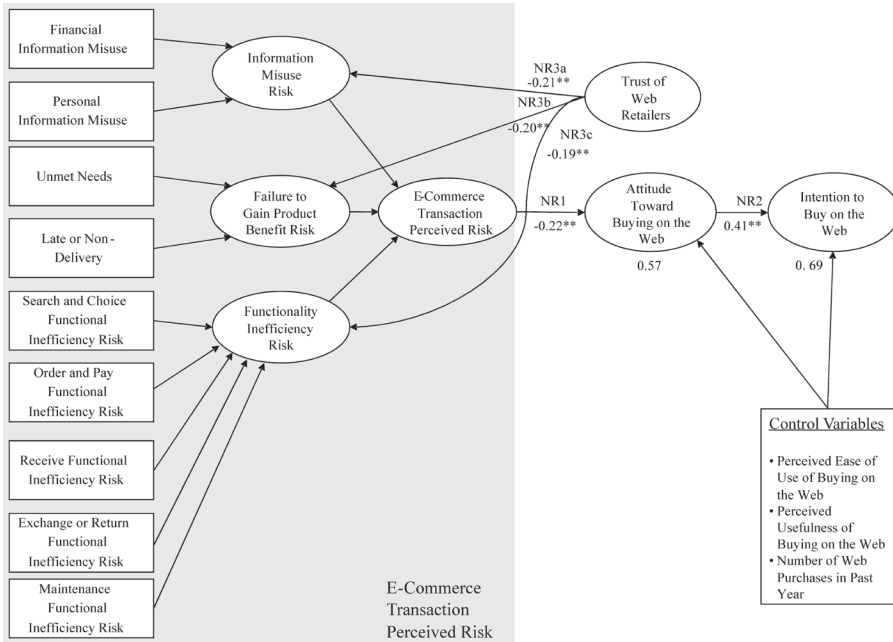


Figure 3. PLS Results of Model Testing for E-Commerce Transaction Perceived

** significant at $p < 0.01$; * significant at $p < 0.05$.

research. The validity and reliability of the adapted measures were also supported by the validity and reliability tests conducted in earlier research (see the references cited in Appendix C).

Due to the cross-loadings of some items and the high correlations of some latent constructs, two procedures were used to test for the presence of common method bias. First, Harman's single-factor test was employed, using exploratory factor analysis to test whether a single common factor accounted for the majority of the variance in all the factors. Harman's test showed that the first factor accounted for 27 percent of the variance of the measures, with 12 factors having an eigenvalue greater than 1.0, which suggests that common method bias was not present in the data. However, Djurkovic, McCormack, and Casimir caution that the absence of a single factor accounting for the majority of variance does not necessarily eliminate the possibility of common method bias [17]. As a result, the procedure for identifying the method factor loadings discussed by Podsakoff et al. as controlling for the effects of an unmeasured latent methods factor was adapted for PLS, as suggested by Liang et al. [34, 51]. In this procedure, two additional types of constructs are included in the model: individual constructs for each of the indicators in the model, and a single construct representing the common method factor for the model, reflected by all the indicators used in the model. Each individual indicator construct is then modeled reflecting both its intended construct and the common method factor construct. The square of the path weight from the common method factor to

each single-indicator construct is interpreted as the variance in the indicator explained by common method variance, while the square of the path weight from the intended construct to the single-indicator construct is interpreted as the variance in the indicator explained by the intended construct. Using this procedure, only eight of the 111 method factor loadings on the single indicator constructs were significant. The average square of the path weight from the common method factor to the single-item indicator for all the paths was 0.005, as compared to 0.92 for the square of the path weight from the intended construct to the indicator. Taken in total, these findings indicate that common method bias is very unlikely to be a problem in this study.

Structural Model Assessment

The data were randomly split into two data sets using the random data selection function of SPSS 15.0. One data set ($n = 206$) was used for model-building purposes, while the second data set ($n = 205$) was retained for model testing.

