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Examining Inefficiencies and Consumer Uncertainty in E-Commerce

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Abstract:

The popularity of e-commerce can be attributed to open (and mostly unbridled) competition with minimal barriers to entry. Yet, recent surveys suggest a general lack of consumer confidence in transacting online. Such findings are troubling — pointing to probable inefficiencies in e-commerce. The question then is: what are these inefficiencies and how do they prompt such consumer uncertainty? In answering the question, this paper surfaces three core e-commerce inefficiencies: seller anonymity, lack of product transparency, and lack of process transparency. It is also contended that consumer uncertainty is not an intrinsic buyer characteristic. Rather, it is contingent upon the information specificity of specific products that consumers transact in B2C and C2C *e-commerce*. Tying together threads from behavioral economics, this paper offers a novel perspective toward understanding electronic market inefficiencies and its consequent effects on consumer uncertainty. Apart from proposing a model of consumer uncertainty in *e-commerce*, the study offers a preliminary empirical validation of the proposed model. Findings suggest that inherent Ecommerce inefficiencies of anonymity and lack of product and process transparencies cause consumer uncertainty. The findings further evidence how buyer uncertainty increases when planning to buy products with high information specificity, especially when product transparency is lacking.

Keywords: *e-commerce* inefficiencies, anonymity, lack of product transparency, lack of process transparency, uncertainty, product information specificity

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I. INTRODUCTION

The dramatic rise of e-commerce comes at a price. While there is no questioning that e-commerce is a rapidly growing phenomenon, consumer-centric e-commerce (i.e. B2C and C2C) is yet to harness the full potential of e-commerce, with “fully one-half of Internet users avoiding buying online” due to various concerns and uncertainties surrounding e-commerce transactions [Verisign 2006, 5]. With minimal barriers to entry, the growing number of buyers and sellers from around the globe can easily attest to the explosive growth in e-commerce - from Amazon.com and Buy.com to Ebay.com and Craigslist.org. On the one hand, newer Web technologies and broadband networks are opening online channels; on the other hand, newer threats exploiting the inherent nature of Internet-based networks are burgeoning—leaving e-commerce customers uncertain: Is the seller credible? Is the product correctly represented? Is the transaction process clear? According to a recent Unisys survey of UK consumers’ attitudes and perceptions surrounding online shopping, “The growth in use of online shopping and banking have brought with them concerns over online security, with 67 percent reporting to be ‘somewhat,’ ‘very’ or ‘extremely’ concerned” [Unisys 2007]. Similarly, the *Wall Street Journal* [2006] reported that only “25 percent of people who researched products online went on to buy the items. But some 63 percent of those purchases were completed at a physical store, not over the Web.” It therefore does not come as a surprise that consumers remain somewhat uncertain about e-commerce transactions [Pavlou et al. 2007].

The following statistics further evidence customer wariness:

- 65 percent of e-commerce shoppers have abandoned a shopping cart/basket or failed to complete an online purchase due to uncertainty stemming from concerns regarding the credibility of the site, the products it sold, and security issues [Forrester Research 2007]
- 79 percent of users are wary about transacting online and look for third-party assurances such as SSL certificates in order to “see that their transactions are protected and to confirm the identity of the Web site owner” [Verisign SSL Information Center 2007]
- E-commerce customers remain wary about seller identity with phishing scams increasing by 167 percent in 2006-2007 [Anti-Phishing Work Group 2006]
- 87 percent of e-commerce customers are worried about how their credit card information and transactions were handled online [TNS 2006]

The aforementioned statistics paint a grim picture of consumer confidence in e-commerce, begging the following research question: *What specific e-commerce inefficiencies precipitate consumer uncertainty in e-commerce?* Specifically, we inquire how inherent and emerging inefficiencies of e-commerce warrant rising uncertainty, thus surfacing the underpinnings of consumer uncertainty in e-commerce. A prelude toward reducing consumer wariness must therefore be a systematic identification of core e-commerce inefficiencies. Central to our inquiry is the assumption that core e-commerce inefficiencies drive consumer wariness surrounding Ecommerce transactions in B2C (Business-to-Consumer) and C2C (Consumer-to-Consumer) scenarios.¹

This study contributes to research and practice in various ways. First, it offers a fresh lens to define and dimension inefficiencies of e-commerce. Before researchers, regulatory agencies, and vendors can devise better ways to counter consumer uncertainty surrounding e-commerce transaction, they must be able to specifically assess the limits of e-commerce. It is only when the limits are identified that specific recommendations can be proposed, legislated, and implemented to reduce consumer uncertainty. Without a proper assessment of e-commerce inefficiencies, consumer participation in e-commerce transactions will, at the very best, remain laden with lingering suspicion that will prevent open transactions in e-commerce. A systematic identification of e-commerce-specific preconditions for uncertainty could therefore be an important step toward mitigating consumer concerns. For consumers, knowing e-commerce inefficiencies will guide them to make more cautious and prudent decisions regarding e-commerce transactions; For technology vendors, knowing the impact of e-commerce inefficiencies on consumer uncertainty can prompt them to devise better technology solutions that can mitigate uncertainty; For sellers, understanding inefficiencies can prompt them to revise their online selling and channel strategies to reduce

¹ The scope of our study is dominated by a consideration of vendors with a pure virtual presence with no physical presence and dealing in tangible goods rather than digital products.

uncertainty; For regulators, an assessment of e-commerce inefficiencies can help spur regulations aimed at better legislations in line with easing e-commerce transaction uncertainties.

The rest of the paper is organized as follows. We first review previous literature on transaction costs to understand e-commerce inefficiencies. Next, we develop a model that addresses the relationship between e-commerce inefficiencies and consumer uncertainty in e-commerce. Asserting that e-commerce transactions do not occur in a vacuum and need to be contextualized by the product purchase, the model is further expanded to examine the contingent effects of the information specificity of product purchases on consumer perceptions of uncertainty. Subsequently, we develop measures and design a study to empirically validate our hypotheses. Results and findings from the investigation are presented thereafter. The paper ends with a discussion of the limitations and contributions of the study.

Theoretical Background

The paper uses Economics of Information Theory [Stigler 1961] and Transaction Cost Economics (TCE) [Williamson 1975; 1985] to surface market inefficiencies and uncertainty as important factor considerations for tracing consumer behavior in e-commerce transactions.

A seminal contribution to the economics of information theory is Stigler's [1961] observation that expanding markets are a function of a growing number of sellers offering myriad product and price options. Stigler's research found that when consumers suffer from imperfect information about product and price options, they will continue to search market information to arrive at satisfactory choices. However, every search incurs cost, and increasing search costs lead to a decreased perception of overall benefits. Building on Stigler's research, Williamson's [1975] transaction cost economics goes beyond search costs to consider exchange-based approaches encompassing costs of securing information about buyers and sellers, costs of seeking information about goods to find a desired combination of price and quality, and costs of coordinating, monitoring, and enforcing contracts. Inefficient markets embody higher transaction costs, particular following a slew of unknown variables—to an extent that perceived transaction costs end up surpassing all benefits of e-commerce transactions, leaving buyers uncertain about e-commerce transaction outcomes.

The roots of Transaction Cost Economics can be traced to understanding how transaction costs are central to any form of economic exchanges [Williamson 1985]. TCE has been used to illustrate the costs of market-mediated exchanges in a variety of areas—from supply chain activities (e.g. outsourcing, procurement, “make or buy” decisions) [e.g. Wang 2002; Subramani 2004] to online consumer behavior [e.g. Teo and Yu 2005; Liang and Huang 1998]. Because e-commerce transactions are fundamentally a contractual economic exchange, high transaction costs embodies in existing market inefficiencies may propel consumers to choose alternate channels (e.g. physical markets).

A common justification for the growth of e-commerce has been a substantial reduction in transaction costs [Malone et al. 1987, Gurbaxani and Whang 1991; Clemons et al. 1993]. However, the argument rested on a direct comparison of search costs for one-to-one purchases between electronic versus physical markets. Simply put, the hypothesis was forwarded using the assumption of a “closed” rather than an “open” market. In a closed market, buyers deal with well known and finite set of sellers and suppliers and are well aware of the product (which are assumed to be homogeneous) and underlying transaction processes. Yet, e-commerce, by virtue of its “openness,” offers buyers the ability to *deal with infinite number of global sellers and suppliers, heterogeneous products, and myriad transaction processes*—contributing to unique e-commerce inefficiencies [Granados et al. 2006].

