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INFORMATION SYSTEMS AND HEALTHCARE–I: TRUST, UNCERTAINTY, AND ONLINE PRESCRIPTION FILLING

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ABSTRACT

Online prescription filling possesses great market potential; however, consumers' perception of uncertainty tends to impede their adoption of online prescription filling. Trust is recognized as a critical factor affecting online shopping in general. We contend that trust can help consumers overcome perceived uncertainty, thereby enhancing their intention to adopt online prescription filling. Drawing on prior research on trust and theory of transaction cost economics, this paper proposes a research model that encompasses three trust antecedents, two sources of uncertainty, and the relationships among trust, uncertainty, and the consumer's intention to adopt online prescription filling. The model was tested empirically using a large sample. It is found that

- (1) calculus-based, knowledge-based, and institution-based trust antecedents significantly affect trust,
- (2) information asymmetry and online drug retailers' opportunistic behavior contribute to perceived uncertainty,
- (3) trust reduces uncertainty and positively affects intention, and
- (4) uncertainty influences intention negatively.

Keywords: trust, uncertainty, online prescription filling, calculus-based trust, knowledge-based trust, institution-based trust, information asymmetry, opportunistic behavior, intention

I. INTRODUCTION

Online prescription filling is an emerging health service that possesses great market potential. Americans in 1999 bought \$158 million worth of prescription drugs over the Internet, and online prescription drug sales will reach \$15 billion by the year 2004 [Pastore, 2004]. Although online demand for prescription drugs should be growing, online pharmacies are struggling to attract customers and make profits [Saliba, 2001]. The institutional environment for online drug selling is chaotic and uncertain. A recent survey found that half of the popular online pharmacies were unlicensed, and one-third did not offer adequate privacy measures to protect patients [Silverman and Perlstein, 2003]. A number of online pharmacies which are not licensed with state pharmacy boards and have no address or phone number are trying to hide from law enforcement [Richards, 2001]. Complicated legal controversies may arise when cross-border prescription filling is involved [Schick, 2002]. As a consequence, consumers' intention to purchase medications online may be impaired.

Consumers' perception of uncertainty offer explanations to their reluctance to adopt online prescription filling. According to transaction cost economics, consumers tend to choose sellers associated with the lowest possible transaction cost [Williamson, 1981]. Uncertainty can increase the transaction cost and erode consumers' buying intention [Liang and Huang, 1998].

Uncertainty in an e-commerce buyer-seller relationship comes from two sources: (1) opportunistic behavior of the sellers and (2) information asymmetry between the buyers and sellers [Ba and Pavlou, 2002; Mishra et al., 1998]. Prior research shows that trust is able to mitigate both opportunism [Doney and Cannon, 1997] and information asymmetry [Ba and Pavlou, 2002] in uncertain contexts. Therefore, we contend that, in the context of online prescription filling, uncertainty can be reduced by building trust.

Trust is recognized as an important factor affecting consumer behavior, especially in the e-commerce context where uncertainty abounds [Ba and Pavlou, 2002; Friedman et al., 2000; Gefen et al., 2003; Pavlou, 2003]. Previous research has identified several antecedents of trust such as calculus-based¹, institutional, and knowledge-based trust [Gefen et al., 2003; McKnight et al., 2002; Rousseau et al., 1998]. When product characteristics differ, these antecedents affect trust in various ways. Prescription drugs differ significantly from other types of products, because they can be life threatening. Therefore, trust issues in online prescription filling are likely to be different from those involving other online products, and warrant careful investigation.

The objective of this paper is to examine various antecedents of trust, the sources of uncertainty, and the relationships among trust, uncertainty, and consumer intention to use online prescription filling. This research makes two contributions to the IS literature.

1. It extends online trust research into the healthcare area.
2. It investigates the impact of uncertainty explicitly.

This paper is organized as follows. Section II presents the research model and proposes the hypotheses. Section III describes the research methods. Then data analysis and results are given in Section IV and the findings are discussed in Section V.

¹ Calculus is not a mathematical term in this context. It refers to the social concept that an individual rationally calculates the costs and benefits of the other individual's cheating or cooperation in a transactional relationship.

II. THEORETICAL DEVELOPMENT

RESEARCH MODEL

Online prescription filling is an emerging phenomenon that involves a number of uncertainties, and building trust is critical for e-vendors to attract consumers. Central issues include

- which factors lead to perceptions of uncertainty,
- what antecedents contribute to trust, and
- how trust and uncertainty affect consumer intention to adopt online prescription filling.

Based on the broad literature on trust and transaction cost economics, a research model is designed to facilitate the investigation (Figure 1).

This model posits that trust positively affects intention, which is consistent with the mainstream trust literature [Gefen et al., 2003; McKnight et al., 2002]. Given that the Internet environment is unpredictable and consumers' perceived uncertainty deters their adoption of online shopping, uncertainty is incorporated as a separate construct. The inclusion of uncertainty into the model is based on the transaction economics research suggesting that uncertainty increases transaction cost and decreases acceptance of online shopping [Liang and Huang, 1998; Williamson, 1981]. This construct is also aligned with the definition of trust, which indicates that trust is necessary only when there is uncertainty [Lewis and Weigert, 1985; Zazzali, 2003]. That is, trust helps people overcome uncertainty. If everything is certain and predictable, there would be no need to build trust. Hence, the model postulates that trust reduces uncertainty.

