EFFECTS OF COMPARISON SHOPPING WEBSITES ON MARKET PERFORMANCE: DOES MARKET STRUCTURE MATTER?

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ABSTRACT

The presence of Comparison Shopping (CS) websites not only allows consumers to gain quick access to multiple merchants' product offers, but also permits consumers to perform extensive comparison of products and prices prior to purchase. Given the significant reduction in search cost, it has been touted that CS websites can put merchants under increased price competition, resulting in commoditized markets, limited value of branding, and ultimately, convergence of prices to the competitive equilibrium. However, some studies suggest that lower search cost could make any price movement apparent to all participating merchants and hence promote price collusion. This research seeks to explicate the conditions under which CS websites are more likely or less likely to intensify market competition. Following the principles of experimental economics, we modeled and examined the impact of CS websites in many simulated markets featuring merchant characteristics (such as absence and presence of market power) and product type (such as commodity products and differentiated products). Through two series of experiments, we find that the lowering of search cost by CS websites could have opposite effects on market performance, depending on the underlying market structure.

Keywords: comparison shopping, experimental economics, search cost, market power, differentiated products

1. Introduction

Conventionally, when an online merchant sets its price, the available information is restricted to those consumers who visit the storefront [Nah & Davis 2002]. The emergence of Comparison Shopping[2] (CS) websites, such as CNET Shopper and PriceGrabber, has revolutionalized how consumers gather price and product information. These CS websites have not only allowed consumers to gain quick access to multiple merchants' product offers, but also permitted consumers to perform extensive comparison of products and prices prior to purchase [Tan et al. 2010]. Specifically, the reduction in search cost, brought about by CS websites may put merchants under increased price competition, resulting in commoditized markets, limited value of branding, and ultimately, the convergence of prices to the competitive equilibrium [Smith 2004; Diamond 1971].

According to the transaction cost theory, information is usually costly to gather [Tirole 1988]. A consumer may terminate the search for better product offers if the anticipated price reduction is lower than the search cost [Stahl

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[2] Comparison shopping is defined as the activity engaged by a consumer who visits more than one merchant prior to making a purchase decision [Wilde and Schwartz 1979].

1989]. Search cost, such as the opportunity cost of the time spent searching, is the cost incurred by a consumer to locate the most suitable merchant to purchase from [Stigler 1961]. As search cost increases, a consumer will acquire less information, and hence, he is restricted to fewer choices. This allows merchants to charge higher prices in equilibrium and the market departs from competitive toward monopolistic outcomes [Stahl 1989; Varian 1980]. Conversely, a reduction in search cost would increase price competition, reduce price dispersion, and push the market transaction price (i.e., the price at which a consumer purchase a product from a merchant) to the competitive equilibrium when search cost is zero [Salop & Stiglitz 1976]. The significant reduction in search cost afforded by a CS website could exert pressure on merchants to price low. For instance, Ellison & Ellison [2001] have found consumers at Pricewatch.com, a CS website specialized in comparing computer components, to be relatively price sensitive (i.e., the consumers are more likely to place greater weight on price attribute over other product attributes), and as a result, merchants listed at the Pricewatch.com website could only sustain narrow profit margins. Such findings are convincing evidence that information-rich CS websites could intensify price competition.

Although the above field of research has made a compelling case on CS websites' impact on market outcomes, a substantial number of researchers have countered with theories and empirical evidence indicating that a reduction in search cost may not necessarily intensify price competition [Diehl et al. 2003]. Starting from Scitovsky [1952], studies on the choice of retail location in conventional markets suggest that while a merchant may face a more intense competition when they physically co-locate, merchants continue to choose to cluster together on the recognition that they are able to attract more consumers by facilitating comparison shopping [Dudey 1990; Scitovsky 1952]. Particularly, Wernerfelt [1994] argues that when consumers incur search cost, they may refrain from making any purchases for fear of later opportunism of finding lower priced offers. By allowing merchants to co-locate, this problem can be alleviated. Indeed, Iyer [2001] suggests that merchants selling commodity products may choose to co-locate to explicitly reduce consumers' search cost and satisfy their urge to compare. Co-located merchants can then differentiate their products to ease competition among themselves. To the extent that merchants choose to facilitate comparison shopping in a conventional market, it is doubtful that the presence of a CS website would definitely be undesirable for merchants. Moreover, it is noteworthy that CS websites have existed on the Internet since the late 1990s.

In the context of online markets, Varian [1999] argues that while a CS website permits consumers easy access to merchants' prices, it also permits merchants themselves to monitor one another's price movements. The significant reduction in search cost, brought about by the CS website, can lower the cost of monitoring and shorten the detection lag (i.e., the time taken to respond to a rival's change of selling price) [Tirole 1988]. If a merchant knows that its rival can observe (i.e., through a CS website) and will match its selling price (i.e., adopting the price-matching strategy), it is more willing to initiate any price increment as it facilitates tacit collusion and raises the merchants' surpluses. This is because any price adjustment is broadcasted and collusion intention is signaled to all the competitors through the CS website [Kreps & Sobel 1994]. Hence, it is less likely that the market price would converge to the competitive equilibrium [see Corts 1997 for review of price-matching literature].

Furthermore, Lynch & Ariely [2000] argue that the economic impact of a CS website may depend on the type of information gathered. Particularly, reducing search cost for price information increases price sensitivity, but reducing search cost for quality information decreases consumer price sensitivity. This argument is in accordance with the advertising literature that notes that consumers tend to exhibit higher price sensitivity when price information is advertised but lower price sensitivity when quality information is advertised [Mitra & Lynch 1995, Degeratu et al. 2000]. The lower price sensitivity could be due to lower perceived product substitutability. Moreover, even if consumers are presented with the lowest priced items, they may not necessarily choose the cheapest [Brynjolfsson et al. 2003]. On the contrary, Smith & Brynjolfsson [2001] have found that some consumers are willing to pay a premium to buy from established merchants such as Amazon. Collectively, the evidence suggests that the market impact of CS websites could vary widely according to the market structure.

Since the current research demonstrates that the market impact of CS websites may differ significantly under different circumstances, our objective is, hence, to explicate the market conditions under which CS websites are more likely or less likely to intensify online competition. To the best of our knowledge, the existing studies have not addressed this important issue in an integrative fashion that considers the underlying market structural conditions in which a CS website functions. Two notable exceptions are Iyer & Pazgal [2003], which includes a game-theoretical model to examine the interaction among merchants, and Diehl et al. [2003], which includes experiments to empirically examine a CS website by varying its decision support capabilities. However, even in the presence of these exceptions, a clear explanation of when and why a CS website intensifies or mitigates online competition is rarely given. We attempt to offer such an explanation in this paper.

To accomplish our objective, this research draws on the Industrial Organization literature on search cost and market structure (e.g., market power, commodity and differentiated product markets) [Tirole 1988] and the

Experimental Economics literature on competition in repeatedly-played oligopoly markets [Davis & Holt 1993], to empirically assess a CS website by simulating the markets in which it functions. Specifically, we contend that the competitive pressure exerted by a CS website may depend on two aspects of market structures: who are selling (e.g., merchants' possession of asymmetry market power) and what are being sold (e.g., product type) [Tirole 1988]. Putting our investigation in these terms, we empirically assess the economic impact of a CS website in markets where products and merchants are asymmetric in quality and selling capacity respectively. More importantly, we conducted two series of controlled experiments, simulating online trading markets, to understand the impact of a CS website on market transaction price (i.e., the price in which a product is traded) and merchant surplus (i.e., the merchant's profit made).

Comparatively, most of the prior studies, with a few exceptions such as Diehl et al. [2003], rely on theoretical modeling [e.g., Iyer & Pazgal 2003] or field data from online storefronts [e.g., Brynjolfsson et al. 2003]. Theoretical modeling of situations may not be adequate because it is often derived from many assumptions and some of them may be defined to simplify the analysis model. Field data are often incomplete in that a plethora of factors in the naturally occurring economy may not be observable and controllable. Laboratory experiments could bridge the gap between theoretical and field studies by yielding more complete information to researchers and allowing them to observe how behavior develops from controlled fundamentals [see e.g., Levecq 2002]. More specifically, laboratory experiments allow the formation of data that address fundamental changes which are often difficult, if not possible, to address with field data [Davis & Holt 1993].

There are various implications of examining the economic issues of CS websites. From a practical perspective, the research sheds light on important aspects of how merchants may cope with the existence of CS websites. There is a growing emphasis on studying issues relating to online competition, given the increasing number of new technologies on the Internet [Bakos 1997]. An understanding into how CS websites influence merchants' pricing strategies and decision-making across different market structures will generate useful insights for those merchants who are interested to co-locate with their competitors at a CS website. This will also provide useful suggestions to CS website marketers in determining which merchant's databases they should interrogate to receive greater Internet presence and higher profitability.

From a theoretical perspective, this study provides a deeper understanding into the influence of CS websites on market competition. Indeed, by developing a deeper understanding into how merchants react and respond to CS websites under various market structures, we will be able to test theories of merchants' pricing strategies developed in a traditional setting in the online context. Furthermore, in designing laboratory experiments using economic principles, we also present an analytic framework by which researchers can use to study the economic impact of online technologies. Hence, this study will benefit Information Systems (IS) researchers who are interested in examining the economic impact of the CS website (technology) on market competitiveness (outcome). It may be of particular interest to those contemplating experimental research to study the economic impact of technology.

In the next section, we present the theoretical background of our study, followed by the main hypotheses that we will be testing. Following that, we describe the experimental designs and the data collection procedures for our two series of experiments. Results of the experiments are then reported and discussed. In the last section, we discuss the implications and limitations of our study, and indicate directions for future research.

2. Theoretical Foundations and Hypotheses

Theoretical analyses of market competition [Kauffman & Wood 2000], product entry [Bohlmann et al. 2002], and market entrances and mergers [Davis & Holt 1994] are usually based on the underlying structural conditions [Tirole 1988]. Market structure is an economic model elucidating merchants' behavior under the two defining conditions of a market: (1) market concentration, or the degree to which merchants possess market power, and (2) product differentiation, or the degree to which products in the market are different [Besanko & Braeutigam 2002; Tirole 1988]. Market power – under which merchants with large market shares coexist with many small merchants, and product types – under which products are identified as commodity or differentiated according to the degree of quality differences, are two key economic concepts that lie at the heart of the economic assessment of competition in a market [Besanko & Braeutigam 2002]. For these reasons, this study proposes a more rigorous examination of the influence of CS websites by varying market structural conditions. In this section, we briefly review the influence of market structures on market performance, and hypothesize how a CS website functions under these market conditions.

2.1. CS websites and market power – who are selling?

Researchers have consistently observed that many online marketplaces (e.g., the book market) are highly concentrated with a small number of merchants possessing the bulk of the market share [Saloner & Spence 2002;

Kauffman & Wood 2000; Haveman 1993]. Specifically, the retailer heterogeneity[3] in size and service levels (e.g., Amazon) could potential contribute to the information asymmetry for the customers. The evidence till now for online markets shows that price and price dispersion[4] are higher than the expected competitive equilibrium, lending further credence to the conjecture that online markets resemble those of oligopolies, with some merchants possessing market power [Clay et al. 2001].

According to the theory of market power, a merchant with market power is able to unilaterally raise prices above the competitive equilibrium as it may possess certain competitive advantages such as business process efficiencies, production capacity, brand equity and patent protections [Bandyopadhyay & Chaturvedi 2001]. Briefly, a merchant (or a group of merchants) possesses market power when it is able to raise prices above the level that they would exist under normal competitive conditions, and enjoy increased profits as a result [Davis & Holt 1993]. Essentially, this implies a situation where a merchant's strengths (e.g., brand equity and selling capacity) enable it to ignore, to a certain extent, the constraints on behavior usually caused by the need to compete with other merchants in the market. This may occur when a merchant is able to increase its selling price without too much fear that it will lose significant amounts of business to its competitors.

A theoretical study conducted by Deneckere [1992] to analyze duopolistic price-leadership games concludes that in the simultaneous-move price-setting game, small merchants (i.e., those without market power) prefer to be followers while large merchants (i.e., those with market power) are indifferent between being leaders, followers or moving simultaneously with others. This is because a large merchant's pricing strategy exerts a great influence on the sales of its smaller rivals; consequently, the large merchant must consider the likely responses of its rivals before setting its own price. Comparatively, small merchants stand to lose more from being undercut than large merchants. Hence, small merchants with a low level of tolerance toward short-term loss from being undercut are less willing to initiate any price increment. This finding has received much empirical support in the electronic commerce realm [e.g., Kauffman & Wood 2000]. Merchants with market power, such as Barnes and Noble and Amazon, exhibit a higher tendency to initiate price increments despite knowing that small merchants would raise their prices to just slightly below the prices of large merchants [Kauffman & Wood 2000].

