

**IDENTIFYING FACILITATORS AND INHIBITORS
OF MARKET STRUCTURE CHANGE:
A HYBRID THEORY OF UNBIASED ELECTRONIC MARKETS**

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ABSTRACT

The *electronic markets hypothesis (EMH)* in the information systems (**IS**) literature suggests that information technology (**IT**) will reduce coordination costs across firms, leading to market-based forms of economic activity. With the advent of the Internet, we have seen a move to unbiased electronic markets. However, in some industries electronic hierarchies or biased markets predominate, contrary to the predictions of the impacts of IT suggested by the EMH. We present a *hybrid theory* to explain how moves to unbiased markets are facilitated and accelerated by IT. This is based on *electronic markets and hierarchies theory*, and the *theory of market design*. We explore how different forces and situational factors can inhibit the move to advanced forms of market-based organization. Together, these theories offer valuable insights to understand which forces will predominate with respect to whether a vertical market will be transformed to a *biased electronic market* or an *unbiased electronic market*. We analyze mini-cases in the context of three business-to-business e-commerce settings: fixed income securities, the electric power industry, and corporate travel services. The industries we have selected exhibit different outcomes which illustrate the value of the new theory relative to predictions involving market structure transformations.

KEYWORDS: Biased markets, business-to-business (**B2B**) e-commerce, e-markets, electronic markets and hierarchies theory, industrial organization, industry structure, market design theory, market structure.

INTRODUCTION

The *electronic markets hypothesis* posits that IT reduces coordination costs between suppliers and buyers, leading to the predominance of market-based forms of economic organization (Malone, et al., 1987). The primary drivers of this move are advanced communication technologies such as the Internet, which provide a technological platform that reduces information search costs. In this environment, a large number of products and suppliers can be evaluated by buyers in order to make well-informed decisions, which may result in unbiased electronic markets.

However, other IS researchers point out that, despite the existence of information and communication technologies, some industries which were expected to move to electronic markets have not done so. Possible explanations have emerged to explain this apparent contradiction, including the *move-to-the-middle hypothesis* and the *risk-augmented transaction cost theory*. On the other hand, Malone, et al. (1987, p. 484) recognize that the EMH leaves other important forces aside, such as stock prices, antitrust regulations, and interest rates. We propose a theoretical framework that aims to understand these forces. We will explain *how* IT favors or inhibits a move to unbiased markets. In this way, we hope to create valuable insights on the dynamics of market structure transformation in the presence of IT.

To facilitate this research, we leverage the *theory of market design* (Schwartz, 1995), which studies the design of market mechanisms or *market microstructures* that enable trade. We use this theory to identify product-specific, competitive and legal forces that, together with IT, influence market design choices that drive the move to unbiased electronic markets. These theoretical contributions provide insights to explain why, in the presence of IT, some industries move to unbiased markets and why others do not.

We next present the theory of electronic markets and hierarchies and the theory of market design. In the third section, we combine elements of these two theories to form a *market-design driven electronic markets and hierarchies theory*, which characterizes the main drivers of a move to unbiased electronic markets. In the fourth section we apply this theoretical development to the market structure transformation of the U.S. bond markets, the electric power industry, and the corporate travel market. In the fifth section, we analyze the facilitators and inhibitors of the move to unbiased markets in these industries. We conclude with a discussion of our theoretical contribution and directions for future research.

THEORETICAL BACKGROUND

In this section, we first present the *electronic markets and hierarchies theory* and the *theory of market design*. We then use elements of the theory of market design to explain how IT shapes strategic choices firms make that may influence an industry's market structure.

The Electronic Markets Hypothesis (EMH)

The EMH predicts that IT will lead to higher use of market transactions as a means to conduct economic activity. The economic rationale is that IT reduces market coordination costs, such as the cost of searching for suppliers, establishing contracts, and buying supplies in the spot market. The EMH also predicts that moves to market-based forms of economic organization will be gradual, in several stages; they won't occur all at once.

Stage 1 is a move from electronic hierarchies to *biased electronic markets*, where suppliers benefit from implementing systems that conceal or distort information about competitors. In Stage 2 competitive and legal forces lead to the adoption of *unbiased electronic markets*, where all options for trading are made available. Finally, in Stage 3, the proliferation of information in unbiased markets leads to *personalized markets*, electronic markets with functionality that allows

buyers to filter the options available for trading.

Despite the theoretical predictions by several IS researchers, real world observations point out that IT has not necessarily been leading to market-based forms of organization. For example, Hess and Kemerer (1994) analyzed mortgage markets in the financial services industry. They suggest that the EMH may need theoretical augmentation because it does not clearly explain the lack of electronic market organization in the industry. Alternative hypotheses have emerged to explain the impact of IT on industrial organization. Clemons, et al. (1993) proposed a *move-to-the-middle hypothesis*. They recognize that IT may also reduce transaction risks, so buyers may prefer explicit coordination through long-term relationships with fewer suppliers over the purchase of supplies in the spot market. This outcome is comparable to the stage in the EMH where biased markets predominate. Wang and Seidman (1995) suggest that, due to negative externalities, it may be optimal for fewer suppliers to join an electronic data interchange (EDI) system. More recently, Kauffman and Mohtadi (2004a) proposed a *risk-augmented transaction cost theory* that is aimed at explaining why economic shocks (including both unexpected supply-side and demand-side events) might change the EMH's predictions. They showed that the possibility of stochastic shocks that impact large buyers' procurement may make them reluctant to transact in a market setting, and prefer more hierarchical approaches to transact.