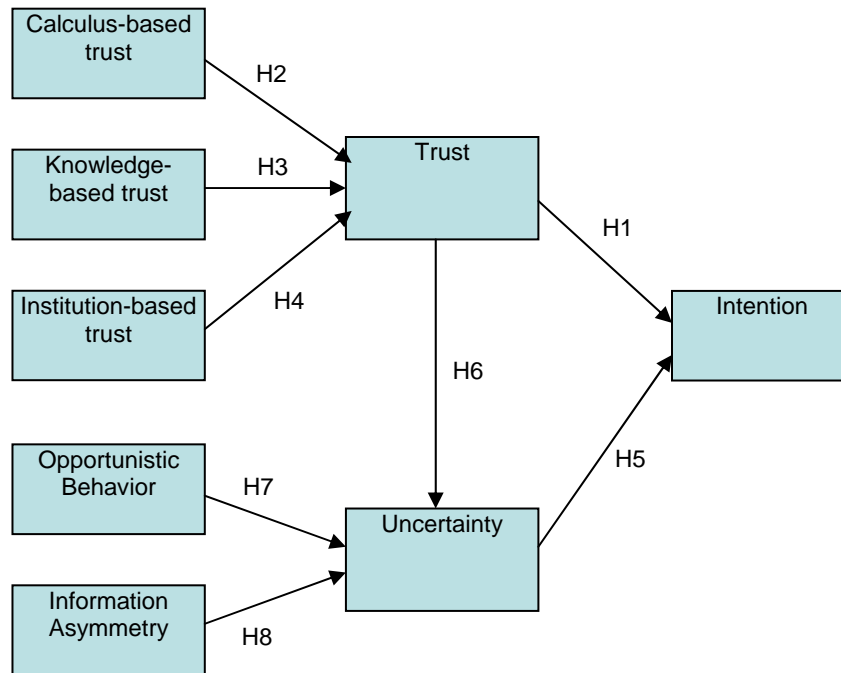


Figure 1. Research Model

To understand what leads to trust and uncertainty in the context of online prescription filling, the model proposes three trust antecedents and two uncertainty sources.

TRUST ANTECEDENTS

1. Trust is complex and multidimensional. [Butler Jr., 1991; Ganesan, 1994; Zucker, 1986]. Multiple research streams shed light on antecedents of trust [McKnight et al., 1998]. Major

antecedents of trust include calculus-based trust, knowledge-based trust, and institution-based trust [Gefen et al., 2003; McKnight et al., 2002; Rousseau et al., 1998]. Given that different products may warrant differing trust building mechanisms [Ba and Pavlou, 2002; Liang and Huang, 1998], the role of each trust antecedent needs to be studied for prescription drugs sold online.

2. Uncertainty originates from two sources [Zazzali, 2003].

- The potential for different goals between transacting partners. Either party could take opportunistic behavior to serve its self-interest.
- Information asymmetry which results from either or both parties not having access to all of the information it needs.

We contend that opportunistic behavior and information asymmetry contribute to uncertainty regarding online prescription filling. Therefore, both constructs are included in the model.

Overall, we believe that this research model is theoretically justified and the addition of uncertainty will likely enrich the understanding of how trust interacts with adoption of online prescription filling.

Next we describe the theoretical basis of each construct and hypothesize relationships among the constructs.

TRUST BELIEFS AND TRUST INTENTION

Trust means that the trustor believes in, and is willing to depend on, the trustee [McKnight et al., 1998; Rousseau et al., 1998]. Based on the theory of reasoned action, McKnight et al. [1998] break down the high level trust concept into two constructs: (1) trusting beliefs and (2) trusting intention.

Trusting beliefs are multidimensional, representing one's beliefs that the trustee is likely to behave in a benevolent, competent, honest, or predictable way in a certain situation. McKnight et al. [2002] report that three trusting beliefs appear most frequently in trust research: competence, benevolence, and integrity. Trusting intention is the extent to which one person is willing to depend on the other person in a given situation. Stewart [2003] explains that several intended actions represent trusting intentions, such as the intent to continue a relationship [Crosby et al., 1990], the intent to pursue long term orientation toward future goals [Ganesan, 1994], and intent to make a purchase [Doney and Cannon, 1997; Jarvenpaa et al., 2000]. In this study, we focus on the intent to buy prescription drugs from e-vendors.

The theory of reasoned action supports the proposition that "positive beliefs regarding an action have a positive effect on intentions to perform that action" [Stewart, 2003]. Empirical research in e-commerce also finds that trusting beliefs exert a significant positive influence on trusting intention [McKnight et al., 2002].

Trust is a critical aspect of e-commerce [Gefen et al., 2003; Reichheld and Scheffer, 2000]. Online purchase can make a customer vulnerable in many ways because the e-vendor is not guaranteed to behave benevolently [Gefen, 2000]. The Internet is a complex social environment, which still lacks effective regulation. When a social environment cannot be regulated through rules and customs, people adopt trust as a "central social complexity reduction strategy" [Luhmann, 1979]. Therefore, online customers must trust an e-vendor; otherwise, the social complexity will cause them to avoid purchasing [Gefen et al., 2003].

Empirical evidence indicates that online customers generally stay away from e-vendors whom they do not trust [e.g., Jarvenpaa and Tractinsky, 1999; Reichheld and Scheffer, 2000] and that a trusting belief in an e-vendor positively influences intention to buy [e.g., Gefen, 2000; Gefen et al., 2003; Stewart, 2003]. Hence, our first hypothesis:

H1: Trust positively affects intention to adopt online prescription filling.

CALCULUS-BASED TRUST ANTECEDENTS

Williamson [1975] expanded the concept of trust to economic transactions. In economic transactions, parties develop trust in a calculative manner [Buckley and Casson, 1988; Dasgupta, 1988]. To make a calculus-based trust choice, one party rationally calculates the costs and benefits of the other party's cheating or cooperating in the transaction [Doney et al., 1998; Lewicki and Bunker, 1995]. Trust develops if the probability is high that the second party performs an action that is beneficial, or at least not detrimental to the first party [Dasgupta, 1988].

