

UNDERSTANDING AND MITIGATING UNCERTAINTY IN ONLINE EXCHANGE RELATIONSHIPS: A PRINCIPAL- AGENT PERSPECTIVE¹

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Abstract

Despite a decade since the inception of B2C e-commerce, the uncertainty of the online environment still makes many consumers reluctant to engage in online exchange relationships.

Even if uncertainty has been widely touted as the primary barrier to online transactions, the literature has viewed uncertainty as a “background” mediator with insufficient conceptualization and measurement. To better understand the nature of uncertainty and mitigate its potentially harmful effects on B2C e-commerce adoption (especially for important purchases), this study draws upon and extends the principal-agent perspective to identify and propose a set of four antecedents of perceived uncertainty in online buyer–seller relationships—perceived information asymmetry, fears of seller opportunism, information privacy concerns, and information security concerns—which are drawn from the agency problems of adverse selection (hidden information) and moral hazard (hidden action).

To mitigate uncertainty in online exchange relationships, this study builds upon the principal–agent perspective to propose a set of four uncertainty mitigating factors—trust, website informativeness, product diagnosticity, and social presence—that facilitate online exchange relationships by overcoming the agency problems of hidden information and hidden action through the logic of signals and incentives.

The proposed structural model is empirically tested with longitudinal data from 521 consumers for two products (prescription drugs and books) that differ on their level of purchase involvement. The results support our model, delineating the process by which buyers engage in online exchange relationships by mitigating uncertainty. Interestingly, the proposed model is validated for two distinct targets, a specific website and a class of websites.

Implications for understanding and facilitating online exchange relationships for different types of purchases, miti-

¹Elena Karahanna was the accepting senior editor for this paper. D. Harrison McKnight and Jonathan D. Wareham served as reviewers. The associate editor and the third reviewer chose to remain anonymous.

gating uncertainty perceptions, and extending the principal-agent perspective are discussed.

Keywords: Uncertainty, agency theory, adverse selection, hidden information, moral hazard, hidden action, fears of seller opportunism, information asymmetry, information privacy, information security, trust, website informativeness, product diagnosticity, social presence, book purchasing, online prescription filling

Introduction

The potential benefits of business-to-consumer (B2C) e-commerce adoption—the consumer’s engagement in online exchange relationships with sellers—have been widely touted. However, despite the decade that has passed since the inception of B2C e-commerce, uncertainty still makes many buyers reluctant to engage in online exchange relationships with sellers, especially for high-involvement purchases.²

To better understand the nature of uncertainty and mitigate its potential harmful role in e-commerce proliferation, we refer to the *principal-agent perspective*, which aims to explain transactional arrangements between self-interested parties with incongruent goals in the presence of uncertainty. The principal-agent perspective, which builds upon the original formulation of agency theory, has been extended by Nobel-winning information economists (Akerlof 1970; Rothschild and Stiglitz 1976; Spence 1973) to markets of imperfect information. Moreover, agency theory has been extended to virtually all types of transactional exchanges that occur in a socio-economic system where information asymmetry, fears of opportunism, and bounded rationality exist (Milgrom and Roberts 1992).

The principal-agent perspective has also been applied to buyer-seller relationships (e.g., Bergen et al. 1992; Mishra et al. 1998; Singh and Sirdeshmukh 2000), typically viewing buyers as principals and sellers as agents. This is because buyers (principals) delegate the delivery responsibility to sellers (agents) who typically have more information about their characteristics, products, and practices. Uncertainty arises since the buyer cannot fully monitor the seller’s behavior, leading to two information problems: adverse selection (hidden information) and moral hazard (hidden action) (Akerlof 1970; Arrow 1985; Jensen and Meckling 1976). *Hidden information* refers to pre-contractual misrepre-

sentation of the seller’s true attributes (seller quality uncertainty), and offering false product information (product quality uncertainty). *Hidden action* refers to the seller’s post-contractual shirking, contract default, and fraud (seller quality uncertainty), and reducing the promised quality of product offerings (product quality uncertainty).

The principal-agent perspective is a useful theoretical lens for understanding and mitigating perceived uncertainty in online exchange relationships for several reasons: First, the concepts of hidden information and hidden action help us identify the sources of uncertainty in online buyer-seller relationships. Second, the principal-agent perspective provides specific ways to reduce uncertainty, through its logic of signals and incentives, which can be extended to mitigate uncertainty perceptions in online buyer-seller relationships. Third, the theoretical assumptions of information asymmetry, fears of opportunism, and bounded rationality are applicable to buyer-seller relationships. Finally, from an IS standpoint, the principal agent perspective maintains that uncertainty perceptions are determined by specific information problems (i.e., hidden information and hidden action) that could be potentially mitigated with the proper use of information systems. Most notably, Eisenhardt (1989, p. 70) suggested that the “next steps for agency theory research are straightforward: *Researchers should focus on information systems, outcome uncertainty, and risk*” (emphasis in original).

Drawing upon and extending the principal-agent perspective, we propose four factors that spawn uncertainty perceptions in online exchange relationships:³ First, the spatial and temporal separation among buyers and sellers creates information asymmetries to the seller’s advantage, giving rise to the buyer’s *perceived information asymmetry*. Second, goal incongruence and the temporal separation between payment and delivery create concerns that the product may not be as promised or that sellers may exploit buyers, thus giving rise to buyer’s *fears of seller opportunism*. Finally, the global and open Internet infrastructure allows the buyer’s private and monetary information to be easily collected, processed, and used by sellers, giving rise to buyer’s *information privacy concerns* and *information security concerns*.

Having understood the key sources of uncertainty (perceived information asymmetry, fears of seller opportunism, information privacy concerns, and information security concerns), this study aims to prescribe how they can be mitigated by re-

²Purchase involvement refers to the intrinsic importance of a product to the buyer (Howard and Sheth 1969).

³Following the principal-agent perspective, the proposed sources of uncertainty are specific to the dyadic buyer-seller relationship, and we do not examine uncertainty due to environmental conditions or third parties that are outside the seller’s control.

ducing the problems of hidden information and hidden action. Following the principal–agent perspective, we propose four uncertainty mitigators: *trust*, *website informativeness*, *product diagnosticity*, and *social presence*, which relate to signals and incentives. Even if we do not herein examine specific signals and incentives, the proposed constructs mitigate hidden information and hidden action based on the underlying logic of *signals* and *incentives*, as explained briefly below.

First, we employ trust due to its favorable role in online buyer–seller transactions characterized by uncertainty (see Ba and Pavlou 2002; Gefen et al. 2003; Pavlou 2003, Pavlou and Fygenon 2006). Trust is defined as the buyer’s intentions to accept vulnerability based on her beliefs that the transaction will meet her confident expectations. Despite the vast amount of work on trust in e-commerce, the mechanisms by which trust facilitates online transactions by reducing uncertainty are still not well understood. Following the logic of signals and incentives, we propose that trust can reduce all four proposed antecedents of uncertainty by mitigating the problems of hidden information and hidden action.

Second, given that the spatial and temporal separation of the online environment creates information asymmetries to the seller’s advantage, website informativeness—the degree to which buyers perceive that a website provides them with resourceful and helpful information—is proposed to overcome the problem of hidden information by enabling buyers to learn more about the seller’s characteristics, products, and information practices. In doing so, website informativeness is proposed to mitigate all four proposed antecedents of uncertainty following the logic of signals and incentives.

Third, given that the online environment makes it difficult for buyers to carefully inspect the product’s condition by “kicking the tires,” product diagnosticity—the extent to which a consumer believes that a website is helpful in terms of fully evaluating a product (Jiang and Benbasat 2004; Kempf and Smith 1998)—is proposed to reduce information asymmetry and fears of seller opportunism related to product quality uncertainty through the logic of signals and incentives.

Fourth, *social presence* is proposed to reduce uncertainty by overcoming the spatial and temporal separation that the online environment creates. Social presence—the extent to which a consumer feels that the online environment closely resembles a physical interaction with a seller (Choi et al. 2001; Short et al. 1976)—captures the effectiveness of online sellers to recreate the notion of human touch (Rice 1993). Therefore, social presence is proposed to reduce information privacy and security concerns that arise due to the online environment through the logic of signals.

Moreover, this study empirically assesses relative effectiveness of the proposed uncertainty mitigators. The study’s results could inform e-commerce practitioners to focus their efforts on the most cost-effective uncertainty mitigators, and thereby design signals and incentives that specifically enhance the impact of the most influential uncertainty mitigators.

The impact of perceived uncertainty on purchase intentions is proposed to be moderated by purchase involvement, the buyer’s perceived purchase relevance (Zaichkowsky 1985). Due to the importance of high-involvement purchases, buyers are more inclined to assign more weight to uncertainty and its potential to result in a greater loss to them for higher involvement products compared to lower involvement products.

Summarizing the preceding arguments, a research model is proposed that aims to understand and prescribe how uncertainty can be mitigated (Figure 1). Purchasing intentions and behavior are hindered by perceived uncertainty, particularly for higher degrees of purchase involvement. In turn, uncertainty is determined by a set of antecedent sources: perceived information asymmetry, fears of seller opportunism, and information privacy and security concerns. In turn, these four factors are mitigated by trust, website informativeness, product diagnosticity, and social presence.

The Nature and Role of Uncertainty Perceptions

Buyer behavior is inherently uncertain given that a buyer’s decisions have consequences that cannot be perfectly predicted (Bauer 1960). Uncertainty refers to the degree to which the future states of the environment cannot be accurately anticipated or predicted due to imperfect information (Pfeffer and Salancik 1978). In buyer–seller relationships, perceived uncertainty is defined as the degree to which the outcome of a transaction cannot be accurately predicted by the buyer due to seller and product related factors. Uncertainty consists of *seller quality uncertainty* (seller hiding its true characteristics, making false promises, shirking, or defrauding), and *product quality uncertainty* (product condition not being as promised, or product quality being compromised). Given that both aspects of uncertainty are closely interrelated and jointly describe the extent by which the outcome of a transaction can be accurately predicted, we focus on the overall degree of perceived uncertainty that incorporates the aggregate perceptions of seller and product quality uncertainty.

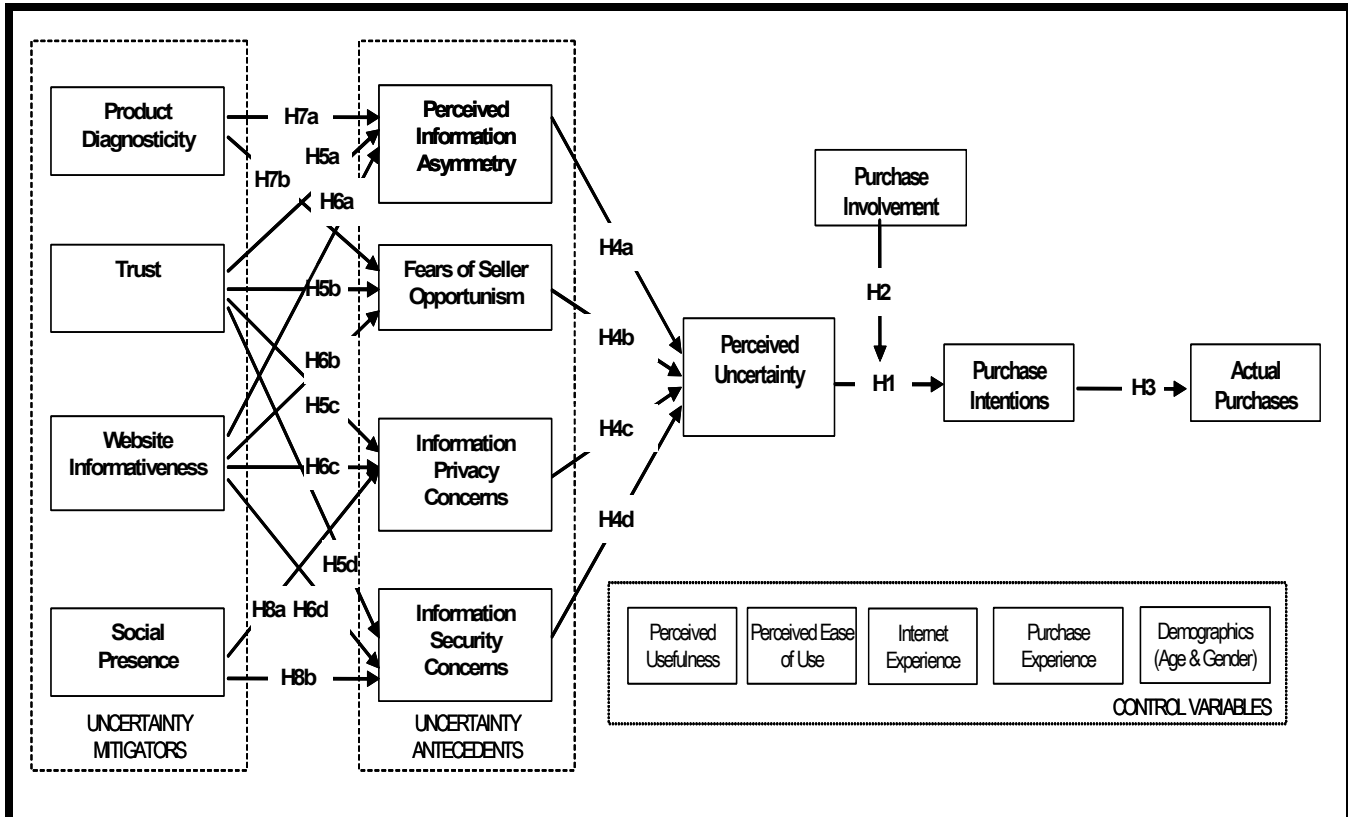


Figure 1. Research Model and Proposed Hypotheses

Even if it may be possible to objectively capture the true degree of uncertainty in online transactions, such scientific assessment may not reflect the buyer's *subjective* view of transaction uncertainty that would essentially drive a buyer's future purchase intentions and actual purchases. We thus focus exclusively on the buyer's *perceived* uncertainty.