Model Building

The first data set was used to test the structure of the e-commerce transaction perceived risk model in Figure 3. Components-based structural equation modeling (SEM) has been supported as an appropriate technique for the analysis of formative constructs [50]. As a result, analysis of the model was conducted using partial least squares (PLS) SEM as implemented in the program SmartPLS [53]. Since PLS does not assess the overall fit of a proposed model, the validity of the model was assessed by examining R^2 of the endogenous variables, the size and significance of the structural paths among the constructs as with a multiple-regression model, and by the adequacy coefficient (R_a^2) used in canonical correlation analysis to assess the relationship between a set of variables and their associated canonical variates [3, 19, 50, 57]. The model was tested according to the procedures recommended by Chin, and consistent with Edwards, using all the indicators of the first-order dimensions to create indicators for the second-order factor [8, 19]. The validity of this model can be assessed from the relative size and significance of the loadings of the first-order constructs on the second-order factor and from the strength and significance of the paths from the second-order factor to the constructs it was proposed to influence.

Using the model-building data, the path weights of all the risk categories to *e-commerce transaction perceived risk* were significant: *information misuse risk* ($\beta = 0.24, t = 12.2$); *failure to gain benefits of product risk* ($\beta = 0.22, t = 13.9$); and *functionality inefficiency risk* ($\beta = 0.71, t = 27.2$). The path weights of e-commerce transaction perceived risk to *attitude toward buying on the Web* were significant ($\beta = -0.46, t = 7.7$). Using this model (without control variables) and the model-building data, *e-commerce transaction perceived risk* explained 21 percent of the variance of *attitude toward buying on the Web*, supporting the structure of the model.

However, Chin and Gopal caution that the PLS method for modeling factors works best when the number of indicators is equal for all the constructs [9]. In the research model, functionality inefficiency risk has five formative indicators, while information misuse risk and failure to gain product benefit risk each have two indicators. To test whether the difference in path weights among the general risks was an artifact of the number of indicators, the model was run using all 10 combinations of two of the five formative indicators for functionality inefficiency risk. In all 10 cases, the path weight for functionality inefficiency risk remained almost double the path weights of the other general risks, ranging from 0.51 to 0.58, averaging 0.55, while the sign and significance of all other paths in the model remained unchanged throughout, indicating that the difference in path weights among the general risks was not an artifact of model construction.

As an alternative to examining the R^2 of the endogenous variables to test the model, Edwards suggests the use of canonical correlation analysis and the adequacy coefficient (R_a^2) to test the relationship of an aggregate construct with its dimensions [19]. This coefficient is the average of the squared structure correlations of the dimensions with *e-commerce transaction perceived risk* in canonical analysis. While no hard rules are available for acceptable levels of R_a^2 , Edwards suggests that an R_a^2 of more than 0.30 represents a commonly accepted threshold for adequacy, while an R_a^2 of more than 0.50 represents a more conservative threshold. For the model-building portion of the data, canonical correlation analysis conducted with SPSS provided support for the model with an adequacy coefficient well above the levels suggested by Edwards ($R_a^2 = 0.69$).

Model Testing

The model was tested again in its full nomological network along with the control variables, using the portion of the data retained for model-testing ($n = 205$). Statistical significance was assessed using a bootstrap procedure and 100 resamples. In this case, the adequacy coefficient was again above the standards suggested by Edwards ($R_a^2 = 0.61$). The results of the structural model assessment of the model test data are provided in Figure 3.

The analysis places e-commerce transaction perceived risk within its nomological network. All control variables were tested to determine their importance to the model in the presence of the independent variables. *Perceived ease of use of buying on the Web* (PEOU), *perceived usefulness of buying on the Web* (PU), and *Web purchase history* were determined to have a statistically significant effect on *attitude toward buying on the Web* and *intention to buy on the Web* in the presence of the modeled independent variables. The control variables for *age*, *gender*, *average Web purchase*, *experience with the Web*, *level of use of the Web*, and *propensity to trust Web retailers* were not found to have a significant effect in the presence of the independent variables of the model and were eliminated from additional analysis.

In the presence of the control variables identified as significant (PU, PEOU, and Web purchase history), the aggregate factor of *e-commerce transaction*

perceived risk was found to be significantly related to *attitude toward buying on the Web* ($\beta = -0.22, t = 3.6$), supporting Nomological Relationship 1 and explaining 57 percent of the variance along with the control variables. *Attitude toward buying on the Web* was significantly related to *intention to buy on the Web* ($\beta = 0.41, t = 5.6$), explaining 69 percent of the variance of *intention to buy on the Web* along with the control variables ($R^2 = 0.69$), providing support for NR2.