Transaction costs are a concern even in physical markets where products are tangible, processes are visible, and sellers have a physical presence [Williamson 1975]. The issue of transaction costs becomes exceedingly germane in e-commerce where products are less transparent (owing to asymmetry, lack of tangibility), sellers are more anonymous, and processes are less visible and defined. These specific e-commerce inefficiencies are best explained by transaction costs. A lack of knowledge of the product, process, and seller creates inefficiencies by raising the buyer's need to monitor and draw more granular contracts in order to thwart opportunism. In a B2C or C2C scenario (the scope of this paper) scenarios, the buyer is unable to monitor or refine contracts before transacting with the seller. Consequently, a buyer becomes wary or uncertain about transacting. Because inherent e-commerce inefficiencies pave way for buyer uncertainty, an understanding of these e-commerce inefficiencies becomes an important prelude to understanding consumer uncertainty in e-commerce.

II. HYPOTHESES DEVELOPMENT

Inefficiencies in Ecommerce

Ecommerce relies on an Internet-based online market comprising of a network of buyers and sellers offering heterogeneous products. E-commerce as a whole is characterized by many benefits, but it does have its problems: cyber crimes, logistical bottlenecks, system breakdowns and hacking incidents—all characteristic of inherent e-commerce inefficiencies.

Any market, online or offline, is inefficient when (a) the true identity of transacting entities is lacking; (b) the true nature of the product is not completely discernible; and (c) the true process cannot be monitored so as to judge seller performance [Williamson 1975]. Recasting Williamson's work and combining fragments from previous literature, this study argues that e-commerce inefficiencies are attributable to network characteristics of anonymity [Kalakota and Whinston 1996], product transparency [Strader and Shaw 1999], and process transparency [Hsu and Soo 2002]. The appropriateness of considering the aforesaid factors can be understood in the light of three common consumer concerns when transacting in e-commerce: Is the seller identifiable and legitimate? Is the product truly at par with its description or lack thereof? Is the transaction process (i.e. order taking, order and financial information handling, and order fulfillment transparent? The very nature of e-commerce precludes consumers from ascertaining the "true" identity of the seller, the "true" nature of "physical" products (including tangibility), or the process by which the product reaches the consumer, therefore leading to consumer uncertainty surrounding e-commerce transactions. The overall hypothesized model is shown in Figure 1.

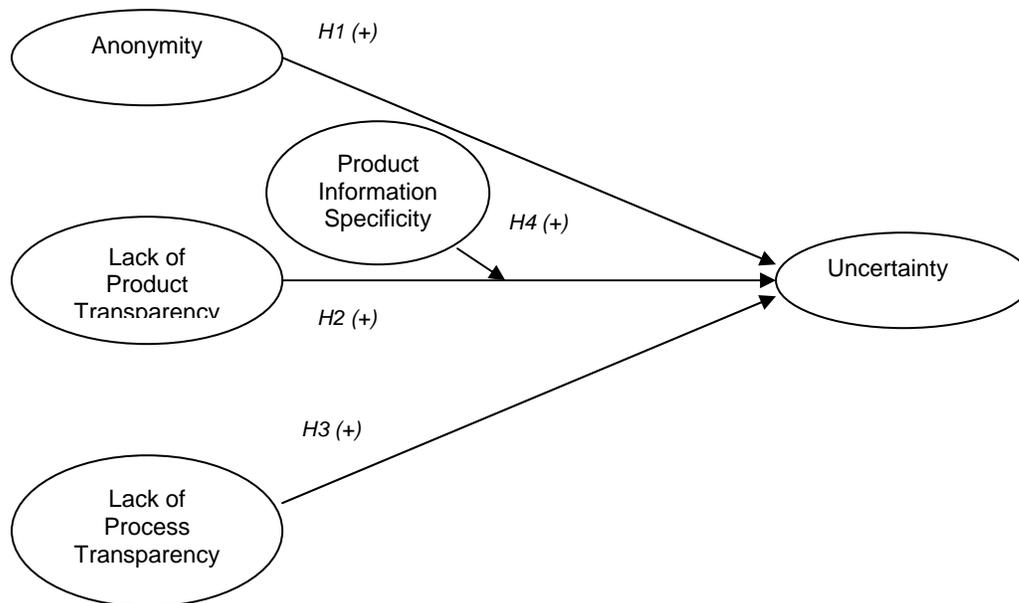


Figure 1. A Model of Uncertainty in E-commerce

Anonymity

In the scope of this paper, anonymity refers to a consumer's perceived inability to determine the true identity of sellers [Williamson 1975]. The open access offered by the Internet has allowed for tremendous growth in the number of sellers. With companies such as Amazon.com (WebStore) and eBay (ProStore) offering easy "e-commerce in a box" solutions that include Web store creation and hosting services, Web-based sellers abound. Yet, only a fraction of these sellers are verifiable. While some buyers are cautious enough to never buy from anonymous sites, Washkuch [2007] in the SC magazine reported that 36 percent of Internet fraud stemmed from anonymous Web sites and via anonymous e-mails — amounting to reported losses of approximately \$200 million in the U.S. alone. With easy availability of spoofing software, it is likely that even cautious consumers can fall prey to spoofed Web sites and phishing scams where customers are misled or deceived to believe the authenticity of a compromised Web site.

Anonymity has been referred to as an inefficiency of e-commerce [Malone, et al. 1989; Kalakota and Whinston 1996]. As mentioned earlier, with minimal entry barriers and the ability to set up a Web site with little or no verification has made participating in e-commerce popular yet "faceless." By virtue of anonymity, a seller can assume a seller can assume and trade using many identities (URLs). From domain names to e-mail IDs,

pseudonyms create anonymity by masking the true identity of sellers, leading to fraudulent representations. While it is true that not all sellers in e-commerce are anonymous, the likelihood of dealing with unknown sellers is presumably higher than in physical markets, owing to minimal barriers to entry. In addition, ongoing threats of phishing, IP spoofing and other available forms of Web-based deception easily allow sellers to easily hide their true identity [Grazioli and Jarvenpaa 2003]. In fact, the Internet Crime Complaint Center (IC3), a joint collaboration of the FBI and the National White Collar Crime Center, has warned consumers of anonymous identity spoofs ranging from masquerading legitimate and existing sellers to masquerading FDIC and even the FBI [IC3 2008]. As a result, consumer concerns of seller anonymity tend to be acute in e-commerce. The popularity of reputation systems, feedback ratings, buyer reviews of sellers, and certification authorities (e.g. Verisign, Thawte) serves to attest to the growing uncertainty faced by buyers about sellers in e-commerce. In particular, Verisign, a certification authority, found that 84 percent U.S. consumers are concerned about the identity of a business and require some form of third-party certification [Verisign 2006].

There is no way for any consumer to actually know if the entities (sellers) are what they really are. In the absence of any physical interaction, transacting entities remain faceless. A seller can easily secure a formal domain name (e.g. www.wallstreetelectronics.com) but may be operating out of a shack in the Maldives. Additionally, simple techniques such as URL cloaking and domain forwarding can mislead customers who remain wary of the authenticity and credibility of the seller. Because the domain name for a seller does not signify knowledge of the seller, there remains a sense of uncertainty surrounding the credibility of a seller. For example, a buyer searching on Froogle for the best price online may find a variety of sellers, and the best price may not be offered by a known seller. Recently, the Barclays Bank Web site was spoofed and compromised the security of its regular customers. Similarly, owing to anonymity, spoofing and masking of identities are easier online than offline. Because dealing with unknown sources (sellers) remains a legitimate concern in e-commerce, a general sense of uncertainty prevails among buyers.