Perceived Uncertainty and Purchase Intentions

As described above, all transactions have a degree of uncertainty about their outcome, and buyers cannot accurately predict whether a transaction will be fulfilled successfully. Successful fulfillment typically suggests that a seller delivers a product identical to the one promised, does so in a timely manner, and honors refund and product guarantees. In contrast, there are numerous possibilities that a transaction may not be fulfilled successfully due to seller or product quality uncertainty. For example, sellers can collect payment but not deliver a product (fraud), deliver a product that differs from the one advertised (lower quality, expired, or counterfeit products), refuse to accept payment and send a product (contract default), prolong product delivery, fail to acknowledge return,

refund, and product guarantee policies, sell the buyer's private information, or not protect the buyer's monetary information, among others. Due to these numerous adverse possibilities, buyers are rightfully concerned about the "downsides" of an online transaction.

Since perceived uncertainty refers to the degree by which the outcome of a transaction cannot be accurately predicted, the future states of the transaction could vary from a successful product fulfillment (delivering the right product in a timely manner and standing behind it) to any combination of the numerous adverse possibilities described above. Since buyers are faced with numerous adverse possibilities, they tend to overestimate the probability of potential losses, even if the probability of such losses is low (Kahneman and Tversky 1979). Hence, uncertainty perceptions give rise to perceptions of risk, which refers to the buyer's own subjective probability of suffering a loss (Chiles and McMackin 1996). In other words, the future states of a transaction can be potentially harmful to buyers, thus raising their risk perceptions. Consequently, perceived uncertainty is likely to result in higher risk perceptions.

Risk perceptions have been shown to erode exchange relationships in general (e.g., Rousseau et al. 1998), and they have also been shown to negatively influence consumer adoption of e-commerce (e.g., Pavlou 2003). If buyers are worried about the outcome of online transactions due to the numerous possibilities of loss, they are likely to restrain their participation in online exchange relationships. We thus formally hypothesize

H1: Perceived uncertainty negatively influences a buyer's intentions to purchase products online.

The Moderating Role of Purchase Involvement

Purchase involvement is defined as the buyer's perceived relevance with the focal purchase (Zaichkowsky 1985). Purchase involvement stems from the intrinsic *importance* of the purchase to the buyer (Howard and Sheth 1969), plus its *symbolic value*, *pleasure value*, *risk importance*, and *risk probability* (Laurent and Kapferer 1985). Irrespective of its exact sources, purchase involvement is a buyer's subjective assessment. The literature has shown that buyers perceive different levels of involvement for different purchases (Laurent and Kapferer 1985). High-involvement purchases are usually ones of expensive, durable goods, such as cars and houses, or purchases that are critically relevant to the buyer, such as drugs. In contrast, low-involvement purchases are usually of low price, non-durable products, such as books.

Purchase involvement has been found to strongly influence buyer behavior, particularly the degree of information searching and the nature of purchasing decision making (Dholakia 2001). First, when buyers are involved in a purchase and are afraid of making a wrong decision, they are likely to meticulously search and analyze all relevant information (Petty et al. 1983). Hence, they are likely to delay, postpone, or even put off their purchase decision until they are satisfied with the information they collect and analyze. Second, due to the high potential for loss in the case of high-involvement purchases, buyers are more inclined to assign more weight to the dimensions of risk importance and risk probability in their decision making (Venkatraman 1989). In doing so, they are more likely to focus on the extent and probability of loss, which in turn will negatively influence their purchase intentions. Therefore, the higher the degree of purchase involvement, the stronger the negative relationship between perceived uncertainty and purchase intentions.

H2: A buyer's purchase involvement positively moderates (reinforces) the negative relationship between perceived uncertainty and intentions to purchase products online.

Consumer Purchase Intentions and Actual Purchases

Research on B2C e-commerce has shown that buyer intentions to engage in online exchange relationships is a strong predictor of actual transactions (Pavlou and Fyngenson 2006). Despite the generally positive relationship between transaction intentions and actual transaction behavior, it is important to empirically verify this relationship in a new context (Straub et al. 1995). We thus hypothesize

H3: Intention to purchase online positively influences a buyer's actual online purchases.

What Drives Perceived Uncertainty? ■

To better understand the nature of uncertainty and mitigate its potentially harmful impact on e-commerce adoption, we refer to agency theory and specifically to the *principal-agent perspective*,⁴ which is employed as a conceptual lens to shed light on how perceived uncertainty can be understood and mitigated in online buyer-seller relationships.

The Principal-Agent Perspective

The principal-agent perspective addresses the ubiquitous agency relationship in which one entity (the principal) delegates work to another (the agent) who performs the work according to a mutually agreed contract (Eisenhardt 1989). Agency relationships are instituted whenever one party depends on another party to undertake some action on its behalf (Jensen and Meckling 1976). The principal-agent perspective virtually applies to all transactional exchanges that occur in a socio-economic system of opportunism, asymmetric information, and bounded rationality (Milgrom and Roberts 1992).

Principals and agents are self-interested parties with incongruent goals, which leads to two information problems: the *pre-contractual* problem of *adverse selection* (Akerlof 1970), and the *post-contractual* problem of moral hazard (Rothschild and Stiglitz 1976). Subsequently, Arrow (1985) introduced

⁴Agency theory is traditionally linked to employment relationships since the principal-agent problem was originally formulated to employer relationships (Berle and Means 1932). We use the term *principal-agent perspective* to include recent developments in agency theory from the information economics literature (Akerlof 1970; Arrow 1985; Rothschild and Stiglitz 1976; Spence 1973).

the more practical terms *hidden information* for adverse selection and *hidden action* for moral hazard, which are subsequently used in this paper.

Hidden information (adverse selection) arises pre-contractually because the agent possesses private (hidden) information about its true quality (Akerlof 1970). Information asymmetry puts principals in a disadvantaged position because they are faced with a pool of agents with undesirable characteristics and they cannot easily discriminate the “cherries” (high quality agents) from the “lemons” (low quality agents) (Wilson 1980). Solutions to the hidden information problem include screening of agents, examining signals from agents, and allowing opportunities for agent self-selection.

Hidden action (moral hazard) takes place post-contractually after the principal hires an agent who may not exert the promised effort or engage in hidden actions that profit her at the principal’s expense (Jensen and Meckling 1976). Hidden action may come into play because the principal cannot perfectly monitor the agent’s behavior or performance. Solutions to the hidden action problem include signals, incentives, bonding, and behavior or performance monitoring.

Hidden information and hidden action are concurrent, yet distinct problems in agency relationships. Even if the principal may overcome the hidden information problem by pre-contractually selecting a high-quality agent, the principal is still exposed to the hidden action problem since the agent may decide to post-contractually skimp on quality. Therefore, even if this study takes place during the pre-contractual phase, it is still influenced by *expectations* of the post-contractual problem of hidden action. Both agency problems thus need to be examined to fully understand agency problems.

While the principal–agent problem was originally formulated to study the separation of ownership and control that arose with the rise of professional managers who were controlling assets they did not own (Berle and Means 1932), it is important to stress the ubiquity of the principal–agent problem and its multiple applications beyond employment relations. Indeed, major developments in the principal–agent perspective were achieved by applying the principal–agent problem outside employment relationships, such as in spot market exchanges (Akerlof 1970) and insurance–client relationships (Rothschild and Stiglitz 1976). The principal–agent perspective has also been extensively examined in the IS literature, such as information systems development projects (e.g., Keil et al. 2000), IT outsourcing (e.g., Bahli and Rivard 2003), and online marketplaces (e.g., Ba and Pavlou 2002; Pavlou and Gefen 2004, 2005).

The Principal–Agent Perspective in Buyer–Seller Relationships

Since the principal–agent perspective is a ubiquitous theory, it has been applied to many types of relationships, including buyer–seller exchange relationships (e.g., Bergen et al. 1992; Mishra et al. 1998; Singh and Sirdeshmukh 2000). Since buyers delegate responsibility to sellers, the principal–agent perspective typically views the buyer as the principal and the seller as the agent, even if it is often possible to have the reverse formulation (e.g., Rothschild and Stiglitz 1976). Applied to online buyer–seller relationships, buyers are viewed as the principals that hire a seller (agent) to deliver a product as advertised in a timely manner.

The agency problems of hidden information and hidden action readily pertain to online buyer–seller relationships: Hidden information refers to the pre-contractual misrepresentation of the seller’s characteristics (seller quality uncertainty) and the quality of its products (product quality uncertainty). Hidden information reflects the buyer’s difficulty to select a high quality seller because low quality sellers may try to misrepresent their true quality and the quality of their products to extract unjustified profits. Hidden action comes into play post-contractually after the buyer has hired a seller who may shirk or cheat the buyer (seller quality uncertainty) by reducing the promised product quality (product quality uncertainty). Table 1 outlines six key requirements for the principal–agent perspective to hold in transactional relationships, and how the application of the principal–agent perspective to online buyer–seller relationships satisfies these requirements.⁵

Applying the principal–agent perspective to buyer–seller relationships, for simplicity, there are two types of sellers: high quality and low quality ones. The high-quality sellers are the *cherries* that are likely to reliably deliver high-quality products as promised in a timely manner, and the low-quality sellers are the *lemons* that are likely to hide their private information and deliver low-quality products. As noted earlier, since seller and product quality uncertainty is inextricably intertwined, low-quality sellers may purposely misrepresent their true characteristics, their information practices, and their products’ true quality so that buyers cannot easily discriminate between high and low quality sellers and products.

⁵We are indebted to one of the reviewers for listing these six key requirements for the principal–agent perspective to hold.

Table 1. Application of the Principal–agent Perspective to Online Buyer Relationships

Characteristics of the Principal–Agent Perspective	Online Buyer–Seller Relationships
Human Action: Principal delegates authority or responsibility to an agent who acts on her behalf.	A buyer (principal) delegates responsibility to a seller to deliver products, and the seller (agent) acts on behalf of the buyer.
Divergence of Interests: Principals and agents have different interests and goals.	Buyers want to get high quality products for as little money as possible, whereas sellers want to deliver as low a quality of products as possible and receive as much money as possible.
Potential for Agent’s Gainful Exchange: Possibility for agents to gain by shirking or acting opportunistically.	Sellers have the potential to act opportunistically by accepting money and not delivering products, delivering products of lower quality than promised, and failing to acknowledge product guarantees and post-purchase support.
Difficulty in Monitoring and Enforcing Human Action: Principals cannot easily monitor agents and enforce their expected actions.	Buyers cannot easily monitor how product delivery is undertaken or easily enforce that sellers will fulfill their end of the transaction.
Agents Not Bearing Consequences of Their Actions: Agents act on behalf of principals who own the assets being managed.	Upon the buyer’s (principal’s) payment, the products to be delivered are no longer owned by the seller (agent) but they are essentially owned by the buyer. The seller thus manages the delivery of the buyer’s products.
Temporal Duration: There is a time lag in which the agent’s actions can be manifested.	Online buyer–seller relationships extend over a long period of time in terms of product delivery, product warranties, product returns, and post-purchase service and support.* Moreover, sellers maintain their buyers’ personal and monetary information over virtually an infinite time after purchase.

*While online buyer–seller relationships have a substantial temporal duration in which the hidden action problem can be manifested, even short-term “spot” exchanges have been examined from a principal–agent perspective. For example, Akerlof’s (1970) seminal work that introduced the term “adverse selection” examined spot exchanges of used cars and solely focused on adverse selection.

Sources of Perceived Uncertainty in Principal–Agent Relationships

Applying the principal–agent perspective to online buyer–seller relationships, perceived uncertainty arises from two primary antecedents due to hidden information and hidden action, respectively: First, perceived information asymmetry, which is due to the fact that buyers perceive sellers to have a greater quantity or quality of information than they have. Second, buyers have fears that sellers may act opportunistically to serve their self-interest due to divergence of interests.

Besides the existing constructs of *perceived information asymmetry* and *fears of seller opportunism*, uncertainty in online buyer–seller relationships is also proposed to arise from the side effects of the transaction, specifically the buyer’s personal information that is rendered during an online transaction. In fact, to engage in online exchange relationships, buyers have to render their personal information, such as their private (e.g., personal data, product preferences) and

monetary (e.g., credit card) information. Extending the principal–agent perspective, we propose two new antecedents of perceived uncertainty: *information privacy concerns* and *information security concerns*. Information privacy concerns and information security concerns make buyers skeptical about online transactions (George 2002), and they have been viewed as two major barriers to e-commerce adoption (Hoffman et al. 1999; Rose et al. 1999).

Information privacy and security concerns have not been studied in the classical applications of the principal–agent perspective in traditional buyer–seller relationships. This is because traditional transactions were not performed on the open Internet infrastructure that allows personal and monetary information to be easily collected, processed, and used. Therefore, the contextual application of the principal–agent perspective in online buyer–seller relationships gives rise to novel sources of perceived uncertainty that have not been relevant in traditional agency relationships. Consequently, information privacy and security concerns are valid exten-

sions of the principal–agent perspective since they relate to *both* hidden information (selecting a seller that has the ability and motivation to adhere to privacy and security policies) *and* hidden action (sellers not adequately protecting or intentionally releasing private and monetary information).