It is clear by now that merchants with market power are assured non-zero returns in most circumstances. Moreover, with the possession of market power, the retaliation for competitors' failure to comply will be sufficiently high to deter non-compliance since the price initiator could leverage its market power to punish its rivals subsequently (e.g., price low to force the small merchant to exit the market). In other words, when a merchant assumed the role of leader and initiates a price increment, the other competitors have to weigh against the incentive and risk of not engaging in price collusion. It is likely that the consequence of not matching a large merchant's price increment will be more severe than that of not matching a small merchant's price adjustment.

In the presence of a CS website, any price increase attempt will be more readily observed. This further boosts the confidence of merchants with market power to initiate price increases. Consequently, in markets where market power prevails, the significant reduction in search cost brought about by a CS website may increase the probability of the market to deviate significantly from the competitive equilibrium and toward the monopoly level[5] [Davis & Williams 1991]. In other words, in the presence of a CS website, merchants with market power will be more willing to initiate price increases and other merchants are more likely to match the price. This will lead to higher market transaction prices than in the absence of a CS website. Consequently, merchants in the presence of a CS website will benefit from higher surpluses. Hence, we hypothesize:

H1a. In the presence of market power, the presence of a CS website will lead to higher transaction prices than in the absence of a CS website.

H1b. In the presence of market power, the presence of a CS website will lead to higher merchant surpluses than in the absence of a CS website.

In the absence of market power, the opposite will be true. Although the presence of a CS website reduces the cost of monitoring competitors, none of the merchants will be willing to initiate any price increase. This is because, in the absence of market power, a merchant is not able to raise its surplus by deviating from the competitors. If a

[3] Retailer heterogeneity may also explain the observed price dispersion in the online markets even in commodity product markets [see e.g. Clay et al. 2001].

[4] According to Stigler [1961], "price dispersion is a manifestation of consumer ignorance of the market". In other words, when consumers are not perfectly aware of the prices or qualities of all products sold by merchants, price dispersion occurs.

[5] One good example of an industry in which such collusion practices are used is the turbine generator industry, dominated by Westinghouse and General Electric. For further details, refer to Tirole [1988] page 241.

merchant initiates any price increase that is not matched by its competitors, it may face a zero surplus since all consumer demands can be satisfied by the other competitors [Deneckere 1992]. In the presence of a CS website, consumers are able to engage in direct price comparisons, and hence, consumers are better informed. Given the lack of market power, merchants will not exhibit a strong preference to assume the role of leader in the market. Hence, they will choose not to initiate any price increment nor deviate from the competitive equilibrium. Consequently, the presence of a CS website can force the market transaction price to converge toward the competitive equilibrium.

In the absence of a CS website, the cost of monitoring competitors' price movement increases and the proportion of uninformed consumers and merchants in these markets will be significantly higher [Diamond 1971]. Merchants can, hence, practice horizontal differentiation and exercise a certain level of monopolistic pricing when consumers experience positive search cost [Salop & Stiglitz 1982; Wilde & Schwartz 1979]. Horizontal differentiation is most often based on Hotelling's 'linear city' concept, where consumers typically have different ideal points modeled along a line [Hotelling 1929]. Consumers suffer increasing disutility as the distance between the consumer's ideal point and the access to information increases. In other words, consumers and merchants are neither able nor willing to visit all the individual storefronts to extract price information. Under such a situation, a merchant may raise its selling price by the amount of search cost. Consequently, the market transaction price in the absence of a CS website will be higher than in the presence of a CS website, and merchants not in the presence of a CS website will be able to benefit from higher surpluses. Therefore, we hypothesize:

H2a. In the absence of market power, the presence of a CS website will lead to lower transaction prices than in the absence of a CS website.

H2b. In the absence of market power, the presence of a CS website will lead to lower merchant surpluses than in the absence of a CS website.

2.2. CS websites and product types – what are being sold?

Theoretical models of product markets are usually distinguished by differentiated and commodity products. Differentiated products are heterogeneous products whose differences are significant to consumers, and are treated by consumers as close but imperfect substitutes. Differentiated products can be distinguished along many dimensions – quality, performance, speed of order fulfillment, warranty, return policy and degree of customization [Maes et al. 1999]. A product is generally labeled in terms of quality, which is used to refer to an attribute (or combination of attributes) that elicits consumer agreement that 'more is better' [Maes et al. 1999].

In online markets where products are not physically available for inspection [Shaked & Sutton 1982] and product information needs to be experienced [Varian 1995], information asymmetry exists. Information asymmetry prevails in a differentiated product market where only the merchants themselves know the true quality of their products. Limited information about the product or service normally results in two undesirable outcomes. When merchants have perfect information and consumers have limited information, market failure may arise, or even if the market exists, only the lowest quality goods may be sold. The reasoning for this is that since consumers are unable to estimate the quality of products with a certain level of confidence, it is to their interest to purchase products of lower prices. This leads to lower incentive for merchants to sell high-quality products with high production cost. These low-quality inefficiencies[6] may be attributed to an externality in which merchants fail to completely capture the benefits of selling high-quality products as the market transaction price is based on the average quality of all products sold in the market [Akerlof 1970]. This phenomenon is commonly termed 'market of lemons' [Tirole 1988].

The presence of a CS website can potentially address the information asymmetry problem by assisting consumers in verifying merchants' product quality claims through third-party expert evaluation information, product reviews and feedback from other consumers. When consumers are able to better gauge the quality of products, merchants are able to practice price and product discrimination according to consumers' preferences and valuations, which should in turn lead to a more efficient market and higher transaction prices [Braverman et al. 1983; Carlton & Perloff 2000]. Comparatively, in the absence of a CS website, consumers are not able to gauge the quality of products, and hence, they would choose to purchase those cheaper. Thus, a priori, we hypothesize:

H3a. In a differentiated product market, the presence of a CS website with price and quality information will lead to higher transaction prices (with sale of higher quality products) than in the absence of a CS website.

[6] To address the information asymmetry problem, several studies [e.g., Lynch et al. 1986] propose that the merchants' identity should be made known prior to purchases, so that merchants would be more willing to build up their reputations and less willing to sell inferior products. In so doing, the overall proportion of high-quality products sold would increase.

H3b. In a differentiated product market, the presence of a CS website with price and quality information will lead to higher merchant surpluses (with sale of higher quality products) than in the absence of a CS website.

However, in the commodity product market where products are essentially identical in product characteristics across different merchants – except possibly differing only in price – the ready availability of price information brought about by a CS website may intensify price competition [Bakos 1997]. This is because the ability of a CS website to find, aggregate, and sort price information from a wide range of merchants will increase the number of informed consumers. It has been found that as the number of informed consumers increases, the pressure on competition increases [Iyer & Pazgal 2003]. Furthermore, since products in a commodity product market are identical, the presence of a CS website should promote price competition among merchants and decrease merchant surpluses [Diehl et al. 2004; Engel et al. 1994].

In the absence of a CS website, we expect the market to deviate from the competitive equilibrium as the search cost and the proportion of uninformed consumers in the market will be significantly higher [Diamond 1971].This is because, as argued earlier, merchants can practice horizontal differentiation and exercise monopolistic pricing when consumers experience positive search cost due to the absence of a CS website [Salop & Stiglitz 1982; Wilde & Schwartz 1979]. Indeed, consumers have reported much navigation difficulties when searching for information using standard search engines on the Internet [Jarvenpaa & Todd 1996]. Therefore, we hypothesize:

H4a. In a commodity product market, the presence of a CS website will lead to lower transaction prices than in the absence of a CS website.

H4b. In a commodity product market, the presence of a CS website will lead to lower merchant surpluses than in the absence of a CS website.

3. Research Methodology

Increasingly, experimental methods are being used to study industrial organizational issues (e.g., antitrust) and to empirically examine different theoretical economic predispositions in the laboratory [Holt & Isaac 2002]. By following the principles of experimental economics, experimenters simplify and abstract real markets through defining: (1) the market institution, and (2) the environment, specifying the endowments, incentives, valuations and costs [Smith 1982; Davis & Holt 1993; Kagel & Roth 1995]. The market institution includes the language of communication (i.e., how each participant communicates and trades), allocation rules (i.e., how the trading units are allocated), cost imputation rules (i.e., how the participants are rewarded for each successful unit traded), and adjustment process rules (i.e., how the experiment starts, transits and stops).

The environment is defined by the supply and demand schedules which summarize the incentives of the participants to trade. In the experimental market, the monetary value of a decision is defined by assigning monetary values to each unit traded. For example, each merchant in the laboratory market is assigned a cost for each unit of a product that it may choose to sell. The difference between the transaction price and the cost determines the merchant's surplus from the sale of that unit. Similarly, a consumer's surplus is determined by the difference between the valuation price and the transaction price.

To test the theory (or economic prepositions), four precepts are needed to control for participants' preferences: non-satiation, saliency, dominance, and privacy [Wellford 2002]. Non-satiation refers to the monotony of utility about cash rewards (i.e., each participant prefers more money to less). Salience means that participants must be motivated to participate and behave rationally. To do so, rewards must be provided and they must increase (decrease) according to the favorable (unfavorable) outcomes. Dominance requires the rewards to be sufficient to compensate each participant for any subjective cost associated with the participation. In other words, a subject's performance and behavior in the experiment are driven by monetary incentives and not any other factors. Privacy means that each participant receives information on his own reward schedule only and not that of other participants.

Through the four precepts, the theory can be further tested for robustness in laboratory markets by examining the conditions that the theory itself suggests. This is to identify conditions in which the theory continues to predict behavior and those in which its predictive ability vanishes. Hence, it is necessary that laboratory results are replicable to facilitate follow-up studies. To achieve this, experimental economists expect experiments to satisfy the fifth precept – parallelism. Parallelism indicates that the hypotheses that are supported in one experiment must also hold in other laboratory or field markets when all the corresponding conditions are held constant. Hence, based on this precept, it is argued that when a theory fails to predict well in a simple laboratory setting under conditions the theory itself suggests, it is difficult to believe that it would predict better in a more complex market in the naturally-occurring economy [Davis & Holt 1993].

Table 1: Summary of Experimental Designs

Market institution		Posted offer			
Information endowment		Private			
Cost and value Parameters		Identical demand and supply schedules per treatment			
Experiment no.	**Session**	**Market manipulation**		**CS website**	**No. of participants (merchant/consumer)**
		Product market	**Market power**		
1	1-2	Commodity	Absence	Presence	5/4
1	3-4		Absence	Absence	5/4
1	5-6		Presence	Presence	5/4
1	7-8		Presence	Absence	5/4
2	9-10	Commodity	Absence	Presence	6/6
2	11-12	Commodity		Absence	6/6
2	13-14	Differentiated		Presence	6/6
2	15-16	Differentiated		Absence	6/6

The ability to control the various features of laboratory markets and to replicate experiments under the same conditions allows an experimenter to discriminate among theories. Indeed, in the laboratory, the experimenter knows the true market equilibrium because the experimenter sets the costs, demand, and other market parameters that underlie the theoretical predictions. Thus, when a merchant cuts (raises) prices in the experiment, the experimenter can unambiguously determine whether it is behaving in a competitive (monopolistic) manner. The market performance resulting from the observed behavior in the laboratory can then be measured against the theoretical predictions. Essentially, experimental economics, for its ability to abstract a market in a simplified form, allows economists and researchers to investigate the possible market reactions prior to a change of policy or introduction of technology. Certainly, such a tool can be utilized by IS researchers for it allows them to examine technology impact on socio-economic well-being in a more precise manner.

Following the principles for valid economic experimentation, we design two series of controlled laboratory experiments to study the effect of CS websites on market performance in an Internet shopping environment (see Table 1). Experiment 1 focuses on the effect of a CS website on market performance where the market power condition is manipulated. Experiment 2 examines the impact of a CS website where the products vary between commodity products and differentiated products. The primary focus of this paper is to address the economic impact of CS websites on market performance, and hence, transaction price fluctuation is the key measurement. All our experimental designs employ a single factor between subject designs for each series of studies. To rule out the possibility of alternative explanations to the experimental results, several measures are taken. First, strict controls on market institution, subject experience, information endowment[7], number of merchants/consumers in the market, and cost and valuation parameters are enforced. Second, the market designs for both experiments are referenced from the prior studies of Davis & Holt [1994] for market power treatment and Davis & Holt [1993] for product type treatment. This allows us to observe the behavioral consequences of the existence of a CS website in different markets and rule out any alternative institutional explanations.

