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The Dark Side of Information and Market Efficiency in E-Markets*

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ABSTRACT

Price dispersion reflects the differences in prices for identical products. While in physical markets such dispersion is prevalent due to high search costs, many researchers argue that search costs and price dispersion will be much lower in electronic markets (e-markets). Empirical evidence does not support this contention, and researchers have studied search costs, market factors, and service-quality factors to explain this dispersion. Previous research has largely assumed that more information is better. By ignoring the dark side of information, we argue that only a partial understanding of price dispersion is possible. In this article, information overload and equivocality are studied as two dark attributes of information that lead sellers to different pricing decisions in e-markets. Hypotheses relating these attributes to price dispersion are supported through analysis of 161 product markets. This work opens up new avenues in the study of e-markets and discusses the implications of these findings for research and practice on consumer and seller decisions.

Subject Areas: Consumer Behavior, E-Markets, Information Equivocality, Information Overload, Market Efficiency, and Price Dispersion.

INTRODUCTION

Efficient market theory, championed by Eugene Fama in 1970, is based on the economic theory of price equilibrium that comes from the interaction of forces of supply and demand. In an efficient market, information is widely available in terms of accessibility and cost and is released to stakeholders at approximately the same time (Gabriel & Marsden, 1990). Prices then fully reflect all available information

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about a particular stock and/or market (Fama, 1998). However, in most markets, price dispersion is prevalent due to information asymmetry (Stigler, 1961).

Electronic markets (e-markets) are interorganizational information systems (IS) in which buyers and sellers communicate information about products and services (Bakos, 1991). The explosive growth of the Internet has led many to predict dramatic reduction in information asymmetry in e-markets, thereby enabling price convergence at the lowest competitive level. It is argued that lower search costs and greater information availability through the Internet reduce information asymmetry and opportunistic behavior, leading to efficient e-markets (Alba et al., 1997; Bakos, 1997; Bailey, 1998). Therefore, prices should converge to the perfect competition level, which is at the sellers' marginal cost (Bakos, 1997; Clay, Krishnan, & Wolff, 2001). This implies that buyers in e-markets should *not* face price dispersion. However, persistent online price dispersion has been found in the literature (Bailey, 1998; Brynjolfsson & Smith, 2000; Clemons, Hann, & Hitt, 2002; Pan, Ratchford, & Shankar, 2002; Baye & Morgan, 2004).

Because cultivating efficient markets is an important aspiration, many researchers have attempted to understand why this is the case. A number of antecedents of price dispersion in e-markets have been identified, mostly from the perspective of search costs of asymmetrically informed consumers and service differentiation. However, the extant literature is inconclusive and incomplete in its coverage of factors, and price dispersion in the e-market is not yet well understood. It is our contention that most of the prior theories make the assumption that more information is always better by generally focusing on information asymmetry and consequent search costs. However, there is another side that is largely ignored and it is reflected in the idea that information might be inconsistent or simply overwhelming. Ackoff (1967) points out that there is a *dark side of information*—not necessarily in the negative sense, but dark in terms of hidden problems.

Our focus is on the nuances regarding the nature of the information itself. The influence of information facets on sellers' pricing decisions and the consequent price dispersion is understudied in the literature. We believe that, because of this, our understanding as to the persistence of price dispersion is limited. Therefore, the objective of this research is on the question,

> *Do different information facets affect price dispersion, thereby influencing market efficiency?*

In the next section, we review the literature about the antecedents of price dispersion. Then, we put forward a theoretical perspective to explain our research model in the e-market and provide our research model and hypotheses. We then present our empirical investigation of the hypotheses using data from Bizrate® (recently changed to Shopzilla®), an information gatekeeper that enables consumers to access a list of prices from competing firms (Baye & Morgan, 2001). Following the methodology and the analysis, we discuss the results and outline implications and future research.

PRICE-DISPERSION LITERATURE

Price dispersion is defined as "the distribution of prices of an item with the same measured characteristics across sellers of the item at a given point in time" (Pan,

Ratchford, & Shankar, 2004, p. 116). Because market efficiency indicates the status of price equilibrium in the market, it reflects price dispersion (or convergence) (Bakos, 1991; Pan et al., 2004). While price dispersion has been explained primarily through search costs, asymmetrically informed consumers, and product heterogeneity in the economics literature (Brynjolfsson & Smith, 2000), literature in e-market studies has focused on three theoretical perspectives to explain the price dispersion: search costs, service differentiation, and market characteristics.

The first and most prevalent perspective is that of the search costs of asymmetrically informed consumers. In the classic Bertrand model of price competition, zero search costs and perfectly informed consumers are assumed, and the result is an equilibrium price that is equal to marginal costs (Tirole, 1998). Price dispersion is usually explained by the violation of one or both of these assumptions (Brynjolfsson & Smith, 2000). There are three types of non-zero search costs due to incomplete information (Stiglitz, 1989). First, consumers incur search costs, such as time and effort, due to incomplete product information, such as price and store locations. Second, consumers incur search costs to find information on product quality. Finally, search costs are attributed to finding a product fit when products are imperfect substitutes. We can examine two convergent views of search costs—from the perspective of buyers who incur the search and from the opportunistic behavior of suppliers.

From the buyers' standpoint, Bakos (1991, 1997) suggested that e-markets favor buyers by reducing their search costs. However, although information is easier to acquire on the Internet than from the traditional retail stores, costs on the Internet are not trivial. Even with search engines, consumers have to spend some degree of time and effort (Du, 2004). Robert and Stahl (1993) show that consumers pay higher prices as searches become more expensive, and costly searches imply greater price dispersion. Lee (1998), in his study of online used-car auction markets, found that Aucnet (http://www.aucnet.co.jp/e/) significantly reduced consumers' search costs by its rigorous inspection report for the product, resulting in a price premium. Urbany, Dickson, and Kalapurakal (1996) note that a consumer's search is a function of five factors. Whether consumers will allocate more efforts to a search depends on economic returns, costs, human capital (such as budget), surrogates (such as age and gender), and psychological returns (such as motivation and shopping enjoyment). Depending on these factors, some buyers will search more and be compensated by finding a lower price, while others will find it too costly to locate the lowest price offered in a market and will give up further search, incurring a higher price (Burdett & Coles, 1997; Lynch & Ariely, 2000; Pan et al., 2002). Therefore, the search model of Urbany et al. (1996) implies that price dispersion is a natural result of this search function.

Alternatively, consumers' search costs are also related to opportunistic behaviors reflected in sellers' pricing strategies in that (i) consumers are imperfectly informed, (ii) information is costly to obtain, and (iii) sellers set prices to leverage consumer heterogeneity in information and search costs (Brynjolfsson & Smith, 2000). Clemons et al. (2002) claim that vendors' opportunistic pricing behavior to extract extra profits from uninformed consumers accounts for the variability in prices. If search costs are trivial, the asymmetric-information issue is resolved because consumers would spend more time and effort to find the fit between desired quality and price. Therefore, the foundation of these two perspectives

Table 1: Price-dispersion literature based on search costs.

Authors	Factors	Dependent Variables
Kocas (2003)	Customer loyalty	Price dispersion in e-market
Ratchford et al. (2003)	Consumer surplus	Price dispersion in e-market
Ba and Pavlou (2002)	Trust in seller	Price premium in e-market
Clemons et al. (2002)	Vendor's opportunism[a]	Price dispersion in e-market
Pan et al. (2002)	Popularity of the product[b]	Price dispersion in e-market
Shankar et al. (2002)	Heterogeneity of awareness[b]	Price dispersion
Brynjolfsson and Smith (2000)	Branding, awareness, trust	Price dispersion in e-market
Lee (1998)	Objective inspection of product quality[c]	Price premium in e-market
Burdett and Coles (1997)	Variance in seller age, variance in seller size	Price dispersion
Wernerfelt (1991)	Brand loyalty	Price dispersion

[a]We use the terms seller and vendor interchangeably as we do buyer and consumer.
[b]Not supported.
[c]In used-car online auction.

(buyer search costs and opportunistic behavior due to asymmetrically informed consumers), which Brynjolfsson and Smith (2000) separate, eventually converges on the search-cost perspective.