Even if it could be possible to extend the content domain of information asymmetry and seller opportunism to capture the notion of information privacy and security concerns by separating the hidden information and hidden action components of privacy and security concerns and appending them to information asymmetry and seller opportunism, respectively, we chose not to do so for four reasons: First, perceived information asymmetry and fears of seller opportunism are existing, well-validated constructs in the principal–agent perspective. Extending the principal–agent perspective by appending new phenomena is risky from both a conceptual and a methodological standpoint. Second, information privacy and information security concerns are two existing, well-validated constructs that have been examined in their own right outside the realm of the principal–agent perspective. Decomposing them to fit the principal–agent perspective and fusing elements of information privacy and security concerns into existing constructs may not do justice to the privacy and security literature. Third, from a methodological perspective, if information privacy and security concerns are viewed by buyers as components of perceived information asymmetry and fears of seller opportunism, their measurement items should empirically tap onto the existing information asymmetry and seller opportunism scales. Finally, the study's primary goal is to fully predict seller-related uncertainty sources. Information privacy and security concerns should thus be allowed to add to the variance explained in perceived uncertainty beyond existing constructs. Therefore, information privacy and security concerns are theorized as distinct constructs that extend the principal–agent perspective beyond its existing constructs to better predict perceived uncertainty in online exchange relationships.

Perceived Information Asymmetry

The principal–agent perspective maintains that the quantity and quality of information is distributed asymmetrically between principals and agents. In most instances, asymmetrical information favors the agent (seller), thereby leading to the seller's information advantage (Nayyar 1990). Information asymmetry has been recognized as a common (hidden information) problem in buyer–seller relationships in which sellers usually possess more information than buyers (Mishra et al. 1998). Perceived information asymmetry is defined as the buyer's perception that the seller has a greater quantity or

quality of information about its products, characteristics, and selling practices.

Under information asymmetry conditions, buyers cannot easily distinguish among high- and low-quality sellers because low-quality sellers try to hide their true characteristics to extract unjustified profits, while high-quality sellers find it difficult to convincingly convey their true quality. Even if buyers try to pre-contractually assess seller and product qualities, a true inference can only be made after the purchase has been completed and fulfilled. However, at the time of purchase, buyers must make a decision without having access to full information. Due to the physical and temporal separation between buyers and sellers in online environments, information asymmetry dominates (Huston and Spencer 2002). Thus, information asymmetry is particularly problematic for online exchange relationships, giving rise to hidden information.

Information asymmetry makes it difficult for buyers to assess the sellers' true characteristics and product quality. The higher the degree of information asymmetry that buyers perceive, the higher their uncertainty perceptions will be about a transaction. Perceived information asymmetry is thus proposed to increase perceived uncertainty.

H4a: Perceived information asymmetry positively influences a buyer's perceived uncertainty.

Fears of Seller Opportunism

The principal–agent perspective assumes that both principals and agents are motivated by self-interest in exchange relationships and, whenever possible, they attempt to exploit the situation to maximize their profits. The hidden action problem emerges when the principal hires an agent who may not perform at the promised quality level to reap unfair profits. Opportunism is possible in agency relationships where there is goal incongruence and agents may act opportunistically since the principal cannot fully monitor the agent's behavior and enforce compliance (Eisenhardt 1989).

Applied to online buyer–seller relationships where sellers' behaviors cannot be easily guaranteed or monitored, sellers may act opportunistically to pursue their own self-interests. Consequently, buyer's fears of seller opportunism are defined as the buyer's concerns that the seller may act opportunistically. Examples of seller opportunism include quality cheating, masquerading true identity, contract default, or not acknowledging product warranties (Mishra et al. 1998). Gefen (2002) also observes that e-commerce renders buyers vulnerable in many ways due to the lack of proven institu-

tional guarantees that online sellers will not act opportunistically by charging unfair prices, posting inaccurate product information, or engaging in fraudulent activities. Due to the potential of hidden action, fears of seller opportunism are proposed to increase seller and product quality uncertainty since buyers are unable to post-contractually monitor, contain, control, or enforce seller behavior.

H4b: Fears of seller opportunism positively influence a buyer's perceived uncertainty.

Information Privacy Concerns

Information privacy refers to the ability to control how an individual's personal information is acquired and used (Westin 1967). In online exchange relationships, sellers collect detailed personal and monetary information from buyers, and they increasingly rely on effective use of buyer information to formulate their marketing strategies (Bessen 1993). While sellers take advantage of personal information to gain an edge, buyers often view this as an invasion of privacy (Culnan and Armstrong 1999). In fact, the tension between organizational use of personal information and a person's information privacy has been touted as one of the most important ethical issues of the information age (Mason 1986).

When buyers disclose their personal information online, two types of information privacy concerns arise from the sellers' inability or unwillingness to effectively manage the buyers' personal information. One relates to the improper use of information due to the absence of appropriate seller controls (Smith et al. 1996). The second relates to the secondary use of personal information without the buyer's consent, for purposes outside the focal transaction (Culnan 1993). Information privacy concerns are defined as a buyer's beliefs about a seller's *inability* and *unwillingness* to protect her personal information from improper use, disclosure to third parties, and secondary use without the buyer's consent.

Information privacy concerns only relate to *seller* quality, and they are distinct from *product* quality uncertainty. It is possible that buyers may have no concerns about the quality of a seller's products and the seller's ability to deliver the right product in a timely fashion, but they still decide not to purchase because of information privacy concerns.

Information privacy concerns relate to both agency problems of hidden information and hidden action. First, information privacy concerns relate to hidden information since buyers may find it difficult to pre-contractually identify and select sellers who have the ability to ensure proper information practices. Second, they also relate to hidden action in the sense that the seller may be unwilling to post-contractually

safeguard a buyer's private information from improper use, and they may engage in secondary use of buyer information without the buyer's consent.

Since information privacy is still largely protected by self-regulation, it is unlikely that all sellers will self-regulate. Due to hidden information and hidden action, information privacy concerns lead to seller quality uncertainty, which stems from a buyer's inability to predict whether a seller will comply with fair information practices. Therefore, buyers cannot accurately predict if their personal information will be fairly used and if they will suffer negative outcomes in the future. Consequently, concerns about information privacy would make buyers perceive online transactions to be uncertain.

H4c: Information privacy concerns positively influence a buyer's perceived uncertainty.

Information Security Concerns

As an open and global communications medium, the Internet is exposed to many security vulnerabilities. A recent study shows that more than two thirds of Americans are concerned about hackers and cyber criminals (McCrohan 2003). For e-commerce to proliferate, buyers must be confident in the seller's ability and willingness to safeguard their monetary information from security breaches during transmission and storage with authentication, encryption, and non-repudiation. Salisbury et al. (2001) show that perceived information security is a stronger determinant of intention to purchase online than the website's perceived ease of use and usefulness. Similarly, Yang and Jun (2002) show that information security is considered the most critical concern for those who do not purchase online. Information security concerns are defined as the buyer's beliefs about a seller's *inability* and *unwillingness* to safeguard their monetary information from security breaches during transmission and storage (Salisbury et al. 2001).⁶ Monetary information includes credit card and social security numbers, user names and passwords, and other information that may lead to financial consequences if stolen (Cheung and Lee 2001).

Information security concerns relate to both hidden information and hidden action since buyers cannot *ex ante* select

⁶While information privacy concerns deal with whether a buyer's personal information is improperly used due to the seller's actions, information security concerns deal with whether a buyer's information is protected from security breaches. While security breaches can theoretically steal all types of buyer information, their primary target is monetary (e.g., credit card) information. For simplicity, the distinction between privacy and security concerns focuses on the protection of *monetary* versus *nonmonetary* information.

sellers who have the ability to adequately safeguard their monetary information and who will *ex post* be willing and able to securely store and protect their monetary information from hackers. Information security concerns lead to seller quality uncertainty, which stems from the buyers' difficulty in assessing a seller's ability and predicts the seller's willingness to safeguard monetary information. Buyers cannot thus accurately predict whether their monetary information will be appropriately safeguarded from security breaches and whether they will suffer financial problems in the future.

H4d: Information security concerns positively influence a buyer's perceived uncertainty.

What Mitigates Uncertainty Perceptions?

Since perceived uncertainty is determined by the agency problems of hidden information and hidden action, uncertainty perceptions can be mitigated from an agency theory perspective through the logic of signals and incentives.

Signals

Signals are designed and sent by agents to disclose their private information about their true quality to principals. Signals can separate both individual sellers and groups of sellers with specific characteristics (Spence 1973). In turn, principals are dynamic recipients of information who actively examine these signals to assess their informational content and credibility (validity) in order to determine the agents' true characteristics.

In theory, effective signals must be visible, unambiguous, and differentially costly among agents in order to allow high-quality agents to differentiate from low-quality ones (Rao and Ruckert 1994). Effective signals must be perceived by the principals as credible commitments by high-quality agents that cannot be easily imitated by low-quality agents.

It is important to note that false signals that are misrepresented from low-quality agents may be falsely perceived by the principals as genuine. In this case, principals may perceive a lower degree of hidden information or hidden action (and thus lower uncertainty perceptions), even if these perceptions may also be based on false information.

Incentives

Incentives are designed to prevent hidden action by making opportunism irrational or costly. In turn, principals assess the

adequacy of various incentives to constrain opportunism and hidden action. In online exchange relationships, in addition to *contracts* that specify the seller's performance or behavior, *repeat sales* and *price premiums* (prices above marginal cost) also create incentives for sellers to act cooperatively. First, the possibility of repeat sales from loyal buyers gives sellers incentives to forego any short-term gains from acting opportunistically and delivering inferior quality products (Rao and Bergen 1992). Second, price premiums can also create incentives that motivate sellers to maintain high quality (Klein and Leffler 1981). Therefore, buyers who want to transact with high-quality sellers tend to render a price premium (Ba and Pavlou 2002), while sellers see price premiums as an incentive to sustain high quality (Pavlou and Gefen 2005). Finally, incentives may be in the form of *penalties* or *sanctions* that make opportunism irrational or costly. For example, third-party legal authorities can be used to penalize opportunistic behavior, thereby preventing hidden action.

Similar to false signals, there is an issue whether incentives are effective in terms of constraining opportunism. For example, incentives such as price premiums and repeat sales may not always work when short-term opportunism may be more profitable than long-term sales. In such cases, buyers may incorrectly believe that hidden action is irrational for sellers, but sellers may act opportunistically since it may be rational for them to do so.


Uncertainty Mitigators


Since both false signals and ineffective incentives may be mistakenly perceived by the principals as effective, principals may underestimate the hidden information or hidden action problem and thereby misjudge the uncertainty of the situation and transact with low-quality sellers. However, only legitimate signals and effective incentives can mitigate *true* uncertainty, whereas both false and genuine signals and incentives may mitigate *perceived* uncertainty. Hence, it is up to the principals to correctly assess genuine signals from high-quality agents (to *truly* mitigate the hidden information problem), and rely on effective incentives for agents to act cooperatively (to *truly* mitigate the hidden action problem). Following Bergen et al. (1992), this study does not aim to evaluate the effectiveness of specific signals and incentives, but rather to test whether, how, and why buyer beliefs that draw from the buyer's *subjective* (whether correctly or incorrectly) evaluation of signals and incentives mitigate perceived uncertainty. Singh and Sirdeshmukh (2000) argue that there is no perfect correspondence between signals and incentives and their evaluation by buyers. Assuming bounded rationality, it is not clear whether all buyers will assess signals in a similar fashion. For example, some naïve buyers may be


fooled by fake signals by low-quality sellers, or they may dismiss legitimate signals posted by high-quality sellers. Likewise, buyers may not similarly perceive the effectiveness of various incentives that would constrain sellers not to act opportunistically. Rather than examining specific signals and incentives, we focus on the buyer beliefs that relate to signals and incentives.


To mitigate the four proposed antecedent sources of perceived uncertainty, we propose a set of buyer beliefs—*trust*, *website informativeness*, *product diagnosticity*, and *social presence*—as explained in detail below.

Trust

 is a psychological state that is most valuable under conditions of uncertainty (Mayer et al. 1995). In fact, if transactions occurred under perfectly certain conditions, there would be no need for trust (Lewis and Weigert 1985).

 has been examined in multiple literatures, including organization theory (Rousseau et al. 1998), economics (Williamson 1993), social networks (Gambetta 1988), and IS (McKnight et al. 2002). However, our focus is on trust in buyer–seller relationships, particularly in online environments.

 Despite several ways to categorize the dimensions of trust, the e-commerce literature mostly distinguishes between three primary dimensions of trust: competence, integrity, and benevolence (Bhattacharjee 2002; Gefen 2002). Accordingly, following Pavlou and Gefen (2004) and Rousseau et al. (1998), trust is defined as a buyer's intentions to accept vulnerability based on her beliefs that transactions with a seller will meet her confident transaction expectations due to the seller's competence, integrity, and benevolence.

 the literature suggests that trust may relate to both signals and incentives (e.g., Pavlou and Gefen 2005), trust is proposed to mitigate all four proposed sources of perceived uncertainty.


Trust and Perceived Information Asymmetry

When buyers find it difficult to make purchasing decisions due to insufficient information, they need other means to substitute for their information deficiency. Trust is proposed as a means for alleviating perceived information asymmetry by allowing buyers to accept the vulnerability associated with accepting the information conveyed by the signals that sellers send to reveal their hidden information. While all sellers send

signals that aim to reduce information asymmetry, buyers are more likely to believe the signals coming from sellers they trust. By only accepting the information contained in signals from trustworthy sellers, buyers will perceive less information asymmetry when transacting with sellers they trust.