Lack of Product Transparency

Concerns about the lack of product transparency arise when the true product characteristics are not easily captured [Strader and Shaw 1999], an issue germane to e-commerce. Product transparency concerns a consumer's ability to completely understand all necessary product attributes required to make an informed decision [Williamson 1975]. While e-commerce has led to unanticipated efficiencies and benefits from dealing with information goods (e.g. financial services, media, news, communication), e-commerce is limited in its ability to "completely" and "truly" represent any physical product. In physical markets, when a buyer visits a physical store and buys a good, the buyer can actually verify various attributes of the product (for example texture and shape) and can also obtain first hand knowledge from a human sales representative. But in the case of e-commerce, an online buyer is merely privy to product information (images, texts) as offered by the online seller. This exemplifies an acute loss of objectivity of the product characteristics.

Herein, it is important to clarify that consumer concerns surrounding product transparency in e-commerce are considerably acute for physical products vis-à-vis information products (e.g. digitized images, documents, mpegs, mp3s). Because information is intangible, consumers transacting information goods are likely to be indifferent about tangibility, irrespective of whether they are transacted in physical or e-commerce. Thus, information products, because of their inherent intangibility, escape the scrutiny that consumers afford to the transparency of physical products. In short, our arguments on the lack of product transparency only consider physical product transactions in e-commerce.

Sellers can create tremendous information asymmetry when dealing with physical goods in e-commerce. In B2C and C2C e-commerce, different sellers may and represent the same physical product in myriad ways online. Lacking a reference frame such as product tangibility in the real world, consumers' understanding of a product is completely captive to the seller's representation of the product. In a recent study of Dutch flower auctions, Koppius et al. [2004] found that online representations of flowers created differential perceptions of the product among buyers. For example, the same flower can be represented by a variety of images and videos shot using different exposures and angles — leading to distinctly different buyer perceptions. Koppius et al. [2004] noted that e-commerce suffers from deficient product representation. For example, when a B2C firm (e.g. Overstock.com) sells a teak table from Indonesia, the online buyer is captive to only the information that the seller site provides. Even if one were an expert in judging furniture, the lack of tangibility coupled with information asymmetry forces one to accept the sellers' claims at face value. To summarize, e-commerce transactions are limited in their ability to capture the true nature of a product, leading to an elevated sense of wariness and uncertainty [Williamson 1975; Liang and Huang 1998] among consumers. E-commerce therefore heightens buyer uncertainty owing to a lack of physical product transparency.

Lack of Process Transparency

In the world of e-commerce, Web technologies can cloak complex linkages subsuming various underlying processes. Take for example a simple Web site interaction. A typical buyer searches for a product, adds it to the

cart, logs in, confirms shipping details, enters payment details and submits it for processing. More often than not, the Web site host, the ISP, search providers, payment verification services, and shipping services include many third party service processes hidden from the purview of the customers. This lack of control leads to a lack of process transparency. Process transparency refers to consumer perceptions of visibility and verifiability of the underlying operation and execution process in any transaction [Williamson 1975]. Whereas transactions in physical markets allow customers to maintain a degree of control of the transaction process, in e-commerce, the control drastically shifts to Web technologies.

Consider the case when a consumer goes to a physical store and makes a purchase. The consumer chooses a product, walks up to the cashier and pays for it, and leaves with the purchase. The physical process is transparent enough to allow the consumer to monitor multiple process mechanisms — from product availability to credit card handling. Moreover, given that payment connections in physical stores use dedicated connections, a “traceable” cashier, and no credit card information storage, buyers remain relatively less uncertain about the transaction process. E-commerce, per se, affords buyers little control over processes that they are privy to in physical markets. The buyer might have an order number, but has no idea of what that is tied to internally, or how correctly it is routed. Neither is the buyer certain of who picked the payment or how it was processed. Nor is buyer certain that their payment information was duly received by the intended party or was injudiciously disseminated to unknown parties. While it is arguably not important for a consumer to know the specifics of the underlying technology, consumers become wary or uncertain when technology masks (and possibly removes) the human elements that are habitually ascribed by consumers to processes in physical settings.²

The physical world offers multiple aforesaid cues that customers can use to ascertain process transparency- cues that are often absent in e-commerce. In e-commerce, Web interfaces and technologies preclude consumers from monitoring process mechanisms. As a result, buyer concerns about identity and credit theft, spyware and malware, phishing, packet sniffing, and spamming abound. The presence of an interface rather than a person further reduces traceability and accentuates process transparency concerns in e-commerce. In e-commerce, the complexity of the processes compounds the threats therein. Devoid of physical references such as a cashier or the buyer swiping a card, picking up the package, and processing the order, buyers in e-commerce have to remain vigilant. Buyers therefore remain uncertain about whether the site is secure (e.g. awareness of https and SSL), whether the network is secure (e.g. presence of spyware on their machine, compromised server, packet sniffing), or whether the data storage is secure (e.g. confidentiality and accessibility³). Moreover, the growing need for accepting cookies and installing plug-ins also creates concerns among buyers who remain unsure and uncertain of their exact operations. In short, while consumers have the privilege of reference points for their purchases in physical markets, consumers are rarely privy to similar references in Ecommerce. Reduced process transparency therefore remains an inefficiency specific to e-commerce transactions, leading to greater consumer perceptions of uncertainty [Federal Trade Commission 2000].

Uncertainty

Uncertainty is defined as the lack of credible knowledge—the quandary of the principally unknowable, unpredictable and uncontrollable future [Lascaux 2003]. In his classic work, Knight [1985: 199] referred to uncertainty as “neither ignorance nor complete and perfect information but partial knowledge.” Adapting definitions from Pavlou et al [2007], Bauer [1960], and Pfeffer and Salancik [1978], this paper defines uncertainty as the inability of consumers to correctly and consistently assess the transactional outcome in e-commerce due to the unavailability of complete and perfect information.⁴

At the heart of consumer uncertainty is the “problem of intuitive estimation” in the absence of a priori probabilities— leading to extreme precariousness of expectations and confidence among consumers [Knight 1985]. Although few studies tend to equate uncertainty to risk [Son et al. 2006], there are concrete differences. According to Knight

2 Process transparencies vary across physical and e-commerce settings even when mirroring similar workflows. For example, even though swiping a card at a gas filling station uses similar workflows, the transparency is considerably higher. First, gas stations and most other automated checkout setups use a dedicated, rather than an open Internet based connection. Second, the lag is between the card swipe and fulfillment is dramatically lower than that of placing an order online. Third, there is a relatively higher level of traceability in a physical site (we can go and inquire from the service center operator) if we feel a sense of disconnect between action and response (e.g. if the station is not activated or if a certain grade of fuel is unavailable). In an e-commerce setup, such cues are commonly absent. That creates chances for opportunistic behavior. For example, a Web site could charge a card even when they know (but unknown to the buyer) of a stockout, practice some form of bait-and-switch tactic, or simply fail to ship and deliver.

3 Confidentiality and accessibility are relatively less of a concern in physical sites where customer information and credit card information are not generally stored.

4 Uncertainty is also distinct from concepts related to a lack of trust. Trust, according to McKnight and Chervany (2001: 34), “is crucial wherever risk, uncertainty, or interdependence exist”- placing trust as a downstream effect of uncertainty (e.g..Pavlou 2003; Gefen et al. 2003).

[1985], while risk deals with situations that have a *calculable a priori* probability, uncertainty is an *incalculable sense of wariness* perceived due to a lack of a priori knowledge. Risk prevails under objective conditions whereas uncertainty prevails in the absence of objectivity.

Reflecting on consumer uncertainty in e-commerce, Brynjolfsson and Smith [2000] and Ratnasingham [2003] note that two underlying technological aspects of e-commerce particularly contribute toward inefficiencies that raise a buyer's sense of uncertainty surrounding e-commerce transactions. First, e-commerce extensively uses technology to remove transparencies afforded by physical markets. Second, open technological infrastructure and standards create an environment for novel threats and modes of deception. E-commerce offers the browser as the window to the world, shrouding underlying elements with technology. A buyer is privy only to that information that is made accessible by the seller. For example, the consumer may know the name of a vendor, or even an IP address but may not know the true identity of the vendor in terms of the exact location, reputation, or reliability of the vendor. The consumer again might know something about the product (e.g. how it looks like from specific angles as per the images) but not how it feels like or how it is to use it. Also, the consumer might have some vague idea of the transaction process, but no knowledge of the complete transaction process sequence. Therefore, incomplete knowledge creates a sense of predicament or uncertainty about e-commerce transactions.

