

# The emerging role of electronic markets



Internet-based electronic marketplaces leverage information technology to match buyers and sellers with increased effectiveness and lower transaction costs, leading to more efficient, “friction-free” markets. The Emerging Role of Electronic Marketplaces on the Internet Markets play a central role in the economy, facilitating the exchange of information, goods, services, and payments. In the process, they create economic value for buyers, sellers, market intermediaries, and for society at large.

Recent years have seen a dramatic increase in the role of information technology in markets, both in traditional markets, and in the emergence of electronic marketplaces, such as the multitude of Internet-based online auctions. Functions of a Market Markets (electronic or otherwise) have three main functions, summarized in Table 1: matching buyers and sellers; facilitating the exchange of information, goods, services and payments associated with market transactions; and providing an institutional infrastructure, such as a legal and regulatory framework, that enables the efficient functioning of the market.

In a modern economy, the first two functions are provided by intermediaries, while the institutional infrastructure is typically the province of governments. Internet-based electronic marketplaces leverage information technology to perform these functions with increased effectiveness and reduced transaction costs, resulting in more efficient, “friction-free” markets. Matching Buyers and Sellers. Markets “clear” by matching demand and supply. This process of matching buyers’ demand with sellers’ product offerings has three main components: determining Matching buyers and sellers • Determination of product offerings - Product features offered by

sellers - Aggregation of different products • Search (of buyers for sellers and of sellers for buyers) - Price and product information - Matching seller offerings with buyer preferences • Price discovery - Process and outcome in determination of prices Facilitation of transactions

• Logistics - Delivery of information, good, or service to buyer • Settlement - Transfer of payment to seller • Trust - Credit system, reputations, rating agencies like Consumer Reports and Better Business Bureaus Institutional infrastructure • Legal - Commercial code, contract law, dispute resolution, intellectual property protection • Regulatory - Rules and regulations, monitoring, enforcement Table 1. Functions of a market COMMUNICATIONS OF THE ACM August 1998/Vol. 41, No. 8 35 Establishing a dialogue and a sense of community among customers can create value by enabling the sharing of experiences, problems and solutions, but also allows the collection of important information about individual consumers. product offerings, search, and price discovery. The behavior of buyers, sellers, and intermediaries is motivated by their desire to maximize their private utility. When markets function well, this also leads to an efficient allocation of productive resources. Viewed this way, markets are the engine and steering system of our economy.

Markets provide sellers with information about demand that allows them to employ economic inputs such as capital, technology and labor, and develop products with characteristics that match the needs of buyers. Sellers determine a schedule of product offerings that they expect will maximize their profits based on: • information about buyer demand; • the cost of inputs; • the available technology for production and distribution of the

information, goods and services purchased by the buyers; and, • the transaction costs of administering production, distribution, and payment. Buyers select their purchases from the available product offerings after considering factors such as price and product characteristics. In obtaining and processing this information, buyers face search costs.

These costs include the opportunity cost of time spent searching, as well as associated expenditures such as driving, telephone calls, computer fees, magazine subscriptions, etc. Typically, sellers exploit these search costs by raising their prices, and thus enjoy higher profits. Similarly sellers may face search costs in locating qualified buyers for their products, such as market research, advertising and sales calls. A key function of markets in our economic system is price discovery, which is the process of determining the prices at which demand and supply “clear” and trade occurs. For certain markets, such as financial markets, this is their primary function.

Markets can employ a number of mechanisms for price discovery. 36 August 1998/Vol. 41, No. 8 COMMUNICATIONS OF THE ACM For instance, some financial markets use one or more of the several types of auctions to determine prices, such as the “call market” auction at the opening of a trading day at the New York Stock Exchange, when bids are accepted up to a certain time and exchange occurs when the market opens. This is the first price that is communicated via the stock market ticker to the market at large, kicking off a day of “continuous market” trading. Other markets, such as the traditional automobile dealership, employ negotiation between buyers and sellers until a price is reached.

In still other markets, such as the typical department store, merchants make firm offers that customers can either take or leave. Facilitation of Transactions. The matching function of a market establishes a bilateral relationship between a buyer and a seller. After a transaction is agreed upon, the product sold must be transported to the buyer (logistics), and payment must be transferred to the seller (settlement). Markets typically incorporate mechanisms for logistics and settlement: when a travel agent uses an airline reservations system to book a flight, the system will generate the itinerary and the ticket, and will process a credit card payment.

Furthermore, market transactions require the establishment of a certain level of trust, which protects buyers, sellers and intermediaries from the opportunistic behavior of other market participants. For instance, this trust role may include banks issuing letters of credit, credit reporting bureaus, or rating agencies such as Consumer Reports and Better Business Bureaus, which keep track of product information and seller reputations, and thus discourage opportunistic behavior. Finally, markets provide the physical infrastructure that allows transactions between the buyers and the sellers to take place. This includes real assets such as physical structures and trading floors, computers and communication networks, and transportation systems. Institutional Infrastructure.