H5a: Trust mitigates a buyer's perceived information asymmetry.

Trust and Fears of Seller Opportunism

 are several incentives for sellers not to behave opportunistically, such as repeat sales and price premiums (Klein and Leffler 1981; Rao and Bergen 1992) and third-party institutional guarantees (Pavlou and Gefen 2004). In fact, to hinder seller opportunism, buyers offer price premiums to deal with trustworthy sellers again (Ba and Pavlou 2002). Institutional third-party authorities encourage cooperative seller behavior by penalizing opportunism. With these incentives in mind, rational high-quality sellers are attracted by long-term profits and are less likely to jeopardize their reputation and long-term profits by acting opportunistically (Rao and Monroe 1996). Realizing that high-quality sellers have incentives not to act opportunistically, buyers are more likely to trust these sellers and assume vulnerability when transacting with them. In contrast, since low-quality sellers are more likely to act opportunistically due to a lack of strong incentives to protect their (poorer) reputation, buyers will trust them less, and will thus be concerned that they may act opportunistically.

H5b: Trust mitigates a buyer's fears of seller opportunism.

Trust and Information Privacy Concerns

As privacy protection is primarily dependent on weak self-regulation (Culnan 2000), buyers can rely on trust to alleviate their information privacy concerns, both pre-contractually and post-contractually.

Pre-contractually, to resolve their buyers' hidden information problem in terms of how their private information is managed, sellers signal their procedural fairness in terms of properly managing private information. Examples of signals include posting their information privacy policy and being accredited by third-party privacy agencies, such as TRUSTe. While all sellers send signals of their information practices, buyers will only believe the signals coming from sellers they trust and are willing to become vulnerable to them. Hence, trust allows buyers to accept the information conveyed by the signals sent by sellers in terms of their procedural fairness. In doing so,

buyers will be less concerned with their information privacy if they transact with sellers they trust. On the other hand, if buyers do not trust the signals sent by sellers regarding their procedural fairness, they will be concerned about their information privacy.

Post-contractually, trust is proposed to reduce information privacy concerns by reducing fears of hidden action, following the logic of incentives. Since rational high-quality sellers have incentives not to exploit their buyer's private information for short-term profits, buyers are willing to trust such sellers and accept the vulnerability associated with sharing their private information. Trust allows buyers to disclose private information (Vidmar and Flaherty 1985), provided that sellers are deemed competent to protect their private information from improper access, and have integrity and benevolence to refrain from selling private information to third parties. Realizing that trustworthy, high-quality sellers are unlikely to jeopardize future sales and price premiums or face institutional penalties from third parties if they exploit their private information, buyers will be less concerned about their information privacy when dealing with sellers they trust.

In sum, trust is proposed to reduce information privacy concerns by mitigating hidden information and hidden action. Empirical evidence also suggests that trust and information privacy concerns are linked with a negative relationship (Culnan and Armstrong 1999; Luo 2002a; Malhotra et al. 2004). We thus hypothesize

H5c: Trust mitigates a buyer's information privacy concerns.

Trust and Information Security Concerns

Similarly, trust is also proposed to reduce information security concerns using the logic of signals and incentives.

Pre-contractually, to alleviate their buyers' information security concerns, sellers signal their competence in managing monetary information by posting their security policies and security technologies, and by having third-parties verify their security practices. While all sellers send such signals, buyers are likely to accept the vulnerability associated with believing the signals only if they are posted by sellers they trust. Hence, buyers are likely to be less concerned about their information security if they deal with sellers they trust. In contrast, if they transact with sellers they do not trust, they will not believe the signals these sellers send, and they will be rightfully concerned about their information security.

Post-contractually, trust is proposed to mitigate information security concerns based on the logic of incentives. Since

rational high-quality sellers have incentives to safeguard their buyers' monetary information from inappropriate access to ensure future transactions with price premiums and avoid losing the accreditation from institutional third parties, they are likely to invest in appropriate security technologies to prevent security breaches. High-quality sellers are even likely to compensate buyers in case of security breaches to maintain their reputation. Realizing that high-quality sellers have incentives not to engage in opportunistic actions with their monetary information to protect their reputation, buyers would be more willing to trust them more and accept the vulnerability associated with sharing their monetary information with them. Therefore, they will be less concerned with their information security when transacting with sellers they trust. In sum, trust is proposed to reduce information security concerns by mitigating hidden information and hidden action.

H5d: Trust mitigates a buyer's information security concerns.

Website Informativeness

Website informativeness emerged from early studies of print and TV advertisements whose goal was to satisfy government requirements for educating consumers by showing information consumers would find valuable (Resnik and Bruce 1977). Website informativeness is defined as the degree to which a website offers information buyers perceive as *useful* (Luo 2002b). This could be *any* information that buyers find *useful*, such as the seller's selling practices, privacy and security practices, and product descriptions. Website informativeness is a perceptual construct (Chakraborty et al. 2002), and it may differ from the objective number and type of informational cues to capture whether buyers perceive the information they receive as accurate, relevant, and credible, and thereby of *use* to them.

Website Informativeness and Perceived Information Asymmetry

To alleviate their buyer's hidden information problem, sellers send signals that reveal their true characteristics, products, and selling practices, and information policies. If the information conveyed by these signals is deemed useful, these signals enhance the buyer's perception of a seller's website informativeness. Therefore, website informativeness captures the information conveyed by signals that is credible to them in terms of obtaining useful seller information. While all sellers send signals that aim to reduce information asymmetry, website informativeness captures the degree to which buyers find these signals credible and find the information content useful. Therefore, the higher the degree of website informa-

tiveness, the greater the quantity and quality of useful information buyers have about a seller's practices, characteristics, and products, and thereby the lower their degree of perceived information asymmetry will be.

H6a: Website informativeness mitigates a buyer's perceived information asymmetry.

Website Informativeness and Fears of Seller Opportunism

Website informativeness is largely the outcome of sellers revealing credible signals with information that buyers consider valuable. When buyers have credible and thereby useful information about sellers, they feel more comfortable predicting that these sellers will not act opportunistically. Being forthcoming in their information sharing also acts as a signal of professionalism and high quality, allowing buyers to predict that sellers will continue to act in a professional, high-quality manner in the future, and thereby to reduce their fears that sellers will act opportunistically.

H6b: Website informativeness mitigates a buyer's fears of seller opportunism.

Website Informativeness and Information Privacy Concerns

To alleviate their buyers' pre-contractual concerns in terms of how private information will be managed, sellers post their information privacy practices on their website. The FTC recommends sellers disclose what information they collect and how they use it. This information signals buyers how their private information will be collected, stored, and used in the future and if there will be any secondary use of their private information. If the information is deemed accurate, relevant, and credible (and thus useful), it enhances a buyer's perception of a seller's website informativeness. When people are informed that their information is used fairly, they are more comfortable disclosing personal information (Culnan and Armstrong 1999). In fact, when buyers are familiar with how their private information is managed, they tend to be less concerned with their information privacy (Sheehan and Hoy 2000). The higher buyers deem the degree of a seller's website informativeness to be, the greater the amount of information buyers will find useful about the seller's ability to protect their personal information, and the lower the degree of information privacy concerns they will perceive.

Detailed information about the seller's information practices also enhances a seller's website informativeness by offering

thorough information that buyers are likely to find useful. Detailed information is likely to act as an incentive, encouraging sellers to post-contractually adhere to their posted information practices to avoid legal problems. The more detailed the information on a website is, the more easily it can be used against a seller in a legal dispute, and sellers will be more willing to protect their buyers private information. Realizing this incentive which the more informative websites create, buyers will be less concerned about hidden action when dealing with sellers with more informative websites.

H6c: Website informativeness mitigates a buyer's information privacy concerns.

Website Informativeness and Information Security Concerns

On their websites, sellers disclose their information security practices to signal that buyer monetary information will be adequately protected. If this information is deemed accurate, relevant, and credible (and thus useful), it shapes the buyer's perception of a seller's website informativeness. The higher a seller's website informativeness is perceived to be, the lower the degree of hidden information buyers will have about the seller's ability to protect their monetary information, and the lower their information security concerns will be.

Moreover, a thorough disclosure of information security practices enhances a seller's website informativeness by offering detailed information that buyers are likely to find useful. Such detailed information is likely to act as an incentive, forcing sellers to post-contractually stand behind their information security policies to prevent legal problems. The more descriptive a seller's information security policy is, the more difficult it would be for the seller to violate the policy and get away with such a violation. Realizing the incentive of sellers whose websites disclose detailed information, buyers will be less concerned about their information security when transacting with sellers who have more informative websites.

Summarizing these arguments, website informativeness is proposed to reduce information security concerns.

H6d: Website informativeness mitigates a buyer's information security concerns.

Product Diagnosticity

Product diagnosticity is defined as the extent to which a buyer believes that a website is helpful in terms of evaluating a

product (Kempf and Smith 1998). Whereas buyers in traditional markets can evaluate a product's quality by kicking the tires, product diagnosticity reflects a website's ability to convey relevant product information to help online buyers accurately evaluate product quality (Pavlou and Fygenon 2006).

Product diagnosticity is related to both signals and incentives. Signals that build product diagnosticity include virtual and functional control (Jiang and Benbasat 2004). Virtual control allows buyers to manipulate product images to see a product from various angles and distances. Functional control allows buyers to try various product functions. Product diagnosticity also relates to incentives by motivating sellers not to post-contractually deviate their product offering from the product information they pre-contractually disclose to prevent legal problems.

Product Diagnosticity and Perceived Information Asymmetry

By providing a real feel for their products and enabling adequate evaluation of product attributes through signals (Jiang and Benbasat 2004), sellers can convey information about the true quality of their products. Product diagnosticity overcomes the barrier due to the lack of physical inspection of products on the Internet (Kirmani and Rao 2000), thereby allowing buyers to accurately evaluate a product's quality. Product diagnosticity thereby alleviates the (adverse) selection of low-quality or incorrect products, and it thus reduces perceptions of product-related information asymmetry.

H7a: Product diagnosticity mitigates a buyer's perceived information asymmetry.

Product Diagnosticity and Fears of Seller Opportunism

By providing a real feel for the product and enabling adequate product evaluation, product diagnosticity is also likely to overcome fears of seller opportunism.

First, comprehensive, descriptive, and graphic product information gives a sense of professionalism to a website, acting as a signal that the seller is of high quality. Such signal allows buyers to pre-contractually predict that the seller is of a high-quality caliber that will continue to post-contractually act in a high-quality manner and not act opportunistically. Indeed, product diagnosticity has been shown to strengthen buyer beliefs about true product quality and enhance their confidence in their product decisions (Kempf and Smith 1998).

Second, facilitating superior product diagnosticity through extensive product information also creates an incentive for sellers not to deviate from the promised product quality because of potential legal problems if the product does not adhere to its advertised quality standards. This creates an incentive for sellers to deliver products as promised and refrain from post-contractually reducing product quality. Product diagnosticity is thus likely to reduce a buyer's fears of receiving a product of inferior quality, and fears of hidden action are likely to be mitigated.

In sum, product diagnosticity is hypothesized to reduce buyers' fears of seller opportunism.

H7b: Product diagnosticity mitigates a buyer's fears of seller opportunism.

Product diagnosticity deals with the website's ability to evaluate products, and it is unrelated to the seller's ability to manage information. Thus, we do not expect product diagnosticity to influence information privacy and security concerns.

Social Presence

The concept of *social presence* is derived from social presence theory (Short et al. 1976), and it refers to the extent to which a medium is perceived as truly conveying the presence of the communicating participants (Rice 1993). Social presence, which is akin to the notion of information richness (Daft and Lengel 1984), creates a perceptual illusion in which a user perceives distant entities as being close (Choi et al. 2001). We use the construct of *social presence* to capture the extent to which buyers perceive the website to effectively convey the presence of the (human) seller behind the website. Social presence is built upon signals, such as virtual agents and IT-enabled human-like interaction.

Social Presence and Information Privacy and Security Concerns

Social presence closely relates to intimacy and psychological closeness (Short et al. 1976), and it addresses the social dimension of online exchange relationships. Drawing upon social presence theory, Kumar and Benbasat (2002) argued that to achieve e-commerce adoption, a website should be treated as a social actor and the relationship between buyers and sellers should be viewed similar to traditional interpersonal relationships. Social presence shortens the perceived social distance between buyers and sellers, making buyers believe that the online exchange relationship is similar to traditional (face-to-face) interpersonal relationships (Kumar

Table 2. Summary of the Effect of the Proposed Uncertainty Mitigators

Uncertainty Sources	Agency Problem(s)	Uncertainty Mitigators	Agency Logic	Hypothesis
Perceived Information Asymmetry	Hidden Information	Trust Website Informativeness Product Diagnosticity	Signals Signals Signals	H5a H6a H7a
Fears of Seller Opportunism	Hidden Action	Trust Website Informativeness Product Diagnosticity	Incentives Signals Signals & Incentives	H5b H6b H7b
Information Privacy Concerns	Hidden Information & Hidden Action	Trust Website Informativeness Social Presence	Signals & Incentives Signals & Incentives Signals	H5c H6c H8a
Information Security Concerns	Hidden Information & Hidden Action	Trust Website Informativeness Social Presence	Signals & Incentives Signals & Incentives Signals	H5d H6d H8b

and Benbasat 2002). Information privacy and security concerns mainly arise due to the physical separation between buyers and sellers that allows private and monetary information to be easily collected, processed, and used (Sheehan and Hoy 2000). Since information privacy and security concerns mainly arise due to the perceived social distance between them and sellers (Choi et al. 2001), buyers will be less concerned with their information privacy and security if they perceive a higher social presence.