Clearly, the EMH has not effectively explained the fall in the number of suppliers that occurred in the automotive industry in the 1990s (Cusumano and Takeishi, 1991; Helper, 1991). To explain this, Bakos and Brynjolfsson (1993) proposed an interpretation based on the *theory of incomplete contracts*. They suggested that buyers have incentives to limit the number of suppliers to maintain supplier incentives to make non-contractible investments (e.g., quality, responsiveness, and innovation). Hence, the equilibrium number of suppliers may decrease in the

presence of IT.

Although theories such as the ones described above help explain *specific* IT-driven outcomes for economic organization, there still is a need to develop a more unified theoretical perspective that can predict all these different outcomes. We offer the theory of market design to generate this perspective, because it offers a theoretical foundation to understand why some firms make choices that contribute to advanced forms of market organization, while others do not.

Market Design Theory

In neo-classical economics, an exogenous mechanism selects prices that establish an equilibrium between supply and demand. The related theory—*market design theory* or *market microstructure theory*—attempts to illuminate this “black box” by taking an alternative view (Clemons and Weber, 1990; Madhavan, 2000; Schwartz, 1995). *Market microstructure* is defined as the set of market participants, institutions and mechanisms that enable trade. It emphasizes that firms make explicit decisions to select trading prices and coordinate transactions that support exchange. Spulber (1999, p. 7) states that “[f]irms create and operate markets: setting prices, carrying out transactions, producing and distributing information, and forming and monitoring contracts.” From this perspective, equilibrium outcomes are the aggregate results of individual firm actions, including choices that affect a market’s microstructure.

The theory of market design focuses on the economic consequences of a trading mechanism’s design. It has been extensively applied in the context of financial markets to understand how electronic trading influences liquidity, efficiency, and the distribution of wealth (Clemons and Weber, 1990; Pagano and Roell, 1996; Schwartz, 1995).

IT, Electronic Markets, and Market Design

IT plays a role in the design of markets because it influences the market information that

enables trade and exchange. In particular, new technologies often allow firms to make new market design choices. Some information-based features of market design that are influenced by IT are market transparency, market-making, price discovery, and trading protocols. We now briefly discuss how IT may influence these market features in the context of electronic trading.

Market transparency specifies the extent to which information is made available to market participants (Hasbrouck, 1995; O'Hara, 1995), including pricing, product, and supplier information. In general, electronic trading increases the potential for market transparency. In turn, firms strategically decide whether to capitalize on this potential in two ways. First, they can make choices regarding the design of a market mechanism, such as their own Internet portal or an electronic exchange in which they have decision-making power (Granados, et al., 2005). Second, they can make strategic decisions to participate in trading based on information disclosure rules. For example, high-demand buyers may express concerns about sharing too much information about their demand forecasts, lest a "wired" supplier will exploit that information and turn prices against them (Kauffman and Mohtadi, 2004b). Similarly, large market participants often avoid trades in markets that require the disclosure of a trader's identity, because it provides signals about their cost structure (Zhu, 2004) or their motivation to trade (Clemons and Weber, 1990; Madhavan, 2000).

Reliance on market-making is another important aspect of market design. To enable trade, some markets rely on intermediary firms that post buy and sell quotes (Madhavan, 2000; Spulber, 1999). These intermediaries are *market-makers*. They reduce the uncertainty risks of sellers and buyers by centralizing the trading process, setting trading rules, and providing market information. Market-makers make choices in these dimensions, while buyers and sellers make decisions regarding the market-making mechanism they will select in the trading process. IT that

enables electronic intermediation transforms the roles that market-makers play to enable trade. For example, Internet-based air travel distribution has emerged in the 1990s through the creation of online travel agents (**OTAs**) and airline portals, forcing brick-and-mortar travel agencies to consolidate and shift their strategic focus towards value-added services.

Price discovery, the process by which market prices are established, is another important aspect of market design. Price discovery involves the recognition by market participants that prices embed new information (Madhavan, 2000; Domowitz, 1995). Market mechanisms such as auctions have a *dynamic* price discovery process: every bid is a new information signal to determine transaction prices. Other market mechanisms, such as posted prices, are more *static*. IT such as the Internet has enabled the creation of novel and dynamic price discovery mechanisms (e.g., electronic auctions), by enabling electronic information search and participation in trade.