Note that calculus-based trust is different from calculative-based trust. Calculative-based trust, also called deterrence-based trust, emphasizes utilitarian considerations that make one to believe that the trustee will not engage in opportunistic behavior because of the costly sanction in place for breach of trust [Ring and Van de Ven, 1994; D. L. Shapiro et al., 1992]. In the absence of any confirmation that the e-vendor will not indulge in distrustful behavior, calculative-based antecedents prominently influence online customers' trust decisions [Kollock, 1999; Reichheld and Scheffer, 2000]. However, it seems unrealistic to assume that there is absolutely no such confirmation in the real world. Consumers can always obtain pieces of information regarding an e-vendor's trustworthiness through a number of channels. Taking this fact into account, calculus-based trust is likely to develop because of credible information regarding the intentions or competence of the trustee [Barber, 1983]. Credible information, such as reputation and certification [Rousseau et al., 1998], can signal that the trustee's claims of trustworthiness are true [Doney et al., 1998]. Theoretical evidence shows that calculus-based trust can be a powerful form of trust to facilitate electronic transactions [Ba and Pavlou, 2002].

In the context of online prescription filling, a rational assumption is that people tend to be cautious and will strive to gather information regarding the e-vendor before making a purchase. Therefore, calculus-based trust is more appropriate in this research. We contend that a customer can develop more trust for an online prescription drug vendor if the customer infers from the vendor's reputation or certification that the vendor's costs for breaking the trust exceed the benefits. Hence, the following hypothesis:

H2: Calculus-based trust antecedent positively affects trust.

KNOWLEDGE-BASED TRUST ANTECEDENTS

Previous research proposes that trust develops as a result of the aggregation of trust-related knowledge by the involved parties [Lewicki and Bunker, 1995]. This knowledge is accumulated either first-hand (based on an interaction history) or second-hand [McKnight et al., 1998]. The first-hand knowledge can be derived from familiarity [Gulati, 1995; Kumar, 1996]. Luhmann [1979] argued that familiarity emerges as a result of learning gained from previous interactions and experiences. For example, familiarity with an e-vendor like www.drugstore.com would be knowledge of the web site gained by surfing the site or purchasing health products from the site. Familiarity reduces environmental uncertainty by imposing a structure [Luhmann, 1979]. In our previous example, structure would refer to the understanding of the site map and the ordering process. In general, familiarity with the situation and various parties involved is found to build trust in business relationships [Kumar, 1996; McKnight et al., 1998]. Past researchers specifically observed that familiarity with an e-vendor and the website of that vendor positively influences trust in that e-vendor [Gefen, 2000]. The second-hand trust related knowledge may come from media or other people. Regardless of whether the knowledge is obtained first-hand or second-hand, knowledge-based trust antecedents are likely to influence respondents' trust in e-vendors. Therefore: .

H3: Knowledge-based trust antecedent positively affects trust.

INSTITUTION-BASED TRUST ANTECEDENT

Institution-based trust means that a person believes the necessary impersonal structures are in place to enable acting in anticipation of a successful future endeavor [McKnight et al., 1998]. Such trust reflects security about a situation because of guarantees, safety nets, or other structures. The concept of institution-based trust comes from sociology, which deals with the structures (e.g., legal protections) that make an environment feel trustworthy [McKnight et al., 2002].

Two types of institution-based trust are discussed in the literature: (1) situational normality and (2) structural assurance [McKnight et al., 1998]. Situational normality is an assessment that success is likely because the situation appears to be normal or favorable. In the context of the Internet, for example, high situational normality would mean that the Internet environment is appropriate, well ordered, and favorable for doing personal business [McKnight et al., 2002]. Structural assurance is an assessment that success is likely because safeguard conditions, such as legal recourse, guarantees, and regulations are in place [Gefen et al., 2003; McKnight et al., 1998; S. P. Shapiro, 1987; Zucker, 1986]. In the context of online prescription filling, for example, a customer who perceives high structural assurance would believe that legal and technical protections (e.g., the Health Insurance Portability and Accountability Act, or HIPAA) safeguard her from a loss of privacy or health insurance.

McKnight et al. [1998] proposed that institution-based trust will affect trusting beliefs and provided three explanations for this relationship.

1. Believing that safety nets exist in a specific situation enables a person to suppose that the involved parties are trustworthy.
2. Believing that institutions reflect the actions of the people involved enables a person to develop trusting attitude about the people who are involved in the institutions.
3. Based on many cognitive consistency studies, institution-based trust will most likely stay consistent with related beliefs such as trusting beliefs.

Gefen et al. [2003] report that institution-based trust antecedents positively affect trust in a book or CD e-vendor. Online-prescription-drug filling is a new Internet-based service. Believing that such a service appears to be normal and government regulations and legal frameworks regarding online-prescription drugs are in place would enable online consumers to perceive that online prescription drug vendors are trustworthy.

H4: Institution-based trust antecedent positively affects trust.

UNCERTAINTY

Uncertainty is a well established concept in transaction cost economics [Williamson, 1981], which asserts that people tend to conduct transactions in a way that minimizes their transaction cost. Uncertainty refers to the extent to which an individual or organization cannot anticipate or accurately predict the environment [Pfeffer and Salancik, 1978]. Prior research demonstrated that uncertainty increases transaction cost and decreases acceptance of online purchasing [Liang and Huang, 1998]. Uncertainty regarding whether trading parties intend to and will act appropriately is a source of transaction risk which erodes exchange relationships and increases transaction costs [Rousseau et al., 1998]. Transaction risks can result from the impersonal nature of the electronic environment. These risks are rooted in two types of concerns:

1. About the identity of online trading parties and
2. about product quality [Ba and Pavlou, 2002].

On the Internet, a dishonest seller can easily masquerade as an honest one to attract a buyer into a fraudulent transaction [Neumann, 1997]. In addition, the lack of information about the true quality of the product or service prior to the actual purchase makes the buyer more uncertain.