H8a: Social presence mitigates a buyer's information privacy concerns.

H8b: Social presence mitigates a buyer's information security concerns.

Social presence influences information privacy and security concerns by reducing the social distance between buyers and sellers. Since information asymmetry and seller opportunism are unrelated to social distance, social presence is neither expected to reduce perceived information asymmetry nor mitigate fears of seller opportunism.

Table 2 summarizes the hypotheses by which uncertainty can be mitigated. Trust and website informativeness are proposed to mitigate all four sources of uncertainty; perceived product diagnosticity to only mitigate perceived information asymmetry and fears of seller opportunism; and social presence to mitigate information privacy and security concerns.

Control Variables

- **Perceived usefulness** is defined as the buyer's belief that a website will enhance personal effectiveness in pur-

chasing products online (Davis 1989). Perceived usefulness can be due to attractive prices, superior products, superior search engines, low search costs, and low shipping costs. Since perceived usefulness has been shown to affect online purchase intention (Gefen et al. 2003; Pavlou 2003), perceived usefulness is included as a control variable on purchase intentions.

- **Perceived ease of use** is the extent to which a user believes that using the system does not require considerable effort (Davis 1989). Perceived ease of use herein refers to whether buyers believe that purchasing products from an online seller would be free of effort, and it is controlled for its impact on purchase intentions.
- **Past Internet Experience.** Since online purchasing involves Internet use, lack of Internet experience impedes buyers from engaging in online transactions. Hence, Internet experience is proposed as control variables on purchase intentions.
- **Purchasing Experience with Online Book Purchasing/ Prescription Filling.** In addition to general Internet transactions, the number of a buyer's specific online transactions with books or prescription drugs is also controlled for, since past transactions are likely to have an impact on purchase intentions and actual purchases (Chaudhuri 1999).
- **Buyer Demographics.** Prior studies have shown that gender and age play a significant impact on user acceptance of technology (Venkatesh et al. 2003). It is conceivable that older people would perceive online purchasing differently. Therefore, gender and age are added as control variables on purchase intentions.

Research Methodology

Research Context

We selected the contexts of *online book purchasing* and *online prescription filling* to empirically test the nature, antecedents, and consequences of perceived uncertainty in online environments. These two contexts were chosen as books and prescription drugs are expected to differ on their degree of purchase involvement. Buyers tend to be cautious when purchasing prescription drugs, which are considered *high involvement* products (Gore et al. 1994); in contrast, buyers are less wary about books, as they are considered *lower involvement* products. Prescription drugs differ from books in at least two ways: First, drugs are taken *in vivo* and are directly related to buyer health (whereas books are not). Second, it is generally more difficult to assess the quality of prescription drugs, which typically require the expertise of healthcare professionals. Buyers are thus more likely to be more involved with their purchases of prescription drugs than with books, and they are more likely to pay more attention to details and analyze product information more systematically. Given that medication errors could lead to morbidity and even mortality, prescription drug buyers are more likely to weigh the severity and probability of loss more heavily (Venkatraman 1989). In contrast, buyers are less likely to be concerned about the negative consequences of problems with book purchases.

Online Book Purchasing

Books are among the earliest and most successful products sold online. In 2000, books generated 14 percent of all online sales in the United States, reaching over \$23 billion in sales by 2004 (AAP 2005). With the major book publishers selling books online, the online book market is rapidly growing, posting a 9.3 percent increase in 2005 over the corresponding period of the previous year (Christman 2005).

Online Prescription Filling

The online prescription filling market is also growing rapidly, increasing from \$158 million in 1999 to \$700 million in 2003 and \$1.4 billion in 2004 (Cohen 2003). However, the online market only accounts for 0.6 percent over \$200 billion prescription drug market (Hoffman et al. 2005). While the online book market is well-established, the online prescription drug market is still evolving. Surveys revealed that 50 percent of prescription filling websites are unlicensed, 33 percent do not have adequate measures to protect their patients,

and many are not licensed with state pharmacy boards, have no address and phone number, and try to hide from law enforcement (Silverman and Perlstein 2003).

In sum, it is interesting to examine these two contexts that differ on their degree of purchase involvement, maturity, and state of evolution in the online market.

Measurement Development

All measurement items for the study's principal constructs were adopted from existing measures, but they were adapted for this study, and are shown, along with their sources, in Appendix A. To test the model's generalizability to both specific websites and groups of websites, online book purchasing focused on a single website (www.BiggerBooks.com) while online prescription filling focused on classes of prescription drug websites in general. Special care was taken to assure that the scales reflected the study's two distinct contexts and targets while maintaining the similarity of items, which were all assessed on a five-point scale anchored at 1 = *Strongly disagree*, 3 = *Neutral*, and 5 = *Strongly agree*. All variables were measured as latent, reflective constructs that are captured indirectly with direct measurement items.

The preliminary instrument was first pilot tested for comprehensiveness and clearness, following Churchill (1979). Second, face validity was assessed by an expert panel of 14 experienced IS researchers and 2 licensed pharmacists. Third, after a small-scale pretest with 22 students, the survey instrument was also pretested with a large-scale study with 291 undergraduate students to check the psychometric properties of the measurement scales. Following these pretests, the measurement instrument was shortened, refined, and validated for its statistical properties.

Survey Administration

Two independent surveys (one for online book purchasing and one for online prescription filling) were separately conducted with distinct sample populations using the same data collection procedure and survey instrument (Appendix A). The online book purchasing study was conducted between November 2005 and January 2006, while the online prescription filling study was conducted between March and May of 2005. For both studies, the initial sample comprised of 1,000 randomly selected online consumers (from a purchased commercial list) who were notified with an e-mail invitation message that linked to an online survey instrument. The participants were offered as incentives several \$100 raffle prizes

Table 3. Demographic Characteristics of Consumer Population

Study	Age (STD)	Gender	Education	Annual Income (STD)	Purchase Experience (Times) (STD)
Books	39.6 (18.5)	51% Women	Some College	\$42,387 (27,221)	4.1 (7.1)
Prescription Drugs	42.5 (19.8)	57% Women	Some College	\$45,134 (28,956)	2.2 (4.3)

and a report that summarized the study's results. The invitees were assured that the results would only be reported in aggregate to guarantee their anonymity and confidentiality.

At the beginning of each data collection session, an introduction to the study's context was presented to inform the respondents about the process needed to purchase products online. For online book purchasing, the respondents were asked to visit a specific website (www.BiggerBooks.com). For online prescription filling, the participants were asked to visit two websites, www.drugstore.com and <http://online-prescriptiondrugs.com/>.⁷ These two prescription filling websites were chosen because the former requires a doctor's prescription while the latter has its own doctors. For both contexts, the respondents were instructed to browse these websites and follow the procedures needed to purchase a specific book or a prescription drug, respectively.⁸ All three websites are typical commercial sites that have the necessary features for consumers to get information about products, learn about the merchant and its practices, and complete online purchases.

Out of the 1,000 invitees for each study, a total of 268 responses were obtained for books (27 percent response rate) and 253 responses (25 percent response rate) for prescription filling. Nonresponse bias was assessed by verifying that (1) the respondents' demographics are similar to those of

typical Internet consumers as reported by online commercial sites,⁹ and (2) by verifying that early and late respondents were not significantly different (Armstrong and Overton 1976). Early respondents were those who responded within the first two weeks (slightly over 50 percent). Each of the two samples was compared based on their demographics (i.e., age, gender, education, annual income, and purchase experience) (Table 3). All t-tests between the means of the early and late respondents for both products showed no significant differences, and the demographics of both samples (Table 3) were similar to the demographics reported by online commercial sites.

After 1 month, the respondents were contacted again to collect data about their *actual* online purchases. A total of 198 responses were obtained for books (74 percent response rate), and 173 for prescription drugs (68 percent response rate).¹⁰ The respondents were asked to report the number of purchases of books or prescription drugs they completed since they responded to the first survey. For books, 92 percent did not engage in any book purchases, 7 percent purchased books once, 1 percent two times, and 1 percent three times. For prescription drugs, 87 percent did not engage in any purchases, 10 percent reported purchasing prescription drugs once, and only 3 percent completed two online drug purchases.

Data Analysis and Results

We used partial least square (PLS) for measurement validation and testing the structural model. PLS employs a component-based approach for estimation, and it places minimal

⁷Since we expected consumers to be less familiar with online prescription filling than online book purchasing, we asked them to browse two websites for prescription drugs and respond to online prescription filling in general, while we focused on a single website for books.

⁸To assure that the respondents actually browsed the selected websites, they were required to click on the respective web links before being able to click on the survey instrument. Specifically, for online book purchasing, we calculated the time the respondents spent on [BiggerBooks.com](http://www.BiggerBooks.com) by measuring the time interval between clicking on the website link and the survey link. All respondents spent at least 1 minute browsing the requested website (mean = 7.1, STD = 2.9). Therefore, all responses were deemed appropriate. We would like to thank one of the reviewers for suggesting this test for assuring that the participants actually browsed the assigned websites.

⁹<http://www.pewinternet.org/trends/DemographicsofInternetUsers.htm> and <http://www.survey.net/content0r.html>.

¹⁰We first used the entire sample of 283 for books and 253 for prescription drugs. We then replicated the analysis with only the matched responses (198 for books and 173 for prescription drugs) and got virtually identical results. The first analysis is reported.

restrictions on sample size and residual distributions. PLS is best suited for testing complex relationships by avoiding inadmissible solutions and factor indeterminacy. Hence, we chose PLS to accommodate the presence of a large number of variables, relationships, and moderating effects.

Descriptive Statistics

The descriptive statistics for the study's two focal products (books and prescription drugs) are shown in Table 4. Consistent with our expectations, the degree of purchase involvement is significantly lower for books ($\mu = 2.2$) than for prescription drugs ($\mu = 2.9$) ($p < .01$).

Measurement Validation

Reliability was calculated using the PLS internal consistency scores.¹¹ Internal consistencies of all principal constructs are considered adequate since they exceed .90 (Table 4).

Convergent and discriminant validity was tested using the following five tests: First, the square root of the average variance extracted (AVE) of all constructs is much larger than all other cross-correlations (Table 4). Second, all AVEs are well above .50, suggesting that the principal constructs capture much higher construct-related variance than error variance. Third, the correlations among all constructs are all well below the .90 threshold, suggesting that all constructs are distinct from each other. Fourth, a principal components factor analysis was performed, where all items loaded on their respective constructs, which were much higher than all cross loadings (omitted for brevity). Fifth, a PLS confirmatory analysis also showed an excellent loading pattern (omitted for brevity) and differentiated among the study's principal constructs. Jointly these five tests suggest adequate convergent and discriminant validity.

The extent of common method bias was assessed with five tests: First, Harman's one-factor test was performed by including all items in a principal components factor analysis (Podsakoff et al. 2003). Evidence for common method bias exists when one factor accounts for most of the covariance. As each factor explains roughly equal variance, the data do not indicate evidence of common method bias. Second, a partial correlation method was used (Podsakoff et al. 2003). The highest factor from a principal component factor analysis was added into the PLS model as another control factor on all

dependent variables. This factor may "contain the best approximation of the common method variance if is a general factor on which all variables load" (Podsakoff and Organ 1986, p. 536). This factor did not significantly increase the variance explained in any of the dependent variables, indicating no common method bias. Third, we ran Lindell and Whitney's (2001) test that uses a theoretically unrelated construct (termed a *marker* variable), which is used to adjust the correlations among the principal constructs. Since we did not measure an unrelated construct (to economize on survey items), we used a modified test (Pavlou and Gefen 2005) in which a weakly related construct—*credit card guarantees* (Pavlou and Gefen 2004)—was used. High correlations among any of the items of the study's principal constructs and credit card guarantees would indicate common method bias as the construct of credit card guarantees should be weakly related to the study's principal constructs. Since the average correlation among credit card guarantees and the principal constructs was $r = .08$ (average p -value = 1.1), there was minimal evidence of common method bias. Fourth, the correlation matrix (Table 4) does not indicate any highly correlated factors (highest correlation is $r = .71$), whereas evidence of common method bias should have resulted in extremely high correlations ($r > .90$). Finally, the study's ultimate dependent variable—actual transaction behavior—was measured with longitudinal data that were independently captured over a month later. These five tests suggest that common method bias is not a major concern in this study.

Testing the Structural Model

The standardized PLS path coefficients for testing the structural model are shown in Figure 2. The interaction variable between perceived uncertainty and purchase involvement was computed following Chin et al. (2003) by cross-multiplying the standardized items of each construct. For clarity of exposition, since all item loadings are greater than .80, they have been omitted. Also, only the significant control variables are shown in Figure 2.

First, as hypothesized, perceived uncertainty has a significant negative impact on purchase intentions for both book purchasing ($b = -.33$, $p < .01$) and prescription filling ($b = -.41$, $p < .01$), validating H1. The interaction effect between perceived uncertainty and purchase involvement was also significant for both book purchasing ($b = -.18$, $p < .01$, $\Delta R^2 = 8\%$) and prescription filling ($b = -.18$, $p < .01$, $\Delta R^2 = 9\%$), validating the moderating role of purchase involvement on the link between perceived uncertainty and purchase intentions (H2). The negative moderating role of purchase involvement suggests its additive effect to the negative relationship between perceived uncertainty and purchase intentions.