Trading protocols represent the rules of trading and transactional exchange. Protocols in exchange are often the result of ongoing business practices and transactional norms (e.g., in financial markets, same-day or next-day settlement of funds or trades), and may also reflect government regulations to ensure fair trading practices, market participation fees and other fixed transaction costs for the market participants.

Market design theory suggests that these information-related design features of a market influence its performance or *market quality*. However, the optimal choice of trading arrangements means different things to different participants in an electronic market. We next present criteria that can be used by market participants to assess market quality in an electronic market.

IT and Electronic Market Quality. *Market quality* measures the extent to which a market

satisfies its participants. Drivers of market quality include liquidity, immediacy, economic efficiency and transaction costs. We next discuss them in more depth in the context of electronic markets.

Liquidity is a critical driver of perceptions of market quality. It can be defined as the extent to which a buyer (seller) is able to find a seller (buyer) to complete a trading transaction in a reasonable amount of time at a reasonable transaction cost. Generally, the higher is the number of market participants, the higher is the market's liquidity. Therefore, IT artifacts that attract and aggregate buyers and sellers have a positive impact on liquidity (Domowitz, 1995). For example, Internet technology has enabled electronic markets (e.g., www.ebay.com) that aggregate buyers and sellers across geographical boundaries, effectively improving market liquidity.

Immediacy is another indicator of market quality. It is the ability of the market to enable a transaction when a market participant so desires. For example, in manufacturing industries firms need resources in time to meet production schedules, so electronic markets that enable continuous B2B trading improve market performance by increasing immediacy.

Economic efficiency is the aggregate value extracted from a trade by its market participants. Generally, by reducing information search costs, IT can improve economic efficiency by enabling mechanisms that permit buyers to find a product and seller that best fits their needs. Similarly, IT may enable sellers to find buyers with higher levels of willingness-to-pay.

Transaction costs represent an important determinant of market quality for both buyers and sellers. The EMH recognizes that IT reduces transaction costs directly, by reducing coordination costs to find a trading partner, transact, and enter into a contractual agreement. In addition, IT can influence transaction costs to the extent that it affects market design choices.

For example, Internet technology allows sellers to post products for sale electronically, effectively reaching a large set of buyers with access to this technology.

Trade-offs in Electronic Market Design. There are trade-offs to be made, since improving one aspect of market quality may hurt another one (Levecq and Weber, 2002). For example, there is usually a trade-off between immediacy and liquidity, because immediacy reduces the amount of participants willing to trade at one time. In addition, suppliers and market-makers are commonly faced with the trade-off between the benefits of a more transparent market to attract buyers and the cost of releasing information to competitors. Market design decisions that buyers, sellers, and intermediaries make depend on the evaluation of these trade-offs in their effort to maximize profits.

The EMH implies that advanced ITs influence market quality trade-offs in favor of unbiased market mechanisms. In the next section, we offer new theory that exposes the forces that, together with IT, influence these trade-offs in favor of unbiased electronic markets.

A HYBRID THEORY OF UNBIASED E-MARKETS

Information and communication technology advances increase market design alternatives and add complexity to a firm's evaluation of market quality trade-offs. For example, in the Internet environment, while traditional players have created electronic market mechanisms to sell and purchase products, non-traditional market-makers or *cybermediaries* have also emerged with niche strategies to compete. Therefore, it is reasonable to assume that in order for most firms to favor a move to unbiased markets in the presence of advanced ITs, certain market forces must influence their decisions in this direction. Likewise, there must be counter-forces that restrict some industries in the move to advanced forms of market organization.

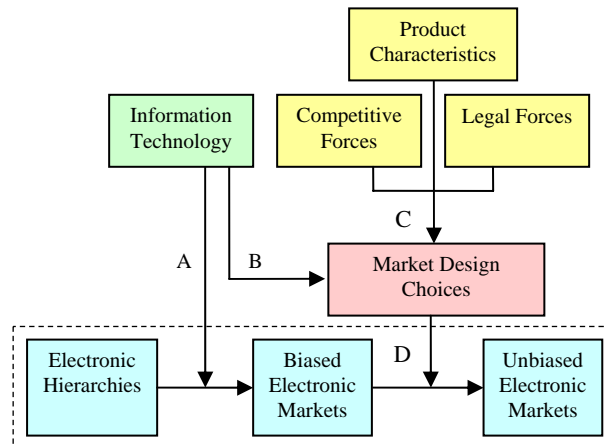
The increase in market quality due to unbiased electronic markets generally is more evident for buyers than for sellers. For buyers, unbiased markets generate liquidity and immediacy by making more trade items available for purchase at any point in time. They increase efficiency if there is a higher probability that they will find a product that better fits their needs. Sellers, on the other hand, have incentives to maintain information advantages and explicit coordination with buyers in the form of *biased electronic markets* (Malone, et al., 1987). How then, can the aggregate IT-enabled strategies of sellers result in the predominance of unbiased markets? What are the forces that drive this process? Likewise, what are the inhibiting forces of a move to unbiased markets?