The institutional infrastructure specifies the laws, rules and regulations that govern market transactions, such as issues related to contract law, dispute resolution, and intellectual property protection, and provides mechanisms for their enforcement. In addition, the dynamics of electronic markets may raise certain antitrust issues. For example, there are large economies of scale in

distribution, as a single online retailer or intermediary can serve a very large market. There are also potential demand-side economies of scale in payment mechanisms and software. These may lead to a winner-takeall market structure [1] with one or a few firms dominating the market. Purchasing a new home - Research city and neighborhood - Find a house - Inspections, title research, appraisals, contracts - Get a mortgage - Moving services - Decorators, furniture, etc. • Planning a vacation - Research destination - Arrange accommodations and travel - Purchase maps, books, information - Check out weather, items to take • Purchasing a car - Research make and model - Select a dealer - Get a loan or arrange a lease - Purchase insurance

Table 2. Components of consumer processes and transaction/distribution cost

How the Internet Affects Markets

Electronic marketplaces, especially Internet-based markets, are having a major impact on the roles of markets discussed previously [2, 12].

Product Offerings.

Two major emerging trends distinguish products in electronic marketplaces from their traditional counterparts: increased personalization and customization of product offerings, and the aggregation and disaggregation of information-based product components to match customer needs and to support new pricing strategies. Electronic marketplaces support personalization and customization in two ways: • Consumer tracking technology allows the identification of individual buyers; information about these buyers, such as relevant demographics, consumer profiles, or comparison with the known preferences of similar consumers, can be used to discover or estimate their specific preferences. Information-rich products lend themselves to cost-effective customization; for instance, delivering an

electronic newspaper tailored to the interests of an individual reader need not be more costly than delivering the same copy to all subscribers. Current personalization and customization technologies use either rule-based systems like Broadvision ([www.broadvision.com](http://www.broadvision.com)) that draw upon sets of expert rules, or collaborative filtering systems like the Firefly Network ([www.firefly.net](http://www.firefly.net)) that utilize the feedback and experiences of consumers with a profile of likes and dislikes similar to the targeted buyer. This allows the practice of “one-to-one marketing,” which is based on understanding individual consumers.

For instance, establishing a dialogue and a sense of community among customers can create value by enabling the sharing of experiences, problems and solutions, but also allows the collection of important information about individual consumers. The ultimate objective is to provide customized services according to individual preferences, whether expressed or inferred. Increased selling effectiveness comes from being able to design appropriate products to address the needs of individual consumers, and from being able to identify the moment when a customer’s purchasing decision is most likely to occur and to be prepared for that moment, one step ahead of the competition. When determining their product mix, sellers must decide which product components or features will be included in each product offering.

For example, the developer of an operating system must decide which features to implement, and whether they will be marketed and priced individually or in a single bundle. These decisions are driven by the relative cost of different product bundles, which includes the following types of costs:

- Production cost: the cost of producing additional units for inclusion in the bundle, including storage, processing, and communications costs incurred in the process.
- Transaction and distribution cost: the cost of distributing a bundle of goods and administering the related transactions, such as arranging for payment.
- Binding cost: the cost of binding the component goods together for distribution as a bundle, such as formatting changes necessary to include news stories from wire services in a newspaper bundle.

Menu cost: the cost of administering multiple prices. If a mixed bundling strategy is pursued, where the available components are offered in different combinations, then a set of  $n$  goods may require as many as  $2^n$  prices (one for each subset of one or more goods).

COMMUNICATIONS OF THE ACM  
August 1998/Vol. 41, No. 8 37 c Marginal Costs Mean Valuation c0 Marginal production, distribution, and transactions are high enough to make both bundled and unbundled Unbundled sales dominate sales unprofitable bundling Bundling is more profitable than unbundled sales Distribution Costs d Figure 1. Phase diagram for bundling and unbundling strategies as a function of marginal cost

Internet marketplaces are changing the constraints imposed by these costs and thus are fostering new types of intermediaries that create value by aggregating services and products that traditionally were offered by separate industries. For instance, Table 2 shows the components of three processes that generate value for consumers. In traditional markets, these components are provided by separate industries. A consumer in the market for a new car might select a make and model based on the experience collected from test drives, research from auto magazines and Consumer



Reports, and recommendations from friends. She would then agree on price, order the vehicle, and take delivery through a car dealer, arrange financing through a bank, and purchase insurance from an insurance company.

By dramatically lowering the transaction, distribution and binding costs, the Internet has allowed intermediaries such as Auto-byTel ([www. auto-by-tel. com](http://www.auto-by-tel.com)) or Microsoft's Carpoint ([www. carpoint. com](http://www. carpoint. com)) to offer all of these products and services, with the exception of an actual test drive. Similar intermediaries are emerging in other areas, such as the Travelocity ([www. travelocity. com](http://www. travelocity. com)) and Microsoft's Expedia ([www. expedia. com](http://www. expedia. com)) travel services aggregators, or Microsoft's Boardwalk Web site that will aggregate products and services related to real estate transactions. The Case of Information Goods. Digital information goods, such as news articles, digital images or music, allow perfect copies to be created and distributed almost without cost via the Internet.