Trust in Web retailers was found to be negatively related to *information misuse risk* at $p < 0.01$ ($\beta = -0.21, t = 3.4$), supporting NR3a; negatively related to *failure to gain product benefit risk* at $p < 0.01$ ($\beta = -0.20, t = 3.6$), supporting NR3b; and negatively related to *functionality inefficiency risk* at $p < 0.01$ ($\beta = -0.19, t = 2.9$), supporting NR3c.

Discussion

Limitations

One limitation of the research presented in this article results from the general nature of the question under study. While the survey collected information about the general behavior of buying on the Web, questionnaire responses may have been influenced by whatever specific products, product classes, retailers, or e-commerce sites the respondents may have had in mind. However, the model was designed to overcome this limitation by defining formative measures that represented a comprehensive census of risk events.

The research also attempted to minimize alternative influences by the use of control variables, such as *number of Web purchases in the past year* and *dollar amount of Web purchases during the past year*. Although *number of Web purchases* was found to be significant when included as a control for *attitude toward buying on the Web* and *intention to buy on the Web*, *dollar amount of Web purchases* was not. Further, when these two indicators were combined to impute an average purchase amount for Web purchases, the result was not found to be significant. Since it is likely that respondents considered a range of product classes and types when completing the survey, the lack of significance of the purchase amount in the past 12 months and the imputed average purchase amount suggest the generalizability of the results across a range of levels of Internet purchase. However, since the actual context of the participants' responses was not a subject of the survey, the generalizability to specific products or product classes, or to a specific retailer or type of e-commerce site, may be a limitation of the research, and should be addressed by future studies.

It is likely that some respondents considered expensive e-commerce purchases when completing the survey, while others considered low-cost items. Clearly, these two cases have the possibility of creating two different levels of one of the general risks (failure to gain product benefits risk), but the other two general risks (information misuse risk and functionality inefficiency risk) may not vary greatly between the two cases. However, the intent of this research was to propose and test a model of e-commerce transaction perceived risk that might be usefully and equally applied to e-commerce purchases of both high and low involvement. Therefore, the difference in the contexts considered by

the two hypothetical respondents would serve to provide a variance in the risk levels measured and the resulting attitude toward shopping on the Web. To further address this limitation, the phrasing of the items measuring the severity of the consequences was self-referential, measuring whether the potential harm was significant to the respondent. This phrasing was intended to deal with differences in the individual tolerance for harm among the respondents, as well as to place the harm in the context of the purchase considered by the respondent.

The sample frame consisted of people currently using the Internet who had volunteered to participate in an e-commerce panel with a marketing research firm, and therefore it is likely to be representative of experienced Internet users and e-commerce users. Since the sample did not include people who were not Internet users, however, the results cannot be generalized to a group of potential customers that might be of interest to e-commerce practitioners. While this limits the generalizability of the research, the usefulness of the findings remains because increasing the purchasing of existing users is likely to be of interest to Internet marketers even in the absence of generalization to people who do not use the Internet at all.

A further limitation is the potentially unlimited number of events stemming from the behavior of buying on the Web. While it is impossible to be certain that all meaningful events were elicited, the procedure followed provides some assurance that at least the most salient of the potential events and their summary beliefs were captured.

Hence, it may be stated that despite certain limitations, this research provides a useful starting point for further investigation of the interesting and useful construct of e-commerce perceived risk and the factors that comprise it.

Conclusions

The research summarized in this article offers a well-developed and tested multidimensional model of e-commerce transaction perceived risk that is much needed. It makes a theoretical contribution by adopting and interpreting seminal marketing theory in the context of e-commerce. It also validates the comprehensiveness of the theory through the identification and classification of the ways consumers are exposed to harm as a result of an e-commerce transaction.

The model guides the development of formative measures for the dimensions of perceived risk with strict attention to content validity. This comprehensive approach to the identification of the dimensions of e-commerce transaction perceived risk made it possible to capture and validate all the relevant perceived risks for the e-commerce consumer in a single study in a way that informs the development of IT tools to reduce perceived risk. The model was tested in an on-line survey, and the dimensions of risk identified in the model were found to form and support the construct of e-commerce transaction perceived risk. The hypothesized relationships of the constructs of e-commerce transaction perceived risk with other constructs in its nomological network were also supported by the survey.