A move to unbiased markets can be viewed as a process by which sellers, in aggregate, evolve to favor and implement unbiased markets. Therefore, market design theory can provide valuable insights to answer the above questions, by interpreting how the different IT-enabled forces will lead most sellers to favor market mechanisms that are unbiased, and similarly, the forces that may inhibit them from doing so.

Next, we leverage the information-based dimensions of market design theory and indicators of electronic market quality—in combination with the EMH—to develop a *market design-driven electronic market and hierarchies theory*. To characterize the key ideas, we offer the following brief explanation.

The driving forces in the move to unbiased markets are IT, competition, product characteristics, and behavior promoted by the legal environment of transaction-making and regulatory compliance. Together, these forces promote a move to unbiased markets by influencing market design choices of sellers. Next, we explain how these forces interact in each stage of the move to unbiased markets, as depicted in Figure 1.

Figure 1. The Driving Forces for Unbiased E-Markets



Note: The stages of the EMH are illustrated in the dashed rectangle. Link A represents the reduction in coordination costs and transaction risks due to IT, which leads to biased electronic markets. Link B shows the impact of IT on market design choices. Link C shows the impact of product characteristics and competitive and legal forces on market design choices. Link D shows that, together, these forces favor a move to unbiased electronic markets.

Link A (Electronic Markets and Hierarchies). The EMH suggests that IT facilitates the move to market-based electronic trading by diminishing coordination costs. However, as the move-to-the-middle and other hypotheses suggest, IT does not fully eliminate the incentives sellers have to implement biased markets in their own self-interest. Therefore, other forces must come into play to facilitate the predominance of unbiased electronic markets.

Link B (IT-Driven Market Design Choices). IT enables new market design choices that improve market quality. Examples include Internet-based auction mechanisms that have created new markets and enhanced existing ones by providing liquidity, immediacy, efficiency, and low transaction costs (e.g. www.ebay.com).

First-movers will benefit most from proprietary technological innovations that increase market quality, but competition is likely to follow. For example, to fully exploit the benefits of reservation systems technology for air travel, Rosenbluth Travel developed an information system that consolidated travel offers from major Computer Reservation Systems (CRSs) to

provide an unbiased, value-added service to its corporate travel customers (Clemons and Row, 1991). The company gained competitive advantage by improving liquidity and efficiency for its customers, through a wider variety of product offers tailored to specific customer needs. Soon competitors replicated this technological innovation, but at that point Rosenbluth travel had consolidated its position in the B2B travel agency services market worldwide. This leads to our first proposition:

Proposition 1 (Market Mechanism Competition Proposition): *In the presence of advanced ITs, sellers will implement innovative electronic market mechanisms that improve market quality.*

On the other hand, firms can take advantage of product complexity, asset specificity and incomplete contracts to lock in buyers through vertical relationships that capitalize on the buyers' associated uncertainty risks, asset-specific sunk costs, and opportunism risk (Clemons, et al., 1993; Brynjolfsson, 1994). In these environments, biased market mechanisms provide market quality by reducing the transaction costs associated with these risks. Note that product complexity can also be embedded in the details of the purchase process. For example, products that can significantly influence the economic outcome of buyers often require complex and detailed evaluation of purchase options. This may explain why mortgage markets have not easily made a move to unbiased markets, despite their information-intensive nature. The large potential impact on the financial performance of dealers and investors requires complex evaluations of the investment risk, including the financial stability and reputation of the issuer. In these cases, biased market mechanisms reduce transaction costs for buyers by reducing transaction risks and opportunism risks.

However, by reducing product complexity and asset specificity, IT may in turn reduce the competitive viability of biased mechanisms. For example, motivated by the complexity of

airline schedules and prices, airline owners of CRSs originally enjoyed economic benefits by controlling and selling airline schedule and price information through preferential agreements. However, travel agencies developed technologies to aggregate, filter and simplify complex information displayed by CRSs, to the benefit of corporate travel customers (Clemons and Row, 1991; Granados, et al., 2005). In response, CRSs have become more open and service-oriented. This leads to our second proposition:

Proposition 2 (Biased Electronic Market Mechanism Competitiveness Hypothesis): *In the presence of reduced product complexity and asset specificity due to advanced ITs, there will be a reduction in the relative competitiveness of biased electronic market mechanisms.*

Together, these two propositions suggest that IT creates competitive pressures for firms to adopt unbiased market mechanisms. However, they fall short of suggesting that, through these economic effects on firms' market design choices, IT leads to the predominance of unbiased markets. In other words, the notion that IT enables new market designs that improve market quality and reduce the effectiveness of unbiased mechanisms does not imply that most firms will favor and implement unbiased market mechanisms. This may explain why some markets have remained biased despite the presence of IT. We contend that, together with IT, other factors and forces must be present in order for unbiased market mechanisms to prevail.

Link C (Product-Specific, Competitive, and Legal Impacts on Market Design Choices).