Taking into consideration the possible effect of the number of players on market performance, we examine the results of Davis & Holt [1994] and Davis & Holt [1993]. The results where the market conditions were the same (i.e., absence of market power in Davis & Holt [1994] and commodity product market in Davis & Holt [1993]) suggest that in both studies, transaction prices converged to the competitive equilibrium. There was negligible difference arising from a slight variation in the number of players in the market. As in Davis & Holt [1993; 1994], the use of less than 10 subjects per session is a common practice and is adequate in experimental economics [Holt & Isaac 2002], and as argued in the Bertrand model, even two merchants are sufficient to make a market competitive [Tirole 1988]. Hence, we can rule out the possibility of any alternative explanation arising from a slight variation in the number of players or a small number of players.

We use the posted offer market institution in all our experiment sessions for this form of institution is very common in online retail stores (e.g., Amazon) and best represents the trading mechanism at a CS website (e.g., mySimon). In the posted offer market institution, merchants quote prices on a take-it-or-leave-it basis (i.e., non-

[7] We have included the discussion on Bertrand Model for in both experiments we have participants playing either the role of consumers or merchants. Since those playing the role of merchants will make pricing decisions (i.e., how to price their products), they are representing their own respective firms.

negotiable). Merchants independently decide on the selling prices, which are shown on a common platform for consumers to view. Consumers then make purchases from merchants at the posted prices [Davis & Holt 1993]. Chiefly, the posted-offer market institution is a laboratory implementation of the price discovery mechanism and the price setting activity commonly used in many retail situations [Holt & Sherman 1990].

3.1. Recruitment

All the experiments are carried out in a public university. A total of 168 undergraduate students with no previous experience of participation in laboratory experiments were engaged in this repeated-buying and selling game on the computer. No special skill or experience is required of the participants. They are told during recruitment that this is an experiment in individual decision-making and they will be paid in cash for participating. It is also pointed out that higher payments are possible based on performance, but are not guaranteed. Participating participants are informed of the time and location of the experiment. The participants perform the experiment on a group basis in the designated laboratory at a specific time. Each participant goes through 2 (training) + 10 (actual) periods. On average, the participants are paid between 10 to 20 dollars for about an hour of their time.

3.2. Trading System

A computerized experimental system simulating the online posted-offer market institution is designed and developed. Using the system, the merchants (consumers) can check the product quantities they can sell (purchase), the associated costs (valuations), listed (purchased) prices and their earnings for both current and previous trading periods. Each and every activity executed by the subjects on the system is tracked and logged in a data file. Particularly, the system records the subjects' choices and the associated results including earnings or losses in each round, and the cumulative payoffs. These data are used to construct the dependent variables that characterize market performance. The web-based system is also used to capture the demographic information and perceptions of the subjects. Extra effort has been expended to ensure that the two experiments are conducted under the same experimental system design. This is to minimize the effect of different website designs (except due to the differences in the intended manipulations) on results obtained and to facilitate the corroboration of the results from the two experiments.

3.3. Procedure

Experiment instructions and procedures are drafted based on the prior experimental studies of Plott & Smith [1978], Davis & Holt [1993], and Kagel & Roth [1995]. Upon arrival, the participants are seated by the experiment administrator at scattered terminals throughout the room to prevent non-institutional interactions and collusion. The participants are randomly assigned to play the role of either merchant or consumer. Participants are given detailed instructions in both paper and digital (i.e., through the computer terminal) forms. All the experiment sessions are conducted by the same experiment administrator who follows a standard set of guidelines and instructions. The administrator informs the participants of the nature and purpose of the study. Each group is given sufficient time to read the experiment case description corresponding to the treatment before they start their market trading activities. The experiment instructions are read aloud to the participants by the administrator to create common knowledge among them. Questions from the participants are repeated clearly before being answered by the administrator. In addition, goals or anticipated outcomes of the experiments are not discussed by the experiment administrator. Prior to the start of each session, the participants undergo two trial trading periods and complete a test designed to check their understanding of the trading rules and incentive structures. To minimize the effect of differences in individual learning capability, the first five trading periods are omitted from the two experiments' data analyses.

The participants are encouraged to deliberate as much as possible while making their decisions and win as much as they could. To reinforce the plausibility of monetary rewards, the experiment administrator carries and unabashedly displays a large stack of cash to the participants. Merchants earn money by selling above their costs while consumers earn by buying below their valuation price. In all the sessions, the consumers are not allowed to purchase above the valuation price and the merchants are not allowed to sell below the cost price. To model heterogeneity in consumers' costs and merchants' valuations, every consumer and merchant in a treatment group comply with different cost and valuation parameters determined by the induced supply and demand schedules used for the experiment session. To reduce the possibility of collusion external to the experimental setting, a different (random) parameter-disguising scalar is added to the demand and supply schedules such that the price units are not readily comparable across experiment sessions.

In each trading period, merchants first simultaneously declare their listed price information and update their own websites. In the CS website availability treatment, the system automatically consolidates all the merchants' price and product information in one single page. After all merchants have submitted their product offer information, a consumer is chosen randomly to shop for his or her purchases in the market. Consumers can visit the seller websites (and CS website if in the CS website availability treatment) to make the purchase decisions. Consumers continue to shop until they have fulfilled the capacity of units bought, are out of eligible sellers or wish

to stop. To satisfy the fundamental assumption that demand (supply) is downward (upward) sloping, consumers (merchants) are restricted to purchase (sell) the highest-valued (lowest-cost) units before any lower-value (higher-cost) units can be bought (sold) [Davis & Holt 1993]. After a consumer has finished the shopping process, another consumer is selected randomly from a waiting mode, and the consumer shopping process is repeated. This form of procurement order is to replicate the online purchasing traffic where an individual website receives consumer traffic in an evenly distributed manner rather than having a website receiving consumers at one time and none in the rest of the time. This approach is in accordance with the extant studies on experimental economics [Davis & Holt 1993, 1994]. A market trading period ends when all consumers have had an opportunity to make purchases, or when all merchants are out of "units" for sale.

After each period, the participants receive an update of their cumulative rewards up to that point in time. To minimize end-game effects whereby participants may exhibit opportunistic behaviors, the participants are not informed of the number of actual trading periods in a session. Last five trading periods are omitted from the two experiments' data analyses to further reduce the end-game effects. At the end of the experiment sessions, the participants are warned not to discuss the experiment details with others.

4. Experiment 1 - Effect of a CS Website under Asymmetry Merchant Market Power

Experiment 1 investigates the impact of a CS website in the absence or presence of market power (Hypotheses 1 and 2). To model the market with market power, we reference the market design developed by Davis & Holt [1994]. Specifically, this set of experiments aims to find out whether the CS website is more likely to limit or divert prices from the competitive equilibrium in markets where the merchants are asymmetric in market power (manipulated through specifying the selling capacities of the merchants). The operationalization of market power by selling capacity is due to the reason that merchants with strong brand equities such as Amazon and Dell are bigger scale players in e-commerce with higher sales volumes and supply capacities.

4.1. Market Design

Experiment 1 encompasses eight sessions involving the posted offer institution, market power and CS website treatments. Each session consists of two sequences of 10 trading periods, with prices being posted publicly by merchants and consumer making their purchases subsequently.

In the absence of market power design, the demand and supply schedules stipulate that each of the five merchants (i.e., S1, S2, S3, S4 and S5) should have a single low-cost unit and merchants S1-S3 have two additional high-cost units each (Figure 1). In total, no merchant has more than three units out of the market capacity of 11 units in the market design. Since the demand is only for eight units at prices above the competitive level, P_c=\$8, any merchant who raises the price above the common competitive level will not be able to sell any of the units on hand. In other words, if all merchants post the highest competitive price, P_c, and offer all units for sale, no merchant is able to unilaterally increase profit because a unilateral price increase will result in no sales and a unilateral decrease will not increase profit. This makes P_c the market equilibrium as no merchant is able to increase profit by raising the price or deviating from the equilibrium. Theoretically, S1, S2 and S3 can earn \$10 each from the sale of 3 units at competitive price (P_c), while merchant S4 and S5 earn \$6 each from the sale of one unit.

In the presence of a CS website, any price cutting measures can be easily observed and hence matched more rigorously, resulting in the transaction price approximating P_c (i.e., \$8). Comparatively, in the absence of a CS website, the cost of monitoring rivals increases. Hence, the transaction price should converge toward the competitive price equilibrium at a slower pace, resulting in a slightly higher transaction price (i.e., $P > P_c$).

In the presence of market power design, market power is created by reallocating merchant S3's high-cost units to S1 and S2 (see Figure 1). S1 and S2 are now able to offer up to four units each, whereas merchants S3 to S5 may offer only one unit each. For merchants S1 and S2, the aggregate capacity of their rivals has decreased by one unit, so a unilateral price increase above the competitive price will result in sales of one unit instead of no unit. It will be profitable for S1 and S2 to price above P_c, such that the increase in revenue for the sale of one unit at monopoly price, P_m=\$16.00, exceeds (i.e., P_m-P_c) the lost profit of $3(P_c–C$[8]) on the three marginal units. This results in the minimum market price, $P_{min}=(3C+P_m)/4$=\$8.50, which is above P_c and below P_m. Consequently, merchant S1 and S2 can earn, on average, a minimum profit of \$14 (calculated as P_m – cost of 1st unit) each while the rest of the merchants can earn \$6.50 (calculated as P_{min} - cost of 1st unit) each.

In the presence of a CS website, any price adjustment is easily detectable. With the reduction in the cost of monitoring competitors' prices, merchants are now able to know when to adjust prices to match their competitors' prices and when to avoid matching prices in a timely manner [Kauffman & Wood 2000]. Therefore, given sufficient incentives to raise the listed price among the larger merchants, the presence of a CS website may drive up the

[8] C denotes the highest cost of all the units.

transaction price by motivating smaller merchants to match the listed price. We could then expect the presence of a CS website to lead to a higher transaction price that is closer to P_m, while its absence would lead to a lower transaction price that is closer to P_{min}.

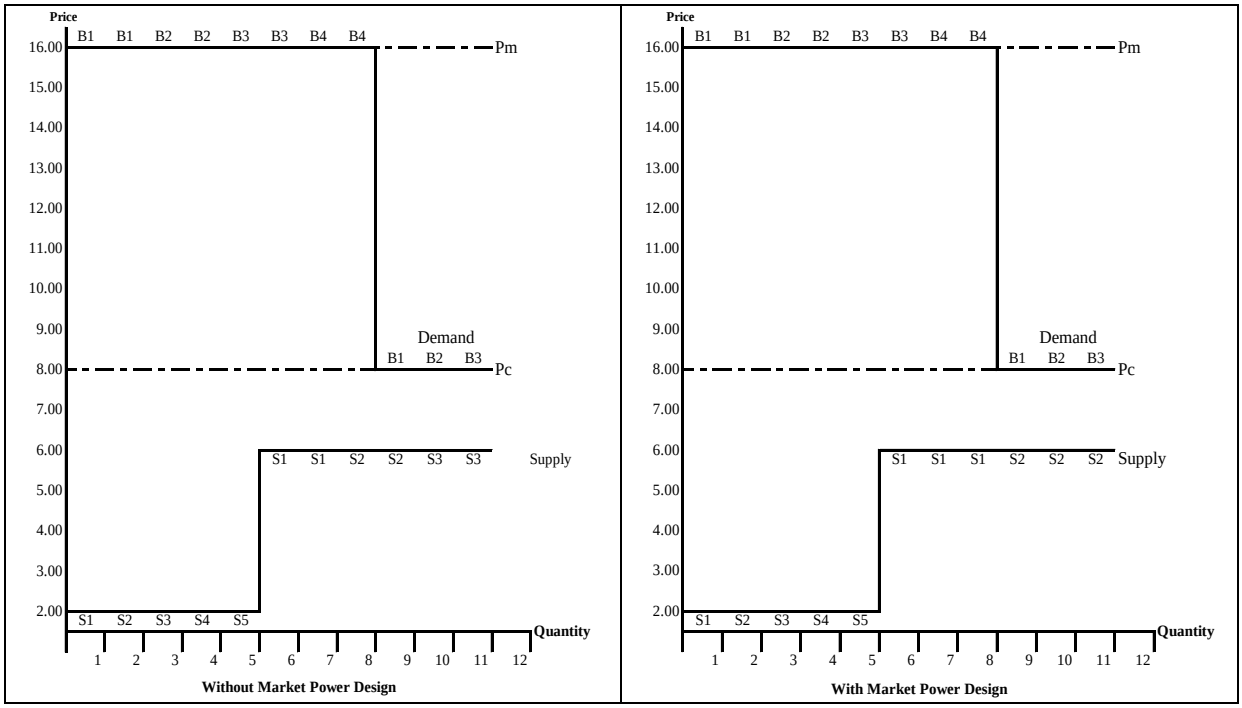

Figure 1: Supply and Demand Schedules for Experiment 1

4.2. Operationalization

In Experiment 1, for each trading period, all merchants decide on the prices to be posted and enter the price information onto the decision screens of the experiment trading system. After all merchants have submitted their product offer information, a consumer is chosen randomly to shop for his or her purchases in the market. In the CS website non-availability treatment, consumers can only obtain information from and trade with each merchant through these individual merchants' price screens. In CS website availability treatment, all the selling price information is consolidated into one single page for all consumers to access. The provision of this aggregated information to the consumers at no cost means that their search cost is reduced significantly. Consumers continue shopping until they have fulfilled the capacity of units bought, are out of eligible merchants, or wish to stop.