At the level of identifying useful dimensions of perceived risk, this research provides a novel contribution by using comprehensive and multiple dimensions of perceived risk that allow researchers and practitioners to isolate the specific effects of IT tools designed to reduce the perceived risks of consumers. The resulting model of e-commerce transaction perceived risk, focused on events grouped according to the ways they expose consumers to harm, will be useful to the e-commerce researcher and practitioner, particularly in the development of related IT tools. For example, to place an on-line order for the delivery of a product, a customer needs to enter delivery information, contact information, and billing information, very likely including a credit card number and expiry date. The entry of this information could be tedious or troublesome to a customer, especially if the customer does not have the relevant credit card information immediately at hand. Software to simplify the ordering procedure functions by saving the customer's information on the retailer's systems. The customer, having entered the information previously at a convenient time, can apply this information to a subsequent order with a "single click." Measurement of perceived risk using a unidimensional construct might suggest that such a tool has limited effect on the perceived risk of the consumer. However, examination of the effect of the tool along the dimensions of perceived risk proposed by this research might reveal two different effects. On the one hand, the tool might do what it is ostensibly intended to do by reducing consumers' perceived risk that ordering and paying for something on the Web might be too difficult or time consuming. On the other hand, because such an IT tool requires that financial information, delivery information, and personal-contact information be stored and ready for use, the IT tool might very well increase the consumer's perceived risk that the information may be misused. So while the net effect of the IT tool on perceived risk may be small, it is important for researchers and practitioners to know the impact on each risk dimension in order to fully understand the situation and thereby encourage positive on-line purchase experiences.

In conclusion, the driving contribution of this research is its identification of the dimensions along which consumers are harmed by e-commerce transaction risks so that the risks can be addressed directly through IT tools or non-IT risk-reducing interventions in future research. The development of formative indicators of these dimensions also provides a necessary basis for future research. By making use of the novel theoretical, methodological, and applied contributions of this study, future research can seek to understand and improve the ways consumers can be helped to overcome their perceived risks of e-commerce transactions.

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Appendix A. Selected Multidimensional Conceptualizations of Perceived Risk.

Study	Dimensions of perceived risk	Perspective
Tung et al. [59]	Choice of product risk Choice of vendor risk	<i>Source orientation:</i> perceived risks are conceptualized as resulting from choices of product and vendor. <i>Source orientation:</i> although only one source of risk was examined empirically, the research specifically distinguishes this source from other sources, such as the nature of on-line context or behavior of entities other than seller.
Pavlou and Gefen [47]	Perceived risk in community of sellers	
Crespo et al. [15]	Financial risk Performance risk Social risk Time risk Psychological risk Privacy risk	<i>Type of harm/event orientation:</i> Types of harm experienced by consumer and events that cause harm are used to develop model of overall perceived risk.
Miyazaki and Fernandez [42]	Privacy concerns Security (third-party fraudulent behavior) Security (on-line retailer fraudulent behavior) Inconveniences of on-line shopping	
Mauldin and Arunachalam [39]	Product/retailer risk Transaction risk Privacy risk Security risk Disclosure risk	<i>Source/event orientation:</i> Security concerns are events that may result in harm for consumer, identified by source of risk (third party or retailer); inconvenience and privacy concerns are events that may result in harm for consumer. <i>Source/event orientation:</i> Sources of risk are product/retailer risk and transaction risk. Privacy risk, security risk, and disclosure risk are events that may generate harm for consumer.

(continues)

Appendix A. Continued.