Similar to Ba and Pavlou's [2002] categorization of uncertainty, Liang and Huang [1998] suggested that two types of uncertainties are relevant in an e-commerce transaction: (1) product uncertainty and (2) process uncertainty. Product uncertainty addresses product quality, while process uncertainty addresses how transactions are carried out. Uncertainty influences consumer acceptance of e-commerce negatively [Jarvenpaa et al., 2000; Pavlou, 2003]. Online prescription filling is a new form of online exchange relationship between patients and prescription drug e-vendors. Since prescription drugs are involved, relatively great uncertainty will likely be perceived by consumers, thus posing a negative impact on the intended use of online prescription filling services.

H5: Uncertainty decreases intention to adopt online prescription filling.

TRUST AND UNCERTAINTY

As a transactional characteristic relevant to trust, the relationship between uncertainty and trust needs to be examined. Trust affects exchange relationships, more so in an uncertain environment such as a Web-based business in which the behavior of an e-vendor cannot easily be guaranteed or monitored [Reichheld and Scheffer, 2000]. Rousseau et al. [1998] observed that scholars in various disciplines reached a consensus that trust is a psychological state developed under conditions of risk and interdependence. Trust is necessary only when there is some uncertainty. If all transactions can be carried out under conditions of absolute certainty, there would be no need for trust [Lewis and Weigert, 1985; Zazzali, 2003]. As a consequence, uncertainty and trust are closely related in a logical sense. They can be viewed as a pair of opposing forces shaping exchange relationships. One objective of trust building is to reduce the trustor's perceived uncertainty so that transaction cost is lowered and a long-term exchange relationship is sustained [Ganesan, 1994]. Prior studies stressed the important role of trust in reducing risk or uncertainty in Internet shopping [Gefen, 2000; Jarvenpaa et al., 2000]. Trust is believed to be able to mitigate opportunism [Doney and Cannon, 1997] and information asymmetry [Ba and Pavlou, 2002] in uncertain contexts.

H6: Trust reduces perceived uncertainty.

OPPORTUNISTIC BEHAVIOR

Opportunistic behavior is prevalent in exchange relationships. In the online buyer-seller relationship, sellers may behave opportunistically by trying to meet their own goals without considering the benefit to the consumer. Examples of opportunistic behavior could include misrepresentation of the true quality of a product or service, incomplete disclosure of information, actual quality cheating, contract default, or failure to acknowledge warranties [Mishra et al., 1998]. In the online prescription filling situation, buyers may question whether they will receive quality health products and services, given the possibility of prescription drug e-vendors behaving opportunistically. For example, to save costs, a drug e-vendor might not hire a licensed pharmacist to check drug-drug interactions for patients although its website claims to do so. Opportunistic behavior draws much attention. Some researchers argue that trust can be defined as the expectation that an exchange partner will not engage in opportunistic behavior. One of the consequences of trust is to reduce perceived uncertainty associated with opportunistic behavior [Bradach and Eccles, 1989; Ganesan, 1994]. Obviously, the more drug e-vendors behave opportunistically, the more uncertainty will be perceived.

H7: Perceived opportunistic behavior of prescription drug e-vendors increases uncertainty.

INFORMATION ASYMMETRY

Information asymmetry is defined as the difference between the information possessed by buyers and sellers [Ba and Pavlou, 2002]. Information asymmetry adds a layer of uncertainty to exchange relationships. Information asymmetry, makes it difficult and costly for buyers to ascertain the attributes of products and services before purchase [Nayyar, 1990]. Necessary

information regarding the quality of products or services may be incomplete or not readily available. Health care is characterized by serious informational asymmetry since health professionals control a specialized body of knowledge that is difficult for patients to evaluate [Arrow, 1963]. Information asymmetry is a problem for Internet shopping because of the physical distance between buyers and sellers [Huston and Spencer, 2002].

Two sets of problems result from information asymmetry [Nayyar, 1990].

1. The moral hazard problems associated with the buyer's inability to observe actions taken by the seller.
2. The adverse selection problems which take place when the buyer is not capable of knowing the seller's characteristics or the contingencies under which the seller operates.

Marketing researchers observed that information asymmetry is characteristic of most buyer-seller relationships [Mishra et al., 1998]. When consumers cannot be adequately informed to make a judgment, they are likely to be subjected to moral hazard and adverse selection problems and perceive a high degree of uncertainty.

H8: Information asymmetry increases uncertainty.

III. RESEARCH METHOD

A survey approach was used for this study. We developed a questionnaire consisting of measurement instruments for the proposed constructs. The questionnaire is shown in Sidebar 1. The instruments were grounded on the theoretical semantics of the constructs. They were reviewed by an expert panel and pre-tested. One hundred and eighty undergraduate business students were asked to participate in the survey. The instrument development and data collection procedures are described in detail in this section.

INSTRUMENT DEVELOPMENT

The constructs of trust and behavioral intention are studied extensively in electronic commerce research. By referring to the extant literature, we composed trust items in such a way that they reflect specific beliefs of consumers in e-vendors' competence, integrity, benevolence, and credibility [Doney and Cannon, 1997; Ganesan, 1994; Gefen et al., 2003; McKnight et al., 2002]. The development of items for consumers' intention to adopt online prescription filling is based on the work of McKnight et al. [2002] and Gefen et al. [2003]. These items intend to measure such trust-related Internet behaviors as providing personal medical information and purchasing prescription drugs from the e-vendor.

Based on their theoretical meanings, we developed items to measure calculus-based, knowledge-based, and institutional trust antecedents. Calculus-based trust derives from credible information about the intentions or competence of the other party (e.g., reputation and certification). [Rousseau et al., 1998] The five items under calculus-based trust were created to measure online prescription filling e-vendor's reputation, word of mouth, licensing, professional personnel, and ethics. Knowledge-based trust is suggested as a prediction process in which trust is created when knowledge about the trustee allows predicting the trustee's behavior [Doney et al., 1998; Gefen et al., 2003; D. L. Shapiro et al., 1992]. Four items were constructed to measure knowledge-based trust: website security, transaction accuracy, medication quality, and medical information correctness.