Malone, et al. (1987, p. 492) remind us that “[p]roducers who start out by providing an electronic hierarchy or a biased electronic market will eventually be driven by competitive or legal forces to remove or significantly reduce the bias.” Our hybrid theory posits that these forces constrain a firm's ability to compete with biased market mechanisms and eventually favor the use of unbiased market mechanisms. Further, the nature of a product may favor or inhibit a move to markets. Products with high digital characteristics and low complexity are more prone to

unbiased market mechanisms.

Products with high *digital characteristics* can be easily represented electronically, enabling information brokerage at a low cost. Since unbiased market mechanisms offer more product options to buyers, they are generally more information-intensive and require flexible tailoring and manipulation of information for buyers. Therefore, the higher are the digital characteristics of a product, the higher is the ability of firms to compete with unbiased market mechanisms relative to unbiased ones. Also, the ease of representing products electronically makes it more difficult for sellers to distort or conceal information because there is competitive pressure from other players who can also provide this information at a low cost.

It follows that IT artifacts that enable digital representations of a product favor a move to unbiased markets. For example, in 2003 online retailer Amazon.com (www.amazon.com) introduced a “Search Inside the Book” feature on its Web site that allows customers to search the text of more than 120,000 books (*Economist*, 2004), effectively increasing market transparency in the book industry. Another example is IT that allows online exchange of music in digital form, which has reduced transaction costs and supported transactional immediacy. This led to the creation of peer-to-peer music exchange markets that support direct artist-led selling and created pressure for record labels to re-evaluate their selling and distribution strategies (Bockstedt, et al., 2005).

Competitive forces tend to make unbiased market mechanisms more viable than biased ones. In the absence of product differentiation strategies, *price competition* prevails. This is the case of many commodity markets, where price is a key determinant of buyer preferences and possible product differentiation strategies are scarce. In these environments, firms will have an incentive

to adopt IT-enabled market designs as strategies for differentiation, rather than fuel the losses from price competition.

In particular, facing the choice of implementing an IT-enabled unbiased market mechanism or competing with prices, firms will prefer to compete with unbiased market mechanisms. The implication is that potential incremental benefits from a biased market mechanism will not offset the potential losses that price competition brings. The implementation of unbiased market mechanisms further increases pressure to eliminate price discrimination. For example, Internet technology has allowed consolidation of international financial and air travel markets, diminishing the ability of firms to price-discriminate based on regional and national borders (Economides, 2001; Reuters, 2004).

Legal forces that have the capability to accelerate the move to unbiased markets arise from public policy that promotes a competitive environment, such as anti-trust laws, consumer protection laws, and regulations that prohibit predatory behavior by firms with market power. These regulations restrict a firm's ability to compete with biased market mechanisms or favor the use of unbiased market mechanisms.

Some laws are explicitly developed to prohibit market design biases that favor a seller. For example, in the 1980's the airline owners of CRSs would give preferential treatment to their own travel options in travel agent screen displays (Copeland and McKenney, 1988), so regulations were created to prohibit this practice. In addition, laws that prohibit anti-competitive behavior indirectly favor unbiased mechanisms, because in the presence of regulations that make explicit price collusion illegal, sellers may prefer unbiased mechanisms to tacitly collude and hence avoid losses from price competition.

Link D (The Move to Unbiased Electronic Markets). The market design-driven electronic

markets and hierarchies theory can be summarized in the following proposition:

Proposition 3 (Unbiased Electronic Market Drivers Proposition): *Advanced ITs, high price competition, high digital product characteristics, low product complexity, and pro-competition policies facilitate the move from biased to unbiased electronic markets. The absence of any of these forces inhibits the move to unbiased electronic markets.*

Next, we test this new theory of electronic markets and hierarchies in the context of three industries that are going through significant market structure transformation due to Internet technology.

INDUSTRY APPLICATIONS OF THE MODEL

The robustness of a theoretical model is largely based on its ability to explain different kinds of outcomes that are observed for a given phenomenon. In our case, the proposed theory is intended to explain differences in the extent to which different industries adopt unbiased electronic market mechanisms. Some industries make it to that point sooner, while others arrive later (and possibly not at all). Thus, it is our goal to determine the extent to which the proposed theory is an effective *variance theory*: we wish to see how well its elements make different predictions related to the different kinds of outcomes that we observe in the marketplace. To accomplish this, in this section we present and discuss three U.S. B2B e-commerce mini-cases: the bond market, the electric power industry, and the corporate air travel market.

Case 1: Emerging Unbiased Electronic Bond Markets

The markets for fixed income securities in the U.S. have traditionally been the province of a group of powerful investment banks that have been able to exercise considerable market power. The result for private corporations and public organizations that wish to issue bonds to obtain capital in the primary market, as well for investment management firms and individuals that wish to trade bonds in the secondary market, is that they have not been able to benefit from some of

the efficiencies that are normally associated with the equities market. These include multiple market designs for trading (e.g., the New York Stock Exchange, NASDAQ, and the after hours crossing markets and electronic communication systems). Instead, for bonds, up until 1997 there were a few viable private electronic markets that permitted bond issuance and trading, but not many (e.g., Bloomberg, Morgan Stanley, First Boston Corporation, etc.) (Bond Market Association, 1997a).