Study	Dimensions of perceived risk	Perspective
Pavlou et al. [48]	Perceived information asymmetry	Source/event orientation: Dimensions of risk are identified as sources of risk to consumer. Information privacy concerns and information security concerns distinguish potential sources (retailer or external) of events that could harm consumer.
	Fears of seller opportunism	
Park et al. [46]	Information privacy concerns	Source/event/type of harm orientation: Sources of risk are the transaction and the product or service purchased; items reflect type of harm that might occur from each source (financial loss, time loss) as well as events that may generate harm (functional loss, security, privacy, nonrepudiation).
	Information security concerns	
	Perceived risk of transaction, including security, privacy, nonrepudiation	
	Perceived risk of product/service, including functional loss, financial loss, time loss, opportunity loss, and overall perceived risk with product/service	
Spiekermann and Paraschiv [55]	Social/psychological risk	Event/type of harm orientation: functional risk and delivery risk are events occurring from transaction that may harm consumer. Types of harm experienced are financial risk and social/psychological risk.
	Functional risk	
	Financial risk	
	Delivery risk	
Featherman and Pavlou [20]	Performance risk	Event/type of harm orientation: Performance risk is event that causes types of harm to occur. Financial risk, time risk, and psychological risk are types of harm that consumer may experience. Privacy risk is a belief of something that could occur that will generate harm.
	Financial risk	
	Time risk	
	Psychological risk	
	Privacy risk	

Appendix B. Categorization of Elicited Events.

Elicited unwanted events	Cause of harm (formative measure)	Risk dimension
The retailer might not be a real merchant	Financial Information misuse: Financial information I reveal when I buy something on the Web might be misused.	Information misuse risk
The seller might falsely represent himself as an agent of a respectable company from which I originally want to buy the product from		
I might not have enough information to choose a trustworthy retailer		
The site might charge my credit card/PayPal more than I agree to		
The retailer might misuse my financial information		
My credit card information may be not stored safely		
My financial information might be intercepted by a third party and misused		
I might be forced to provide personal information to get the product I want		
The site might build a profile of me based on my purchases		
The retailer might fail to protect my personal information from hackers		
The Web site might sell my personal information	Personal Information misuse: Personal information I reveal when I buy something on the Web might be misused.	Information misuse risk
The retailer data might use my information and send e-mails to me without my permission		
My personal information might be intercepted by a third party and misused		
Product information on-line may be incomplete		
The recommendation agent may give me biased advice		
The features or models showing in the Web site may not be authentic		
The recommendation agent may not give me all the correct information on the product		
I might not be able to specify the features of products		
The recommendation agent might misunderstand my needs		
The recommendation agent might not be effective in its determination of the best product on the market		
The agent may not work well or give inaccurate results		
The product list used by the recommendation agent might not be complete		
The retailer may not be fully knowledgeable about the product		
There might not be reliable/reputable recommendation agents for this product		
The recommendation agent may not have a powerful algorithm to filter products		
The recommendation of the recommendation agent might not match with my expectations		

(continues)

Appendix B. Continued.

Elicited unwanted events	Cause of harm (formative measure)	Risk dimension
The retailer may lead me to some product it wants to sell and not something I would really need or like		
Other shoppers comments and reviews might not be authentic		
The site might provide product virtual experience that is not representative of real use		
The retailer might not be able to understand my requirements		
I might not be able to articulate my requirements according to the specifications of the site		
I might be misled by technical information that I can't understand		
I might not be able to ask all the questions I need to ask		
The information I am given might be outdated		
The item might be damaged when I receive it		
I might be sent a counterfeit or illicit product		
I might purchase the wrong product		
I might not be satisfied with the product although it fits my expressed preferences		
I won't be able to smell, taste, touch, experience, and examine the product before I purchase it		
The product might not receive the approval of friends and family		
The virtual product experience might be misleading		
There are longterm downsides to the product that might not surface during sample testing		
The information on how to use the product might not be detailed enough		
The product use information provided might be wrong		
Instructions on the product might not be clear		
I might not be able to ask questions		
The recommendation agent might recommend an unreliable product		
The recommendation agent might recommend an overpriced product		
The product received might not be what I ordered		
I might not be able to download a product		
The item might be lost in transit		
The tested product might be different from the product shipped		
The retailer may go out of business after I have purchased something		
The retailer may not ship to where I live	Late arrival: Something I buy on the Web might arrive too late or not at all.	Failure to gain product benefits risk