McKnight et al. [2002] suggest that the measures of institutional trust should be adapted to be more specific to the context of a particular trustee. Although institutional trust has usually contained two dimensions: structural assurance and situational normality, we contend that, in the context of online prescription filling, structural assurance is the dominant dimension, while situational normality may not be applicable. We do so because consumers are concerned about

SIDEBAR 1: QUESTIONNAIRE**Calculus-based Trust**

1. I think online prescription drug retailers have a good reputation.
2. People around me (friends, relatives, colleagues, etc) have had good experience in purchasing prescription drugs online.
3. I think online prescription drug retailers are licensed
4. I think online prescription service is handled by health care professionals.
5. I think online prescription drug retailers are ethical.

Knowledge-based Trust

1. I know whether prescription service websites use appropriate technology to ensure online security or not.
2. I know whether prescription service websites use appropriate technology to ensure accurate online transactions or not.
3. I know whether the prescription drugs bought from websites are of good quality or not.
4. I know whether the information provided on prescription service websites are correct or not.

Institution-based Trust

1. I think there are laws and regulations to control the behavior of online prescription drug retailers.
2. I think there are laws and regulations to protect Internet shoppers.
3. I think the Health Insurance Portability and Accountability Act (HIPAA) will protect my privacy when I order my prescription drugs online.
4. I think there are industry standards with which online drug retailers have to comply.
5. I think ordering prescriptions online is widely accepted as a norm.

Trust

1. I think online prescription service is handled in a competent manner.
2. I think online prescription service is reliable.
3. I think online prescription service is safe.
4. I think online prescription service is secure.
5. I think online prescription service is trustworthy.
6. I trust online prescription drug retailers.

Uncertainty

1. I am not sure that online prescription service is good for me.
2. I think I will be exposed to many risks if I order my prescription drugs online.
3. I feel that ordering my prescription drugs online involves a high degree of uncertainty.
4. I am afraid that something unpredictable may happen if I place my online prescription order.
5. Online prescription service is an unclear process to me.

Opportunistic Behavior

1. I think online drug retailers' first priority is making profit rather than providing patient-centered services.
2. The prescription drugs sold online could be manufactured in another country where lower drug quality standards apply.
3. The prescription drugs sold online could be of low quality.
4. The prescription drugs sold online could be expired or close to expiration.
5. The prescription drugs sold online could be adulterate drugs.

Information Asymmetry

1. From the information provided by the prescription drug website, I cannot tell if the company is reputable.
2. From the information provided by the prescription drug website, I cannot tell if the drug quality is good.
3. From the information provided by the prescription drug website, I cannot tell if the company is legitimate.

Intention

1. I intend to use online prescription service in the near future.
2. It is likely that I will purchase prescription drugs online in the near future.
3. I would provide my personal information (credit card, medical record, etc) to get my prescription drugs online in the near future.

the medication quality. Therefore, they want safety structures such as regulations to be in place. In addition, online prescription filling is an innovative phenomenon that is anything but normal. Compared with e-commerce sites selling other commodities, online prescription filling sites need physician prescriptions and personal medical information. Compared with brick-and-mortar pharmacies, the pharmacists at online prescription filling sites do not help patients in person. Given that online prescription filling is not anchored to consumers' past experience, it seems that situational normality contributes to distrust rather than trust. Based on these considerations, we

believe that it is more appropriate to use only structural assurance to represent institutional trust in this study.

Structural assurance refers to the perception of the existence of safety nets or structures in a specific context to promote success [Gefen et al., 2003; S. P. Shapiro, 1987; Zucker, 1986]. As a result, we created five items to measure the consumers' perception of laws, regulations, HIPAA, industry standards, and dispute resolution procedures regarding online prescription filling.

We created items to measure uncertainty, opportunistic behavior, and information asymmetry on the basis of their substantive meanings. Uncertainty refers to the extent to which it is not possible to anticipate or predict the environment accurately [Pfeffer and Salancik, 1978]. We developed five items about uncertainty to measure the extent to which consumers cannot predict the outcome of online prescription filling.

Assuming that e-vendors tend to behave to serve their self-interests and shift risks to consumers [Mishra et al., 1998], we designed five opportunistic behavior items to capture consumers' perceived risks associated with the quality of prescription drugs. Information asymmetry derives from the difference between the information possessed by buyers and sellers [Ba and Pavlou, 2002].

Given that the interest of this research is consumer adoption, we created three information asymmetry items to estimate the extent to which consumers lack information regarding e-vendors, although information asymmetry could also mean that e-vendors lack information regarding consumers.

The knowledge-based trust items are assessed by a seven-point scale where 1 means "Know nothing at all" and 7 means "Know extremely well." The items of all the other constructs are assessed by using a seven-point scale where 1 means "Strongly disagree" and 7 means "Strongly agree."

Face validity of the items was examined by an expert panel consisting of three MIS professors, 11 business doctoral students, and two licensed pharmacists. After some wording modifications, the questionnaire was pre-tested in a paper based format with 22 undergraduate business students to ensure that the questions are understandable. After the questionnaire was finalized, a Web-based questionnaire was created for this study so that responses could be inserted automatically into a database.

DATA COLLECTION

The main data collection targeted at the online consumers who were undergraduate business students at a University in the Southeastern region of the United States during the spring semester of 2004. At the beginning of the data collection session, an introduction (Appendix I) to online prescription filling was presented to inform the students about procedures needed to fill prescriptions online. Two online pharmacy websites were listed on the questionnaire and respondents were requested to browse through them. No specific facts about the trustworthiness of the two e-vendors were provided, but consumer information concerning buying medicines and medical products online that were prepared by U.S. Food and Drug Administration (FDA) was provided. The consumer information includes tips, warnings, guides, and FAQs about online prescription filling. Respondents were then asked to complete the online questionnaire based on their perceptions of online prescription filling. Respondents were allowed to search for more information if they thought it was necessary for them to answer the survey questions. Of the 180 students queried, 35 did not complete the survey. A total of 145 completed questionnaires were obtained.