¹¹The composite reliability score is $(\sum \lambda_i)^2 / [(\sum \lambda_i)^2 + \sum \text{Var}(\epsilon_i)]$, where λ_i is the indicator loading, and $\text{Var}(\epsilon_i) = 1 - \lambda_i^2$.

Table 4. Descriptive Statistics, Correlations, and Average Variance Extracted

Constructs	Mean (STD)	Reliability	1	2	3	4	5	6	7	8	9	10	11	12
Books														
1. Actual Purchases	.12 (.44)	n/a	1.0											
2. Purchase Intentions	2.1 (0.9)	.98	.50**	.98										
3. Perceived Uncertainty	3.4 (0.9)	.95	-.30**	-.54**	.92									
4. Seller Opportunism	3.4 (0.9)	.92	-.22**	-.30**	.44**	.88								
5. Information Asymmetry	3.5 (0.8)	.96	-.16*	-.25**	.49**	.24**	.95							
6. Privacy Concerns	3.7 (0.8)	.96	-.20**	-.33**	.46**	.53**	.32**	.86						
7. Security Concerns	2.2 (0.8)	.97	-.21*	-.32**	-.44**	.51**	.27**	.63**	.88					
8. Trust	3.1 (0.8)	.97	.20*	.22**	-.38**	-.40**	-.18**	-.39**	-.39**	.86				
9. Social Presence	2.0 (0.8)	.96	.11	.15*	-.16**	-.12*	-.13*	-.27**	-.20**	.17**	.91			
10. Product Diagnosticity	2.8 (1.0)	.93	.14*	.18*	-.08	-.18**	-.13*	-.13*	-.10	.11	.37**	.94		
11. Website Informativeness	2.8 (1.0)	.97	.19*	.20**	-.25**	-.21**	-.22**	-.24**	-.20**	.13*	.15	.16**	.94	
12. Purchase Involvement	2.2 (1.0)	.96	.22*	.20**	-.15**	-.11*	-.15*	-.17*	-.10*	.12*	.07	.06	.090	.85
Prescription Drugs														
1. Actual Purchases	.16 (.36)	n/a	1.0											
2. Purchase Intentions	2.6 (1.1)	.98	.44**	.98										
3. Perceived Uncertainty	3.6 (1.0)	.96	-.26**	-.50**	.90									
4. Seller Opportunism	3.5 (1.0)	.95	-.21*	-.32**	.60**	.84								
5. Information Asymmetry	3.6 (0.8)	.96	-.14	-.27**	.55**	.25**	.94							
6. Privacy Concerns	3.8 (1.0)	.95	-.18*	-.34**	.50**	.58**	.32**	.87						
7. Security Concerns	2.4 (0.9)	.98	-.19*	-.35**	-.34**	.49**	.26**	.71**	.90					
8. Trust	3.2 (0.8)	.91	.20*	.40**	-.41**	-.45**	-.23**	-.44**	-.49**	.80				
9. Social Presence	2.0 (0.9)	.96	.10	.29**	-.25**	-.17**	-.27**	-.27**	-.27**	.28**	.93			
10. Product Diagnosticity	2.7 (1.0)	.95	.10	.20**	-.25**	-.31**	-.13*	-.16*	-.21**	.28**	.39**	.95		
11. Website Informativeness	3.0 (1.0)	.97	.24**	.26*	-.29**	-.22**	-.22**	-.33**	-.21**	.23**	.15*	.23**	.94	
12. Purchase Involvement	2.9 (1.1)	.95	.19*	.34**	-.17**	-.12*	-.14*	-.18**	-.20**	.27**	.11	.05	0.6	.82

Note: ** denotes significant correlations at the p < .01 level, * at p < .05 level. The diagonal elements (in bold) represent the square root of AVE.

The tests for the moderated relationships followed Carte and Russell (2003), testing whether the variance explained due to the moderated effects is significant beyond the main effects, using the following **F-statistic** (p. 481):

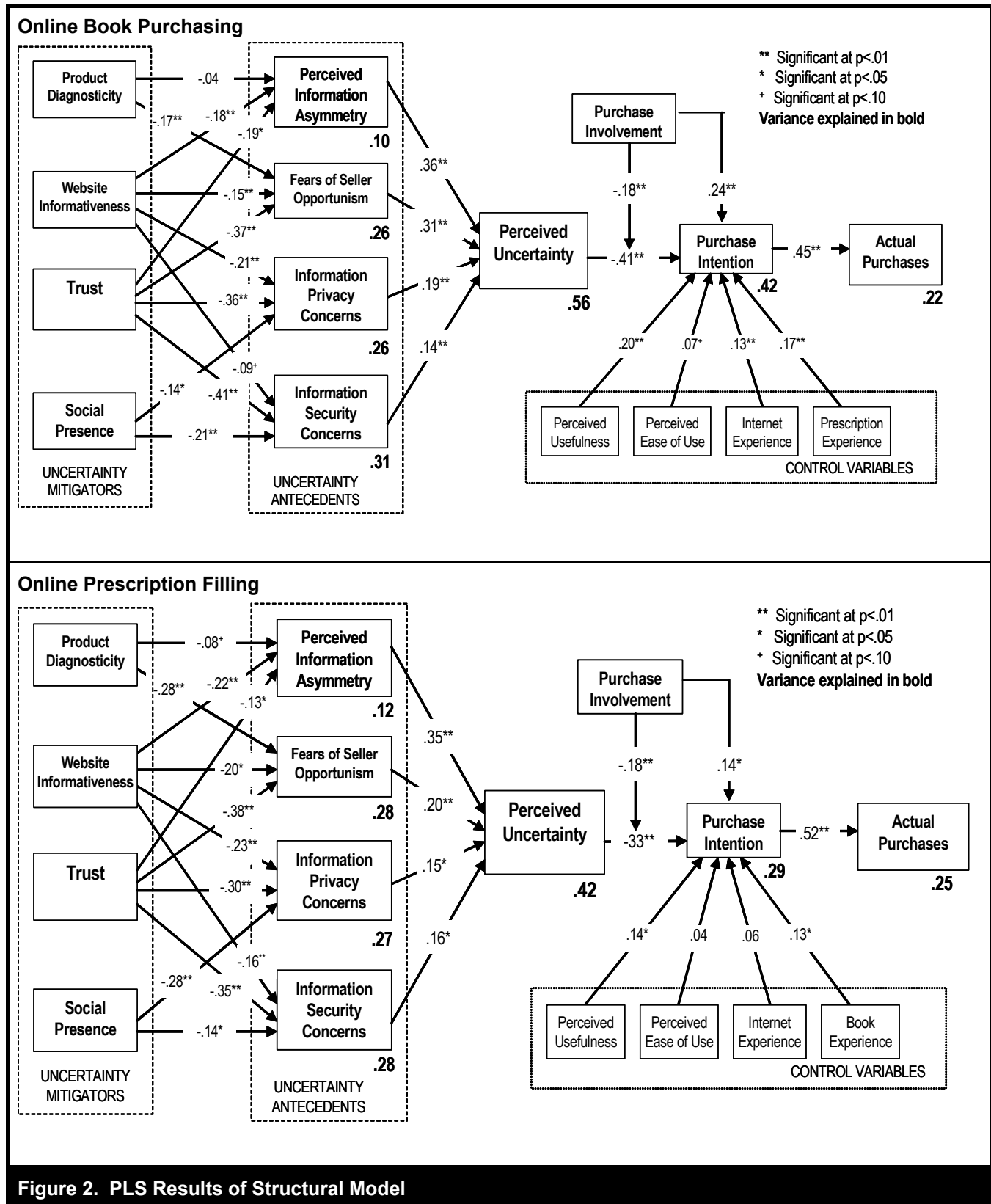
$$F(df_{interaction} - df_{main}, N - df_{interaction} - 1) = \frac{[\Delta R^2 / (df_{interaction} - df_{main})]}{F[(1 - R^2_{interaction}) / (N - df_{interaction} - 1)]}$$

The F-statistic for online book purchasing was 1.10 (p < .05) and for prescription drugs was 1.24, (p < .05), thereby supporting the significant role of the proposed moderating effects of purchase involvement.

To further validate the moderating effect, Cohen's f² t, which compares the R² value of the interaction effect over the main effect, was performed using the following equation (Chin et al. 2003):

$$Cohen's f^2 = \frac{R^2(\text{interaction model}) - R^2(\text{main effects model})}{[1 - R^2(\text{main effects model})]}$$

Controlling for the study's control variables, the variance explained on purchase intentions was 29 percent for online book purchasing and 42 percent for prescription filling when accounting for the interaction effect, whereas only 21 percent



and 33 percent, respectively, was explained with only the main effects. Cohen's f^2 for book purchasing was .11 and .13 for prescription filling. Both f^2 values are classified as medium effects (Chin et al. 2003), thus confirming H2.

Carte and Russell recommend against the interpretation of main effects in the presence of moderating effects with *interval* scale measures, suggesting instead the use of *ratio* scale measures.¹² Since purchase involvement is an interval scale, our emphasis is on its moderating effect on the relationship between perceived uncertainty and purchase intentions, not its direct impact on purchase intentions.¹³

Finally, the coefficient between purchase intention and actual purchases over time was significant for both online book purchasing ($b = .52, p < .01$) and ($b = .45, p < .01$), thus supporting the longitudinal hypothesis H3. The variance explained for actual purchases was 25% percent for books and 22 percent for prescription drugs.

In terms of the sources of perceived uncertainty, all hypothesized paths are significant in both studies, explaining 42 percent of its variance for online book purchasing and 56 percent for online prescription filling. For books, perceived information asymmetry ($b = .35, p < .01$), fears of seller opportunism ($b = .20, p < .01$), information privacy concerns ($b = .15, p < .05$), and information security concerns ($b = .16, p < .05$) were all significant. For prescription drugs, the hypothesized impact of fears of seller opportunism ($b = .31, p < .01$), perceived information asymmetry ($b = .36, p < .01$), information privacy concerns ($b = .19, p < .01$), and information security concerns ($b = .14, p < .01$) were also significant. These results provide support for H4a, H4b, H4c, and H4d, respectively.

In terms of the proposed uncertainty mitigators, all four variables have a substantial mitigating effect (Table 5).

First, trust reduces information asymmetry for books ($b = -.13, p < .05$) and prescription drugs ($b = -.19, p < .01$); fears of seller opportunism for books ($b = -.38, p < .01$) and prescription drugs ($b = -.37, p < .01$); privacy concerns for books ($b = -.30, p < .01$) and prescription drugs ($b = -.36, p < .01$);

¹²Ratio scales are continuous scales with ordered data and a natural zero (see Carte and Russell 2003 for more details).

¹³Purchase involvement is essentially a quasi-moderator, both moderating the impact of perceived uncertainty on purchase intentions, and also having a direct impact on purchase intentions, ($b = .14, p < .05$) for book purchasing and ($b = .24, p < .01$) for prescription filling. However, its direct impact on purchase intentions is beyond the scope of this study. We thank one of the reviewers for bringing up this point.

security concerns for books ($b = -.35, p < .01$) and prescription drugs ($b = -.41, p < .01$), thereby supporting H5a, H5b, H5c, and H5d, respectively.

Second, website informativeness has a significant impact on information asymmetry for books ($b = -.22, p < .01$) and prescription drugs ($b = -.18, p < .01$); seller opportunism for books ($b = -.20, p < .01$) and prescription drugs ($b = -.15, p < .01$); privacy concerns for books ($b = -.23, p < .01$) and prescription drugs ($b = -.21, p < .01$); and finally security concerns for books ($b = -.16, p < .01$) and prescription drugs ($b = -.09, p < .10$). These results support H6a, H6b, and H6c, but not H6d.

Third, product diagnosticity has a significant impact on fears of seller opportunism for books ($b = -.28, p < .01$) and prescription drugs ($b = -.17, p < .01$), but only a weak impact on information asymmetry for books ($b = -.08, p < .10$) and prescription drugs ($b = -.04, n/s$). These findings support H7b, but not H7a.

Fourth, social presence positively influences information privacy concerns for book purchasing ($b = -.28, p < .01$) and prescription drugs ($b = -.14, p < .05$) and information security concerns for books ($b = -.14, p < .05$) and for prescription drugs ($b = -.21, p < .01$), thereby validating H8a and H8b, respectively.

We also tested a competing model in which the four antecedent sources of uncertainty were directly linked to purchase intentions, following Baron and Kenny's (1986) formal test for mediation.¹⁴ Despite being initially significant (when perceived uncertainty was excluded from the PLS model), all four uncertainty mitigators became insignificant when perceived uncertainty was included as an independent variable in the model, indicating that perceived uncertainty *fully* mediates the impact of its four antecedent sources on purchase intentions.

Another competing model was tested in which trust, website informativeness, product diagnosticity, and social presence were directly linked to perceived uncertainty, using Baron and Kenny's mediation test. While their direct effects were initially significant (when perceived information asymmetry, fears of seller opportunism, information privacy concerns, and security concerns were excluded from the model), they became

¹⁴Baron and Kenny's (1986) test for mediation compares three competing models. One with only the hypothesized direct effects, another with only the hypothesized indirect effects, and an integrative one with both the direct and indirect effects. Full mediation is evidenced shown if the indirect effects become insignificant when the direct effects are included in the integrative model.