There have been significant public policy debates related to the relative “opaqueness” of the bond market (Bond Market Association, 1997b). Prices have been difficult for investors to see because trade-related information has been closely guarded by the market-making investment banks. It has been in their interest to stall the move to newer market designs that permit fuller transparency (Kauffman and Lu, 2004). This practice is facilitated by the inherent complexity of bonds relative to equities. Firms that have one or two issues of stock (common and preferred) may have numerous bond series, reflecting coupon values and the maturity of the debt. In addition, some bonds are callable (can be paid off early), and thus embed options while others are not. Therefore, there may be millions of fixed income securities compared to a few thousand shares (Allen, et al., 2001).

During the 1990s though, the impacts of new technologies began to be felt (Economides, 2001). For example, in the beginning of the decade and prior to gaining authority as a primary issuer of bonds like investment banks, commercial bank J. P. Morgan innovated with a dial-in screened-based bond issuance market for “vanilla debt” (i.e., the most well known corporate names). Although the system, Capitalink, did not succeed, it nevertheless sensitized the market to the possibilities that technology held for transforming market design in support of bond issuance.

Then, during the growth of the Internet, other well known investment banks, government agencies and entrepreneurs staked out positions with technology-based approaches to the trade of various kinds of fixed income securities (Bond Market Association, 1998-2003). These included MarketAxess (www.marketaxess.com) for bond trading among institutional investors, the Bloomberg Municipal System (www.bloomberg.com), and the U.S. Treasury's TAAPsLink (www.publicdebt.treasury.gov), among others. In fact, a variety of players in the marketplace put together different types of electronic markets, including: auction systems, inter-dealer systems, multi-dealer systems, single-dealer systems, and cross-matching systems (Bond Market Association, 2003). The last of these brings together institutional investors and bond dealers in periodic Internet sessions, to give them a chance to "negotiate" somewhat more complex matches (e.g., complicated portfolio strategies and large positions).

Because of the existence of many single-dealer markets which are using the Internet as a means to involve their own institutional investment clients, there is still a good level of bias in the bond market. Some of these systems are reachable via the Internet, while others are only available through an intermediary, Bloomberg Inc., the preeminent quote vendor and financial news network (Bond Market Association, 2002). They include Lehman Brothers (www.lehmanlive.com), Credit Suisse First Boston (www.csfb.com), Merrill Lynch (www.ml.com), Morgan Stanley (www.morganstanley.com) and J. P. Morgan (www.jpmorganexpress.com), among others, and reflect the fact that the prior "oligopoly players" are still using the new technologies to make markets for bonds based on client relationships, instead of a full-fledged market-based approach.

However, there have been significant advances in liquidity, transparency and market fairness in the trade of bonds thanks to Internet technology. Kauffman and Lu (2004) analyzed the

structure and performance of digital bond markets in the U.S., and concluded that the range and depth of their innovations is path-breaking. We note the following representative examples: BondHub (www.bondhub.com) is an Internet-based cross-matching bond-trading digital intermediary. It provides an open, price-transparent, anonymous counter-party service for trading of municipal and corporate bonds and mortgage-backed securities. BondHub is primarily for financial advisors, mutual funds managers, and bond market-makers. Market participants are able to post bids and offers, as well as requests for quotes on an Internet-based secondary market trading system. A second example is the proprietary system, the Bloomberg Bond Trader (www.bloomberg.com). The firm provides customers with live bid and offer quotes of all contributing dealers in both a composite and attributed format. Portfolio managers and traders benefit from price discovery. Yet it gives them the flexibility to submit requests for single or multi-dealers orders and inquiries to aid in price discovery.

The Internet has provided a basis for pushing the capabilities for bond exchange beyond what was historically observed (Economides, 2001), when bonds were largely traded in biased electronic markets. In addition, it is clear that with this new technology has come greater impetus for competition around new and enhanced market designs (Kauffman and Lu, 2004). But the emergence of unbiased electronic markets for bonds has been slowed down by their own nature. Bonds are not as commodity-like as stocks. So the considerations that are necessary to produce a high liquidity, immediate and transparent market process may still be affected by the inherent complexity of bonds. This may explain why only 10% of corporate bonds were electronically traded in 2000 (Allen, et al., 2001).

Case 2: The Move to E-Markets for Electric Power

The electric power industry has three supply functions: generation, transmission, and

distribution. Once electricity is generated, it is transmitted to a distribution center, which in turn delivers it to final customers. This is accomplished through complex electric networks or *grids*.