The implicit rationale in this reasoning is that sellers' opportunistic behavior from information asymmetry imposes transaction risk on consumers (Williamson, 1985). This risk can be reduced either by searching more or by establishing trust between sellers and buyers (Ba & Pavlou, 2002). Trust reduces the need for searching more by alleviating opportunistic pricing. Consumers are willing to pay a premium for these reduced search costs provided through trust. Brand and loyalty have the same role as trust in relation to search costs. Sellers with brand recognition (Wernerfelt, 1991; Brynjolfsson & Smith, 2000), trusting relationships (Brynjolfsson & Smith, 2000; Ba & Pavlou, 2002), customer loyalty (Kocas, 2003), or size and history (Burdett & Coles, 1997) are able to charge higher prices than those without, because consumers are willing to pay a premium for the reduced search costs. Taken together, the search-cost perspective finds reasons for price dispersion, focusing on factors like asymmetrically informed consumers and subsequent search costs, and the substitutes for high search costs, such as trust, branding, and loyalty. Table 1 shows price-dispersion research based on search-cost theory.

A second perspective for price dispersion in e-markets is the service-differentiation perspective. Whereas the results for the product heterogeneity on price dispersion are consistent in the economics literature, price-dispersion literature about e-markets has been concerned more with service differentiation, which adds value to the product, than with the product itself. With interactiveness and

Table 2: Price-dispersion literature based on service differentiation.

Authors	Factors	Dependent Variables
Cao et al. (2003)	Consumer satisfaction with ordering process, price tolerance of consumers	Satisfaction with fulfillment process in e-market (loyalty)
Cao and Gruca (2004)	Postpurchase service	Price dispersion in e-market
Ratchford et al. (2003)	Differences in service[a]	Price dispersion in e-market
Pan et al. (2002)	Service quality[b]	Price dispersion in e-market
Pan et al. (2001)	Consumer involvement	Price dispersion in e-market
Smith et al. (2000)	Shopping convenience, reliability in fulfillment	Price dispersion in e-market

[a]Not supported.
[b]Partially supported.

multimedia functions enabled by the Internet, e-tailers are capable of providing unprecedented pre- and postsale service to consumers. The service-differentiation perspective focuses on service-quality factors that are added to products, such as selection aid, ease of ordering, on-time delivery, and tracking. The premium that consumers are willing to pay becomes the source of price dispersion in e-markets.

As described in Table 2, the presence of service differentiation has been continuously cited as a source of price dispersion in e-markets (Smith, Bailey, & Brynjolfsson, 2000; Pan et al., 2002; Cao & Gruca, 2004). Shapiro and Varian (1999) emphasized complementing service to differentiate a product, which would lead to lock-in or added value for the product. Cao, Gruca, and Klemz (2003) indicate that consumers can tolerate higher prices if they are satisfied with ordering or fulfillment processes. Smith et al. (2000) claim that shopping convenience and reliability in fulfillment contribute to price variance in e-markets. Further, Pan et al. (2002) investigated the role of vendor service quality as an antecedent to price dispersion. Their research revealed no specific pattern across product categories, but they found partial support for the effects of e-tailer service quality on price. Ratchford, Pan, and Shankar (2003) reveal that measured differences in e-tailer service have little effect on price.

The third perspective about price dispersion focuses on market characteristics. This perspective attempts to find reasons for price dispersion, focusing on market factors, such as average price, number of competing firms, and time.

In the e-market price-dispersion literature (Table 3), Morgan, Orzen, and Sefton (2006) focus on how price changes depend upon the e-market timeline and on different competitive situations. Increase in competitors enabled by ease of entry (Gielens & Dekimpe, 2001) in e-markets is known to affect price dispersion. Pan, Ratchford, and Shankar (2001) assert that the average price of a product affects price dispersion, while Ba and Pavlou (2002) similarly posit that price premiums are stronger for expensive products than inexpensive ones. Pan et al. (2001, 2002) also note the influence of the number of competitors on price dispersion, but could not find a significant effect of stages in the product life cycle. While inflation has not been studied in the e-market context, Parks (1978) pointed out its effect on price dispersion in the traditional market.

Table 3: Price-dispersion literature based on market characteristics.

Authors	Factors	Dependent Variables
fMorgan et al. (2006)	Time, number of firms	Price dispersion in e-market
Ba and Pavlou (2002)	Product price (moderator)	Price premium in e-market
Pan et al. (2002)	Stage in product life cycle[a]	Price dispersion in e-market
Pan et al. (2001)	Number of competitors, average price	Price dispersion in e-market
Cohen (1998)	Mean price	Price dispersion
Parks (1978)	Inflation	Price dispersion

[a]Not supported.

Interestingly, while the factors from these three perspectives seem to be fairly comprehensive, prior studies do not report consistent findings with regard to explaining the variance of price dispersion in e-markets. For example, Brynjolfsson and Smith (2000) found a significant effect of awareness on price dispersion, while Shankar, Urban, and Sultan (2002) did not. Betancourt and Gautschi (1993) found a significant effect of service quality on price dispersion in the traditional market, while others found only partial support (Pan et al., 2002) or a minor explanatory power in the e-market (Ratchford et al., 2003). Therefore, we believe that there are other sources that have not been explored, but are notably influential.

Considering that the important condition for market efficiency is availability of information, the extant literature seems largely to have overlooked the influence of information facets on pricing decisions. As we see from this review, the majority of price-dispersion literature regarding the e-market is concerned with the gap of information quantity between sellers and buyers or information asymmetry, which is the basis of the search-cost perspective. While it is plausible that this perspective plays a role in the e-market, the search-cost perspective is too restrictive because there are information quality issues and other information quantity issues, which compensation for safe transaction or searching more cannot explain. It is not only the search for information, but also the nature of the information itself that matters in the price dispersion of the e-market. Thus, we will focus on the effect of the largely overlooked dark side of information on price dispersion in this study.

Information Facets

When objective information is given to consumers who would like to buy a product, they behave based on rational economic theory. Thus, consumers engage in a best-value choice strategy, by which they choose a product with the least overall cost in terms of price and the most benefit in terms of expected quality. In this situation, firms in e-markets may face fierce competition, because consumers incur low search costs and there are low entry barriers in the e-market. Thus, price convergence to lower price will eventually occur. However, in many cases, the type and nature of information in e-markets influences the decision making of market participants. Incomplete information represents the dark side of information. It can misguide consumers and allow sellers to make pricing decisions that increase dispersion in the e-market context. In this section, we explore this dark side of information

by reviewing three frequently cited facets of incomplete information in the IS literature: uncertainty, overload, and equivocality.

Information uncertainty occurs when information is unavailable to make a transaction. Information uncertainty represents the absence of information (Daft, Lengel, & Trevino, 1987; Kydd, 1989). If we say that complete information is at one end of a continuum, a high level of information uncertainty would be at the opposite end. When information is absent or less than required, more information is pursued. Additional information (to resolve uncertainty) can be reached at the cost of increased search. Therefore, information uncertainty reflects the search-cost perspective described earlier, with the assumption that more information is always better. The dark side of information comes in when information is given, but is too much to make an effective decision (overload) or when available information is contradictory (equivocal).

Information overload exists when more than the required information exists and creates a cognitive burden on the receiver (Hiltz & Turoff, 1985; Malhotra, 1982). Information overload occurs when the number of alternatives increases (Lee & Lee, 2004). Miller (1994) claims that individuals can process about seven chunks of information, while Malhotra (1982) has shown the dysfunctional effects of information overload when consumers are provided with 10 or more alternatives. Facing information overload, consumers' confidence in their purchasing decision is not high (Hiltz & Turoff, 1985). Thus, there exists a negative relationship between the number of alternatives and how consumers value each alternative, ultimately leading to lower decision effectiveness (Keller & Staelin, 1987).