As alluded to earlier, we claim that inefficiencies inherent to e-commerce (i.e. anonymity, lack of product transparency, and lack of process transparency) are prime candidates for increased perceptions of uncertainty regarding transactions in e-commerce. In the world of e-commerce, simplification is commonly achieved by shifting control from the consumer to the technology. From cookies to plug-ins, technology tries to simplify the environment by reducing the need to understand how transactions are orchestrated. While that has certainly made e-commerce popular, it has greatly reduced control, knowledge, and predictability regarding the outcome of transactions in the e-commerce [Hodgson 1997], leading to perceptions of uncertainty. In short, consumers' lack of information is attributable to inherent e-commerce inefficiencies -thus raising their perceived uncertainty.

Hypothesis 1: Perceived increase in anonymity in e-commerce would increase consumer perceptions of uncertainty about e-commerce transactions.

Hypothesis 2: Perceived lack of product transparency in e-commerce would increase consumer perceptions of uncertainty about e-commerce transactions.

Hypothesis 3: Perceived lack of process transparency in e-commerce would increase consumer perceptions of uncertainty about e-commerce transactions.

Product Information Specificity

Building on Choudhury and Sampler [1997], we define product information specificity as the demand and reliance placed by a consumer on product information that is specific and timely to assist them in their decision-making (i.e. their purchase). The relevance of this concept gains ground in light of the fact that consumer transactions in e-commerce are contextualized by products that are purchased. Product information specificity thus refers to the contingent condition that we had mentioned earlier in the paper. Central to each product are specific features on which consumers expect to gain information. Information regarding features of some products may be more necessary than other products. Product information specificity refers to how important and suited knowledge (about the product) is for an individual. Putting it in another way, it explains how critical consumers perceive the specific product information is (in order to make the purchase).

Product information specificity is rooted in Williamson's [1975] concept of asset specificity, acknowledging the fact that information is a key asset in any exchange. The criticality of the information as an asset duly influences our perceptions of the environment that serves it. Higher product information specificity implies a greater degree of vulnerability, particularly under the condition of existing inefficiencies.

Recalling our definition, information specificity is a consumer's demand for and reliance on specific information. Given that e-commerce inefficiencies signify a lack of information about the varied aspect of the product (in terms of a lack of product transparency), they create a condition where consumer demands for specific information are likely to remain unmet, leading to increased uncertainty. Simply put, if the information that consumers seek is critical to their subsequent decisional behavior yet incomplete owing to e-commerce inefficiencies of a lack of product transparency, uncertainty is likely to be high.

Coupled with this inefficiency, information specificity can influence perceptions of uncertainty in consumers in a variety of contexts. Choosing financial instruments offers an appropriate exemplar. Given product information specificities of different financial instruments, it is more likely that consumers would require more complete



information on financial products such as mutual funds and stocks (e.g. ratios, analyst opinions and estimates) than for commercial paper.

What we argue is that different products having different levels of information specificity (due to the fact that different products have different ranges and complexities of attributes and a consumer would accordingly demand different levels of information about different products) may require differing levels of product transparencies so as to satisfy this need for information. In other words, a lack of product transparency in e-commerce will produce different levels of uncertainty depending upon the information specificity of different products. Within the context of the information asymmetry that exists between buyers and sellers in e-commerce, increased information specificity increases the probability of “unknowable attributes about a product.” This puts greater onus on a transparent representation of the product so as to provide more information about that product. However, due to the fact that e-commerce products suffer from a lack of transparent representation (as already argued), this only serves to increase the negative effects that this lack of transparency might have, i.e. increase the impact of a lack of product transparency on consumer uncertainty in e-commerce. Hence we hypothesize:

Hypothesis 4: Consumer perceptions of product information specificity positively moderate the direct effect of a perceived lack of product transparency on consumer perceptions of uncertainty surrounding e-commerce transactions.

Control Variable: Gender

Among several demographic factors, gender effects have been theorized to play an important role in understanding consumer behavior surrounding technology [e.g. Slyke, et al. 2002; Venkatesh and Morris 2000; Adam et al. 2004]. Prior research in IS confirms significant difference in online shopping behavior between men and women. In particular, studies have suggested that men use the Internet for shopping purposes more than women do [Rodgers and Cannon 2000; Wells and Chen 1999]. Other studies [e.g. Rodgers and Harris 2003] confirm that women are more uncertain about e-commerce transactions, partly because they perceive e-commerce inefficiencies more than their gender counterpart. Understanding that there may be a gender effect in uncertainty, gender is treated as a control variable in this study.

III. RESEARCH METHODOLOGY

To confirm the hypotheses, a preliminary empirical study was conducted. Central to the model are two themes: (a) the relation between e-commerce inefficiencies and consumer uncertainty, conforming to Williamson's [1971] rationalization of consumer behavior and, (b) the influence of product information specificity on uncertainty. Given the lack of pre-validated measures, intense theorization and iterative refinement was used to develop and test preliminary measures, from piloting to the administration of the questionnaire. We begin by addressing the development of preliminary measures for the constructs in this model.

Developing Measures for the Constructs

Particular care was given towards the development of the instrument, especially due to the dearth of existing measures for our constructs of interest. In the process, the measures initially developed were presented to both experts and non-experts in order to verify face and content validity. Experts recruited were e-commerce researchers; non-experts were recruited from faculty in other areas who were, nonetheless, well acquainted with instrument development. All developed measures were then pilot tested, refined, and validated⁵ for clarification and coherence. Our entire instrument can be found in the Appendix.

E-commerce Inefficiencies

Not much exists in previous research that develops measures for the three constructs used to dimension e-commerce inefficiencies. Thus, particular attention was paid to theorization and refinement in order to develop these items. A total of 13 items were developed for measuring e-commerce inefficiencies: five items for anonymity, and four each for lack of product transparency and lack of process transparency. With respect to anonymity, we identified “true” knowledge about sellers and the predictability of their behavior as major concerns. With respect to lack of product transparency, we identified the discernability of product characteristics and attributes and comparability with other products within e-commerce as major concerns. For the lack of process transparency, we were concerned with the verifiability, awareness and control that consumers feel about e-commerce transactions. These concerns served as the underlying rationale for items developed for measuring e-commerce inefficiencies. As

⁵Pilot data was collected from students (n=200) during initial instrument development. Final data collection focused on gaining participation from the general population of online shoppers following the recruitment scheme as detailed hereafter. Results across the pilot sample and the final sample show negligible difference. The pilot study results are omitted for the sake of brevity.

mentioned earlier, these measures underwent face and content validity checks by both experienced e-commerce researchers and researchers with expertise in instrument development. Following their approval, this instrument was pilot tested for further possible refinements. The pilot tests indicated that any modification to the items measuring e-commerce inefficiencies was not necessary.

Uncertainty

Surprisingly, uncertainty measures are also scarce in literature, even though almost every work on e-commerce mentions uncertainty either directly or indirectly. A very recent study by Pavlou et al. [2007] measures uncertainty; however, their conceptualization of uncertainty revolves around sellers and products and is different from our conceptualization of uncertainty that revolves around transactions in e-commerce. This is why their measures were not suitable within the scope of our study. Hence, we had to draw from our conceptualization of uncertainty in order to develop measures for the construct. As with the measures of e-commerce inefficiencies, the items measuring uncertainty were presented to experienced e-commerce researchers and researchers with expertise in instrument development for face validity. Following their approval, the items measuring uncertainty were pilot tested for further possible refinements. The pilot tests resulted in a very minor modification to the scale measuring uncertainty.

Product Information Specificity

We developed our own measures of product information specificity. Our development of the items was based on our conceptualization and definition of information specificity. With respect to product information specificity, we diagnosed three critical aspects of product information specificity: complete, latest, and accurate information about the product. We viewed these as the primary consumer demands before purchasing a specific product in an online shopping environment (or, for that matter, any shopping environment). Items were presented to experienced E-commerce researchers and researchers experienced in instrument development. Again, following their approval, the items were pilot tested and the pilot test results did not necessitate any change in any of these items.