The electric power industry has been vertically-integrated since its inception. Policy makers advocated single ownership of electricity's production process in a location under the notion that a regulated electric power monopoly, through economies of scale, would lead to higher efficiency, lower costs, and hence lower prices for consumers. Led by the UK, since the 1980s several countries have introduced deregulation to increase market-based structures in the industry. *Unbundling* of the production functions is now common, where generation, transmission, and distribution are run by separate business units within a firm (or in some cases by different companies). In addition, independent producers that generate power for their own use (i.e. non-utilities) got access to the power grid in order to sell excess production. Nevertheless, natural monopolistic structures remain, especially in the transmission and distribution sectors, since it is economically unlikely that competitors will emerge for already well-established grid infrastructures.

In addition to these major structural and regulatory changes in the industry, technology has become available to enable novel and dynamic electronic market designs. Auction-based mechanisms are now common for procurement of U.S. electric power. In particular, *power exchanges* have emerged that allow firms to make bids and offers for electric power and transmission rights (Cramton, 2003). For example, in 1998 the California Power Exchange was established. (See www.caiso.com.) In this exchange, sellers and buyers trade electric power a day in advance. However, inherent industry complexities have caused complications in the effort to develop efficient markets. These complexities are the inability to store electricity and transmission constraints (Cramton, 2003).

Because of an inability to store electricity, there is a need for markets to effectively balance real-time supply and demand. An imbalance can lead to waste of electric power or power outages. Therefore, close to the day of delivery, demand becomes price-inelastic. Strategic behavior by suppliers in this situation has resulted in higher prices, as experienced in several markets during peak periods since deregulation (Mount, 2000).

Power grids are fragmented geographically, so not all electric power supply is available to a specific region. In addition, transmission is constrained by potential network congestion. In auction markets for transmission rights, large power generators have incentives to withhold on offers in order to increase the price of the remaining offers. These incentives may result in sub-optimum power allocation and higher prices (Joskow and Tirole, 2000). Therefore, market mechanisms for electric power need to consider these issues in order to offer high market quality.

Despite the regulatory and technological changes in the electric power industry, a true competitive environment will take years to develop. In addition, by ignoring the complexities of the electric power market, instances of flawed regulations for market exchange design have emerged, resulting in higher prices, power outages, and dissatisfied customers (Cramton, 2003). Government policy and competitive forces have yet to evolve to enable the development of sound and unbiased electronic markets for electric power.

Case 3: Unbiased Markets for Corporate Travel

Corporate travel accounts for approximately 55% of total air travel passengers (PhocusWright, 2003). Historically, brick-and-mortar travel agencies created liquidity and efficiency in the market by searching for the best prices and services for business travelers. Travel agencies took advantage of the high complexity of airline prices and product description in CRSs to intermediate the market. In addition, they aggregated demand for corporations to

negotiate lower prices and value-added service with airlines (Clemons and Row, 1991), contributing to the segment of the industry known as *managed business travel*.

With the advent of the Internet, online travel sales increasingly threaten the market-making position of traditional travel agencies. In 2003, approximately 40% of U.S. airline tickets were sold via the Internet (Airline Business and SITA, 2003). An important driver of this trend is the increased level of market transparency facilitated by technologically-innovative, unbiased and customer-friendly online travel agencies (OTAs) such as Orbitz (www.orbitz.com) and Expedia (www.expedia.com) (Granados, et al., 2005). In the same year, approximately 20% of U.S. corporate travel revenue was managed online (Phocuswright, 2003), a significant amount relative to the overall percent of retail sales through the Internet, which was approximately 2% (U.S. Census Bureau, 2004).

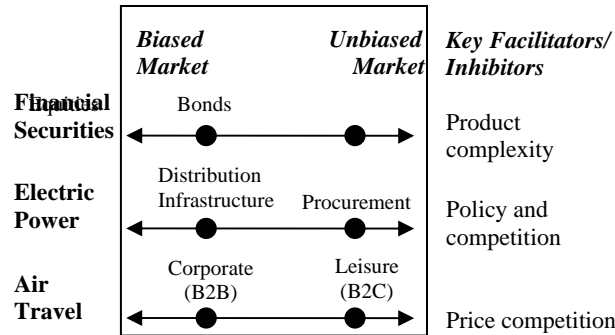
However, while unbiased OTAs have successfully penetrated the leisure and unmanaged business travel markets, they are just beginning to make inroads in the managed business travel segment. This is because, due to the service requirements of business travelers, there may be a limit to the value that can be extracted from Internet-based reservation-making (Chircu and Kauffman, 2001). Nevertheless, recently major OTAs have developed strategies to further penetrate the corporate travel business segment, and brick-and-mortar travel agencies such as Carlson Wagonlit Travel are being forced to respond with their own Internet-based market mechanisms that offer the lowest prices in the market (Reinan, 2004).

DISCUSSION

Electronic commerce technologies have facilitated a move from electronic hierarchies to electronic markets in the U.S. bond market, electric power, and corporate travel industries. In

this section we discuss the different facilitators, inhibitors, and market design dimensions that explain each industry's status in the move from biased to unbiased markets. (See Figure 2.)