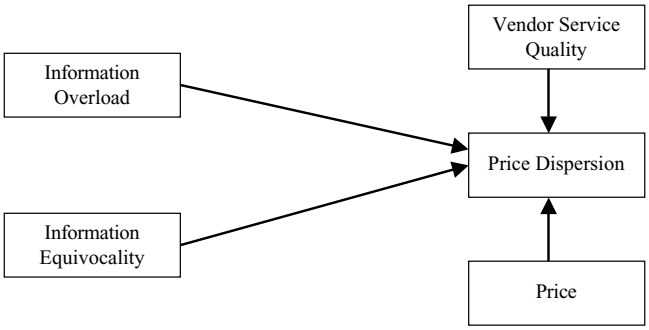
Information equivocality arises in ambiguous situations with multiple, conflicting views among stakeholders (Kydd, 1989). High equivocality means confusion and lack of understanding (Daft & Lengel, 1986). Here, even with information available, consumers have a hard time dealing with its ambiguity (Koufteros, Vonderembse, & Jayaram, 2005). One of the challenges of e-markets is that consumers cannot get a feel for a product or its quality. Consumers depend on feedback from others, which is assumed to reduce quality uncertainty (Chen & Wu, 2004). Feedback from other users serves as a quality index for a product, reduces quality uncertainty, and confers a high degree of confidence to a purchasing decision (Schuber & Ginsburg, 2000). However, conflicting feedback could *increase* information equivocality.

Our focus is not on information uncertainty (absence of information), but on the *dark side of available information* that cannot be resolved from a search-cost perspective. Our research model proposes that price dispersion is a consequence of information overload and equivocality (Figure 1). In the following, we draw from the prior discussion to establish the two core hypotheses pertaining to these information facets.

RESEARCH HYPOTHESES: INFORMATION FACETS AND PRICE DISPERSION

A consumer might have different product choices in a decision-making process. It is critical to recognize that there might be information overload regarding which

Figure 1: Research model.



product to buy out of available choices. Consumers may short-list products and then compare short-listed products (i.e., compare the products' quality and prices before making a final decision). However, because price dispersion relates to a specific product, we focus our attention on a particular product. Therefore, consumers have to juggle with ambiguity about product-quality information and product-specific information available from a large number of vendors.

In order to understand the basis for price dispersion under conditions of incomplete information, we draw on Tellis and Gaeth's (1990) model of strategy choice and the economic concept of reservation prices. Tellis and Gaeth's model focuses on the lack of reliable information available for consumers to use when making choices. It suggests that consumers could perceive the same products differently based on the products' information characteristics. When incomplete information is given, price is better known than quality. Customers then use price as a cue (e.g., as a proxy for quality) in determining their choice of strategy. Sellers then can take advantage of these different consumer strategies. The concept of reservation prices suggests that every consumer has a price he or she is willing to pay for a product (Posavac, 2001). This reservation price has been frequently used for pricing models and becomes a key benchmark for both sellers and buyers (Kohli & Mahajan, 1991; Shaffer & Zhang, 1995; Jedidi & Zhang, 2002), especially when the markets provide incomplete or conflicting information.

Information Overload

When the lack of information is an issue, consumers can search for more information at an additional cost. However, as Web shopping grows, online vendors provide an ever-increasing amount of product-related information. In the case of information overload, consumers can filter existing information at an additional cost or use simple cues as decision criteria due to their limited processing capacity (Bettman, Luce, & Payne, 1998). Chang and Wildt (1996) found that price becomes an important cue when a large amount of information is provided to consumers.

In using the price cue, consumers do not always search for the lowest prices online (Brynjolfsson & Smith, 2000; Ba & Pavlou, 2002). This is well described in Tellis and Gaeth's (1990) strategy choice model. While the model is concerned

with incomplete information, such as ambiguous or conflicting information, we argue that the model can also be applied to information overload. Overload is a form of incomplete information that overwhelms the decision maker so that she or he cannot readily surmise relevant information. In such situations, consumers may face decision ineffectiveness and use price as the cue. The strategy choice model shows that consumers opt for three different strategies when price is better known than quality. The price-seeking strategy is choosing the highest-priced product to maximize the expected quality from inference research. If consumers are risk-averse, they will choose the price-aversion strategy by choosing the lowest-priced product to minimize the immediate costs (or losses). Consumers can also do their best by adopting the best-value strategy based on their bounded rationality to process information.

However, price dispersion is based on sellers' pricing decisions. Sellers often segment a market using demographic descriptors such as geography or product benefit (Choffray & Lilien, 1978; Hlavacek & Ames, 1986). Wilson (1971) and Webster (1984) emphasize the importance of buying-behavior-oriented segmentation such as the one based upon consumer strategies. A seller may focus intensively on a segment that has the highest potential in pursuit of profits. With low entry barriers, many of the sellers in e-markets are small with limited resources. Researchers have long acknowledged that, when small companies want to compete against bigger players, the best approach may be target marketing (Freeman, 1992). Targeting necessarily involves a segment-selection problem (Weylman, 1999; Brouthers & Nakos, 2005). Rangan, Moriarty, and Swartz (1992) show that a seller targets the buyer behavior that will yield the highest potential volume of sales required for profitability. Thus, if a seller expects that a low-price strategy targeting price-averse consumers will bring more profits through high sales volumes than a high-price strategy targeting price-seeking consumers, it will target the price-averse consumers.

Sellers targeting price-averse consumers may attract consumers through a low-price strategy such as promotional sales (Pashigian & Bowen, 1991; Kocas, 2005) and purchase reinforcement (Blattberg & Neslin, 1989). Some sellers can use a product as a loss leader (Jeffrey & Garrity, 1999) that is sold below cost in an effort to stimulate other profitable sales or to gain entry into an established market (Carpenter & Nakamoto, 1990). Sellers targeting price-seeking consumers may attract consumers through a high-price strategy that signals high product quality and/or seller quality. This signal can be generated via advertising (Wolinsky, 1983), warranties (Lutz, 1989), or brand reputation (Tsao, Pitt, & Berthon, 2006). Such signals may uphold the high prices, fitting with the behavior of price-seeking consumers. Also, to produce profits, sellers can price products other than loss leaders higher than other sellers do.

It is our contention that, in an e-market, sellers are vigilant enough to be aware of the information available to consumers. Under conditions of information overload, sellers will take advantage of consumer strategies by segmenting the market based on prices. In sum, different seller pricing strategies are self-sustainable under conditions of consumer heterogeneity in buying strategies. Without such heterogeneity (i.e., if all consumers were seeking low prices), there would be price convergence. However, with information overload, a variety of consumer strategies

will be operational, and prices in the market will diverge depending on which consumer strategy the sellers target. This leads to our first hypothesis:

H1: Information overload has a positive relationship with price dispersion in e-markets.

Information Equivocality

As consumers face conflicting or ambiguous information for their purchasing decisions, they need objective information to resolve the ambiguity. Wooten and Reed (1998) find that others' opinions about product quality are more likely to influence consumers' product evaluations when the consumers lack clear, direct experience with the product. Online feedback systems, such as consumer ratings about a product, may be employed to provide third-party opinions, but ratings are only an aggregation of subjective evaluations. Also, even with expert opinions, more searching does not guarantee unbiased results.

A high variance in consumer evaluations further increases information equivocality. Consumers perceive differences in quality of a single product depending on which reviews they give more credence and also depending on the importance of specific product attributes. These differences in product-quality perceptions lead consumers to have differences in the amount they are willing to pay (reservation price) for the same product.

Here again, this is fertile ground for sellers to engage in different pricing strategies. Unless a seller has a monopolistic market position to sell the same products across all consumer reservation prices (Spiegel, Ben-Zion, & Taylor, 1998), the seller has to estimate the true retail value of a product for their pricing decisions. Equivocality in consumer feedback makes the true value estimation difficult. A solution in this situation is to rely on consumer reservation prices (Gupta, Hill, & Bouzdine-Chameeva, 2006). To compete with oligopolistic or big players, small sellers prevalent in e-markets will pursue target marketing after segmenting the market based on different consumer reservation prices. According to Anderson, Jain, and Chintagunta (1993), managers consider consumer reservation prices as the core part of marketing strategy. Depending on the selected target of consumers who have similar reservation prices, a seller's pricing strategy will differ from that of other sellers. Thus, if a seller expects that a low-price strategy targeting consumers of a low reservation price will bring more profits through high sales volumes than a high-price strategy targeting consumers of a high reservation price, the seller will target the low-reservation-price consumers. In sum, information equivocality causes consumer heterogeneity in reservation prices, and sellers target this heterogeneity through different pricing strategies leading to price dispersion.