Empirical Study

This study was conducted as a part of a larger research on online intermediation. An online survey was used for the study and was administered at the time of the Thanksgiving season. The time of administering the survey was deemed appropriate because of the propensity of purchases (including online purchases) during this season. The survey participants were recruited through a snowball sampling strategy [Goodman 1961]. In this case, students of an undergraduate class in e-commerce were asked to recruit three active online shoppers among their family and relatives as respondents to the online survey containing the items measuring the constructs of interest. The students had to furnish contact information for every participant (name, age, years of experience with online shopping, telephone number, e-mail address). Specific URLs were created and distributed to the actual participants taking this survey. Being students of an E-commerce class, the initial target group was sufficiently skilled and knowledgeable to identify such active online shoppers amongst their family and relatives. Such a sampling approach has been used before in IS research [e.g. McMurtrey et al. 2002]. Apart from providing contact information, students also signed an honor code testifying diligent recruitment and distribution of the survey and instructions. Students were awarded bonus research credit for recruiting participants. Recruitment was voluntary and all participants were noted of requisite privacy and anonymity of their responses. A total of 71 students were solicited, leading to 139 usable responses (out of a possible 213), for a response rate of approximately 65 percent.

As already mentioned, the participants answered an online survey questionnaire that contained items measuring the constructs. Additionally, in order to gauge that the participants answering the survey were current online shoppers, the questionnaire also asked them of their frequency of online shopping within the last six months. Items measuring the constructs used Likert scales, ranging between "Strongly Agree" and "Strongly Disagree." Participants were enquired of popular online purchases to arrive at different product types to measure information specificity. Participant responses led us to partition product information specificity by three product categories: DVD recorder, Automotive GPS and HDTV. Each set of participants was asked to imagine a purchase of the corresponding product while answering the questionnaire, thus ensuring that we covered a broader swathe of product price range and product information specificity in order to remove possible product related effects that might confound our results. Of course, each of the imagined purchases had still to be of a somewhat substantial nature so that they might also trigger consumer concerns. Eighty-five of the participants who answered the survey were males (61.2 percent) and 52 (37.4 percent) were females. Two participants did not report their gender. Table 1 shows the descriptive statistics including the mean scores for the constructs of our study. Also, the respondents reported a moderate (3-5) to considerable (greater than 20) degree online shopping frequency within the past six months, thus testifying to the fact that they were indeed true online shoppers and were appropriate respondents to answer our survey.

An issue with any quantitative behavioral research is the existence of possible common method biases.

Table 1. Descriptive Statistics, Composite Reliability and Average Variance Extracted

| Construct | Mean | Std. Deviation | Composite Reliability | Average variance extracted |
|------------------------------|--------|----------------|-----------------------|----------------------------|
| Anonymity | 4.076 | 1.1127 | .88 | .59 |
| Lack of Product Transparency | 3.6313 | 1.38553 | .92 | .73 |
| Lack of Process Transparency | 3.7320 | 1.33765 | .93 | .77 |
| Information Specificity | 4.0316 | .90106 | .93 | .81 |
| Uncertainty | 3.019 | .7293 | .88 | .59 |

Podsakoff et al. [2003] note several techniques to reduce common method biases in behavioral research. Accordingly, in this research design, the issue of possible common method biases in the survey responses was greatly eliminated by ensuring anonymity of the respondents, reducing evaluation apprehension (through the instructions), using improved scale items (through pilot testing), introducing a different temporal and social context of measurement (the respondents did not answer the questions at the same time, nor did they answer them at the same place), demand characteristics (due to the fact that the survey respondents did not meet any of the researchers and were only contacted by the appropriate students).

Furthermore, the possibility of any common method biases remaining were tested through the Harman’s Single Factor Test, one of the most widely used techniques to discern possible existing common method biases [Podsakoff et al. 2003]. This test revealed that there were no significant common method biases in our research study. Similarly, there was no evidence of any non-response bias.

The partial least squares (PLS) approach to structural equation modeling was used for data analysis. PLS graph, version 3.0, build 1126 was used for the analysis. Compared to traditional statistical methods, PLS is advantageous as it enables simultaneous assessment of the measurement and the structural models [Gefen et al. 2000]. Also, PLS does not make any distributional assumptions or assumptions about the scale of measurement [Fornell and Bookstein 1982]. In particular, because PLS is seen as an excellent technique for theory building [Fornell and Bookstein 1982], its use in analyzing our model seems appropriate. Also, given our sample size, PLS was deemed appropriate because of Chin et al’s [2003] recommendation of a heuristic of 10 subjects per construct while using PLS.

Measurement Model

Because the instrument was developed from scratch, particular attention was paid towards assessing the reliability and validity of the instrument prior to our hypotheses testing. In PLS, general reliability and validity are assessed by the measurement model, mainly used to analyze reliability, convergent validity and discriminant validity [Fornell and Larcker 1981]. A high level of composite reliability above 0.70 is recommended [Nunnally 1978]. As seen in Table 1, composite reliabilities in the study were much higher than the recommended threshold of 0.70, thus ensuring reliability of the instrument.

Gefen and Straub [2005] lay down clear guidelines on assessing instrument validity using PLS. In their opinion, convergent validity “is shown when t-values of the Outer Model Loadings are above 1.96” [p. 97]. Table 2 shows the loadings of each item on its corresponding factor and the corresponding t-value. It can be easily seen that the t-values for each loading are far above the recommended threshold, thereby demonstrating very high convergent validity.

According to Gefen and Straub [2005], discriminant validity is assessed by a two-step process: 1) the loadings of the items on their respective theoretical constructs are high while their (items’) loadings on the other theoretical constructs are low and, 2) the AVE for each construct is much greater than the squared correlations between any pair of latent constructs.⁶ Following Gefen and Straub’s [2005] procedure of obtaining the loadings and the cross loadings for each construct (shown in Table 4), we can see that the loadings of items on their respective constructs are much higher than their loadings on other constructs. Also, loadings of items on their respective constructs satisfied the usually recommended value of 0.7 [Nunnally 1978] and exceeded it considerably in most cases. Thus, condition 1 of the discriminant validity assessment was satisfied. For condition 2, we examined the AVE for each construct and compared it to the squared correlation between any two constructs. Table 3 shows that the AVE for

⁶ Alternately, the square root of the AVE is much greater than the correlations between any pair of latent constructs.

each construct is much higher than the squared correlation between any pair of latent constructs. Also, as shown in table 2, all the AVE scores for each construct were higher than Fornell and Larcker's [1981] recommended value of 0.5. Thus, condition 2 for discriminant validity is also satisfied. Altogether, the measurement instrument offered acceptable psychometric properties.

| Construct | Variables | Factor Loading | T-Value |
|---------------------------------|------------------|-----------------------|----------------|
| Anonymity | ANON1 | 0.697 | 11.62 |
| | ANON2 | 0.792 | 20.60 |
| | ANON3 | 0.788 | 20.55 |
| | ANON4 | 0.812 | 28.19 |
| | ANON5 | 0.737 | 12.60 |
| Lack of product transparency | PROD1 | 0.855 | 27.33 |
| | PROD2 | 0.868 | 33.00 |
| | PROD3 | 0.903 | 46.17 |
| | PROD4 | 0.794 | 21.83 |
| Lack of process transparency | PROC1 | 0.899 | 46.93 |
| | PROC2 | 0.900 | 35.21 |
| | PROC3 | 0.854 | 27.48 |
| | PROC4 | 0.856 | 26.74 |
| Product Information Specificity | INFO1 | 0.886 | 37.84 |
| | INFO2 | 0.912 | 79.56 |
| | INFO3 | 0.886 | 44.36 |
| Uncertainty | UNC1 | 0.761 | 15.83 |
| | UNC2 | 0.735 | 15.30 |
| | UNC3 | 0.747 | 17.36 |
| | UNC4 | 0.778 | 20.05 |
| | UNC5 | 0.761 | 23.18 |