Table 5. Summary of the Effects of the Uncertainty Mitigators and Hypotheses Testing

Uncertainty Mitigator	Uncertainty Source	Hypothesis	Books	Prescription Drugs	Support?
Trust	Information Asymmetry	H5a	-.13 [*]	-.19 ^{**}	Yes
	Seller Opportunism	H5b	-.38 ^{**}	-.37 ^{**}	Yes
	Privacy Concerns	H5c	-.30 ^{**}	-.36 ^{**}	Yes
	Security Concerns	H5d	-.35 ^{**}	-.41 ^{**}	Yes
Website Informativeness	Information Asymmetry	H6a	-.22 ^{**}	-.18 ^{**}	Yes
	Seller Opportunism	H6b	-.20 ^{**}	-.15 ^{**}	Yes
	Privacy Concerns	H6c	-.23 ^{**}	-.21 ^{**}	Yes
	Security Concerns	H6d	-.16 ^{**}	-.09	No
Product Diagnosticity	Information Asymmetry	H7a	-.08 [*]	-.04	No
	Seller Opportunism	H7b	-.28 ^{**}	-.17 ^{**}	Yes
Social Presence	Privacy Concerns	H8a	-.28 ^{**}	-.14 ^{**}	Yes
	Security Concerns	H8b	-.14 [*]	-.21 ^{**}	Yes

^{*}Significant at $p < .01$; ^{**}Significant at $p < .05$; ^{*}Significant at $p < .10$.

insignificant when the four hypothesized sources of uncertainty were included in the model. These findings confirm the proposed *full* mediating role of the four antecedent sources of perceived uncertainty in the relationship between the four uncertainty mitigators and perceived uncertainty.

Despite the design difference between books and prescription drugs (specific seller versus sellers in general), the results were very similar, with two notable differences: First, consistent with the logic that perceived uncertainty is more influential for higher involvement products, the impact of perceived uncertainty on transaction intentions was significantly higher ($t = 4.56, p < .01$)¹⁵ for prescription drugs ($b = .41$) than for books ($b = .33$). Second, the variance explained in perceived uncertainty was higher ($\Delta R^2 = 14\%$) for prescription drugs than for books. The empirical explanation for these differences is due to the higher impact ($t = 6.04, p < .01$) of seller opportunism for prescription drugs ($b = .31$) than for books ($b = .20$), which may be due to the fact that fears of seller opportunism may be more salient for higher involvement purchases. Despite the greater role of uncertainty for prescription drugs in the study's results, the actual importance of uncertainty may have been downplayed by the fact that the study's context was prescription filling websites in general.

¹⁵ To test the statistical difference between the two models, the PLS path coefficients were compared using Chin et al.'s (2003) equation, which is an adaptation of the traditional t-test for comparing regression coefficients between independent samples.

Nevertheless, the results suggest the model's generalizability to different products (which differ in terms of their purchase involvement) and also to different targets (single seller versus classes of sellers in general).

Discussion

Key Findings and Contributions

This study has several key findings that are validated in two distinct empirical studies with two different products (books and prescription drugs) and two different targets (single website and class of websites). First, the results confirm the significant negative impact of perceived uncertainty on purchase intentions, validating the paper's proposition that the existence of uncertainty perceptions is a major impediment to online exchange relationships. Second, by showing the impact of purchase intentions on transactions over time, this study contributes to the emerging e-commerce literature where longitudinal studies are few and sparse. Third, the impact of perceived uncertainty on purchase intentions is moderated by purchase involvement, further stressing the potentially destructive impact of perceived uncertainty for purchases that are important to consumers. Fourth, drawing upon and extending the principal-agent perspective, the study sheds light on the nature of perceived uncertainty in online environments by proposing and validating a set of four antecedents—perceived information asymmetry, fears of seller opportunism,

information privacy concerns, and information security concerns—which jointly explain a substantial degree of the variance in perceived uncertainty. Fifth, it proposes and tests four uncertainty mitigators—trust, website informativeness, product diagnosticity, and social presence—introducing a set of influential factors built through signals and incentives to mitigate uncertainty’s destructive impact. Finally, the entire structural model with the full mediating role of perceived uncertainty and its four antecedent sources helps delineate the process by which a set of uncertainty-reduction beliefs facilitate actual online transactions.

The paper’s primary contribution is to introduce perceived uncertainty and its underlying sources as key mediating variables in a model that explains the adoption of B2C e-commerce. By theorizing the nature of uncertainty perceptions and its underlying sources by drawing upon and extending the principal agent perspective, this study contributes to our enhanced understanding of a fundamental set of constructs that has been overlooked in the e-commerce literature. Attempting to explain and predict online exchange relationships without understanding the mediating role of uncertainty, its nature, and its underlying sources is likely to result in theories that are incomplete and potentially misleading. Second, by viewing online transactions as principal-agent relationships, this study has identified a set of influential factors that have the potential to mitigate uncertainty by overcoming the agency problems of hidden information and hidden action. Third, from a descriptive perspective, this study describes the process by which a set of uncertainty-reduction factors facilitate online exchange relationships through the key mediating role of perceived uncertainty. Fourth, it contributes to the principal-agent perspective by identifying and integrating the constructs of information privacy and security concerns. Fifth, by validating the proposed model with two distinct products that differ in their degree of purchase involvement, it sheds light on the adoption of high-involvement products that has been ignored by the e-commerce literature. Finally, the results suggest that the proposed model is robust to both specific websites and classes of websites in general.

Implications for Theory and Research

Implications for B2C E-Commerce Adoption

Despite a decade since the inauguration of B2C e-commerce with its widely touted benefits, the uncertainty of the online environment still makes many buyers reluctant to engage in online exchange relationships. Uncertainty perceptions due to imperfect information, fears of seller opportunism, and

information privacy and security concerns prevent buyers from purchasing online, resulting in insufficient consumption and even in an inefficient allocation of resources. By introducing and validating the mediating role of product and seller quality uncertainty as a major impediment to the adoption of B2C e-commerce, this study aims to bring uncertainty perceptions to the forefront of e-commerce research. Also, by formally conceptualizing the key antecedent sources of perceived uncertainty, it aims to guide future research on where to focus its efforts in terms of mitigating uncertainty perceptions. Finally, this study introduces four influential factors that are shown to have a substantial role in mitigating perceived uncertainty, paving the road for identifying additional factors that can specifically mitigate each of the proposed four antecedent sources of perceived uncertainty.

To better conceptualize the nature of perceived uncertainty in online environments and develop a research agenda for B2C e-commerce adoption, we formally proposed that online transactions be viewed as agency relationships, justifying how the proposed principal-agent perspective readily applies in online buyer-seller relationships (Table 1). The principal-agent perspective brings forth the underlying agency problems of hidden information and hidden action, which helped us identify the four antecedents of perceived uncertainty: information asymmetry, fears of seller opportunism, and information privacy and security concerns. By attempting to reduce the hidden information and hidden action problems, we identified a set of variables that mitigate uncertainty perceptions by overcoming these two agency problems.

Consistent with the study’s conceptualization, the impact of perceived uncertainty on online transaction intentions is reinforced when the buyers are highly involved with their purchases. The moderating role of purchase involvement suggests that the potentially destructive impact of perceived uncertainty becomes even more pronounced, further confirming the study’s rationale for viewing perceived uncertainty as an important variable in B2C e-commerce research. Nonetheless, the proposed model is validated for both low (books) and high (prescription drugs) involvement purchases, implying its generalizability to various products and levels of purchase involvement. Moreover, while the literature has asserted that purchase involvement impacts consumer behavior (Engel and Blackwell 1982), this study specifically explains the exact role of purchase involvement in terms of moderating the impact of uncertainty on purchase intentions.

Most e-commerce studies either focus on a single website or classes of websites. To the best of our knowledge, this is the first study to examine a model with both a single website and a class of websites as the focal targets. In doing so, this study

demonstrates the robustness of the data to various targets, implying the model's generalizability. Nevertheless, the study's focus on two contexts (lower versus higher purchase involvement) highlights some interesting differences. While buyers have largely adopted online transactions for low-involvement commodities (e.g., books, CDs), they have still not accepted online transactions of high-involvement products, such as prescription drugs. Nevertheless, the literature has focused on low-involvement products, almost exclusively. By comparing the high-involvement context of online prescription filling with the low-involvement context of online book purchasing, this study makes meaningful comparisons among products with different purchase involvement levels. For higher involvement purchases, perceived uncertainty has a greater impact on purchase intentions, while the proposed sources of uncertainty explain a much higher variance in perceived uncertainty, primarily driven by the greater impact of fears of seller opportunism. For more involved purchases, buyers are rightfully more concerned about seller opportunism. As expected, the antecedents and consequences of information privacy and security concerns were similar across purchase involvement levels. The uncertainty mitigators had a similar effect across the two contexts. Integrating these findings, the key factor that distinguishes between lower and higher involvement purchases is in fact perceived uncertainty with its antecedents and consequences.

Implications for Understanding and Mitigating Uncertainty in Online Environments

Having shown the negative impact of perceived uncertainty on the proliferation of online transactions, this study suggests that understanding and mitigating perceived uncertainty is a primary issue for B2C e-commerce research. However, the literature has viewed perceived uncertainty as a "background" mediator with insufficient conceptualization, operationalization, and measurement. The identification and validation of the four proposed antecedents of uncertainty—perceived information asymmetry, fears of seller opportunism, and information privacy and information security concerns—provides a comprehensive understanding of the nature of uncertainty perceptions in online environments.

While hidden information and hidden action are abstract concepts that cannot be easily operationalized or measured, perceived information asymmetry, fears of seller opportunism, and information privacy and security concerns are specific and measurable constructs. The proposed view of uncertainty that builds upon the principal-agent perspective helped us identify specific uncertainty mitigators, which can overcome hidden information and hidden action through the logic of

signals and incentives. Having shown that the proposed mitigators reduce uncertainty *indirectly* through the four sources of uncertainty, a unitary uncertainty construct might preclude the comprehensive study of how uncertainty can be fully mitigated. Despite our four-dimensional view of uncertainty, the proposed four antecedents explain about 50 percent of the variance in perceived uncertainty, thus calling for future research on more comprehensively identifying antecedents of perceived uncertainty beyond the dyadic buyer-seller context by including the role of the environment and third parties.

The results suggest that trust, website informativeness, product diagnosticity, and social presence are four central means for facilitating e-commerce adoption. By empirically showing the full mediating role of perceived uncertainty and its antecedents, the resulting structural model explains the process by which a set of uncertainty-reduction variables facilitate purchase intentions by mitigating perceived uncertainty through the reduction of hidden information and hidden action.

In doing so, this study contributes to the emerging B2C e-commerce literature that has shown direct relationships between online transaction intentions and trust (e.g., McKnight et al. 2002), website informativeness (e.g., Luo 2002a), product diagnosticity (Jiang and Benbasat 2004), and social presence (e.g., Gefen and Straub 2004). This study suggests that the impact of these variables is *indirect* through perceived uncertainty. Accordingly, it shows that information privacy and security concerns do not have a *direct* impact on purchase intentions (Salisbury et al. 2001), showing that their effect is *fully* mediated by perceived uncertainty. The study thus offers a basic blueprint for mitigating perceived uncertainty, enticing future research to identify additional uncertainty mitigators and integrating them in a nomological network with perceived uncertainty as a key mediator.

Moreover, this study shows the relative effectiveness of each uncertainty mitigator on each uncertainty antecedent. Since uncertainty mitigators are costly to develop, it is important to understand their relative effectiveness in mitigating uncertainty, and specifically, on which antecedent of uncertainty is most influential. Trust and website informativeness are shown to have a substantial effect on all antecedents of uncertainty. In contrast, social presence is shown to only mitigate information privacy and security concerns, and product diagnosticity to reduce perceived information asymmetry. These findings have prescriptive implications to focus on uncertainty mitigators that target specific sources of uncertainty.

It is important to note that the proposed model is a perceptual model that describes how various buyer beliefs influence buyer behavior by reducing uncertainty perceptions. In this

sense, if these favorable buyer beliefs are shaped by false signals or incentives (or any other deceitful means), this could lead to *erroneously* low uncertainty perceptions and potential transactions with opportunistic sellers. Nonetheless, the proposed model would still hold even if the proposed uncertainty mitigators are built on false premises.¹⁶ If the means by which buyer beliefs are built are credible, a buyer's perceived uncertainty would be rightfully mitigated and any buyer would be likely to transact with only high-quality sellers.

Implications for the Principal-Agent Perspective

Since the principal-agent perspective serves as the underlying conceptual basis for the proposed structural model, this study extends this theoretical perspective to online exchange relationships in two important ways.

First, whereas perceived information asymmetry and fears of seller opportunism have been proposed within the principal-agent perspective, the role of information privacy and information security concerns has not been identified. Even if the role of information privacy concerns has long been identified (Westin 1967) and applied to B2C e-commerce (e.g., Malhotra et al. 2004), the open nature of the Internet has dramatically changed the nature of agency relationships. The impact of information security concerns has also been extended to online transactions (e.g., Salisbury et al. 2001). By introducing and integrating information privacy and security concerns into the principal-agent perspective and showing that they are theoretically and empirically distinct from the existing constructs of perceived information asymmetry and fears of opportunism, this study integrates the principal-agent perspective with information privacy and security theories.¹⁷

Information privacy and security concerns may not only be relevant to online buyer-seller relationships, but they may also generalize to other agency relationships in which

personal and monetary information are involved. For example, while employees are the agents in employment relationships, employers having access to their employees' private and monetary information may raise the employees' information privacy and security concerns, rendering employers as the agents who are trusted by the employees to protect their information.