4.3. Results

Prior to statistical testing, the data are assessed for normality and homogeneity of variance requirements of parametric statistical tests. The Shapiro-Wilks test for normality shows that the dependent variables of transaction price and merchant surplus do not satisfy the normality requirement. Similarly, the univariate Levene's homogeneity of variance tests reveals that the variances of the dependent variables are also non-homogeneous. Hence, non-parametric Mann-Whitney U tests are used to detect the significant effects for the dependent measures at the five-percent significance level.

Table 2: Result of Statistical Tests for Experiment 1.

Market outcome variables	**Market power absent**			**Market power present**		
	CS website present	**CS website absent**	**Effect of CS website**	**CS website present**	**CS website absent**	**Effect of CS website**
Transaction price (Std. Dev.)	8.226 (0.266)	8.687 (0.398)	Z = -3.760 P < 0.01 **	12.648 (1.350)	10.280 (0.487)	Z = -4.761 P < 0.01 **
Merchants' % of surplus	37.516 (3.172)	38.780 (3.156)	Z = -0.974 P = 0.341	70.781 (12.475)	51.843 (5.985)	Z = -4.369 P < 0.01 **

** Significant at 5% level (2-tailed)* *** Significant at 1% level (2-tailed)*

Table 2 summarizes the results of the statistical tests. As shown in the table, significant differences in the transaction prices exist in the CS website treatment in both designs and several interesting patterns can be observed in all eight sessions. In the presence of market power, the existence of the CS website leads to significantly higher transaction prices ($z = -4.761$, $p < 0.01$) and merchants' surpluses ($z = -4.369$, $p<0.01$). Hence, H1a and H1b are supported. From Figure 2, we can see that the transaction price approaches the monopoly price P_m, though there is no indication that the transaction price would stabilize. One plausible explanation for the significance is the synergy effect of market structure and search cost. In the presence of market power, smaller merchants (S3-S5) are only able to raise the price above P_{min} if at least one of the larger merchants (S1-S2) prices above P_{min}. Since any price change in the presence of the CS website would be more noticeable and be matched faster, the average transaction price is raised and ultimately results in a higher aggregated merchants' surplus (Figure 3).

The influence of the CS website in the absence of market power design is clearly visible in the graphical analyses of the market transactions (see Figure 2). The presence of the CS website yields significantly lower transaction prices ($Z = -3.760$, $p < 0.01$) but no significance effect is detected for merchants' surplus ($Z = -0.974$, $p > 0.05$). Hence, H2a is supported but H2b is not. The price movement in Figure 2 suggests that in the presence of the CS website, transaction price converges toward the competitive equilibrium (P_c) faster than that in the absence of the CS website. A likely reason for the observation is that when none of the merchants possesses any market power or any other competitive advantage (e.g., product differentiation), no one is willing to be the price leader to initiate any attempt to collude. Hence, merchants engage in a price war. The presence of the CS website merely speeds up the convergence. Hence, even though by avoiding the CS website (i.e., in the absence of CS website), merchants could price higher, but they would, ultimately, still face perfect competition unless they possess any competitive advantage that distinguishes them from their rivals or the ability to withstand the loss from being undercut.

4.4. Discussions

In Experiment 1, we empirically test the influence of CS website on market performance by varying the market structural characteristic – possession of market power. Our findings from Experiment 1 generally support the results of prior price-leadership studies [Davis & Williams 1991; Deneckere 1992] and indicate that in the presence of market power, the availability of CS website can lead to significantly higher market transaction price. From our operationalization of market power through selling capacity, merchants with market power are motivated to initiate price raising attempts. Leveraging on a CS website, a merchant can signal price collusion by raising its selling price [Kreps & Sobel 1994]. This is clearly broadcasted by the CS website to all the competitors. Competitors do often match the price in the following trading period. A plausible explanation is that the presence of a CS website reduces the cost of cross monitoring among merchants. Any price change initiated by large merchants will thus be detected and trigger a cooperative or punitive reaction by their rivals with minimum delay. This finding also concurs with Varian [1999] that under certain market circumstances (e.g., market power conditions), online merchants may in fact benefit from the presence of a CS website that aggregates merchants' offers.

However, in the absence of market power condition, the results harmonize with the past Internet competition literature indicating that the presence of a CS website can lead to lower transaction prices [Ellison & Ellison 2001]. The availability of a CS website intensifies competition and forces transaction prices to converge to the competitive equilibrium. This is because when none of the merchants has sufficient incentive to initiate any price increment, they will not be inclined to assume to role of price leader in the market. Interestingly, we do observe that even in the absence of a CS website the transaction price does still fall to the competitive equilibrium but at a slower pace. This may imply that even if CS websites do not exist on the Internet, it is likely that merchants will still have to face intense competition. The presence of CS websites merely makes this more apparent. Hence, it is conceivable to advise merchants to differentiate themselves, to utilize CS websites as an avenue to satisfy consumers' urge to practice comparison shopping [Scitovsky 1952] and to reach out to competitors who will 'cooperate' in price setting attempts [Deneckere 1992].

Convincingly, findings from Experiment 1 suggest that the presence of a CS website can improve communicability among market players. Its presence permits information asymmetries among competitors to be reduced. It also allows for the immediate evaluation of competitors' pricing through consolidated webpages, thus enabling a merchant to review, detect, and match or beat the prices of their competitors in a timely manner. However, whether merchants benefit (or suffer) from an upward (or downward) pricing pressure will largely depend on: (1) the incentives (this is induced by market power in the experiment) for merchants to initiate price raising attempts, and (2) the presence of a CS website to reduce the cost of monitoring competitors.

Although this set of experiments provides compelling empirical evidence of the economic impact of a CS website on price, it sheds little light on whether the provision of a CS website will further benefit consumers besides in the price. More specifically, in markets with product differentiation, will the provision of a CS website raise product quality level and prevent consumers from being cheated by unscrupulous merchants? Experiment 2 seeks

both to provide an instantiation of the phenomenon of a CS website in the context of differentiated product markets, and to supplement the findings of Experiment 1 by theorizing the economic implications of a CS website.