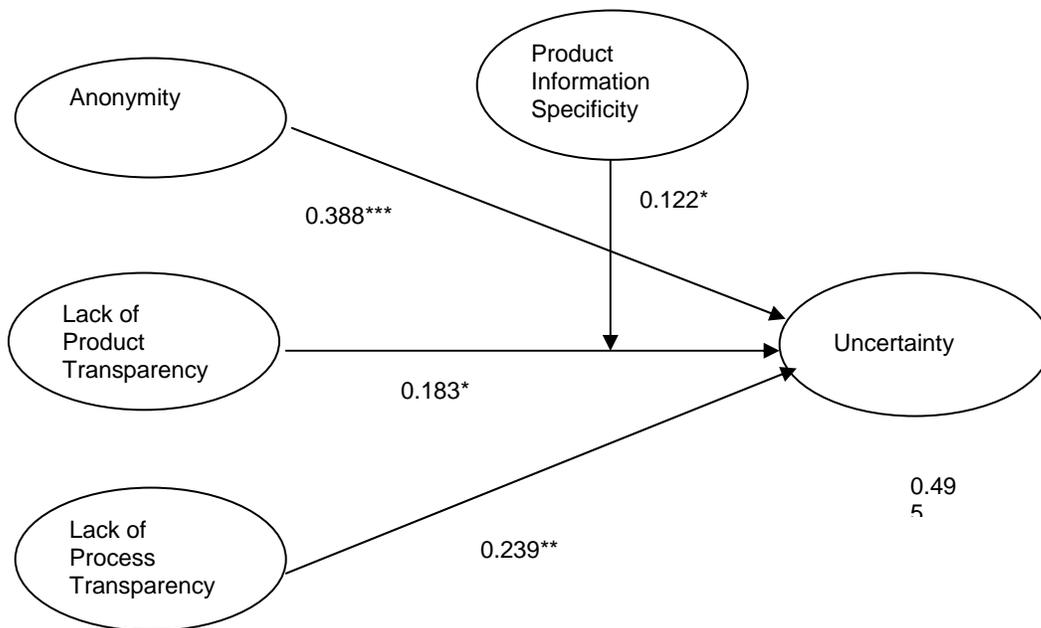


Figure 2. Structural Model



Table 3. Squared Correlations between Constructs and Average Variance Extracted (Note: AVEs are represented across the diagonal)

| | Anonymity | Lack of Product Transparency | Lack of Process Transparency | Uncertainty | Product Information Specificity |
|---------------------------------|-------------|------------------------------|------------------------------|-------------|---------------------------------|
| Anonymity | 0.59 | | | | |
| Lack of Product Transparency | 0.21 | 0.73 | | | |
| Lack of Process Transparency | 0.22 | 0.37 | 0.77 | | |
| Uncertainty | 0.36 | 0.29 | 0.31 | 0.59 | |
| Product Information Specificity | 0.00 | 0.03 | 0.02 | 0.00 | 0.81 |

Table 4. Factor Loadings and Cross Loadings

| Construct | | Anonymity | Lack of Product Transparency | Lack of Process Transparency | Product Information Specificity | Uncertainty |
|---------------------------------|-------|--------------|------------------------------|------------------------------|---------------------------------|--------------|
| Anonymity | ANON1 | 0.697 | 0.378 | 0.322 | -0.178 | 0.331 |
| | ANON2 | 0.792 | 0.367 | 0.437 | -0.093 | 0.421 |
| | ANON3 | 0.788 | 0.408 | 0.393 | -0.060 | 0.495 |
| | ANON4 | 0.812 | 0.386 | 0.384 | -0.031 | 0.519 |
| | ANON5 | 0.737 | 0.250 | 0.255 | 0.060 | 0.487 |
| Lack of Product Transparency | PROD1 | 0.337 | 0.855 | 0.484 | -0.156 | 0.462 |
| | PROD2 | 0.402 | 0.868 | 0.528 | -0.147 | 0.420 |
| | PROD3 | 0.458 | 0.903 | 0.570 | -0.085 | 0.514 |
| | PROD4 | 0.386 | 0.794 | 0.513 | -0.174 | 0.428 |
| Lack of Process Transparency | PROC1 | 0.412 | 0.581 | 0.899 | -0.111 | 0.507 |
| | PROC2 | 0.425 | 0.533 | 0.900 | -0.113 | 0.474 |
| | PROC3 | 0.345 | 0.450 | 0.854 | -0.109 | 0.486 |
| | PROC4 | 0.455 | 0.585 | 0.856 | -0.145 | 0.486 |
| Product Information Specificity | INFO1 | -0.145 | -0.239 | -0.164 | 0.886 | -0.081 |
| | INFO2 | -0.023 | -0.133 | -0.153 | 0.912 | 0.011 |
| | INFO3 | -0.089 | -0.196 | -0.107 | 0.886 | -0.043 |
| Uncertainty | UNC1 | 0.403 | 0.410 | 0.439 | 0.034 | 0.761 |
| | UNC2 | 0.377 | 0.371 | 0.443 | 0.014 | 0.735 |
| | UNC3 | 0.519 | 0.368 | 0.412 | -0.093 | 0.747 |
| | UNC4 | 0.447 | 0.420 | 0.355 | 0.005 | 0.778 |
| | UNC5 | 0.529 | 0.473 | 0.479 | 0.003 | 0.807 |

Structural Model

The structural model is shown in Figure 2. In PLS, the predictive power of the structural model can be known by the variance explained in the endogenous constructs [Chin 1998]. Falk and Miller [1992] mention that a substantive model should explain at least 10 percent of the variance in endogenous constructs. Following this benchmark, our model shows substantial predictive power. As shown in Figure 2, the model explains 49.5 percent of the variance in consumer uncertainty in e-commerce.

The interaction effect of product information specificity was tested following recommendations by Chin et al.'s [2003].⁷ The two important statistics recommended by Chin et al. [2003] were considered: the effect size of the

⁷ For a detailed discussion on how to conduct moderator analysis using PLS, see Chin et al. (2003).

interaction coefficient and the significance of the interaction coefficient. In this paper, the effect size of the interaction⁸ was calculated to be 0.02 and is adequate according to Cohen [1988] and Chin et al. [2003]. As Chin et al. [2003] note, a small effect size “does not necessarily mean an unimportant effect” [p. 211]. This is confirmed by the fact that the next statistic, the interaction coefficient, was significant. Thus, following Chin et al.’s [2003] recommendations, we do see a moderating effect of product information specificity.

Table 5 shows the results of our hypotheses testing. As can be seen, all hypotheses were strongly supported in that the path coefficients were significant. All proposed antecedents were found to be strong predictors of consumer uncertainty in e-commerce. Product information specificity was also found to be a significant moderator of the effect of lack of product transparency on consumer uncertainty. As the results show, an increase of one standard deviation in product information specificity would increase the effect of lack of product transparency on uncertainty from 0.183 to 0.305. As expected, we also did not find a significant main effect of product information specificity on consumer uncertainty in e-commerce.

| Hypothesis | Causality (sign) | Path Coefficients | Supported? |
|-------------|---|-------------------|------------|
| Hypothesis1 | Anonymity -> Uncertainty (+) | 0.388*** | Yes |
| Hypothesis2 | Lack of Product Transparency -> Uncertainty (+) | 0.183* | Yes |
| Hypothesis3 | Lack of Process Transparency -> Uncertainty (+) | 0.239** | Yes |
| Hypothesis4 | Moderating Effect of Product Information Specificity on Lack of Product Transparency -> Uncertainty (+) | 0.122* | Yes |

Finally, gender, as a control variable was found to be statistically insignificant in explaining consumer uncertainty. While Esrock [1999] remarked that women in e-commerce suffered from a greater sense of uncertainty, our findings do not show any differences, implicating that women and men view uncertainty in e-commerce in a similar fashion.

IV. DISCUSSION

Results from our data reveal interesting findings about consumer behavior surrounding e-commerce transactions. Apart from proving empirical validation of our theory, they also provide interesting insights into the nuances of consumer uncertainty in e-commerce. Consumer uncertainty seems to be fueled the most by their perceptions of anonymity prevalent in e-commerce, following by their perceptions of lack of process transparency and lack of product transparency. Following Williamson [1975] postulations of market inefficiencies, the findings imply similar behavioral tones.

Of the three inefficiencies seller anonymity seems to impact consumer uncertainty the most. It is important for buyers to be aware of seller’s identity so as to reduce their lack of knowledge of sellers in drawing up and enforcing their contracts. In e-commerce, minimal barriers to entry allow any seller to assume any identity and open shop. In addition, possibilities of rampant opportunistic behavior loom large, especially with instances of unscrupulous deceptive behavior [Grazioli and Jarvenpaa 2003]. Because it is unlikely and improbable that consumers transacting in e-commerce can remain knowledgeable of all possible sellers selling their wares, consumers remain fraught with uncertainty.