<p>The site might allow for ordering when product is not in stock</p> <p>The site might indicate availability when there is none</p> <p>I might not receive a number to track the shipment</p> <p>I might not know whether item is in stock or not</p> <p>I might not know the expected shipping/delivery date</p> <p>The product may not ship on time</p> <p>The delivery might be delayed</p> <p>I might not get the product when I expect or need it</p> <p>The item might be damaged when I receive it</p> <p>The product might appear to be in stock but is not</p> <p>The recommendation agent might waste my time and energy without actually coming up with valid results</p> <p>There might be too much information from too many sources to choose</p> <p>I might not be able to choose the best retailer because the Internet has too many choices</p> <p>The Web site might have an inefficient Web site design</p> <p>The recommendation agent might take a long time to process my inquiry</p> <p>The Web site might not work</p> <p>I might not know how to effectively use the site or its tools</p> <p>The recommendation agent might ask me too many unnecessary questions</p> <p>The recommendation agent might ask question I can't understand</p> <p>The Web site might be difficult to use</p> <p>I might not have enough information to make a purchase decision</p> <p>The Web site may only accept my order if I provide enough detail of the product, which I may not know about</p> <p>I might be forced to enter same information again and again</p> <p>I might not receive a confirmation of my order</p> <p>The exchange rates shown might be wrong</p> <p>I might get charged for the wrong item</p> <p>The price on item and price paid might not match</p> <p>The seller might charge me taxes when taxes are not charged where the seller is located</p>	<p>Functionality inefficiency risk</p> <p>Functionality inefficiency risk</p>	<p>Finding and choosing functional inefficiency: Finding and choosing something to buy on the Web might be too expensive, too difficult, or too time consuming.</p> <p>Ordering and paying functional inefficiency: Ordering and paying for something I buy on the Web might be too expensive, too difficult, or too time consuming.</p>	<p>(continues)</p>

Appendix B. Continued.

Elicited unwanted events	Cause of harm (formative measure)	Risk dimension
I may need to deal with customs to receive the product Someone needs to stay home to receive the delivery Shipping may be costly The retailer might charge me unexpected shipping, sales tax, and customs charges	Receiving functional inefficiency: Receiving something I buy on the Web might be too expensive, too difficult, or too time consuming.	Functionality inefficiency risk
I may not be able to return the product, because the retailer no longer exists on-line There are no local stores willing to accept my return The site might provide misleading information on where to return the product I might have to incur costs when trying to return or replace the product The return procedures might be stringent, tedious, and time consuming I might not be able to change my mind once the transaction is final There might be no way to return a product if it was a download I can't test a piece of software and return it later	Exchange functional inefficiency: Exchanging or returning something I buy on the Web might be too expensive, too difficult, or too time consuming.	Functionality inefficiency risk
There may be no warnings of ways in which the product can be damaged I might not understand the instructions I have no one to talk with before, during, and after the purchase I might not be able to find the vendor when the product needs maintenance The vendor might not be able to find me when the product needs maintenance (I changed my address or e-mail address) Upgrades and patches might not be available for software products It might be difficult for me to have the product repaired even under warranty I may not be able to access a help desk or customer service The site might misinform me about maintenance needs I may have to spend a lot of money to send the product to the service location The seller might provide false information regarding warranties and maintenance	Maintaining functional inefficiency: Maintaining something I buy on the Web might too expensive, too difficult, or too time consuming.	Functionality inefficiency risk

Appendix C. Survey Items.

Sources of Adapted Variables

Variable	Adapted from
Trust in Web retailers	Pavlou et al. [48]
Attitude toward buying on the Web	Stewart [56]
PEOU; PU	Wixom and Todd [65], Gefen et al. [22]
Internet experience; Internet use	Kim and Benbasat [29]
Intention to buy on the Web	Developed for this research

Items Used in Field Survey

Attitude toward buying on Web (ATBW): Disagree-Agree, 5-point Likert scale

- | | |
|-------|---|
| ATBW1 | I like buying on the World Wide Web. |
| ATBW2 | My experiences buying on the World Wide Web have generally been positive. |
| ATBW3 | I do not enjoy buying on the World Wide Web. |

Trust in Web retailers (TWR): Disagree-Agree, 7-point Likert scale

- | | |
|------|--|
| TWR1 | Promises made by e-commerce Web sites are likely to be reliable. |
| TWR2 | I do not doubt the honesty of e-commerce Web sites. |
| TWR3 | I expect that e-commerce Web sites will keep the promises they make. |
| TWR4 | I expect that e-commerce Web sites have good intentions toward me. |
| TWR5 | I expect that the intentions of e-commerce Web sites are benevolent. |
| TWR6 | I expect that e-commerce Web sites are well meaning. |
| TWR7 | I expect that e-commerce Web sites are competent. |