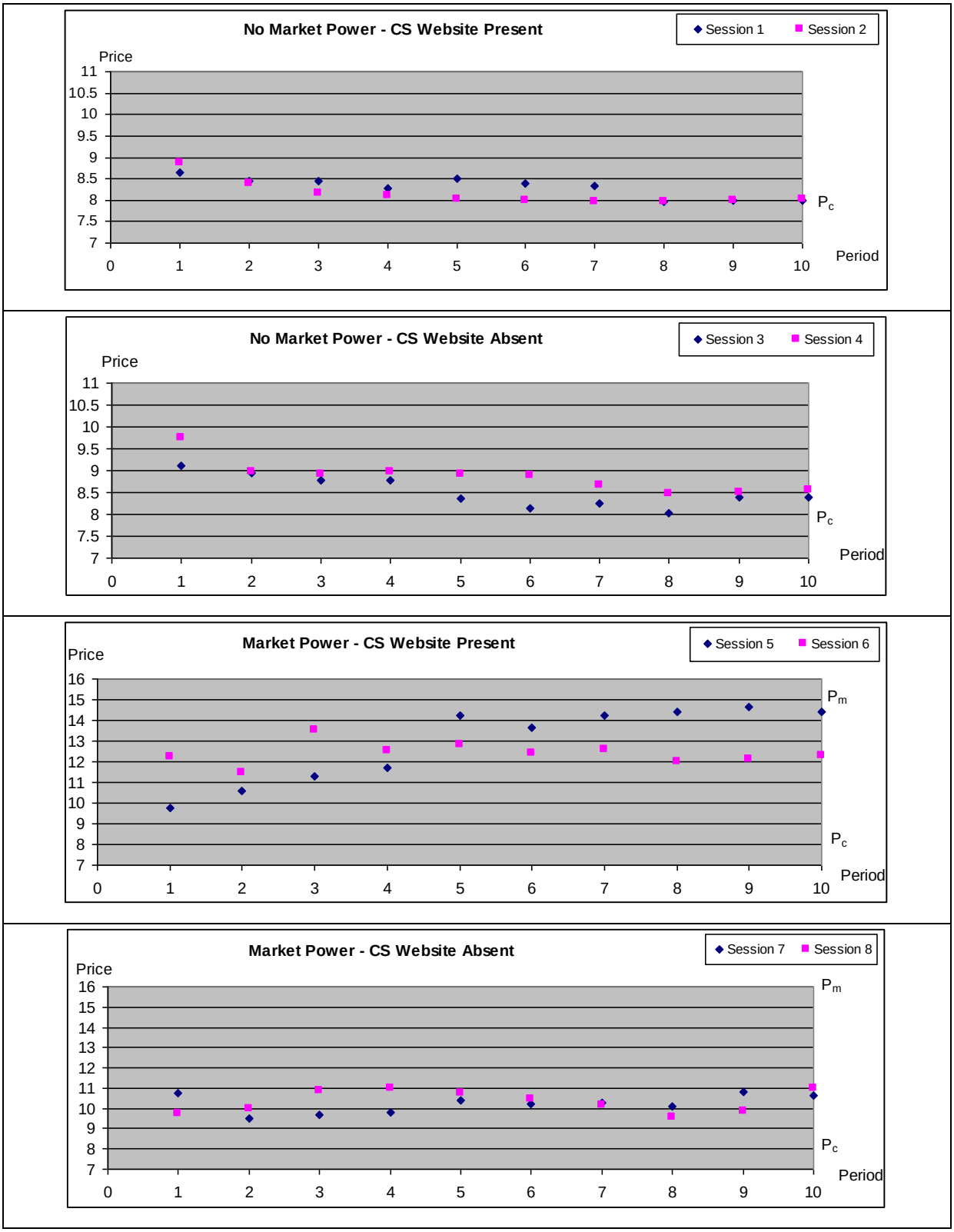

Figure 2: Transaction Prices in Experiment 1

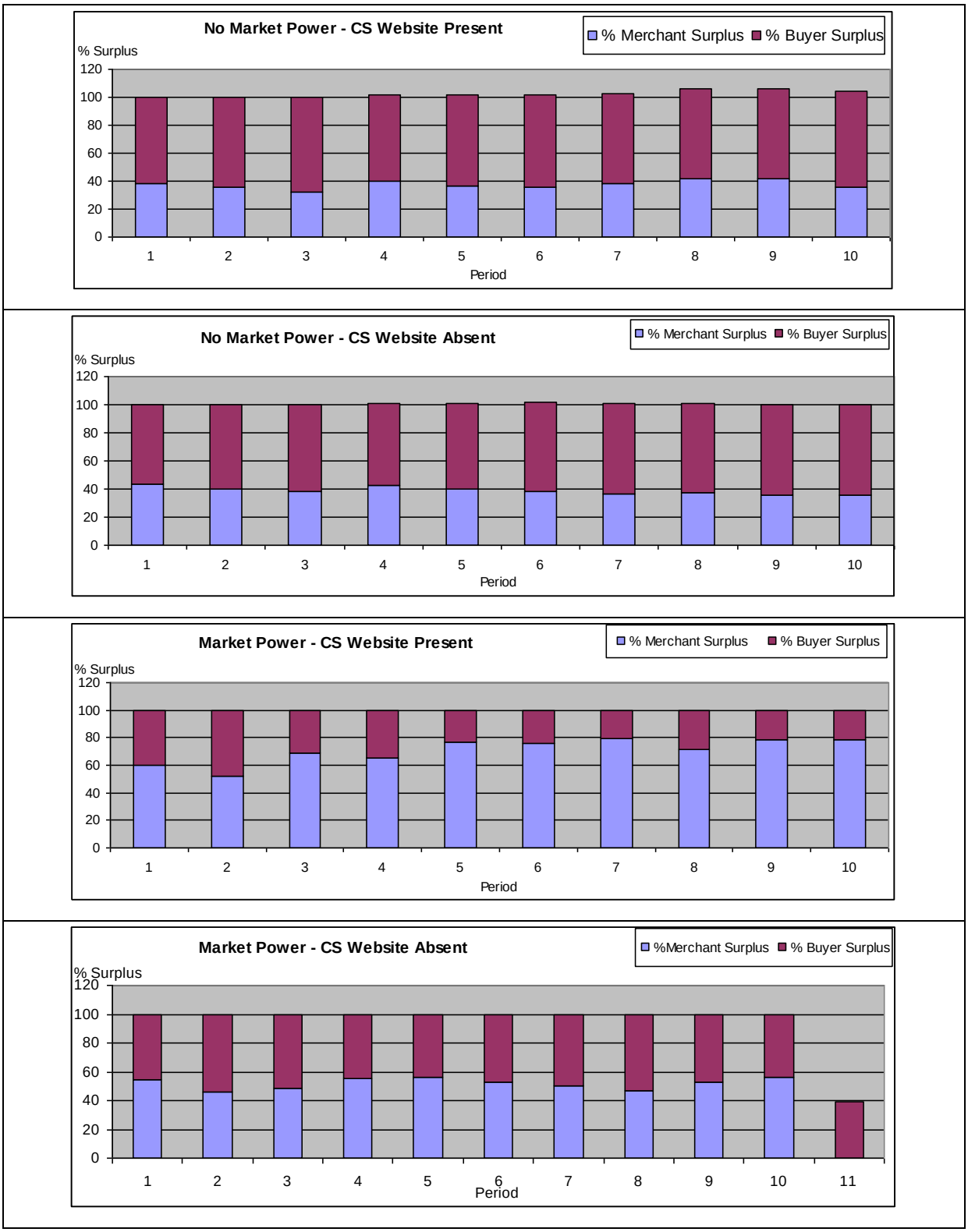

Figure 3: Surpluses in Experiment 1

5. Experiment 2 - Effect of a CS Website in a Differentiated Product Market

Experiment 2 investigates the impact of a CS website in a commodity product market and a differentiated product market (Hypotheses 3 and 4). To model the product markets, we reference the market design by Davis & Holt [1993]. Our objective here is to examine whether a CS website is more likely to intensify or mitigate price competition in different product markets.

5.1. Market Design

Experiment 2 encompasses eight sessions involving posted offer institution, product type and CS website treatments. Similar to Experiment 1, each session in Experiment 2 consists of two sequences of 10 trading periods, with prices being posted publicly by merchants and consumer making their purchases subsequently. Figure 3 depicts the induced demand and supply schedules in a differentiated product market where the products traded are of either "regular" or "super" quality. In the commodity product market, the demand and supply schedules are identical to that of the regular quality product in the differentiated product market.

In the commodity product market design, the demand and supply schedules stipulate that each of the six merchants (i.e. S1, S2, S3, S4, S5 and S6) should have two units of "regular" quality to sell and each of the six consumers (B1, B2, B3, B4, B5 and B6) has up to two units of "regular" quality to purchase. Each of the consumers has a high-value and a low-value unit (except for B1 who has the same valuation price for two units). It is clear from Figure 3 that the predicted competitive price is between \$1.30 and \$1.40. Since, the demand is only for five units at price above the competitive level, P_c = \$1.40, and there are six merchants of two units selling capacity, any merchant who raises the price above the common competitive level will not be guaranteed to sell any of the units on hand. This makes the \$1.40, the market equilibrium price as no merchant is able to increase profit by raising the price or deviating from the equilibrium. Evidently from Figure 3, merchants are expected to benefit from 50% of the total surplus.

Similar to the argument put forward in Experiment 1, the presence of CS website will make any price cutting attempt to be easily observed and hence matched more rigorously, resulting in the transaction price approximating the competitive price equilibrium of \$1.40. Comparatively, in the absence of CS website, the cost of monitoring competitors increases. Thus, the transaction price should converge toward the competitive equilibrium at a slower pace, resulting in a slightly higher mean transaction price (i.e., $P > P_c$).

In the differentiated product market design, the product market is characterized by the trading of either "regular" or "super" quality products. The equilibrium predictions are computed based on the 'Super' quality product because it is generally assumed that rational consumers prefer higher quality products that provide higher levels of utility and consumer welfare. As evident in Figure 3, the demand for 'super' quality product is five units at price above the competitive level of \$2.10, any merchant who raises the price above the common competitive level will not be assured of selling any units on hand. Hence, \$2.10 is the market equilibrium price for 'super' quality product market as no merchant is able to increase profit by raising the price or deviating from the equilibrium.

In the presence of CS website, consumers are able to better gauge the merchants' product quality claims through third-party expert evaluation information. When consumers are more informed, merchants are able to practice price and product discrimination. This should lead to higher transaction price which can rise above competitive price of \$2.10 and merchants can extract up to 100% of the total surplus available. However, in the absence of CS website, consumers are not able to effectively gauge the quality of the products and hence choose to purchase those of lower prices. Hence, the transaction price can expected to slightly higher than the competitive price of \$2.10 due to positive search cost but lower than the transaction price in the presence of CS website due to difficulty in determining the product quality.

5.2. Operationalization

To examine the impact of a CS website on product choice, the trading system and the CS website are implemented slightly differently from Experiment 1 in Experiment 2. In Experiment 2, for each trading period, all merchants chose the relevant product offer choices, such as quality level (in differentiated product treatment) and price, and enter the product offer information onto the decision screens of the experiment trading system. After all merchants have submitted their product offer information, a consumer is chosen randomly to shop for his or her purchases in the market. In the commodity product market treatment, the CS website is designed to be the same as in that in Experiment 1. However, in the differentiated product market treatment, the CS website provides consumers with not only merchant and current price information, but also the corresponding historical price and actual product quality information. Consumers continue shopping until they have fulfilled the capacity of units bought, are out of eligible merchants, or wish to stop.

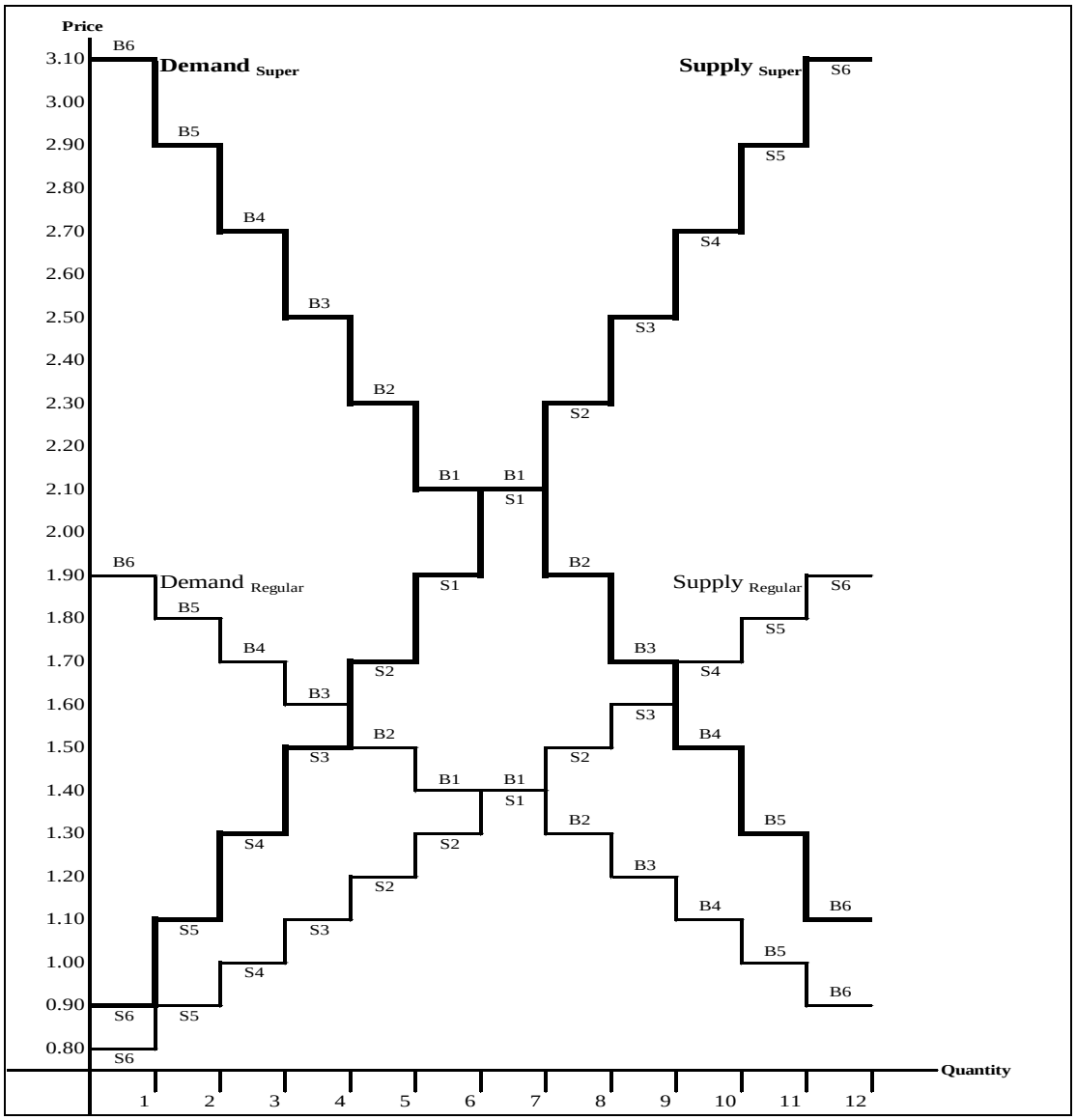

Figure 4: Demand and Supply Schedules for Experiment 2

5.3. Results

The collected data are also assessed for normality and homogeneity of variance. Both the Shapiro-Wilks and univariate Levene's Homogeneity of variance tests reveal that the population is decidedly non-normal and the variances of the dependent variables are also non-homogeneous. Hence, the non-parametric Mann-Whitney U test is used to detect the significant effects of the CS website. Table 3 depicts the results of the statistical tests.

Table 3: Result of Statistical Tests for Experiment 2

Market outcome variables	Commodity product market			Differentiated product market		
	CS website present	CS website absent	Effect of CS website	CS website present	CS website absent	Effect of CS website
Transaction price (Std. Dev.)	1.445 (0.103)	1.550 (0.075)	Z = -4.004 P < 0.01 **	1.724 (0.247)	1.881 (0.212)	Z = -2.340 P = 0.02 *
Merchants' % of surplus	67.830 (27.769)	86.871 (30.513)	Z = -3.003 P < 0.01 **	97.242 (60.385)	162.924 (87.904)	Z = -3.287 P < 0.01 **