Perceived lack of process transparency also offers an important cue towards understanding consumer uncertainty. As mentioned earlier, Williamson [1975] had noted that market mechanisms are inefficient when they fail to cater to contractual concerns. After all, transactions initialize contracts between buyers and sellers. A consumer entering a contract with a seller expects to have complete information of the process by which contract obligations are being fulfilled. In e-commerce, the transaction process is far less transparent than in physical markets. E-commerce affords consumers little control and monitoring the efficiency, effectiveness, or security surrounding the transaction from checking inventory to order fulfillment. Compounding the lack of process transparency are ever-growing online security concerns such as identity theft. Opacity of the transaction process eliminates consumer control. Consequently, it becomes difficult for uninformed consumers to monitor and enforce the contract, thus increasing their uncertainty about transacting in e-commerce.

⁸ Effect size of interaction = $f^2 = (\text{Difference in variance explained in the endogenous construct between the main effects and the interaction effects model}) / (1 - \text{variance explained in the main effects model})$.

Finally, in line with Williamson [1975], a lack of product transparency is also tied to consumer uncertainty, however the effect is less pronounced than the effects of anonymity and lack of process transparency. This relatively lesser concern can be attributed to the emergence of newer Web application technologies such as Flash, VRML, and 3D rendition that make it easier to replicate reality. For example, related to technologies that increase product transparency, Jiang and Benbasat [2004] show how richer forms of online renditions allow consumers to easily diagnose product attributes. However, while new technologies may partly alleviate the limited representational capabilities of text or 2D graphics, intangibility still remains a concern that continues to fuel consumer uncertainty.

With regard to the influence of product information specificity on uncertainty, it only assumes significance in the presence of lack of product transparency. There were no main effects of product information specificity on consumer uncertainty. This indicates that consumer demands for information are strongly tied to the perceptions of representational inefficiencies of products in e-commerce. We can argue that this criticality of product information assumes importance due to product intangibility in e-commerce. This actually raises an interesting focus for merchants and vendors in online environments: attracting consumers in e-commerce could become easier for noncritical products such as commoditized products where gaining complete information is not an immediate buyer objective vis-à-vis products with high information specificity where consumers feel a strong need to procure all available information about the product.

We should also take time to delineate the limitations of our study. One limitation is the issue of the imagined purchase that renders an artificial flavor. In our defense, we should mention that given the consumer concerns were so acute in an imaginary purchase (as our empirical data showed good support for our theory), we might safely assume that consumer concerns in real purchases would be significantly higher. Another limitation of the study is in its treatment of all consumers as a homogeneous segment, an issue that, as we describe below, fuels ground for future research. Furthermore, there is of course the possibility for further refinement of our instrument through future research. Given that past research has hardly dwelt on the constructs of interest in our study, we aimed to provide an initial starting point for measuring these constructs. Even though the results show good reliability and validity of our instrument, we acknowledge the fact that there could be a possibility for future refinements (especially through empirical investigations in differing contexts) in order to develop measures more robust than ours.

V. CONTRIBUTION AND IMPLICATIONS

Contribution to Research

One of the paper's foremost contributions is that it is one of few research attempts to systematically define and model the link between e-commerce inefficiencies and consumer uncertainty. It borrows concepts from transaction cost economics and translates these concepts into individual consumer perceptions. Such an integrative theoretical treatment has been hitherto absent in the literature. Moreover, previous literature has rarely attempted to delineate antecedents to consumer uncertainty in e-commerce. In fact, while previous studies [e.g. Pavlou 2003; McKnight and Chervany 2001] have argued for the relevance of uncertainty in understanding e-commerce phenomena, uncertainty as a core construct has remained somewhat unexplored in mainstream IS research in e-commerce [with the exception of Son et al. 2006]. Furthermore, Son et al. [2006] theorize about the downstream effect of uncertainty in their model, but what causes uncertainty, especially within the realm of e-commerce, has been left relatively unanswered.

Second, the paper investigates the contingency of product information specificity and its influence on consumer uncertainty. Thus this paper provides for a product contingent consideration in understanding uncertainty. While previous e-commerce research has referred to product considerations, the concept of product information specificity has escaped previous scrutiny. The articulation of this concept can be thought to be another important contribution of the paper.

Third, apart from the general model development, this research systematically develops measures to assist operationalization of constructs. Measures of e-commerce inefficiencies and consumer perceived uncertainty are developed, refined, and tested for reliability and validity. By doing so, the study provides an initial set of measures that can be helpful for future research in this area. Thus, this study provides a starting point for an in-depth analysis, both theoretical and empirical, of the nature of e-commerce, and provides initial measures to facilitate those analyses.

Fourth, the paper furthers theoretical model and instrument development with subsequent empirical validation. Hitherto, there has been a significant paucity of available instruments to measure market inefficiencies and uncertainty. The paper's operationalization and instrument development could therefore assist future researchers embarking on investigating phenomena related to e-commerce inefficiencies. Furthermore, the paper confirms that consumer perceived uncertainty in e-commerce is indeed a function of e-commerce inefficiencies of anonymity, lack

of product transparency and lack of process transparency. The empirical study unravels the uncertainty phenomenon in e-commerce, an issue addressed to a limited extent (and from a different perspective) in previous literature.

Contribution to Practice

This paper also provides significant implications for practice, particularly in light of the empirical results. *First*, it confirms consumer uncertainty in transacting in e-commerce. The issue is core to practice. It is important for companies marketing wares online to understand that inherent consumer uncertainty can be reduced by decreasing anonymity and increasing product and process transparencies. Anonymity can be reduced by increasing consumer awareness of the vendor through media or by third-party assurance mechanisms. Process transparency can be reduced by open disclosure surrounding the storing and use of information, security policies (e.g. level of encryption offered), among others. Product transparency can be increased by a variety of rich media representations, e.g. shockwave, 3D rendering, VRML, etc.

Second, the relatively lower effect of lack of product transparency as compared to anonymity and lack of process transparency may provide important strategic cues to e-commerce vendors. Consumers may perceive a lack of process transparency and anonymity as inherent conditions in expanding digital networks and therefore consider them uncontrollable, irrespective of the type of products they intend to purchase. Positive network externalities and the convenience of Web technologies as a black box have contributed to a lack of general understanding of who occupies a node in the network or how information flows between nodes. As a result, sellers should direct their immediate attention towards reducing anonymity and process transparency, followed by product transparency.

Third, as mentioned earlier, the moderating influence of product information specificity on the effect of product transparency on uncertainty provide interesting cues on possible strategies by e-commerce vendors. It could be appropriate that e-commerce vendors sell products for which there could be lesser demand for consumer information (before the purchase). If the product information specificity were decreased, consumer perceptions of uncertainty would also decrease due to the positive moderating effect. This paves the way for greater use of the Web as a possible channel for products requiring lesser critical information about them.

Limitations and Future Research Implications

The scope of our investigation offers several future research directions. *First*, future research could try to empirically validate the proposed model across different samples. A possible limitation of our research was in treating all participants as a homogeneous set. It may be the case that different segments of consumers could differ in their perceptions of e-commerce inefficiencies and uncertainty. Future attempts at validating the model should expand the sample to encompass different consumer segments. We can then understand whether consumer sensitivity to e-commerce inefficiencies can be attributed to other factors characterizing the consumer segment (e.g. culture, lifestyle). For example, are particular cultures more conscious of uncertainty than others? Are income-based lifestyles different in their perceptions because of higher disposable income? For example, a person with high disposable income may be less uncertain about transacting expensive items in e-commerce than a person with low disposable income. Similarly, demographic characteristics such as age and education may produce different perceptions of uncertainty.

Second, future research could investigate other moderators that could influence consumer uncertainty. For example, regional policies could have a significant effect on consumer uncertainty, particularly because of the global nature of e-commerce. In Europe, strict privacy laws and opt-in policies could perhaps mitigate consumer uncertainty vis-à-vis the United States. Often having recourse to law can raise consumer confidence. Again, the level of e-commerce adoption in different countries may offer an interesting perspective on consumer perceptions of uncertainty. For example, in countries that are nascent in their experience of online transactions, consumers might be enamored by the novelty to an extent that it overshadows inherent uncertainties.