In addition, equivocal information leads consumers to process shortcuts, causing inaccurate inference (Keller & Staelin, 1987) and consequent decision ineffectiveness. As discussed earlier, inconsistent information either creates risk aversion (Lerner & Keltner, 2001) that leads consumers to take the price-aversion strategy or produces reliance on price cues that leads consumers to take the price-seeking strategy (Tellis & Gaeth, 1990). These different consumer strategies provide sellers in an e-market with opportunities to choose their target consumers and leads to divergent pricing strategies. Therefore, we expect that information equivocality

Table 4: Variables/factors controlled in this study.

Variables/ Factors	How They Are Controlled
Product heterogeneity	Implicitly controlled by ensuring that selected products are homogenous
Product brand	Applicable when comparing non-homogenous products. This factor is implicitly controlled by selecting only homogenous products
Product itself	Implicitly controlled by ensuring that all selected products are "new." Refurbished items and open items were not selected. Manual data collection was deemed appropriate as opposed to any program for ensuring this criterion
Product availability	Implicitly controlled by selecting vendors who had products "in stock." Information from vendors who listed the product in consideration as "out of stock" was not collected
Vendor service quality	Explicitly controlled by including variance of vendor service-quality ratings as a control variable. Further, this factor is controlled implicitly to an extent by the nature of the sample selection
Price	Explicitly controlled by including average price of product as a control variable
Time/Market factors	Implicitly controlled by ensuring collection of all product-related information in one sitting. For example, if a particular product had 30 vendors, prices from all the 30 vendors are collected in one sitting

will enable sellers to leverage consumers' levels of decision ineffectiveness and differences in reservation prices by following various pricing strategies that lead to greater price dispersion.

H2: Information equivocality has a positive relationship with price dispersion in e-markets.

In sum, to illustrate the relevance of the effects of information facets on price dispersion, we contrast the traditional literature, in which price dispersion in e-markets is explained through the search-cost perspective with the consumers' strategy choice model and the reservation price arguments, and the sellers' corresponding strategies. We argue that this dark side of information has positive effects on price dispersion in e-markets.

Control Variables

A number of factors described earlier have been studied as antecedents to price dispersion. Table 4 shows variables that are either explicitly or implicitly controlled in this study. The two control variables explicitly controlled are product price and vendor service quality. Each represents major factors studied earlier: price from the market-characteristics perspective and service quality from the service-differentiation perspective.

Product price is known to affect price dispersion. Cohen (1998) and Pan et al. (2001) argue that average price has a negative influence on price dispersion. Smith et al. (2000) suggested that price dispersion may vary with product costs. If a price for a product is high, consumers will be careful and search more, which will lead to price convergence at a lower level. Conversely, if the price for a product is relatively low, consumers will not bother to spend time and effort to find a better or lower priced one. Therefore, we use price as a control variable.

Vendor service quality was adopted from the service-differentiation perspective. Service quality of e-tailers is known to affect price dispersion. Researchers have argued that firms providing better service will charge higher prices as compared to other firms (Brynjolfsson & Smith, 2000; Varian, 2000). However, empirical reports suggest the contrary, that is, good firms charge less than bad firms (Baylis & Perloff, 2002; Pan et al., 2002). Regardless of the direction of impact, these studies suggest that service quality affects price dispersion. To account for this, vendor service quality is included as a control variable.

DATA AND METHODOLOGY

For a price-dispersion study, we deemed it important that information regarding prices be available for homogenous products from multiple vendors. Additionally, we recognized that our study should require data about the information facets (overload and equivocality) and vendor service quality in a large e-market. Data from a large market was desirable for our research because we could expect greater validity for the study results as opposed to small-market data, from which results could be an artifact of market immaturity. There are at least two ways in which this information could be gathered. One way is to collect data about a product from vendors who sell it. To accomplish this, it would be necessary to compile the list of all vendors who sell products from a particular product category. This is impractical and too time consuming. Also, this data collection approach could be potentially biased by selection of vendors, and any price dispersion could be attributed to asymmetric information on vendors (i.e., this approach would be too restrictive, because not all consumers know about all the vendors). Further, this approach makes it difficult to collect information on product quality that is tied into our construct of information equivocality.

Another alternative is to use information from an infomediary that provides information about prices, information characteristics (including information regarding product quality), and vendor service quality. It is critical that a reputable infomediary be selected (i.e., reputable as acknowledged by vendors). Based on these criteria, we selected Bizrate® (bizrate.com) as our data source to empirically test our hypotheses. Bizrate® was established in 1996 and attracts 13.2 million unique visitors each month (Bizrate®, 2004). Bizrate® lists information about products, vendors, and prices, and also evaluates and rates vendors and their services. Bizrate® ratings are used by other price-comparison Web sites and, in some cases, even by vendors themselves to illustrate signs of service quality. Further, Bizrate® has been used in previous price-dispersion studies (Baylis & Perloff, 2002; Pan et al., 2002). Because consumers shopping via an infomediary are informed about all vendors, price dispersion observed at an infomediary could be attributed to

factors beyond traditional reasoning of information asymmetry but rather, as we argue, to the facets of information itself.

Unit of Analysis

Because price dispersion, by definition, relates to prices charged by different vendors for the same product, a single product was used as the unit of analysis. Each product was identified based on a unique identifying number. Each specific product identified (e.g., the Nikon D70 digital camera) was treated as a single data point. Products were selected from electronics and computer categories largely consistent with previous research. A total of 2,771 price quotes for 161 products from 129 different vendors were manually collected from December 2004 to March 2005. Therefore, 161 distinct e-markets were studied. The classification of these products is shown in Table 5.

Operationalization

The dependent variable, price dispersion, is measured as the normalized difference between the highest price and the lowest price for a particular product (i.e., the range divided by the average price for a particular product). This measure is consistent with previous research (Pan et al., 2004). Our measure of information overload includes the number of vendors with a "good" or higher rating selling the same product. Information equivocality captures the disagreement among the consumers regarding the product quality, operationalized as the variance among the product review ratings (i.e., if all consumers agree on product quality, then there is no equivocality). The control variables, price and vendor service quality, are operationalized as the average price across sellers for the product, and the standard deviation of vendor ratings, respectively (i.e., if all the vendors have similar service quality as measured by ratings, then there is no service differentiation among vendors). The definitions of constructs and their operationalization are shown in Table 6.

Cross-Validation of Measures

In this study, the number of vendors for a particular product is used as a measure of information overload, and standard deviation of product-quality ratings is used as a measure of information equivocality. A survey was conducted to cross-validate and enhance the validity of these measures. A sample of 48 Internet users was given scenarios consisting of shopping for seven different products. These users had an average of 8.79 years of Internet experience and had used the Internet to buy products previously. Careful instructions were provided, and no reference to the number of vendors or product reviews was made in the instrument. Subjects were encouraged to browse the information provided about a product. Scenario 1 consisted of five products with varying numbers of vendors (from 3 to 71). Based on literature (Eppler & Mengis, 2004), a multi-item information-overload scale was developed and used to measure perceptions of information overload. Correlation between actual numbers of vendors and the perceived information overload was significant at 1%, indicating that users perceive information overload as the number of vendors increases. Scenario 2 consisted of two products with varying

Table 5: Descriptive statistics.

Product[a]	*N*[a]	Mean	Std. Dev.
Digital Camera	20	460.08	60.32
Camcorder	8	724.38	91.76
Camera	19	384.80	55.88
TV	8	2,096.27	252.29
DVD Player	10	319.92	41.96
PDA	4	881.34	110.47
MP3 Player	18	176.08	19.46
CD Player	1	72.67	2.00
Printer	24	244.15	38.35
Monitor	5	391.80	40.39
Hard Drives	11	86.51	9.58
DVD/VCR Combo	3	152.96	204.66
Bridge and Routers	16	82.98	10.84
NIC	4	69.97	6.94
Graphic Cards	3	138.88	10.32

[a]Each row represents a product category and *N* represents the number of unique products in each category. For example, we identified 20 unique products that fit our criteria from the digital camera category.

Table 6: Construct definition and operationalization.