** Significant at 5% level (2-tailed)* *** Significant at 1% level (2-tailed)*

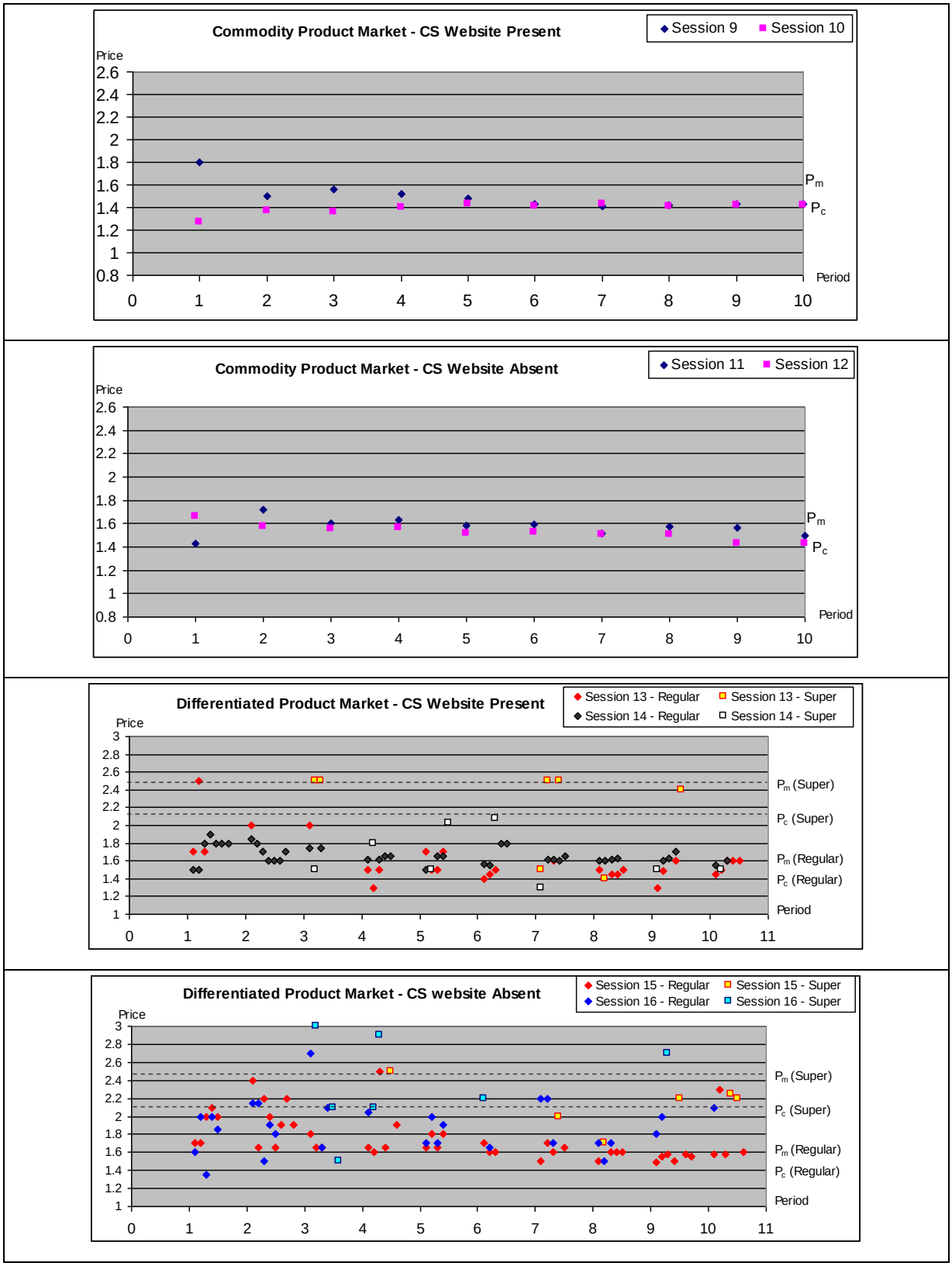

Figure 5: Transaction Prices in Experiment 1

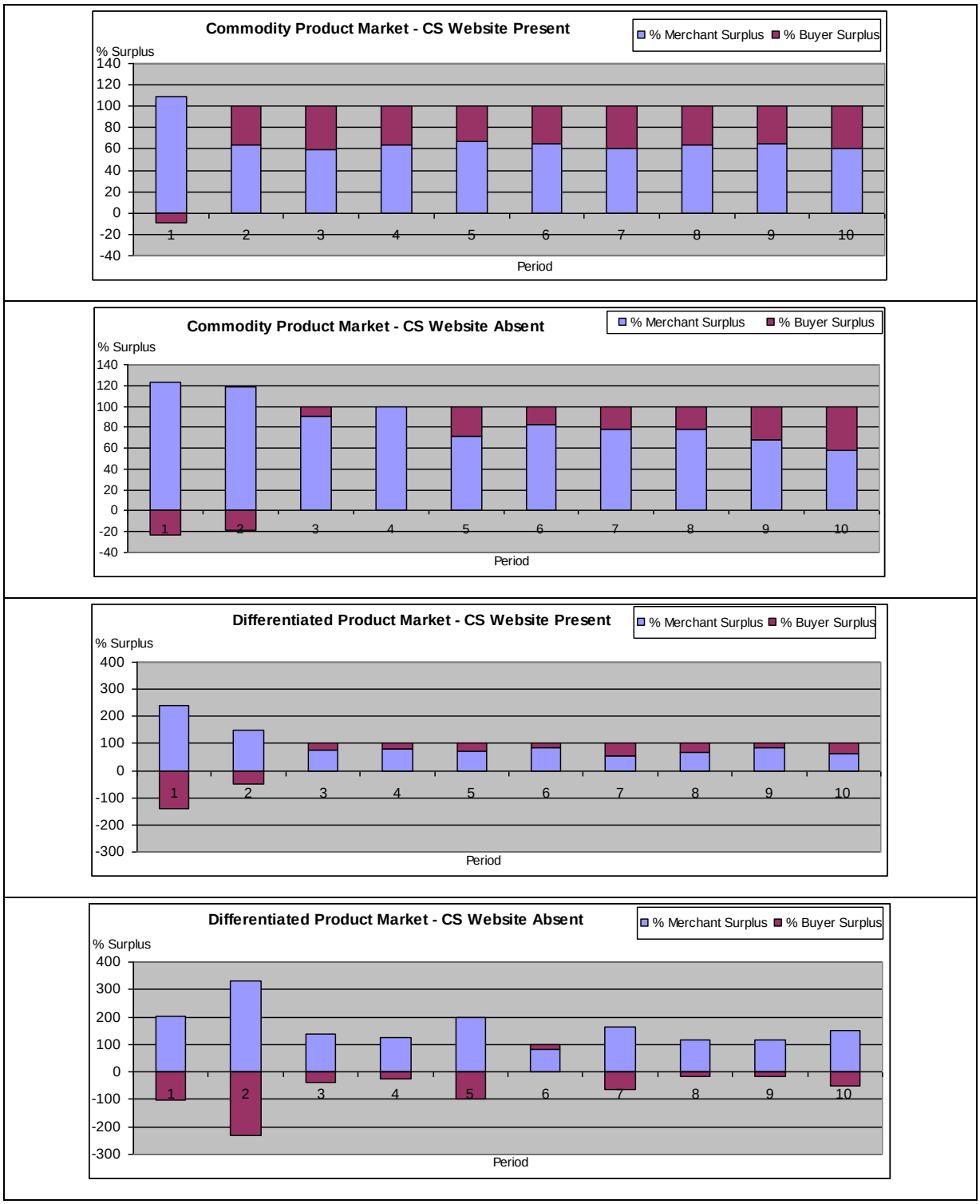

Figure 6: Surpluses in Experiment 2

In the differentiated product market treatment, the theoretical prediction is that the presence of CS website should lead to higher transaction prices and higher merchants' surpluses. However, the results indicate that the existence of the CS website leads to significantly lower transaction prices ($z = -2.340$, $p < 0.05$) and merchants' surpluses ($z = -3.287$, $p < 0.01$). Hence, H3a and H3b are not supported. The presence of the CS website fails to significantly increase the number of high-quality products sold (Figure 5). The number of super products sold in the

presence of the CS website is only 16 compared to 13 in the absence of the CS website. The units transacted in both markets are mainly dominated by regular products. In the absence of the CS website, almost all of the super products sold command prices near the competitive price of $2.10. In the presence of the CS website, most of the super products are sold below the competitive price of $2.10. However, in both markets, it seems that merchants are able to sell regular products above the competitive price of $1.40. Consequently, the merchants in the presence of CS website are not able to extract a higher percentage of the total surplus than those in the absence of CS website (Figure 6). It is imperative to note that the percentage of merchant's surplus could rise above 100% as the merchants could sell the "regular" quality product at the "super" quality product's price range.

The influence of the CS website in the commodity product market is clearly visible in the graphical analyses of the market transactions (see Figure 5). In the absence of the CS website, market transaction prices cluster, high above the competitive price of $1.40, at $1.55 while in the presence of the CS website, they cluster around the competitive equilibrium price of $1.40 (Figure 5). Hence, H4a is supported. Furthermore, the presence of the CS website leads to significantly lower merchants' surplus. Hence, H4b is also supported.

5.4. Discussions

In Experiment 2, we empirically test the influence of CS website on market performance by varying the market structural condition of product type – commodity and differentiated product markets. Results from Experiment 2 suggest that in differentiated product market, CS website neither raises product quality level nor help merchants practice price/quality discrimination despite the provision of current and historical information on merchants, product quality and prices to consumers at no cost. Merchants appropriate most of the total trading surplus. A CS website is only useful to the extent that it improves consumer welfare by preventing consumers from being cheated by dishonest merchants who sell low-quality products at high prices. Careful examination of the data reveals two interesting explanations for the rampant provision of low-quality products. First, our data indicate that consumers who have been cheated become very wary of dishonest merchants and high-priced goods, and would not purchase any merchant-proclaimed high-quality goods. It is important to note that opportunistic behaviors displayed by merchants can engender distrust between consumers and merchants, which in turn leads to the breakdown of high-quality product markets.

Second, in the data, no high-quality products are sold in the first few periods, and in the availability of the CS website, only an average of 19.44% of the goods traded (16 out of 84 transactions) are of high quality. Consequently, the CS website used in our markets is not able to provide much information about high-quality products to allow consumers to form expectations of price vis-à-vis quality. This result suggests that externality plays an important role in the online marketplace. For example, we observe in our data that when the markets are overwhelmed with low-quality products, the externality effect of the visibility of low-quality product transactions generates negative feedback among consumers. Such externality effects of the visibility of high/low-quality product transactions are of a self-perpetuating nature in such markets [Shapiro & Varian 1999]. Similarly, when the market is flooded with low-quality products, merchants are more likely to believe that there is no market for high-quality products. Hence, they are more reluctant to sell high-quality products. In sum, the outcome of markets is very much dependent on the strategic behaviors of merchants and consumers. The presence of a CS website makes such externality more noticeable.

In the commodity product market treatment, the findings concur with previous economic literature, which deduce that providing price information to consumers should lower price [Bakos 1997], and are consistent with the results from the absence of market power treatment in Experiment 1. The presence of a CS website apparently facilitates the attainment of the competitive equilibrium. Thus, it is conceivable to argue that CS website addresses the costly problem of gathering information and achieve the dual objectives of eliminating search cost and providing more information.

6. Implications for Theory and Practice

Implications of the findings from this study can be broadly classified in two categories – theoretical contributions and implications for online businesses. As a theoretical contribution, most extant literature have paid particular attention to how consumers benefit from significant reduction in search cost [see e.g., Ellison & Ellison 2001] but this study includes the examination of CS website's influence on merchants' pricing strategies. The results from the experiments starkly challenge the implicit assumption that consumers, using CS websites, are likely to benefit from lower search cost in obtaining information, and thus increase competitive pressure among merchants due to the enhanced opportunities for price comparison [Diehl et al. 2003; Lynch & Ariely 2000]. In fact, the findings provide compelling empirical evidence that there are differentiated price consequences (i.e., market competitiveness) of CS websites under different market structural conditions.

Predominantly, in the commodity product market and the absence of market power treatments, the findings concur with extant literature that lowering search cost will intensify market competition [Salop & Stiglitz 1976]. However, when merchants possess sufficient incentive (i.e., possession of market power) to initiate any price increase attempt, CS website can foster tighter "co-petition" among the merchants and hence results in transaction price deviating from competitive equilibrium. Since there is recurring evidence indicating that there exists an asymmetry market power distribution among the merchants [Saloner & Spence 2002] and online transactions are mostly concentrated on those larger merchants (e.g., Amazon.com), the examination of CS website's impact under asymmetry merchant market power condition becomes critical. We expect this work to spur further research to understand the online pricing dynamics of the merchants and how online technologies affect the competition. Further, although researchers have suggested that the problem of information asymmetry between merchants and consumers can be resolved by providing additional information such as warranties on parts and services for products [Alerlof 1970], our results show that in differentiated product market, the provision of CS website may not be sufficient to resolve the market of lemon problem. Nonetheless, CS website does, to certain extent, allow the consumers to be aware of the dishonest merchants who sell low-quality products at high prices. In view of the fact that a growing number of shopping transactions will take place electronically, the role of CS website in making dishonest merchants more noticeable will consequently become more important in building consumers' confidence to shop online. Indeed, there is an increasing number of studies conducted to examine the economics aspect of product sales and information aggregation online [Bock et al. 2007; Clay & Tay 2001; Madnick & Siegel 2002; Zhu et al. 2008a, 2008b].