Third, we feel that this research would further benefit from a longitudinal treatment of consumer uncertainty in Ecommerce. New laws, RFC (Request for Comments), and ever increasing consumer experience may change consumer perceptions of Ecommerce. It would be interesting to investigate the dynamics of consumer uncertainty.

Fourth, future research could try to review the model in light of B2B transactions only. Although we can argue that our model is likely to be valid for consumers in both B2C and B2B, a further examination could likely reveal interesting variations. A more granular look into inter-firm relationships could potentially unravel specifics of business perceptions of e-commerce. It is possible that consumer purchases in online markets are an indefinite set, while business procurement is better defined. Anonymity concerns may be different because of the experience businesses have in developing, monitoring, and enforcing contracts to assure certainty of sellers. Furthermore, business

concerns have a pretty fixed set of suppliers and partners whom they deal with. Concerns about product transparency may be different because of greater product knowledge of repeated procurement of similar goods and services. Again, business concerns operating in online markets have arguably better knowledge of the procurement and delivery processes that occur, especially in comparison to a consumer who has lesser business knowledge in any case.

Fifth, future research can extend our work on delineating electronic market inefficiencies by investigating the relationship between specific electronic market inefficiencies on different types of threats in e-commerce such as phishing, spamming, or spoofing, among others. Could particular inefficiencies contribute toward particular consumer threats in e-commerce? For example, a lack of process transparency could be exploited by unscrupulous electronic market vendors to “phish” unsuspecting consumers, thereby increasing their uncertainty. Work that extends the model to incorporate relevant consumer threats in e-commerce can significantly add to our understanding of the dynamics of user behavior in e-commerce.

Sixth, while our study is defined by an examination of buyer uncertainty, it would be interesting to examine the seller’s perspective when dealing with buyers in e-commerce. What is the interplay of the aforementioned inefficiencies and contingencies on seller uncertainty? After all, buyers can and sometimes do use inherent e-commerce inefficiencies for opportunism. For example, a buyer may not be credible even after apparently remitting payment. Fraud schemes perpetrated by buyers in e-commerce run the gamut. According to the IC3 [2007], buyers use fraud schemes such as escrow service fraud, Counterfeit checks and international money orders and drafts, advance fee fraud, among others. It would be interesting for future research to examine the dynamics of seller uncertainty in light of growing threats.

Finally, future research could extend the model by illustrating how consumer uncertainty in e-commerce contributes towards consumer trust in intermediaries. Trust is a function of uncertainty. According to Akerlof [1970], the importance of trust surfaces only when consumers face uncertainty. A similar argument is forwarded by Williamson [1985] who finds that calculative-based trust becomes an issue when consumers face uncertainty surrounding existing market mechanisms. If consumers are wary because of certain inefficiencies, it is likely to weigh heavily on their levels of trust and can be key to explaining how intermediaries “can be a critical means of building trust, at least with consumers who perceive considerable uncertainty in their online shopping environment” [Son et al. 2006: 494]. This would help us better understand the reasons behind the current rise in online intermediation and whether this is driven by the uncertainty consumers perceive surrounding e-commerce transactions.

VI. CONCLUSION

The objective of this paper was to theorize and empirically test a model of e-commerce inefficiencies and its effect on buyer uncertainty surrounding e-commerce transactions, particularly in light of contingencies of product information specificity. By applying a behavioral economic rationale, this study illuminates on the role of situational market factors to understand the development of consumer uncertainty surrounding e-commerce transactions.

One of the most important perspectives of e-commerce is the capability provided for the purchase of products and information online [Kalakota and Whinston 1996]. This paper tries to understand as to how inefficiencies in e-commerce lead to market failure and an erosion of consumer confidence (through increased uncertainty) [Williamson 1985]. The relative novelty and exploding growth of e-commerce has made it imperative that it be studied and unraveled so as to guide consumers and electronic vendors into making e-commerce an efficient playing field. Especially, issues of security and electronic payments and vendor transparency through advertising have been identified to be some of the core issues in e-commerce [Ngai and Wat 2002]. Vendor transparency is directly related to this paper’s concept of seller anonymity, while security and electronic payments are directly related to process transparency. This paper thus touches upon some of the core concerns identified in the e-commerce literature. Two other important issues arise from this paper. They are technological issues and strategic issues. This paper provides the technological and strategic formulations for making e-commerce more efficient. For example, the argument for the rich representation of products relates to the technological issues while more vendor transparency in reducing anonymity relates to greater identifiability of the vendor and correspondingly, strategic advertising issues.

E-commerce represents interplay between technology, society and economy [Reynolds 2000]. Even though this interplay is complex, there are clear indications of rapid e-commerce growth, primarily fuelled by technological and process innovations and advances. The future of e-commerce lies in virtualization, deregulation, globalization, disintermediation and re-intermediation and convergence, all well tied to the e-commerce efficiencies [Chircu 1999]. However, for e-commerce to live up to its potential, it should be important to pay careful attention to the nature and inefficiencies of e-commerce and address them. Investigating buyer uncertainty using the lens of e-commerce inefficiencies thus provides a blueprint to explore and facilitate the advancement of e-commerce.

To conclude, the paper shifts its examination from dyadic considerations popular in existing e-commerce literature to reflect on surfacing e-commerce inefficiencies and its consequences on buyer uncertainty. Although e-commerce began with a promise of frictionless efficiency, a scrutiny of the e-commerce environment reveals a dark side — inherent inefficiencies that engender uncertainty, particularly because of the faceless and opaque nature of transactions. While punitive measures from legislation can surely attempt to reduce inefficiencies, reducing consumer uncertainty will perhaps require more market transparency and institutional structures that can regulate the shortcomings of e-commerce. Only then can e-commerce be both efficient and effective.



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EDITOR'S NOTE: The following reference list contains the address of World Wide Web pages. Readers, who have the ability to access the Web directly from their computer or are reading the paper on the Web, can gain direct access to these references. Readers are warned, however, that:

1. These links existed as of the date of publication but are not guaranteed to be working thereafter.
2. The contents of Web pages may change over time. Where version information is provided in the References, different versions may not contain the information or the conclusions referenced.
3. The authors of the Web pages, not CAIS, are responsible for the accuracy of their content.
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APPENDIX

| Items measuring each construct | | |
|---------------------------------|----------|--|
| Construct | Variable | Item |
| Anonymity | ANON1 | I believe that sellers represent themselves exactly as what they are in Ecommerce. |
| | ANON2 | I believe that I have all necessary information about any seller in Ecommerce. |
| | ANON3 | I believe that I will be able to predict the behavior of any seller in Ecommerce. |
| | ANON4 | I believe that I can trace the identity of any seller in Ecommerce. |
| | ANON5 | I believe that sellers in Ecommerce never use pseudonyms to hide their true identity. |
| Lack of product transparency | PROD1 | A product can be represented exactly in Ecommerce as it is in the physical world. |
| | PROD2 | Products in Ecommerce are as tangible as they are in a physical world. |
| | PROD3 | I believe that Ecommerce offer me the ability to verify all important product attributes under my consideration. |
| | PROD4 | I believe that Ecommerce represent products so as to enable easy comparison with competing products. |
| Lack of process transparency | PROC1 | I am aware of the exact steps involving the operation and execution of any transaction in electronic e markets. |
| | PROC2 | I can verify the exact steps involving any transaction in Ecommerce. |
| | PROC3 | I can control the way my information and transactions are handled in Ecommerce. |
| | PROC4 | I can verify all actions by any seller in Ecommerce concerning my purchase process. |
| Product Information Specificity | INFO1 | I require complete knowledge about this product before transacting. |
| | INFO2 | I require latest information about this product before transacting. |
| | INFO3 | I require accurate information about this product before transacting. |
| Uncertainty | UNC1 | I can predict the outcome of any transaction in Ecommerce. |
| | UNC2 | I have the necessary information and knowledge about all possible threats in Ecommerce. |
| | UNC3 | My decision-making in transacting in Ecommerce will always be optimal. |
| | UNC4 | I believe that transactions in Ecommerce are not risky. |
| | UNC5 | I have control over the outcome of any transaction in Ecommerce. |

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