Of the respondents, 60 were women and 82 were men, with some data missing from the gender entries. Most respondents had previous online shopping experience ($n = 129$). The average age of the respondents was 21.58 ($SD = 2.92$) ranging from 18 to 43. Descriptive statistics are

displayed in Table 1. All scales ranged from 1 to 7, and showed a reasonable dispersion in their distributions across the ranges, as seen in the standard deviations.

Table 1. Descriptive Statistics

Construct	Mean Score (SD)
Calculus-based	3.68 (1.05)
Knowledge-based	2.81 (1.40)
Institutional	4.32 (1.12)
Trust	3.39 (1.32)
Uncertainty	5.14 (1.29)
Opportunistic behavior	5.21 (1.15)
Information asymmetry	4.76 (1.30)
Intention	2.16 (1.45)

Means scores refer to the average value of the response to all questionnaires in a category construct.

IV. DATA ANALYSIS AND RESULTS

PLS Graph 3.0 software was used for data analysis since it is appropriate for dealing with small samples [Chin, 1998a]. Chin [1998b] recommended that PLS outputs could be used to assess both the outer measurement and the inner causal relationships of a research model. Adopting this recommendation, we employed the PLS statistics to analyze the reliability and validity of the measurements and test the proposed hypotheses. A bootstrapping approach was used to generate 300 random samples from the original data set by using sampling with replacement. In PLS analysis, missing values in the data set are handled by pairwise deletion [Fornell and Cha, 1994]. We coded the missing values as 9999 so that PLS Graph would recognize them.

Table 2 exhibits the Cronbach's alpha and the composite reliability of the constructs. All the reliability coefficients are above .70, showing sufficient internal consistency. Table 3, which shows the construct pair-wise correlations, demonstrates that the constructs used in this study provide sufficient discriminant validity.

Table 2. Construct Reliabilities

Construct	Cronbach's alpha	Composite Reliability
Calculus-based	.80	.86
Knowledge-based	.89	.92
Institution-based	.77	.84
Trust	.94	.95
Uncertainty	.89	.92
Opportunistic behavior	.87	.91
Information asymmetry	.91	.94
Intention	.94	.96

Table 3. Construct Correlations

Construct	1	2	3	4	5	6	7	8
1. Calculus-based	.55*							
2. Knowledge-based	.35	.75*						
3. Institution-based	.58	.22	.51*					
4. Trust	.68	.38	.52	.78*				
5. Uncertainty	-.38	-.31	-.19	-.58	.70*			
6. Opportunistic behavior	-.32	-.19	-.18	-.33	.59	.66*		
7. Information asymmetry	-.25	-.09	-.19	-.36	.43	.33	.84*	
8. Intention	.30	.28	.22	.43	-.59	-.37	-.22	.90*

* AVE = average variance extracted

Table 4 shows the factor loadings of the items of each construct. The loadings are in acceptable range and the t values indicate that all of them are significant at the .01 level. The high loadings suggest that the convergent validity of the instruments is adequate. Therefore, the items of each construct are actually determined by the construct they intended to measure. The discriminant validity of a construct was examined by comparing the square root of the construct's average variance extracted (AVE) and the correlations between the construct and any other construct. The criterion is that in order to show sufficient discriminant validity the square root of the AVE should be greater than all of the correlations [Chin, 1998b].

Table 4. Construct Factor Loadings

Construct	Indicator	Loading	t value
Calculus-based	1	.70	17.54
	2	.54	10.20
	3	.76	21.90
	4	.83	42.40
	5	.81	33.28
Knowledge-based	1	.84	29.76
	2	.91	55.26
	3	.87	41.01
	4	.83	25.21
Institutional	1	.61	9.87
	2	.74	18.18
	3	.78	25.20
	4	.77	23.81
	5	.66	11.33
Trust	1	.78	22.97
	2	.87	47.25
	3	.93	81.96
	4	.91	77.58
	5	.92	67.85
	6	.87	48.55
Uncertainty	1	.79	22.78
	2	.91	66.81
	3	.93	116.87
	4	.88	64.00
	5	.63	10.94
Opportunistic behavior	1	.71	16.83
	2	.81	26.38
	3	.91	60.52
	4	.83	27.04
	5	.79	26.55
Information asymmetry	1	.91	73.32
	2	.94	79.67
	3	.90	45.78
Intention	1	.94	69.30
	2	.95	45.02
	3	.95	95.42

Figure 2 presents the estimates obtained from PLS analysis. The R^2 value of .36 indicates that the model explains a good amount of variance in intention to use online prescription filling. We find support for H2, H3 and H4, where we expected calculus-based, knowledge-based, and institutional trust antecedents to positively impact trust ($b = 0.53$; $b = 0.15$; $b = 0.17$). Opportunistic behavior and information asymmetry significantly lead to uncertainty, showing support for H7 and H8. As predicted by H6, perceived uncertainty can be reduced by trust ($b = -0.39$). While trust plays an important role in increasing consumers' intention of adopting online