Construct	Definition	Operationalization
Information overload	A situation in which more relevant information is available than can be processed effectively	Number of sellers rated highly for a product
Information equivocality	A situation in which there is conflicting information that a consumer has to process to make an informed choice	Standard deviation of consumers' product ratings
Price dispersion	Differences in prices for the same product across multiple sellers	Price range adjusted by average price of the same product
Price	Price charged for a product	Average price for a particular product across vendors
Service quality	Service quality of a vendor	Standard deviation of service quality across different vendors for a particular product

product review ratings. Significant correlation at 1% was found between perceived product quality (as measured by a scale) and the computed measure of information equivocality used in this study. In sum, these results enhance confidence in the information overload and information equivocality measures employed in this work.

Data Collection Process

Our study required information about prices charged for a product and about product quality; so product selection was dependent on the availability of this information. A product was selected if there were at least three distinct reviews written about that product (required for information equivocality). Then, an assessment was conducted regarding whether the selected product was available from multiple good vendors. We identified good vendors as any vendor that had at least a "satisfactory" rating on all four Bizrate® rating dimensions. There are three reasons for selecting only good vendors. First, price dispersion is attributed to vendor service heterogeneity. By selecting only good vendors, we can provide a limited, sampling-based control of this factor. Second, good vendors offer real alternatives for consumers, and a high number of such vendors represents overload. Third, many of the vendors with bad ratings are unstable (i.e., most of these vendors are not in business for long, and their ratings frequently change from "satisfactory" to "poor" to "not yet rated"). The process used for selecting the products is outlined in the flowchart in Figure 2.

The following information was collected for the selected products: the number of reviews written for that product, the products' ratings, the number of vendors selling the same product, the prices offered by different vendors for the same product, the quality ratings for different vendors selling the same product, and information about the products. Data were collected manually (as opposed to via any program) to ensure that the products were identical. For any selected product, a vendor was not selected if the vendor was selling a refurbished item or if the item was out of stock.

DATA ANALYSIS AND RESULTS

Results of correlation analysis among the variables used in this study are presented in the Appendix. Regression analysis was used to test the hypotheses. Data were screened for outliers using the cutoff of Mahalanobis Distance (significance at .001 level) and residuals. Seven cases were identified as outliers, and these cases were deleted from further analysis. This resulted in a total sample size of 154 (i.e., 154 different products). The residuals were checked for normality and constant variance (Cohen, Cohen, West, & Aiken, 2003). The results suggested no deviation from the required conditions of normality and constant variance. Therefore, regression analysis was deemed appropriate. Hierarchical regression was conducted in two stages. In the first model, price dispersion was regressed on control variables of price and vendor service quality. Information overload and information equivocality were added in the second model. The results of this analysis are shown in Table 7.

The results of the control variables were mixed. As expected, average price was negatively and significantly related to price dispersion. However, vendor service quality was found to have no significant relationship with price dispersion.

Information overload and information equivocality were added in Model 2, and the results from this model test our study's hypotheses. Results suggest that, as the number of vendors for a particular product increase, the price dispersion for that product increases. Information overload demonstrated a statistically significant,

Figure 2: Flowchart for data collection process.

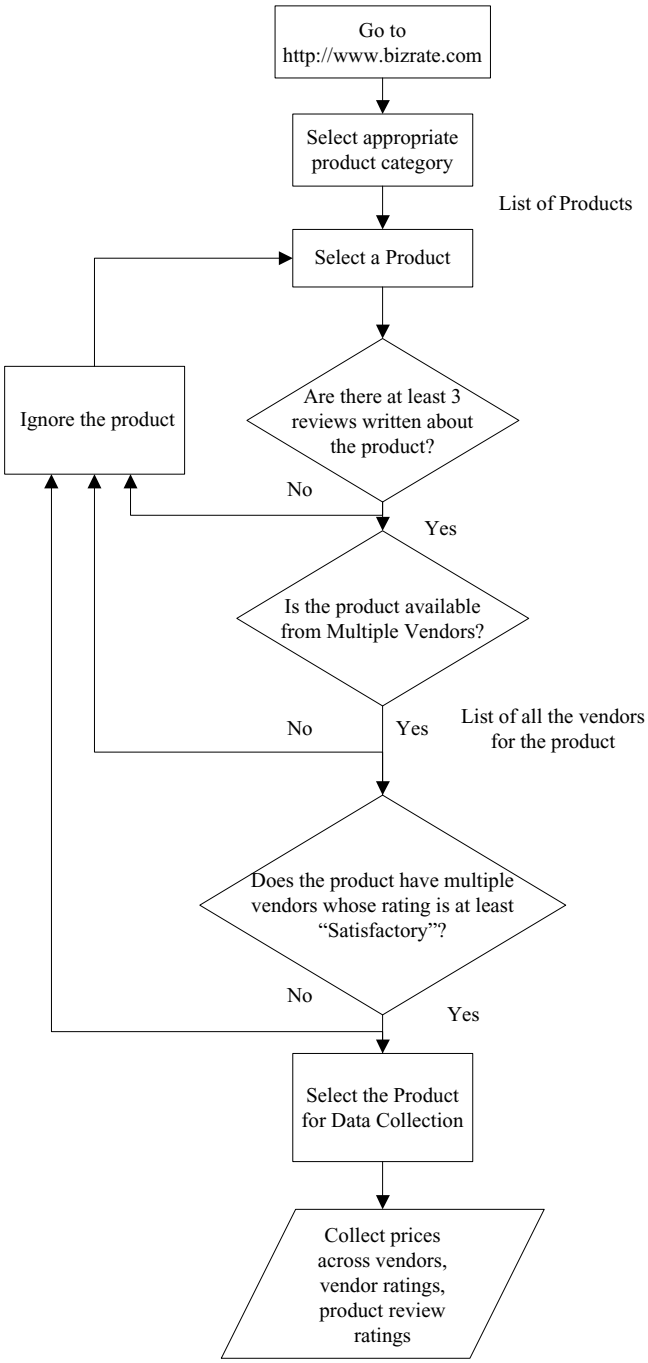
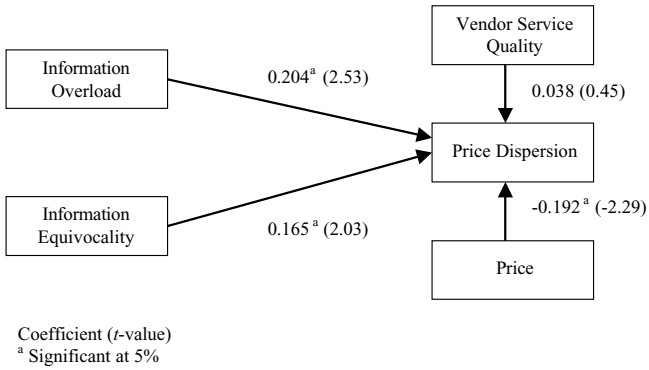


Table 7: Regression analysis.

Model	*B*	*t*	Significance	Collinearity Statistics		Adj. R^2 Change	*F* Change	Sig. *F* Change
				Tolerance	VIF			
1 (Constant)		5.029	.000			.023	2.639	.075*
Service quality	.038	.447	.327	.980	1.021			
Price	−.192	−2.294	.012**	.980	1.021			
2 (Constant)		2.345	.010			.076	5.052	.008***
Service quality	.043	.525	.300	.973	1.027			
Price	−.168	−2.047	.022**	.971	1.030			
Information overload	.204	2.526	.007***	.994	1.006			
Information equivocality	.165	2.029	.022**	.986	1.014			

*Significant at 10% level.
**Significant at 5% level.
***Significant at 1% level.

Figure 3: Model with results.



positive relationship with price dispersion (p value of .007). Therefore, this result supports Hypothesis 1.

Results regarding information equivocality suggest that, as the equivocality of information about the product quality increases, price dispersion for that product increases. Information equivocality demonstrated a statistically significant and positive relationship with price dispersion (p value of .022). This result supports Hypothesis 2. The research model with results is shown in Figure 3.

DISCUSSION

This study confirms existence of online dispersion found in previous research, suggesting that there are caveats to the predicted Bertrand price competition for e-markets. The logic of the Internet and e-markets suggests a reduction of information

asymmetries between consumers and sellers, which will lead to lower search costs and price convergence. We believe that persistent findings of online price dispersion indicate that we have to look beyond the search-cost perspective related to information asymmetry in explaining price dispersion.