Intention to buy on Web (IBW)

- | | |
|------|--|
| IBW1 | I intend to buy on the Web. Disagree-Agree, 7-point Likert scale |
| IBW2 | I predict I will buy on the Web. Disagree-Agree, 7-point Likert scale |
| IBW3 | I plan to buy on the Web. Disagree-Agree, 7-point Likert scale |
| IBW4 | When do you intend to buy on the Web next? Categorical: Within 1 month; 1 to 3 months; 3 to 6 months; 6 to 12 months; not within 12 months |

Perceived ease of use of buying on Web (PEOU): Disagree-Agree, 7-point Likert scale

- | | |
|-------|--|
| PEOU1 | Buying on the Web is easy to do. |
| PEOU2 | It is easy to become skillful at buying on the Web. |
| PEOU3 | Learning to buy on the Web is easy. |
| PEOU4 | Buying on the Web is clear and understandable. |
| PEOU5 | When I buy on the Web, it is easy to do what I want to do. |

Perceived usefulness of buying on Web (PU): Disagree-Agree, 7-point Likert scale

- | | |
|-----|--|
| PU1 | Buying on the Web improves my ability to make good purchase decisions. |
| PU2 | Buying on the Web allows me to get my shopping done more quickly. |
| PU3 | Buying on the Web allows me to enhance my purchasing effectiveness. |
| PU4 | When I buy on the Web, my performance in purchasing is improved. |

Probability of exposure to harm: Semantic differential, each item measured with Improbable-Probable;

Unlikely-Likely; Rare-Frequent, on 7-point scales

- | | |
|-------------|---|
| FinProb1-3 | "Financial information I reveal when I buy something on the Web might be misused."
This outcome is: |
| PersProb1-3 | "Personal information I reveal when I buy something on the Web might be misused."
This outcome is: |
| NeedProb1-3 | "Something I buy on the Web might not meet my needs." This outcome is: |
| LateProb1-3 | "Something I buy on the Web might be delivered too late, or not at all." This outcome is: |
| SrchProb1-3 | "Finding and choosing something to buy on the Web might be too expensive, too difficult, or too time consuming." This outcome is: |

(continues)

Appendix C. Continued.

PayProb1-3	"Ordering and paying for something I buy on the Web might be too expensive, too difficult, or too time consuming." This outcome is:
GetProb1-3	"Receiving something I buy on the Web might be too expensive, too difficult, or too time consuming." This outcome is:
ExchProb1-3	"Exchanging or returning something I buy on the Web might be too expensive, too difficult, or too time consuming." This outcome is:
FixProb1-3	"Maintaining something I buy on the Web might be too expensive, too difficult, or too time consuming." This outcome is:

Consequence of exposures to harm: Semantic differential, each item measured with Meaningless to me–Meaningful to me; Unimportant to me–Important to me; Insignificant to me–Significant to me, on 7-point scales

FinCons1-3	"Financial information I reveal when I buy something on the Web might be misused." If this happens, the negative consequences I will experience are . . .
PersCons1-3	"Personal information I reveal when I buy something on the Web might be misused." If this happens, the negative consequences I will experience are . . .
NeedCons1-3	"Something I buy on the Web might not fit my needs." If this happens, the negative consequences I will experience are . . .
LateCons1-3	"Something I buy on the Web might be delivered too late, or not at all." If this happens, the negative consequences I will experience are . . .
SrchCons1-3	"Finding and choosing something to buy on the Web might be too expensive, too difficult, or too time consuming." If this happens, the negative consequences I will experience are . . .
PayCons1-3	"Ordering and paying for something I buy on the Web might be too expensive, too difficult, or too time consuming." If this happens, the negative consequences I will experience are . . .
GetCons1-3	"Receiving something I buy on the Web might be too expensive, too difficult, or too time consuming." If this happens, the negative consequences I will experience are . . .
ExchCons1-3	"Exchanging or returning something I buy on the Web might be too expensive, too difficult, or too time consuming." If this happens, the negative consequences I will experience are . . .
FixCons1-3	"Maintaining something I buy on the Web might be too expensive, too difficult, or too time consuming." If this happens, the negative consequences I will experience are . . .

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