Figure 2. Relative Status of U.S. Industry Sectors in the Move to Unbiased E-Markets



Notes: (1) Unbiased electronic markets are less predominant in bond markets than equity markets due to the higher product complexity of bonds. (2) While electric power is increasingly traded through electronic market mechanisms in part due to pro-competition policies, the distribution infrastructure is still monopolistic in nature. (3) Price competition in leisure travel markets has facilitated the move to unbiased electronic markets. However, differentiation strategies possible in corporate travel markets have inhibited this move.

IT and Product Complexity: Electronic Bond Markets

Bonds exhibit a high level of product complexity relative to other financial securities. This may explain why the proliferation of unbiased market mechanisms has been slower than in equity markets. Technologies and innovative market mechanisms that reduce product complexity will further enable the trade of bonds through unbiased market mechanisms. However, IT-driven pressure to adopt unbiased market mechanisms is structurally weakened by the complexity of bonds, which still makes biased market mechanisms viable. Experienced market-makers and suppliers such as investment banks will continue to benefit from IT-enabled market mechanisms that focus on differentiated services to generate *liquidity* and provide *efficient* selling mechanisms that lock in dealers and investors, despite higher transaction costs. In contrast, equity markets have made a faster move to unbiased markets because product complexity is not an inhibitor in this process.

More generally, the higher the level of product complexity, the less is the pressure that IT exerts on suppliers and intermediaries to adopt unbiased market mechanisms. (See the Biased Electronic Market Mechanism Competitiveness Proposition). This is because firms can provide value-added services to simplify product complexity for the buyer. Buyers face uncertainty and opportunism risks that suppliers and intermediaries can mitigate by offering long-term contractual agreements and business relationships, resulting in the viability of biased markets.

IT and Legal Forces: The Electric Power Industry

The interaction of IT and legal forces that influence a move to unbiased markets is best represented by the case of the electric power industry. Deregulation and pro-competition laws have enabled a move to markets in an industry that was historically regulated to maintain hierarchical forms of organization. In addition, the move to markets was facilitated by the commodity nature of electricity, where opportunities for product differentiation by power generators and distributors are scarce. Therefore, in a few years after deregulation laws started in 1985, market-based pricing and the introduction of centralized electronic exchanges were initiated in several U.S. regions. This led to price competition and the decrease of market prices (Silverman, 1994).

However, it is worth noting that recent research and analysis of U.S. electric power exchanges suggests market design flaws have caused inefficient outcomes and monopolistic behavior by suppliers in the electric power and transmission rights markets. Regulators have ignored the inherent risks that exist because electric power cannot be stored, which makes power generation and demand load uncertainties risky for suppliers and buyers.

Better *price discovery* mechanisms such as futures markets and negotiated contracts should be considered to enable market valuation of these risks. This is consistent with the risk-

augmented theory of electronic markets (Kauffman and Mohtadi, 2004a), which suggests hierarchical or biased market approaches are viable in settings where demand and supply shocks add risk to trade.

IT and Competitive Forces: Corporate Travel

Competition for *market transparency* has led independent OTAs to penetrate air travel distribution with unbiased electronic market mechanisms. However, the competitive forces that favor unbiased electronic mechanisms in leisure air travel are mitigated in corporate travel by a lower degree of price competition. The market power that corporations obtain through consolidation of demand by travel agencies and the need for value-added services (e.g., handling complex trips and time-sensitive itinerary changes) reduces the pressure on corporate travel providers to compete with unbiased market mechanisms. Therefore, opportunities for product differentiation make biased market mechanisms viable in corporate travel.

However, the battle for corporate travel consumers will continue. The current efforts of OTAs to penetrate the managed corporate travel business will depend on their ability to design market mechanisms that combine market transparency with an ability to provide quality service to the business traveler. Likewise, brick-and-mortar travel agencies are responding to the competitive pressure of better informed customers due to the Internet-enabled market transparency, by reducing the level of bias of their market mechanisms.

CONCLUSIONS AND RESEARCH DIRECTIONS

We have proposed a new market design-driven electronic markets and hierarchies theory to explain and predict the role of IT on market structure transformations. Our core rationale is as follows: We assume that sellers have economic incentives to adopt biased market mechanisms. However, IT advances and product-specific, competitive, and legal forces will create competitive

pressure for firms to adopt unbiased market mechanisms, resulting in a move to unbiased markets.

Our analysis suggests that the variance in extent of the move to unbiased markets in the bond, electric power, and corporate travel markets can be well explained by this new theory of electronic markets and hierarchies. In particular, we found that the inhibitors of a move to unbiased markets are forces opposite to the ones that favor this move (i.e. high product complexity in bond markets, low price competition in corporate travel).

As directions for future research, we propose analytical model development that explains how IT, product-specific, competitive, and legal forces constrain a firm's ability to adopt biased market mechanisms, in favor of a move to unbiased markets, as well as more in-depth case studies of current real-world, IT-enabled market transformations to test and enhance our theory.

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