Similar to the arguments made by Ackoff (1967) and others, we make the case for the unintended effects of information in e-markets. For example, Ackoff (1967) asserts that more information does not necessarily imply better decisions because of overload problems, and even with relevant information provided, it may not be possible to make effective decisions because of ambiguity and complex decision processes. Drawing a parallel, we argue that information overload and equivocality in e-markets lead consumers to follow different strategies. This provides fertile ground for sellers to engage in segmentation strategies that lead to price dispersion. Our results suggest that *just removing information asymmetry in markets may still allow sellers to maintain different prices and inhibit perfect price competition*. We believe that our study treads new ground in explaining price dispersion and market efficiency that goes beyond the search-cost perspective.

The dysfunctional effects of information overload on decision quality are well known. The search-cost perspective suggests that the emergence of e-markets combined with an increase in the number of sellers leads to price convergence. Contrary to this view, our study empirically provides support for the negative effect of having too many alternatives (sellers), leading to decision ineffectiveness among consumers. Specifically, we found that, as the number of sellers increase, price dispersion increases. Consumers adopt different strategies when faced with information overload, and sellers' pricing strategies reflect these differences.

Firms invest in feedback systems to add value by reducing uncertainty about product quality. Our study suggests that these, too, could have unintended effects. Specifically, we found that, when consumers write conflicting reviews about the quality of a product, price dispersion actually increases. Consumers' perceptions of differing quality creates variance in reservation prices for the same product, which in turn feeds into sellers' pricing strategies, resulting in price dispersion. These results suggest that price dispersion might actually reflect an equilibrium condition in e-markets.

The results are also consistent with the strategy choice model (Tellis & Gaeth, 1990). Tellis and Gaeth argued that consumers pursue different strategies, such as best value, price seeking, and price aversion because of incomplete information that does not allow them to make effective decisions. We have shown evidence that information overload and information equivocality lead to different consumer decisions (many of which are arguably ineffective decisions), which are reflected in different seller pricing strategies. Therefore, price dispersion could be attributed to these information characteristics above and beyond the search-cost arguments. In effect, it can be argued that consumers have different reservation prices based on the strategies they choose. Ironically, the information that is supposed to make markets efficient seems to have a different side that makes the markets inefficient.

It should also be noted that, as would be expected, product price had a negative influence on price dispersion. Either consumers expend more efforts for higher-priced products, or vendors realize that the costs of opportunistic behavior outweigh the benefits. Either way, the result that price dispersion is lower for higher-priced

products is consistent with previous research. The variance in vendor service quality did not explain significant variation in price dispersion consistent with some previous research (Pan et al., 2002; Ratchford et al., 2003).

These results support the trend of dramatic predictions—not so dramatic results made in IS literature. As early as 1958, Leavitt and Whisler predicted dramatic structural changes due to advances in IT. However, the results suggested that the effects of IT on organizational structure are context dependent. Similarly, dramatic predictions are made about impacts of IT on markets (i.e., perfect competition levels at marginal costs). However, results on price dispersion indicate a more complex decision process.

Future Research

Our study makes some important contributions to price-dispersion and e-market-efficiency literature. To the best of our knowledge, this is the first study that explains price dispersion through information facets. In doing so, it extends the nomological network by including information facets as antecedents for price dispersion. Future research should consider these factors when studying price dispersion in online markets. For example, the relationship between information overload and price dispersion could be explored in depth. Is there a specific point (i.e., number of sellers) at which the information overload sets in? Is this threshold different for e-markets as compared to traditional markets? Initial response to the above question is that the threshold for e-markets could be higher.

As information on sellers is related to price dispersion, it would be interesting to learn whether information on products is related to price dispersion, and, if so, in what way. Would detailed product descriptions overwhelm consumers in a manner similar to the effect of too much information about sellers? Or would detailed product descriptions help consumers see through the versioning strategies vendors use?

Another fruitful avenue would be to measure the amount of information (in bits) involved with a decision using the information structure formulae (Lurie, 2004). Further, demands placed by information overload and information equivocality might imply that consumers may be using decision cues or only shopping with known firms. This would imply that firms might benefit from enhancing their awareness and visibility. It would be valuable to investigate whether high-visibility firms enjoy advantages (i.e., the ability to charge higher prices) over other firms when consumers face information overload. Also, would these premiums change when the information issues are effectively resolved by the presence of infomediaries in the value chain?

The present work has looked at differences in pricing strategies across vendors for a same product. To further strengthen the results presented in this article, future research could analyze pricing strategies of the same vendor across different products to determine whether the pricing strategy varies in different products depending on information overload and equivocality.

Finally, with the ever-growing amounts of online information content, customers are increasingly being forced to process more information to make decisions. In cases in which information overload is too high, customers may be

inclined to go with tried-and-trusted players. Given this, customer retention and customer loyalty might take on increased significance in e-markets. Studies that examine consumer behavior under different information conditions would be very useful in understanding e-markets.

Implications for Practice

Our study offers several implications for both researchers and for practice. Past research about price dispersion has been focused from the perspectives of search costs, service differentiation, and market characteristics. Our study underscores the influence of information facets by empirically validating the significant effect of these facets on price dispersion.

In general, studies about price dispersion have important implications for consumers, vendors, infomediaries, and regulators. For consumers, this study suggests that levels of price dispersion might exist. The availability of information itself or aggressive search behavior might not reduce this dispersion and consequently might not lead to the competitive equilibrium. In fact, the availability of information itself could constrain the decision processes of consumers and lead them to follow different pricing strategies. Consumers may have to depend more on decision-aiding agents to alleviate some of the problems created by characteristics of information. Consumers are cautioned not to blindly believe the hype of e-markets.

For vendors, the results suggest that, even on the Internet and despite reduced search costs, it is possible to maintain differential pricing. Vendors can base their pricing decisions on the different consumer strategies and reservation prices that result from different facets of information. This could even be done dynamically as vendors track information facets of the e-marketplace. For the more devious vendors, the study might suggest that information overload and ambiguity be used as tools to reduce market efficiency. Vendors can undertake different information strategies to avoid direct price competition (Grover & Ramanlal, 1999).

The results provide strong implications for information-providing companies or infomediaries. These companies have opportunities to change their business models and work on behalf of consumers by providing potentially value-added services that increase market efficiencies. Our results suggest that the problem of information overload is persistent and may become second nature in an e-market. Given this, infomediaries seem to be pushing the available information to consumers without providing efficient decision aids. This phenomenon looks similar to the design issues of the 1970s, where IS were inherently based on a push philosophy. By working closely with consumers and understanding their decision processes, infomediaries can design and provide better decision aids in addition to the information on products, vendors, and so on.

Similarly, our results on information equivocality have implications for infomediaries. Firms like Bizrate® could differentiate themselves by complementing their consumer-oriented ratings with objective evaluations (like consumer reports) about product quality for customers. This could reduce the equivocality of product-quality information that consumers face, which will help them in the decision-making process. Therefore, given that consumers are unable to make effective decisions when faced with information overload and information equivocality,

the role of infomediaries becomes crucial. If these companies establish centrality within their business networks, then they can wield power and bias to take the market in a direction of their choosing. Similar biases were observed in networks like SABRE, where the provider of the information service controlled a major distribution channel. Regulators should play a watchdog role in observing how information is being disseminated on the Web. Price dispersion is reflective of market inefficiency, and regulators may have to intervene if there are indications of exploitive competition. For instance, because equivocality regarding product quality is shown to affect price dispersion, product reviews could be misused.

This study raises the possibility of inherent inefficiencies in e-markets, whereas the traditional view conceived e-markets as efficient with convergence toward the marginal price. It is widely acknowledged that advances in technologies help markets, as opposed to hierarchies and a phenomenon like the Internet would drive markets to a point at which prices for a product are close to the sellers' marginal costs. These efficient markets favor consumers. However, based on simple economic arguments, Grover and Ramanlal (1999) posit different scenarios that suggest that IT could potentially favor suppliers, thereby suggesting the possibility of inefficient markets. Vendors make strategic decisions like versioning, bundling, and so on based on their differential access to IT capitalization. Even though infomediaries might tilt this balance in IT capitalization by providing services that increase consumers' information-processing abilities, this study shows the negative consequences of information, that is, effects of information on decision-making processes in an e-market (negative from consumers' perspective). This implies that the nature of the e-market itself could provide the limiting condition to commoditization, with greater network effects resulting in greater information overload and equivocality.