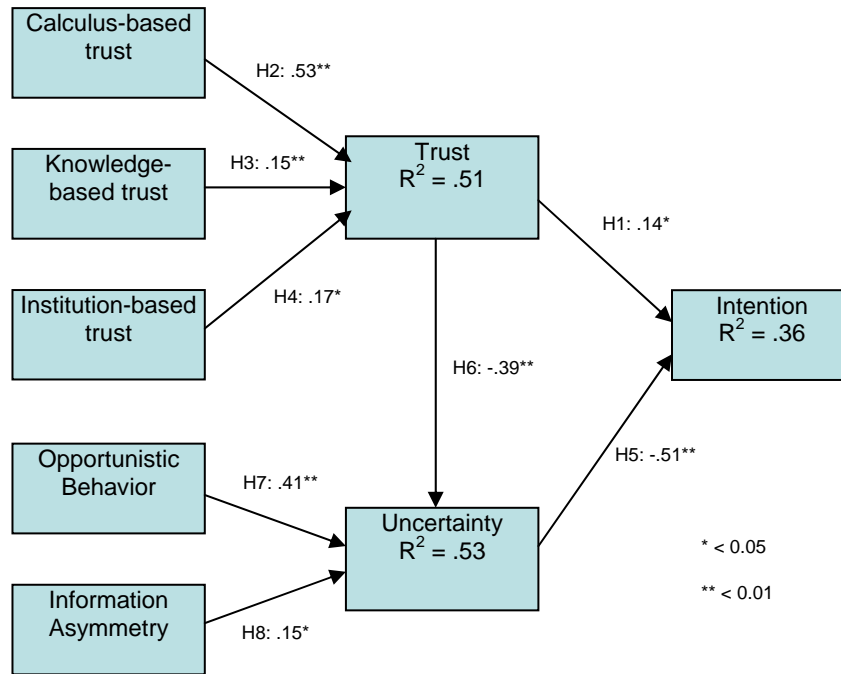


Figure 2. PLS Analysis Results

prescription filling ($b = 0.14$), uncertainty seems to have a more salient effect on decreasing this intention ($b = -0.51$). Thus, we have found support for all of the research hypotheses.

V. DISCUSSION

TRUST AND UNCERTAINTY

Many factors can affect consumers' decision to purchase prescription drugs from an e-vendor. This study examined two critical factors, trust and uncertainty. The results indicate that both trust and uncertainty affect intention significantly. The path weights in Figure 2 indicate that the effect of uncertainty is stronger on intention than trust. Given that trust also reduces uncertainty, it appears that uncertainty takes a mediating role between trust and intention. This finding is consistent with the theoretical conceptualization of trust which suggests that trust is a psychological state developed to cope with uncertainty and reduce transaction cost [Zazzali, 2003].

Since prescription drugs are related to health, we can assume that consumers consider them to be more critical than ordinary products such as books and electronics. Consequently, the same degree of uncertainty may be perceived differently by consumers purchasing prescription drugs and other products from the Internet. Our findings indicate that trust can be built to enhance consumers' intention to use online prescription filling. It is important to recognize that uncertainty plays a significant role in shaping this intention, and that the effect of trust is primarily realized by reducing uncertainty.

ANTECEDENTS OF TRUST

The model testing results show that all of the three antecedents of trust significantly contribute to trust. This finding indicates that e-vendors' reputation, consumers' knowledge and familiarity with online prescription filling, and the safety nets in the institutional environment can augment consumers' trust in online prescription filling services. Examining the relative importance of the

three antecedents (calculus-based, knowledge-based, and institution-based) shows that calculus-based antecedents impact trust most strongly.

In a prior study [Gefen et al., 2003] found that the strongest effect on trust comes from institutional antecedents and that knowledge-based antecedents have no significant effect. That is, there is a discrepancy about which antecedent is the most important determinant of trust. Note that we do not intend to compare the two studies rigorously since they use different measurement items to measure the same constructs. Hence, the comparison is limited at the conceptual level. Table 5 shows the path weights of trust antecedents in both studies.

Table 5. Trust Antecedents in Two Studies

Trust Antecedents	Gefen et al. [2003]	This Study
Knowledge-based	Insignificant	.15**
Institution-based		
Structural Assurances	.37*	.17*
Situational Normality	.33**	
Calculative-based	.18**	n/a
Calculus-based	n/a	.53**

*=significant at .05 level. **=significant at .01 level

The discrepancy from this conceptual level comparison suggests that trust building is related to product specificity. Gefen et al. [2003] studied online shopping of books and CDs, while we studied online prescription filling. It has been recognized that different products are associated with differing transaction specific risk and cost in e-commerce [Ba and Pavlou, 2002; Liang and Huang, 1998]. When purchasing prescription drugs, we believe that people want their e-vendor to be reputable, professional, licensed, and ethical, because these attributes might affect the quality of drugs and services they receive. Compared with calculus-based trust, institution-based and knowledge-based antecedents are not as important because consumers prefer to get things right in the first place rather than resorting to technological or regulatory protection after adverse drug events occur. In this setting, adversity could be related to morbidity or mortality. Therefore, calculus-based antecedents were found to be the most dominant determinant. This finding corroborates Ba and Pavlou's [2002] assertion that calculus-based trust can be a powerful form of trust to facilitate electronic transactions.

OPPORTUNISTIC BEHAVIOR AND INFORMATION ASYMMETRY

Our results confirm that opportunistic behavior and information asymmetry are sources of uncertainty. The path coefficients from opportunistic behavior and information asymmetry to uncertainty are 0.41 and 0.15, respectively. This finding suggests that consumers are more concerned with e-vendors' opportunistic behavior than information asymmetry. If e-vendors sell adulterated or expired medications to consumers, the result could be life-threatening. Opportunistic behavior and information asymmetry may interact with each other. An opportunistic e-vendor can post inaccurate policies which lead to information asymmetry, whereas the inability of consumers to examine the prescription filling process gives e-vendors chances to behave opportunistically. Future research is called for to examine the interaction between these two constructs and its impact on consumers' online medication purchasing behavior.

THEORETICAL IMPLICATIONS

The investigation of trust and its antecedents in online prescription filling extends the research on trust to the healthcare related area. Given the distinct characteristics of prescription drugs, the trust building mechanism may be product specific and different from what was found in prior

studies. In addition, by including uncertainty explicitly in the research model, we extended the current literature that examines trust in e-commerce but mostly assumes the existence of uncertainty.