Mediated online transactions are also subject to information privacy and security concerns, even if the agents in this case may be the mediating parties and the principals are the transaction (buyer and seller) parties. For instance, data transmitted over the open Internet infrastructure are beyond the seller's full control. Also, third-parties provide ancillary security services to sellers. In this sense, these third-party services become agents to these sellers who are transformed into principals on behalf of their buyers, aiming to safeguard their information privacy and security. More complex agency relationships can thus be examined beyond the traditional dyadic agency context when information (privacy and security) concerns are involved in online exchange relationships.

Second, by integrating trust, website informativeness, product diagnosticity, and social presence with the economic constructs of the principal-agent perspective, this study integrates sociological (trust and social presence), marketing (website informativeness and product diagnosticity), and IS (information privacy and information security concerns) theories with economic (principal-agent) theory. In doing so, it enhances our understanding of how economic theories can be informed by other theories to reduce the agency problems of hidden information and hidden action. In extending agency theory to marketing, Bergen et al. (1992) urged researchers to look beyond the "economic rationality" assumption and incorporate social and psychological factors into agency theory. This finding calls for future research on identifying and integrating additional factors from other disciplines to inform and further extend the principal-agent perspective.

Implications for Practice

Since commercial websites must mitigate perceived uncertainty to facilitate online transactions, this study has practical implications by identifying the exact sources of perceived uncertainty that need to be mitigated, and also by proposing a set of specific uncertainty mitigators that commercial websites can readily employ.

This study's findings suggest that commercial websites can mitigate uncertainty by enhancing their trustworthiness (trust),

¹⁶The concern for false signals and ineffective incentives is a well-known limitation of the principal-agent perspective. Accordingly, research on antecedents of trust, website informativeness, product diagnosticity, and social presence also face the same limitation in terms of the credibility of their various proposed antecedents. Since this study does not explicitly measure any signals or incentives, it is beyond its scope to design and test the credibility or effectiveness of any particular signals or incentives.

¹⁷While information privacy and security concerns are herein proposed to extend the principal-agent perspective, it is necessary to clarify that agency relationships are context specific (Bergen et al. 1992). Consequently, the proposed extension may solely apply to the specific context of online buyer-seller relationships, and it may not readily generalize to other types of agency relationships. Future research could examine the generalizability of the proposed extension to other agency relationships.

providing informative content (website informativeness), clearly describing their products (product diagnosticity), and providing a sense of social presence. Commercial websites should invest in credible signals and incentives that build trust, website informativeness, product diagnosticity, and social presence. First, to enhance buyer's trust, they can receive accreditation by reputable institutions. For prescription filling websites, for example, they can be licensed by the NABP (<http://www.nabp.net>) and provide a link to the NABP to signal their standing. They can also provide FDA approval on the drugs they sell. For book websites, trust can be built through accreditations with the Association of American Publishers (AAP). Second, to increase website informativeness, commercial websites can signal their fair information practices, and have third-party authorities (e.g., TRUSTe or VIPPS) verify their practices. They can also publicize what consumer information is collected and which consumer activities are monitored. Third, to increase their product diagnosticity, websites can enhance their virtual control (Jiang and Benbasat 2004) by displaying multiple product images of their prescription drugs or books. Finally, to enhance social presence, they can employ virtual advisors and decision support technologies. Also, since human pharmacists can play a key role in emulating social presence, prescription filling websites could hire registered pharmacists and allow them to virtually interact with their consumers, either on real-time or by e-mail.

Since the proposed beliefs are costly to build, this study empirically specifies their relative effectiveness in mitigating uncertainty. Since trust and website informativeness were shown to reduce all uncertainty sources, managers are well advised to focus on these beliefs. Also, for websites whose consumers may be worried about their information privacy and security, a sense of social presence is shown to specifically target these two sources of uncertainty. Finally, for websites whose consumers have fears of seller opportunism, product diagnosticity seems to specifically target this particular source of uncertainty. In general, by empirically revealing the relative effectiveness of various buyer beliefs on specific sources of uncertainty, this study helps practitioners focus their investment efforts in shaping their buyers' beliefs.

Since uncertainty is a greater impediment to purchasing for high involvement products, sellers of such products must place uncertainty reduction at the core of their strategy. Specifically, buyer's fears of seller opportunism are the major difference between high and low involvement purchases. Therefore, managers should recognize that these fears should be their primary focus when selling higher involvement products.

Finally, the fact that the proposed model is validated for two very different products and targets suggests that the study's practical implications may extend beyond books and prescription filling websites to other B2C websites.

Limitations and Suggestions for Future Research

This paper has a number of limitations that create some interesting opportunities for future research.

The application of the principal-agent perspective to online buyer-seller relationships is not without its critics. While proponents argue that the principal-agent perspective can be liberally applied because agency problems are ubiquitous (Ross 1973; Shapiro 2005), opponents maintain that it should only be used in employment relationships. To overcome criticism that the application of the principal-agent perspective violates any fundamental economic assumptions, we explain that online buyer-seller relationships are not "spot" exchanges and satisfy the principal-agent perspective's key theoretical requirements (Table 1). However, since the principal-agent perspective is generally a contentious theory in the literature (Eisenhardt 1989; Perrow 1986), future research is required to determine the theory's viability and usefulness to online exchange relationships and other buyer-seller contexts.

The scope of perceived uncertainty was restricted to seller and product quality aspects, excluding uncertainty sources due to the environment or third parties. Future research could attempt to have a more holistic view of uncertainty to incorporate uncertainty sources beyond the dyadic buyer-seller context.

Trust, website informativeness, and purchase involvement are measured as unidimensional variables. This precludes studying how different trust dimensions (i.e., competence, integrity, benevolence) (Gefen et al. 2003) or how different dimensions of website informativeness may influence the four proposed sources of perceived uncertainty. Also, the five dimensions of purchase involvement (importance, symbolic and pleasure value, risk importance, and probability) may have a different moderating role on the uncertainty-purchase intentions relationship. Future research could examine how specific dimensions of trust and website informativeness would affect perceived uncertainty in different ways. Also, trust was conceptualized, operationalized, and measured as the buyer's trusting beliefs drawn from seller trustworthiness.

Future research could study other types of trust (e.g., willingness to depend) and their impact on uncertainty reduction.

Our random sample of respondents may not have been particularly interested in prescription drugs or books, and they may not have been highly motivated to respond. However, since several of the respondents did actually purchase the focal products during the next month after taking the survey, their motivation level might have been adequate. Still, future research could attempt to collect data from consumers who would be more likely to purchase our focal products on a regular basis to achieve a higher degree of motivation. Moreover, since the respondents were not asked to purchase prescription drugs or books during their familiarization with the study's context, perhaps their uncertainty perception may not have been as high had they been asked to engage in actual purchases. Nevertheless, perceived uncertainty emerged as a key mediating variable in the proposed model, explaining a substantial portion of the variance in purchase intentions for both levels of purchase involvement. Nonetheless, to fully capture the role of perceived uncertainty, future research could design an experimental scenario in which the respondents are actually asked to purchase the focal products.

In addition, the respondents might have been influenced from both their prior purchase experience and also from their exposure to the familiarization task in which they were asked to visit certain commercial websites. In terms of their purchase experience that was explicitly measured, its only impact was on purchase intentions (which was accounted for). Also, purchase experience did not have a statistically different effect across the two products, even if the respondents were more experienced with online book purchasing. In terms of the familiarization task, we tried to select prototypical websites that would not bias the respondents either positively or negatively. Future research could experiment with other familiarization tasks and different levels of purchase experience to examine their potential impact on the proposed model.

Online prescription filling may not be a prototypical high involvement purchase since it is very heavily regulated. Even if many high involvement purchases may also be regulated, future research could study other high involvement products that do not enjoy high government regulation to examine whether uncertainty perceptions may be different.

It is important to note that *only* the relationship between purchase intentions and actual purchases was empirically observed over time, implying that causality cannot be inferred from the study's cross-sectional data. Future research could

longitudinally test the proposed model to prove causal interrelationships among the study's constructs.

Conclusion

This paper argues that online buyer–seller relationships can be better understood if they are viewed as agency relationships. The paper's basic premise is that perceived uncertainty is a barrier to online transactions, especially for high involvement products. Drawing upon and extending the principal–agent perspective, it proposes four sources of perceived uncertainty due to hidden information (adverse selection) and hidden action (moral hazard) problems: perceived information asymmetry, fears of seller opportunism, and information privacy and security concerns. This paper then proposes a set of uncertainty mitigators—trust, website informativeness, product diagnosticity, and social presence—and demonstrates their mitigating effect on the proposed sources of perceived uncertainty. In doing so, it sheds light on how online buyer–seller relationships can be facilitated by overcoming perceived uncertainty due to agency problems.

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Appendix A

Measurement Items for Principal Constructs

Intention to Transact (Ajzen 1991)
Given the need, I intend to transact with prescription filling websites/BiggerBooks in the near future.
Given the need, I plan to purchase prescription drugs/books from prescription filling websites/BiggerBooks.
Perceived Uncertainty (Torkzadeh and Dhillon 2002)
I feel that filling my prescription online/purchasing books from BiggerBooks involves a high degree of uncertainty.
I feel the uncertainty associated with online prescription filling/purchasing books from BiggerBooks is high.
I am exposed to many transaction uncertainties if I fill my prescription online/purchase books from BiggerBooks.
There is a high degree of product uncertainty (i.e., the product you receive may not be exactly what you want) when purchasing prescription drugs online/purchasing books from BiggerBooks.
Purchase Involvement (Laurent and Kapferer 1985)
Prescription filling/Purchasing books is important to me.
For me, prescription filling/purchasing books does not matter (reverse coded).
Fears of Seller Opportunism (Gundlach et al. 1995; Jap and Anderson 2003)
Given the chance, prescription filling websites/BiggerBooks might send me counterfeit prescription drugs/used (instead of brand new) books.
Given the chance, prescription filling websites/BiggerBooks might send me prescription drugs of low quality/worn out books with highlights, scratches, or bumps.
Given the chance, prescription filling websites/BiggerBooks might send me prescription drugs that are expired or close to expire/books with missing pages.
Given the chance, prescription filling websites/BiggerBooks might breach formal or informal agreements to their/its benefit.
Perceived Information Asymmetry (Dunk 1993; Mishra et al. 1998)
Prescription filling websites have/Biggerbooks has more information about the quality of their prescription drugs/books than I do.
Prescription filling websites have/Biggerbooks has more information about how my prescription filling/book order will be handled than I do.
Prescription filling websites have/Biggerbooks has more information about the quality of their/its selling practices than I do.
Information Privacy Concerns (Salisbury et al. 2001; Smith et al. 1996)
I am concerned that prescription filling websites are/BiggerBooks is collecting too much information about me.
It bothers me when prescription filling websites ask/BiggerBooks asks me for personal information.
I am concerned about my privacy when browsing prescription filling websites/BiggerBooks.
I have doubts as to how well my privacy is protected on prescription filling websites/BiggerBooks.
My personal information could be misused when transacting with prescription filling websites/BiggerBooks.
My personal information could be accessed by unknown parties when transacting with prescription filling websites/BiggerBooks.

Information Security Concerns (Salisbury et al. 2001; Yang and Jun 2002)
I feel secure in providing sensitive information (e.g., credit card number) when transacting with prescription filling websites/Biggerbooks (reverse coded).
I would feel totally safe providing sensitive information about myself to prescription filling websites/Biggerbooks (reverse coded).
I would feel secure sending sensitive information to prescription filling websites/Biggerbooks (reverse coded).
The security issue of sensitive information was a major obstacle to my online purchases from prescription filling websites/Biggerbooks.
Overall, prescription filling websites are/Biggerbooks is a safe place to send sensitive information (reverse coded).
Trust (Gefen 2002)
Prescription filling websites understand/Biggerbooks understands the market they work in. [Competence]
Prescription filling websites know/Biggerbooks knows a lot about prescription drugs/books. [Competence]
Promises made by prescription filling websites/Biggerbooks are likely to be reliable. [Integrity]
I do not doubt the honesty of prescription filling websites/Biggerbooks. [Integrity]
I expect that prescription filling websites/Biggerbooks will keep promises they make/it makes. [Integrity]
I expect that prescription filling websites have/Biggerbooks has good intentions toward me.[Benevolence]
I expect that the intentions of prescription filling websites/Biggerbooks are benevolent. [Benevolence]
I expect that prescription filling websites are/Biggerbooks is well meaning. [Benevolence]
Website Informativeness (Luo 2002b)
Prescription filling websites/Biggerbooks would give me quick and easy access to large volumes of information.
Information obtained on prescription filling websites/Biggerbooks would be useful.
I would learn a lot from using prescription filling websites/Biggerbooks.
I think the information obtained on prescription filling websites/Biggerbooks would be helpful.
Social Presence (Gefen and Straub 2004)
There is a sense of human contact in prescription filling websites/Biggerbooks.
There is a sense of personalness in prescription filling websites/Biggerbooks.
There is a sense of human warmth in prescription filling websites/Biggerbooks.
There is a sense of human sensitivity in prescription filling websites/Biggerbooks.
Product Diagnosticity (Jiang and Benbasat 2004)
I expect prescription filling websites/Biggerbooks to help me get a real feel for prescription drugs/books.
I expect prescription filling websites/Biggerbooks to help me carefully evaluate prescription drugs/books.
Perceived Usefulness (Pavlou and Fygenson 2006)
Prescription filling websites/Biggerbooks would be useful in purchasing prescription drugs/books.
Prescription filling websites/Biggerbooks would enhance my effectiveness in purchasing prescription drugs/books.
Perceived Ease of Use (Pavlou and Fygenson 2006)
Learning to use prescription filling websites/Biggerbooks would be easy for me.
My interaction with prescription filling websites/Biggerbooks would be clear and understandable.

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