Limitations

This study has certain limitations that must be acknowledged. First, the data obtained are observed data and not the actual transactional data. Given that Bizrate® updates the price information frequently, we do not believe that this is a serious limitation. Second, we did not include shipping costs in calculating the price of a product. Potentially, shipping costs could influence the amount of price dispersion. However, previous research (Brynjolfsson & Smith, 2000; Scholten & Smith, 2002; Ancarani & Shankar, 2004) has found no differences in the pattern of price dispersion when comparing prices with and without shipping costs. For example, Scholten and Smith (2002) report that adding shipping costs to price only reduces price dispersion by about 1%. Considering this, we would expect the results of this study to hold even when shipping costs are included. Third, while we controlled for major market and service-quality factors, attributes like overall market size and seller age were not controlled. This might have reduced the power of the study.

CONCLUSION

This study is a first step in developing antecedents to price dispersion based on different facets of information (i.e., information overload and information equivocality). We argue that the conventional search-cost perspective used to

explain reasons for price dispersion is restrictive. We purport that the nature of the information itself should not be neglected and could have unintended consequences. Results provide support for the effects of information overload and information equivocality on price dispersion. These information facets, increasingly pervasive in today's burgeoning e-markets, allow sellers to sustain different pricing strategies and to reduce the efficiency of these markets. We believe that, as these information attributes take on increasing significance in the future, it is imperative that researchers continue to understand their role in e-markets.[Received: December 2005. Accepted: June 2006.]

REFERENCES

Ackoff, R. L. (1967). Management misinformation systems. *Management Science*, *14*(4), 147–156.

Alba, J., Lynch, J., Weitz, B., Janiszewski, C., Lutz, R., Sawyer, A., & Wood, S. (1997). Interactive home shopping: Incentives for consumers, retailers, and manufactures to participate in electronic marketplaces. *Journal of Marketing*, *61*(3), 38–53.

Ancarani, F., & Shankar, V. (2004). Price levels and price dispersion within and across multiple retailer types: Further evidence and extension. *Journal of the Academy of Marketing Science*, *32*(2), 176–187.

Anderson, J. C., Jain, D. C., & Chintagunta, P. K. (1993). Customer value assessment in business markets: A state-of-practice study. *Journal of Business to Business Marketing*, *1*(1), 3–30.

Ba, S., & Pavlou, P. A. (2002). Evidence of the effect of trust building technology in electronic markets: Price premiums and buyer behavior. *MIS Quarterly*, *26*(3), 243–268.

Bailey, J. (1998). *Intermediation and electronic markets: Aggregation and pricing in Internet commerce*. Doctoral Dissertation, Massachusetts Institute of Technology, Cambridge, MA.

Bakos, J. Y. (1991). A strategic analysis of electronic marketplaces. *MIS Quarterly*, *15*(3), 295–310.

Bakos, J. Y. (1997). Reducing buyer search costs: Implications for electronic marketplaces. *Management Science*, *43*(12), 1676–1692.

Baye, M. R., & Morgan, J. (2001). Information gatekeepers on the Internet and the competitiveness of homogeneous product markets. *American Economic Review*, *91*(3), 454–474.

Baye, M. R., & Morgan, J. (2004). Price dispersion in the lab and on the Internet: Theory and evidence. *Rand Journal of Economics*, *35*(3), 449–466.

Baylis, K., & Perloff, J. M. (2002). Price dispersion on the Internet: Good firms and bad firms. *Review of Industrial Organization*, *21*(3), 305–324.

Betancourt, R. R., & Gautschi, D. (1993). Two essential characteristics of retail markets and their economic consequences. *Journal of Economic Behavior and Organization*, *21*(3), 277–294.

Bettman, J. R., Luce, M. F., & Payne, J. W. (1998). Constructive consumer choice processes. *Journal of Consumer Research*, *25*(3), 187–217.

Bizrate® (2004). News Release, accessed November 2004, available at http://www.bizrate.com/content/release__rel–155.html.

Blattberg, R., & Neslin, S. (1989). Sales promotion: The long and the short of it. *Marketing Letters*, *1*(1), 81–97.

Brouthers, L. E., & Nakos, G. (2005). The role of systematic international market selection on small firms' export performance. *Journal of Small Business Management*, *43*(4), 363–381.

Brynjolfsson, E., & Smith, M. (2000). Frictionless commerce? A comparison of Internet and conventional retailers. *Management Science*, *46*(4), 563–585.

Burdett, K., & Coles, M. (1997). Steady state price distributions in a noisy search equilibrium. *Journal of Economic Theory*, *72*(1), 1–32.

Cao, Y., & Gruca, T. S. (2004). The influence of pre- and post-purchase service on prices in the online book market. *Journal of Interactive Marketing*, *18*(4), 51–62.

Cao, Y., Gruca, T. S., & Klemz, B. R. (2003). Internet pricing, price satisfaction, and customer satisfaction. *International Journal of Electronic Commerce*, *8*(2), 31–50.

Carpenter, G. S., & Nakamoto, K. (1990). Competitive strategies for late entry into a market with a dominant brand. *Management Science*, *36*(10), 1268–1278.

Chang, T., & Wildt, A. R. (1996). Impact of product information on the use of price as a quality cue. *Psychology and Marketing*, *13*(1), 55–75.

Chen, P., & Wu, S. (2004). The impact of online recommendation and consumer feedback on sales. *Proceedings of the International Conference on Information Systems*, Washington, DC.

Choffray, J., & Lilien, G. L. (1978). A new approach to industrial market segmentation. *Sloan Management Review*, *19*(3), 17–29.

Clay, K., Krishnan, R., & Wolff, E. (2001). Prices and price dispersion on the Web: Evidence from the online book industry. *Journal of Industrial Economics*, *49*(4), 521–539.

Clemons, E., Hann, I., & Hitt, L. (2002). Price dispersion and differentiation in online travel: An empirical investigation. *Management Science*, *48*(4), 534–549.

Cohen, M. (1998). Linking price dispersion to product differentiation—Incorporate aspects of customer involvement. *Applied Economics*, *30*(6), 829–835.

Cohen, P., Cohen, J., West, S. G., & Aiken, L. S. (2003). *Applied multiple regression/correlation analysis for behavioral sciences*. Mahwah, NJ: Erlbaum.

Daft, R. L., & Lengel, R. H. (1986). Organizational information requirements, media richness and structural design. *Management Science*, *32*(5), 554–571.

Daft, R. L., Lengel, R. H., & Trevino, L. K. (1987). Message equivocality, media selection, and manager performance: Implications for information systems. *MIS Quarterly*, *11*(3), 355–366.

Du, N. (2004). Does higher search cost lead to higher price? *A price comparison between online and retail bookstores*. Working paper, University of Arizona, Tucson, AZ.

Eppler, M. J., & Mengis, J. (2004). The concept of information overload: A review of literature from organization science, accounting, marketing, MIS and related disciplines. *The Information Society*, *20*(5), 325–344.

Fama, E. F. (1998). Market efficiency, long-term returns, and behavioral finance. *Journal of Financial Economics*, *49*(3), 283–306.

Freeman, K. M. (1992). Target marketing: The logic of it all. *Journal of Consumer Marketing*, *9*(3), 15–18.

Gabriel, P. E., & Marsden, J. R. (1990). An examination of market efficiency in British racetrack betting. *Journal of Political Economy*, *98*(4), 874–855.

Gielens, K., & Dekimpe, M. G. (2001). Do international entry decisions of retail chains matter in the long run? *International Journal of Research in Marketing*, *18*(3), 235–259.

Grover, V., & Ramanlal, P. (1999). Six myths of information and markets: Information technology networks, electronic commerce, and the battle for consumer surplus. *MIS Quarterly*, *23*(4), 455–485.

Gupta, D., Hill, A. V., & Bouzdine-Chameeva, T. (2006). A pricing model for clearing end-of-season retail inventory. *European Journal of Operational Research*, *170*(2), 518–540.

Hiltz, S. R., & Turoff, M. (1985). Structuring computer-mediated communication systems to avoid information overload. *Communications of the ACM*, *28*(7), 680–689.

Hlavacek, J. D., & Ames, B. C. (1986). Segmenting industrial and high-tech markets. *Journal of Business Strategy*, *7*(2), 39–50.