We demonstrated in this paper that uncertainty serves as a mediating role between trust and intention. If uncertainty is removed, the variance explained will be decreased significantly. Therefore, including uncertainty enriches our understanding of the relationship between trust and intention. Another contribution to the literature is that we looked into two sources of uncertainty, opportunistic behavior and information asymmetry and found that both contribute significantly to uncertainty. Future investigations are needed to examine the relationship between trust and specific sources of uncertainty.

PRACTICAL IMPLICATIONS

The findings suggest that prescription drug e-vendors can increase consumer adoption by building trust. While building all three types of trust antecedents are necessary, building calculus-based trust is the most effective. Efforts need to be made to understand how the characteristics of prescription drugs affect transaction specific uncertainty and consumer behavior so as to formulate appropriate strategy to mitigate the uncertainty.

LIMITATIONS

A limitation of this study is that the respondents of our survey are undergraduate business students. This sample is possibly not representative of the general population of online consumers, since they are young and are highly experienced in using computers. Therefore, caution needs to be taken when generalizing our findings to other populations, especially older populations. We speculate that, if an older sample is employed, the strength of trust will decrease and the effect of uncertainty will increase given that older people tend to be more scrupulous than the younger generation. Another limitation is that the interactions among trust, uncertainty, and their antecedents are not investigated fully. New insights might be gained by further analysis based on theory..

FUTURE RESEARCH

Our results lay a foundation for future research. Two directions are suggested.

1. Investigate the interaction between trust and uncertainty. Efforts should be made to explain how trust reduces uncertainty. The relationships among trust, information asymmetry, and opportunistic behavior also need to be studied.
2. Test our model with a population older than the current sample. A practical suggestion is to invite people active on senior websites such as www.seniornet.org to participate in a study. It is also possible to survey computer savvy seniors in large active senior centers and senior retirement homes. The results can be compared with the current study to see if age influences people's perceptions of trust and uncertainty.

VI. CONCLUSION

Drawing on prior research in consumer trust and theory of transaction cost economics, this paper proposes a research model to investigate the precedents of trust, the sources of uncertainty, and their relationships with the consumer's intention to adopt online prescription filling. The model was tested empirically using a large sample of students. The data analysis results provide strong support for all seven hypotheses derived from the model. Specifically, it is found that

- (1) calculus-based, knowledge-based, and institution-based antecedents of trust affect trust significantly,

- (2) information asymmetry and online drug retailers' opportunistic behavior contribute to perceived uncertainty of online prescription filling,
- (3) trust reduces uncertainty and positively affects intention, and
- (4) uncertainty influences intention negatively.

A theoretical contribution of this paper is that we found relationships between trust antecedents and trust are product specific. When healthcare products are involved, calculus-based trust antecedents are the strongest determinant of trust. A second theoretical contribution is that the understanding of trust on consumer intention is augmented by taking uncertainty into account. Few prior studies incorporate both trust and uncertainty into the same model and examine their relationship with behavioral intention. Our study found that trust reduces uncertainty, and uncertainty's effect on intention is stronger than that of trust. This finding implies that uncertainty is an important factor affecting consumer intentional behavior in trust-related research.

As to practical contribution, this paper suggests that trust is important for online prescription filling. Online pharmacies should pay attention to all three types of trust antecedents to reduce consumers' perceived uncertainty and increase their intention to purchase prescription drugs online. Online pharmacies ought to focus on building reputation. They should indicate clearly on their websites that they are registered with the Board of Pharmacies and their prescription filling transactions are handled by licensed healthcare professionals. They should also attempt to increase consumers' knowledge about their product, service, and technology. For example, they can add consumer feedback mechanism on their websites so that previous buyers can share their experience with potential buyers. In addition, online pharmacies should incorporate institution-based structural assurances into their websites such as, in the United States, HIPAA compliance certificates and links to FDA online pharmacy regulations.

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APPENDIX I. BRIEFING FOR SURVEY RESPONDENTS

1. How to purchase prescription drugs online

Ordering prescription drugs online allow patients to get prescription drugs directly from the Web. There are two ways to do it:

Go to a prescription drug site, click on the prescription drug you want, fill out and submit your personal medical information, wait to be approved from the licensed doctor of the online company, and then purchase the prescription drug. Please follow the link given below, surf the website and get an idea of the ordering process. **DO NOT PURCHASE ANYTHING.**

- <http://www.online-prescriptiondrugs.com>

Get the prescription from your local doctor and provide all the relevant information (insurance and doctor's contact information) to the web site. The website will contact your doctor to confirm your condition. If approved, they send you the drugs. An example of an order form for this option is at the web address given below. Please follow the link given below to get an idea of the order form. **AGAIN DO NOT PURCHASE ANYTHING.**

- <http://www.pharmacycarecentre.com/onlineprescrip.htm>

2. FDA consumer information

Food and Drug Administration prepared consumer information about online purchasing of medicines and medical products. This information will help you get familiar with the current online pharmacy practice status. You can find this information by visiting the following two links.

- <http://www.fda.gov/buyonline/>
- <http://www.fda.gov/oc/buyonline/faqs.html>

Please don't take the survey until you have gone through the online prescription filling steps required on the two websites in Section 1 and read the FDA customer information. The webpage <http://www.fda.gov/buyonline/> links to other web sites related to online prescription filling. You may want to check them out.

3. Survey instructions

The purpose of this survey is to get your perceptions and opinions about online prescription filling and related factors. Please read each question carefully and select the option that is the closest to what you feel. If you are not sure about how to answer a question, you may want to get help from information resources available to you. For example, you can search the Internet. Please note there is no right or wrong answer to the questions. They simply measure what you perceive. Data completeness is important to us. Please ensure that you answer all questions.

The data you provide will be anonymous. Your participation is completely voluntary. You are free to withdraw from the study at any time.

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