Methodologically, this study has applied findings from research in industrial organizational and experimental economics in an effort to extend the existing literature on CS websites by examining the influence of CS websites on merchants' behaviors under different market structures, by means of a realistic simulated electronic commerce environment. Empirical analyses of the economic significance of CS websites have traditionally focused on analytical modeling or econometric analysis [e.g., Ellison & Ellison 2001]. However, these studies suffer from several methodological limitations such as the inability to minimize confounding effects in econometric analysis. Motivated by Smith [1982], we have turned to experimental methods to theorize the impact of CS websites on market performance. Following closely to the precepts of experimental economics, we are able to observe clear causal relationships among CS website, market structural conditions and market performance. From our knowledge, the use of experimental economics by IS researchers is rare with few exceptions such as Levecq [2002]. Indeed, this view is shared by Kim et al. [2002] who proposed conducting virtual field experiments, which makes it feasible and effective to test e-commerce research hypotheses with the appropriate level of experimental controls. We believe that the amount of effort devoted to conduct two series of experiments and to report experimental procedures in details will allow IS researchers to appreciate the uniqueness and usefulness of experimental economics research method. To this end, we have also extended the use of experimentation method beyond examining the institutional factors (e.g., auction) [see Davis & Holt 1993] to study Internet technology's (i.e., CS website) influence on economical well being.

Our findings have equally significant implication for online merchants (e.g., Amazon.com) and CS website marketers (e.g., Dealtime.com) that seek to increase the volume of online shopping and are eager to learn about what it takes to satisfy online consumers and increase profit margins. For the CS website marketers, this study is relevant to them in that it provides empirical evidence to challenge the general belief that the presence of CS websites will lower the value of branding and reduce profit margins. As more consumers recognize the value of CS website in online shopping, the use of CS website is likely to increase. However, the value of CS website depends on the amount of merchants' price and product information available. To attract both consumers and merchants, CS website marketers have to be cautious to the type of merchants' product databases to interrogate and list on the CS websites. On the one hand, listing all small-scale merchants (i.e., those without market power) will force the price down to competitive equilibrium and hence, will benefit the consumers most. On the other hand, listing all large-scale merchants (i.e., those with market power) may promote price collusion and raise the price towards monopoly equilibrium. Hence, CS website marketers need to carefully balance the advantages and disadvantages of interrogating merchants' product databases.

For the merchants, this study will allow the merchants to make better decisions in terms of whether to allow CS website to interrogate their product databases. In traditional markets, merchants choose to physically co-locate to reduce consumers' search cost and facilitate comparison-shopping [Iyer 2001; Dudey 1990]. It is questionable that in online markets, merchants would be against the idea of virtual co-location. Our findings indicate that online merchants should appreciate the improved communicability brought about by a CS website. Essentially, merchants can actually leverage CS websites to demonstrate their product superiority, monitor and respond to competitors' pricing strategies, and market their products and services strategically. Merchants should not view CS websites as a

catalyst to intensify market competition, but rather, depending on the underlying market structure, a place where favorable marketing strategies can be derived and pursued. Furthermore, on the basis of trust-building, merchants can use a CS website strategically in their attempts to establish successful long-term relationships with their consumers.

Certainly, merchants can block CS websites from interrogating their databases and benefit from an increase in consumer search cost. However, as more merchants choose to co-locate at a CS website, consumers may eventually choose to trade only with merchants that are listed at CS websites for convenience and for a wider variety of selection. Furthermore, merchants that are not listed in a CS website may be perceived negatively as merchants charging higher prices. Indeed, as more consumers develop the habit of shopping through CS websites, it is very likely that merchants that are not listed at CS websites will be bypassed and ignored. In addition, merchants with market power can leverage such CS website to signal other merchants to price higher [Kauffman & Wood 2000] and merchants without market power can "follow the leader" by setting the price to be slightly lower than that of the larger merchants' [Haveman 1993].

While merchants stand to profit from the presence of CS websites, consumers can continue to benefit from it through engaging in comparison shopping. Although CS websites may not be able to bring about perfect market outcomes, as evident in the results of Experiment 2, the facilitation of access to multiple merchants' product information can easily reveal any unscrupulous acts. Essentially, the presence of technology can promote a more harmonized trading environment where both merchants and consumers benefit.

7. Limitations and Suggestions for Future Research

This study has some limitations which offer several opportunities for future research. First, our set of experiments restricts the market to a small number of merchants. We contend that despite the small number of players in each experiment session, we are able to project significant differences in transaction prices. Our experiment of five merchants is analogous to the situation where a consumer separately browses the top few websites resulting from a search with a standard search engine. Besides, the results of our experiments indicate that consumers are unable or unwilling to compare all merchants' offers simultaneously, even if the number of websites involved is small. This inability or unwillingness impairs market outcomes. We can deduce two reasons for the behavior from our observations of our experiments and the log data of search frequency in the experiments. First, consumers appear to favor the satisficing search strategy whereby they purchase the first product they come across that is priced below their valuation. Second, consumers are likely to exhibit a high degree of cognitive laziness or miserliness by not bothering or attempting to remember prices they have previously viewed and by not opening multiple windows on their computer screen to facilitate comparison. However, as the experiment proceeds, consumers begin to realize who the merchants with the lower price offers are. Hence, the competitive price equilibrium toward the end of the experiment session is observed.

Second, although our research has utilized a laboratory experimental setting with strict controls (e.g., the number of consumers and merchants in the markets, and the type of market institution), there may exit concern over the realism of the study since the experiment participants are all university students. Given that our laboratory markets are real markets in the sense that principles of economics apply there as elsewhere, and the subjects earn real profits within the context of realistic market trading rules [Smith 1982], we believe the experiments have met certain level of realism. Furthermore, prior studies comparing the use of students and practitioners as subjects could not find sufficient evidence indicating a difference in the results between the two sources of recruitment [Holt & Issac 2002]. Hence, we contend that our choice of students is appropriate and the results should be able to explicate the economic impact of CS websites with confidence. Nevertheless, we do recognize that there may be some reservations about the limited generalizability of the results and future research can be conducted with different demographic populations. However, we consider this a matter of calibration, and what we expect to generalize from our study is the conceptual point about the impact of CS websites on online competition rather than specific findings about market outcome variables in the presence of a CS website.

Third, our operationalization of market structural conditions is restricted. While we believe that data provide a systematic yet conservative test of CS website, additional operationalization of the factors (e.g., market power and CS website) will likely to provide new insights. In particular, brand establishment could be another key factor determining whether a merchant possesses market power [Smith & Brynjolfsson 2001] besides selling capacity. Regulatory interventions and online feedback mechanisms as those implemented in eBay [Ba & Pavlou 2002] may be able to better facilitate the consumers in gauging the quality of the products and hence, better address the problem of information asymmetry and raise the overall product quality level in the markets.

Future research could also be conducted to examine the pricing strategies of merchants and the search or purchase strategies of consumers in scenarios where collective buying is possible and merchants can choose either to

block or not to block a CS website from interrogating their product databases, and where consumers are differentiated into business consumers and end consumers [Floh and Treiblmaier 2006; Zhou et al. 2007]. In addition, along the lines of Lyer & Pazgal [2003], we hope to investigate the pricing and surviving strategies adopted by the existing CS websites in relation to merchants and consumers in business-to-business (B2B) and business-to-consumer (B2C) environments. Third, we are also interested in the characterization of the demand and supply schedules of the experimental goods traded in our experimental markets. We hope to experiment with a wider variety of supply and demand schedules (e.g., the introduction of more merchants and consumers) that could more accurately represent those of specific products or information services available in online marketplaces (e.g., wine).

8. Conclusions

Increasingly, more innovative and technologically advanced websites are being deployed in the electronic commerce environment to assist consumers in online shopping [Lim & Benbasat 2000; Todd & Benbasat 1992]. Particularly, CS websites can be a boon to consumers gathering vast amounts of price and product information and engaging in more extensive comparison among the available options [Tan et al. 2010]. However, these technologies need to be applied with care to reduce potential negative side effects – such as commoditizing markets and limiting the value of branding due to a higher level of comparison shopping, and to generate positive effects – such as promoting cooperation among merchants.

This study contributes to our understanding of the effects of CS website on merchant's behavior and market performance in various market structural conditions. Theoretically, this study is one of the first to fill the gap between the lack of rigorous empirical research on CS website and the increasingly popular use of CS website on the Internet. Referencing the experimental economics literature, this study conducted two series of experiments to systematically examine the economic impacts of CS website to help CS website marketers, online merchants and consumers to make more prudent decisions. The thoroughness of the market designs and the meticulous execution of the experimental procedures will enrich the extant experimental approach commonly adopted by the IS researchers. Empirically, the results provide compelling empirical evidence that there are differentiated price consequences of CS websites under different market structural conditions of market power possession and types of product traded. Applying the appropriate strategies, merchants could leverage or exploit CS websites to reach out to more consumers and increase profit margins.

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APPENDIX
Experiment Instructions

This study's experiment instructions followed closely to Davis and Holt (1993; 1994) instructions. Except for section 9.2 and 9.3, which were distributed to individual participants depending on whether they assumed the role of buyers or sellers, the rest of the sections were distributed to all the participants. Below is a set of instruction for session 11 (i.e., CS website absent and commodity product market treatment).

General Instruction

This is an experiment in the economics of market decision making. The instructions are simple, and if you follow them carefully and make good decisions, you may earn some amount of money which will be paid to you in cash immediately after the experiment.

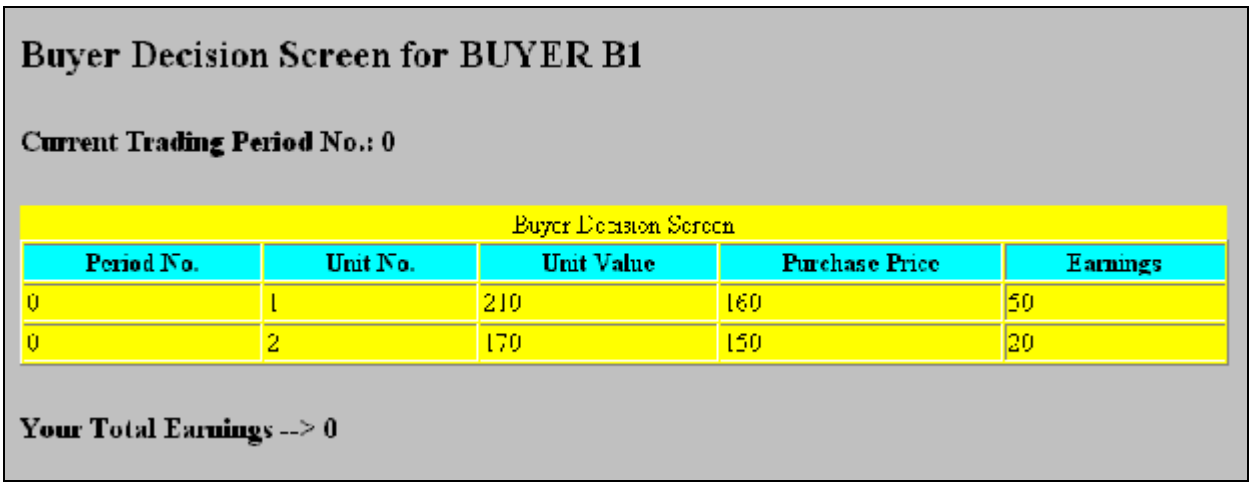
In this experiment, we are going to set up a market in which some of you will be buyers and some of you will be sellers. The product to be traded in this market is divided into distinct items or "units". We will not specify a name for the product; we will simply refer to units.

Trading will occur in a sequence of trading periods. The prices that you negotiate in each trading period will determine your earnings, in dollars and cents. The experiment application system that you will be interacting with will keep track of your earnings automatically as the experiment progresses.

Specific Instructions for Buyers

Buyer decisions and earnings will be recorded automatically on an experiment application module named the Buyer Decision Screen shown in Figure A-1. Trading periods are designated by separate rows. In each trading period, a buyer may purchase up to two units. For the first unit (labeled as 1 in the column marked "Unit No.") that may be bought during a period, the buyer receives the amount listed in column 3, marked "Unit Value". Similarly, if a second unit (labeled as 2 in the column marked "Unit No.") is bought during the same period, the buyer receives the amount listed in column 3, marked "Unit Value". A buyer may purchase one or both units in a period and may buy from either a single seller or different sellers. Below is the information on the number of units you can purchase and their redemption value in ONE trading period. Please do NOT reveal this information to anyone. It is your own private information.

You can purchase up to X units at redemption value of _____ each.