Jedidi, K., & Zhang, Z. J. (2002). Augmenting conjoint analysis to estimate consumer reservation price. *Management Science*, *48*(10), 1350–1368.

Jeffrey, D., & Garrity, B. (1999). For brick & mortar retail, biz is solid but buzz is silent. *Billboard*, *111*(49), 3–4.

Keller, K. L., & Staelin, R. (1987). Effects of quality and quantity of information on decision effectiveness. *Journal of Consumer Research*, *14*(2), 200–213.

Kocas, C. (2003). Evolution of prices in electronic markets under diffusion of price-comparison shopping. *Journal of Management Information Systems*, *19*(3), 99–119.

Kocas, C. (2005). A model of Internet pricing under price-comparison shopping. *International Journal of Electronic Commerce*, *10*(1), 111–134.

Kohli, R., & Mahajan, V. (1991). A reservation-price model for optimal pricing of multiattribute products in conjoint analysis. *Journal of Marketing Research*, *28*(3), 347–354.

Koufteros, X., Vonderembse, M., & Jayaram, J. (2005). Internal and external integration for product development: The contingency effects of uncertainty, equivocality, and platform strategy. *Decision Sciences*, *36*(1), 97–133.

Kydd, C. T. (1989). Understanding the information content in MIS management tools. *MIS Quarterly*, *13*(3), 276–290.

Leavitt, H. J., & Whisler, T. L. (1958). Management in the 1980s. *Harvard Business Review*, *36*(6), 41–48.

Lee, B., & Lee, W. (2004). The effect of information overload on consumer choice quality in an on-line environment. *Psychology and Marketing*, *21*(3), 159–183.

Lee, H. G. (1998). Do electronic marketplaces lower the price of goods? *Communications of the ACM*, *41*(1), 73–80.

Lerner, J. S., & Keltner, D. (2001). Fear, anger, and risk. *Journal of Personality and Social Psychology*, *81*(1), 146–159.

Lurie, N. (2004). Decision making in information-rich environments: The role of information structure. *Journal of Consumer Research*, *30*(4), 473–486.

Lutz, N. A. (1989). Warranties as signals under consumer moral hazard. *Rand Journal of Economics*, *20*(2), 239–255.

Lynch, J., & Ariely, D. (2000). Wine online: Search costs affect competition on price, quality and distribution. *Marketing Science*, *19*(1), 83–103.

Miller, G. A. (1994). The magical number seven, plus or minus two: Some limits on our capacity for processing information. *Psychology Review*, *101*(2), 343–352.

Malhotra, N. K. (1982). Information load and consumer decision making. *Journal of Consumer Research*, *8*(4), 419–430.

Morgan, J., Orzen, H., & Sefton, M. (2006). An experimental study of price dispersion. *Games and Economic Behavior*, *54*(1), 134–158.

Pan, X., Ratchford, B. T., & Shankar, V. (2001). *Why aren't the prices of the same item the same at me.com and you.com? Drivers of price dispersion among e-tailers*. Working paper, eBusiness Research Center, The Pennsylvania State University, University Park, PA.

Pan, X., Ratchford, B. T., & Shankar, V. (2002). Can price dispersion in online markets be explained by differences in e-tailer service quality? *Journal of the Academy of Marketing Science*, *30*(4), 433–445.

Pan, X., Ratchford, B. T., & Shankar, V. (2004). Price dispersion on the Internet: A review and directions for future research. *Journal of Interactive Marketing*, *18*(4), 116–135.

Parks, R. (1978). Inflation and relative price variability. *Journal of Political Economy*, *86*(1), 79–95.

Pashigian, B., & Bowen, B. (1991). Why are products sold on sale?: Explanation of pricing regularities. *The Quarterly Journal of Economics*, *106*(4), 1015–1038.

Posavac, S. S. (2001). Overbidding in value elicitation: When consumers report inflated reservation prices, and what to do about it. *Journal of Consumer Psychology*, *11*(2), 87–97.

Rangan, V. K., Moriarty, R. T., & Swartz, G. S. (1992). Segmenting customers in mature industrial markets. *Journal of Marketing*, *56*(4), 72–82.

Ratchford, B. T., Pan, X., & Shankar, V. (2003). On the efficiency of Internet markets for consumer goods. *Journal of Public Policy & Marketing*, *22*(1), 4–16.

Robert, J., & Stahl, D. O. (1993). Informative price advertising in a sequential search model. *Econometrica*, *61*(3), 657–686.

Scholten, P. A., & Smith, A. (2002). Price dispersion then and now: Evidence from retail and e-tail markets. In M. R. Baye (Ed.), *The economics of the Internet and e-commerce: Advances in applied microeconomics*. Oxford, UK: Elsevier, 63–88.

Schuber, P., & Ginsburg, M. (2000). Virtual communities of transaction: The role of personalization in electronic commerce. *Electronic Markets*, *10*(1), 45–55.

Shaffer, G. Z., & Zhang, Z. J. (1995). Competitive coupon targeting. *Marketing Science*, *14*(4), 395–416.

Shankar, V., Urban, G. L., & Sultan, F. (2002). *Trust and e-business strategy*. Working paper, Sloan School of Management, Massachusetts Institute of Technology, Cambridge, MA.

Shapiro, C., & Varian, H. R. (1999). *Information rules: A strategic guide to the network economy*. Boston: Harvard Business School Press.

Smith, M., Bailey, J., & Brynjolfsson, E. (2000). Understanding digital markets: Review and assessment. In E. Brynjolfsson & B. Kahin (Eds.), *Understanding the digital economy*. Cambridge, MA: MIT Press, 99–136.

Spiegel, U., Ben-Zion, U., & Taylor, T. (1998). Profit maximization and social optimum with network externality. *Manchester School*, *74*(2), 138–155.

Stigler, G. (1961). The economics of information. *Journal of Political Economy*, *69*(3), 213–225.

Stiglitz, J. (1989). Imperfect information in the product market. In R. Schmalensee & R. Willig (Eds.), *Handbook of industrial organization*. Oxford, UK: Elsevier, 769–844.

Tellis, G. J., & Gaeth, G. G. (1990). Best-value, price-seeking and price aversion: The impact of information and learning on consumer choices. *Journal of Marketing*, *54*(2), 34–45.

Tirole, J. (1998). *Theory of industrial organization*. Cambridge, MA: MIT Press, 209–212.

Tsao, H., Pitt, L. F., & Berthon, P. (2006). An experimental study of brand signal quality of products in an asymmetric information environment. *Omega*, *34*(4), 397–405.

Urbany, J. E., Dickson, P. A., & Kalapurakal, R. (1996). Price search in the retail grocery market. *Journal of Marketing*, *60*(2), 91–104.

Varian, H. R. (2000). Market structure in the network age. In E. Brynjolffson & B. Kahin (Eds.), *Understanding the digital economy*. Cambridge, MA: MIT Press, 137–150.

Webster, F. E. (1984). *Industrial marketing strategy* (*2nd ed.*). New York: Wiley.

Wernerfelt, B. (1991). Brand loyalty and market equilibrium. *Marketing Science*, *10*(3), 229–245.

Weylman, C. R. (1999). Open closed doors. *Executive Excellence*, *16*(3), 18–20.

Williamson, O. E. (1985). *The economic institutions of capitalism*. New York: Free Press.

Wilson, D. T. (1971). Industrial buyers' decision-making styles. *Journal of Marketing Research*, *8*(4), 433–436.

Wolinsky, A. (1983). Prices as signals of product quality. *Review of Economic Studies*, *50*(163), 647–658.

Wooten, D., & Reed, A., II. (1998). Informational influence and the ambiguity of product experience: Order effects on the weighting of evidence. *Journal of Consumer Psychology*, *7*(1), 79–99.

APPENDIX: CORRELATION MATRIX

	Vendor Service Quality	Price	Information Overload	Information Equivocality	Price Dispersion
Vendor service quality	1.0000				
Price	.1211	1.0000			
Information overload	.0373	−.0419	1.0000		
Information equivocality	−.0822	***−.1480****	−.0134	1.0000	
Price dispersion	−.0073	**−.1617****	**.1754**	.0823	1.0000

*Bold italic significant at 10%.
**Bold significant at 5%.

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