Buyer Decision Screen for BUYER B1

Current Trading Period No.: 0

Buyer Decision Screen

Period No.	Unit No.	Unit Value	Purchase Price	Earnings
0	1	210	160	50
0	2	170	150	20

Your Total Earnings --> 0

Figure A-1: Buyer Decision Screen

Buyers earn money by purchasing units at prices that are below their redemption values. Earnings from the purchase of each unit are computed by taking the difference between the redemption value of the unit and the purchase price. Total earnings are computed by adding up the earnings on all units purchased. In other words,

Earning for ONE unit purchase = Value of the unit – Purchase Price

Suppose, for example, in period 0 on the decision screen, the value of your 1st unit is $210, as shown in column 3 ("Unit Value") of the row for Period 0, Unit No.1, and suppose that the value of your 2nd unit is $170, as shown in column 3 ("Unit Value") of the row for Period 0, Unit No.2. If you pay $160 for your first unit, you would see this amount in column 4 ("Purchase Price"), and your earnings would be $210 - $160 = $50 on the 1st unit, as shown by the entry in column 5 ("Earnings") of the row for Period 0, Unit No.1. Similarly, suppose that you buy a second unit at $150, which is recorded in column 4 ("Purchase Price"). Then your earnings for this unit would be $170 - $150 = $20, as shown by the entry in column 5 ("Earnings") of the row for Period 0, Unit No.2. Your total earnings for the period would be $50 (on the 1st unit bought) + $20 (on the 2nd unit bought), which equals $70.

Earnings in above example are for illustrative purposes only; actual earnings will be lower and depicts in the system. Subsequent trading periods are represented by rows: Period No.1, Period No.2, etc.

Importantly, a buyer does not receive the value for a unit unless the unit is purchased. Thus, earnings for each unpurchased unit in a period are zero. If you are a buyer, the first unit you purchase during a period is your "1st unit", regardless of whether or not other buyers have previously bought units in the period. You cannot buy your second unit before your first unit. At the end of each period, your cumulative total earnings will be recorded below the table in your decision screen.

Specific Instructions for sellers

Seller decisions and earnings will be recorded automatically on an experiment application module named the Seller Decision Screen shown in Figure A-2.

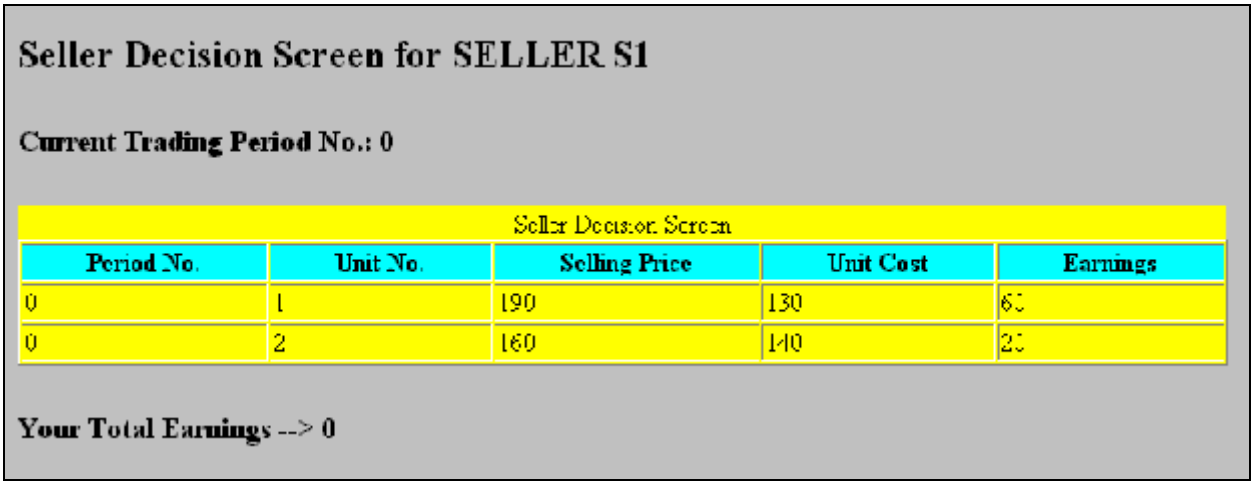


Figure A-2: Seller Decision Screen

Trading periods are designated by separate rows. In each trading period, a seller may sell up to two units. For the first unit (labeled as 1 in the column marked "Unit No.") that may be sold during a period, the seller incurs a cost of the amount listed in column 4, marked "Unit Cost". Similarly, if a second unit (labeled as 2 in the column marked "Unit No.") is sold during the same period, the seller incurs the cost listed in column 4, marked "Unit Cost". A seller may sell one or both units in a period depending on his or her own choice. Below is the information on the number of units you can sell and their costs in ONE trading period. Please do NOT reveal this information to anyone. It is your own private information.

You can sell X units at cost of _____ each.

Sellers earn money by selling units at prices that are above their costs. Earnings from the sale of each unit are computed by taking the difference between the selling price and the unit cost. Total earnings are computed by adding up the earnings on all units sold. In other words,

Earning for ONE unit sold = Selling Price – Cost Price

Suppose, for example, in period 0 on the decision screen, the cost of your 1st unit is $130, as shown in column 4 ("Unit Cost") of the row for Period 0, Unit No.1, and suppose that the cost of your 2nd unit is $140, as shown in column 4 ("Unit Cost") of the row for Period 0, Unit No.2. If you sell your first unit for $190, you would see this amount in column 3 ("Selling Price"), and your earnings would be $190 - $130 = $60 on the 1st unit, as shown by

the entry in column 5 ("Earnings") of the row for Period 0, Unit No.1. Similarly, suppose that you sell a second unit at $160, which is recorded in column 3 ("Selling Price"). Then your earnings for this unit would be $160 - $140 = $20, as shown by the entry in column 5 ("Earnings") of the row for Period 0, Unit No.2. Your total earnings for the period would be $60 (on the 1st unit sold) + $20 (on the 2nd unit sold), which equals $80.

Earnings in above example are for illustrative purposes only; actual earnings will be lower. Subsequent trading periods are represented by rows: Period No.1, Period No.2, etc.

Importantly, a seller does not incur the cost for a unit unless the unit is sold. Thus, earnings for each unsold unit in a period are zero. If you are a seller, the first unit you sell during a period is your "1st unit", regardless of whether or not other sellers have previously sold units in the period. You cannot sell your second unit before your first unit. At the end of each period, your cumulative total earnings will be recorded below the table in your decision screen.

Market Trading Rules

The market for this product is organised as follows: we open the market for each trading period. Each commencement of a trading period will be announced by the experiment administrator. Each seller decides on a price offer, which he or she will enter through the experiment application system (see Figure A-3). Sellers also select a quantity offer to be entered through the experiment application system. The quantity offer represents the maximum number of units a seller is willing to sell at his or her price offer.

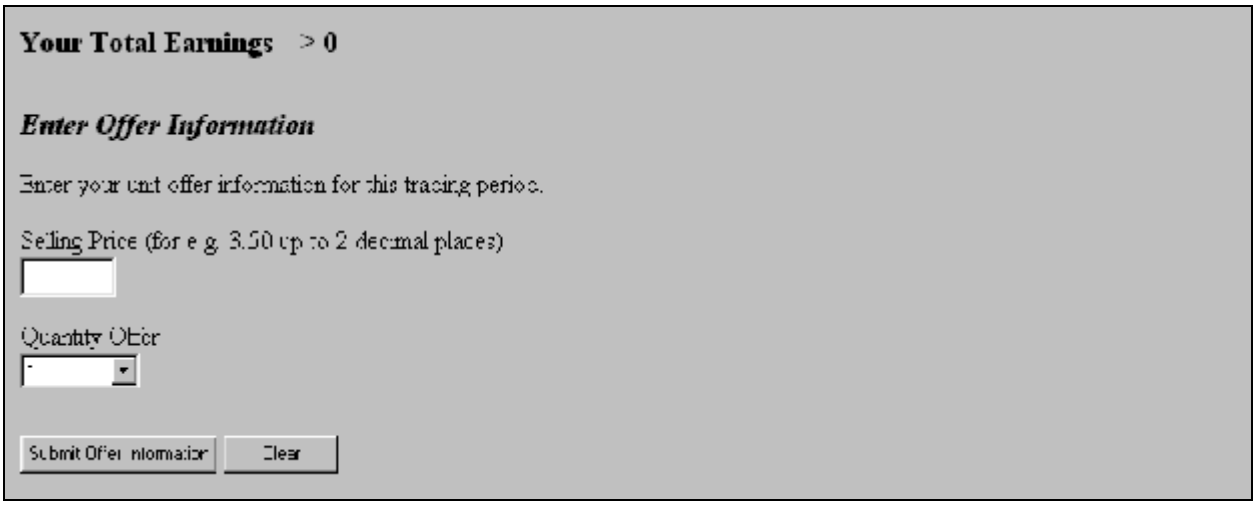


Figure A-3. Seller Submitting Unit Offer Information

The sellers will be given two minutes to submit their price and quantity offers. After all sellers have chosen price and quantity offers, the experiment application system will display all the price offers of the sellers on individual sellers' price screens which all the buyers can see by accessing them separately. Note that the quantity offers are not displayed. Sellers' identification numbers will be used to label their price offers on the experiment application system.

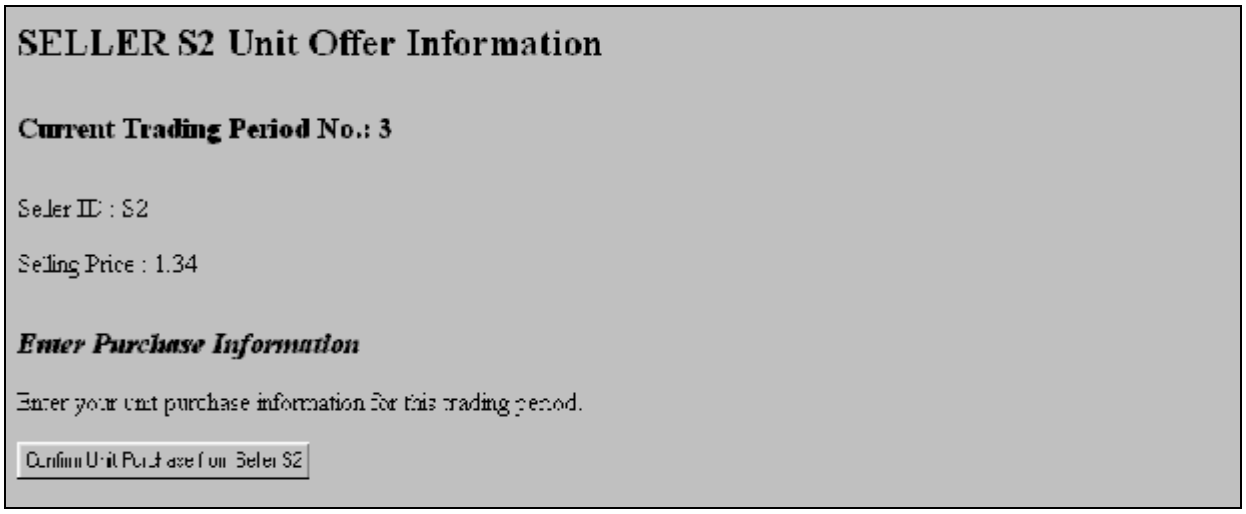


Figure A-4. Buyer Submitting Unit Purchase Information

Buyers will then be free to make bids to purchase whatever quantities they desire (subject to given capacity requirements). Buyers are also free to specify the seller from whom they wish to buy. Purchases will be made as follows: a buyer will be chosen using random numbers, and will indicate the particular seller to transact with through the experiment application system (see Figure A-4). Only one buyer at a time is allowed to purchase units and a buyer has as much time to make purchases as is needed.

Upon the experiment application system's confirmation of a buyer's acceptance of a seller's price offer, the contract information is automatically logged in both the buyer's and seller's decision screens. A buyer is allowed to purchase up to his or her capacity of units, and to purchase those units from any seller desired. However, a buyer cannot purchase a unit from a seller who has sold all of the units offered.

When the first buyer has made all desired purchases, another buyer will be selected at random and will make purchases in the same manner described in the previous paragraph. The process will be continued until all buyers have had a chance to make purchases or all sellers are out of units. This completes the trading period. We will reopen the market for a new trading period by having sellers submit new price and quantity offers, and the process will be repeated. In all trading periods, you are not to speak to any other person. All interactions and transactions for contracts are to be performed through the experiment application system.

Things to note:

1. As a buyer (seller), you can only buy (sell) as many units as you have values (costs).
2. There is no carryover of units not traded across trading period.
3. Always buy (sell) units in order of unit number.