The Internet is thus precipitating a dramatic reduction in the marginal costs of production and distribution for these goods, while micropayment technologies are reducing the transaction costs for their commercial exchange. Bakos and Brynjolfsson [6] point out that this creates new opportunities for repackaging content through strategies such as bundling, site licensing, subscriptions, rentals, differential pricing and per-use fees. All of these schemes can be thought of as either aggregating or disaggregating information goods along some dimension.

For instance, aggregation can take place across products, as when software programs are bundled for sale in a software suite or when access to various content of an online service is provided for a fixed fee. Aggregation can also take place across consumers, as with the provision of a site license to multiple users for a fixed fee, or over time, as with subscriptions. Many information goods have been bundled solely to save on transaction, distribution and menu costs, yet these costs are much lower on the Internet. Thus software and other types of content may be increasingly disaggregated and metered, as on-demand software applets or as individual news stories and stock quotes.

Independent of the cost considerations mentioned previously, Bakos and Brynjolfsson [6] show that aggregation of large numbers of information goods can be a powerful strategy that results in higher profits for sellers as well as a socially desirable wider distribution of the goods. This is due to the ability of aggregation to change the shape of the demand curve faced by the sellers to one that is easier to exploit. Aggregation can be a surprisingly profitable strategy when marginal production costs are low and consumers are homogeneous. Bakos and Brynjolfsson's analysis provides a framework to understand the emergence of intermediaries that aggregate online content, such as America Online and Yahoo! , as well as the increasing use of subscription pricing in the sale of information goods by companies such as Netscape, Dow-Jones, or Reuters.

Figure 1 graphically summarizes this discussion and depicts the impact of marginal cost  $c$  and distribution/transaction cost  $d$  on the desirability of bundling large numbers of information goods. Search. Electronic

marketplaces lower the buyers' cost to obtain information about the price and product features of seller offerings as well as the sellers' cost to communicate information about their prices and product characteristics. For instance, a buyer in the market for a 400MHz Pentium II microprocessor can easily compare the prices of different sellers by using a specialized search engine like Pricewatch ([www.pricewatch.com](http://www.pricewatch.com)) or ComputerESP ([www.computeresp.com](http://www.computeresp.com)), as shown in Figure 2.

Similarly, links to manufacturers' Web sites can be used to obtain detailed information about the product features of different laptop computers. By lowering buyers' search costs, electronic markets increase economic efficiency. Not only do buyers incur lower costs even after considering more product offerings, they also benefit from being able to identify and purchase products that better match their needs. Several Internet-based technologies assist buyers' searching: multimedia, high bandwidth, and rating sites provide more product information. Search engines help buyers identify appropriate seller offerings. The search engines can be hierarchical directories (like Yahoo! , generic tools (like AltaVista in early 1998), or specialized tools that work best in the context of specific markets (such as Pricewatch and ComputerESP for computers and peripherals, or Expedia and Travelocity for airline tickets and other travel products).

Intelligent agents such as Bargainfinder ([bf.cstar.ac.com/bf](http://bf.cstar.ac.com/bf)) or Jango ([www.jango.com](http://www.jango.com)) have been developed to scout the Web and compare product offerings by price or features on the behalf of the buyers. These technologies keep lowering buyers' search costs. The lower search costs enable new markets to emerge. For example, low buyer search costs and

global reach allowed Onsale. com (www. onsale. om) to create markets in goods like secondhand cameras; otherwise the search costs would be too high to enable potential buyers and sellers to find each other in a conventional market. Several other intermediaries are emerging to facilitate the process of matching buyers and sellers. Among many others they include Yahoo! , Pricewatch, Netbot's Jango, and several other search engines, Web directories and shopping agents. They also include providers for product information (e. g. , CNet, trade magazines), recommendations and personalization (e. g. , Firefly Network), and information about sellers such as Bizrate. Price Discovery. Electronic marketplaces enable new types of price discovery to be employed in different markets.

For example, some airlines auction last-minute unsold seats to the highest bidders, and Web-based auctions at Onsale. com have created for consumer goods markets that function like the financial markets. Intermediaries such as Priceline (www. priceline. com) allow buyers to specify product requirements and the amount they're willing to pay, and then make corresponding offers to the participating sellers, reversing the traditional functioning of retail markets. Finally, agents such as Kasbah (ecommerce. media. mit. edu/kasbah) and Tete-a-Tete (ecommerce. media. mit. edu/tete-a-tete) that can negotiate purchases on behalf of buyers and sellers, may restructure the price discovery process in Internet marketplaces [11].

The ability to customize products, combined with the ability of sellers to access substantial information about prospective buyers, such as demographics, preferences and past shopping behavior, is greatly improving sellers' ability to price discriminate—that COMMUNICATIONS OF THE ACM

August 1998/Vol. 41, No. 8 39 is, to charge different prices for different buyers. Pricediscrimination is a powerful tool that allows sellers to increase their profits, and reduces the consumer surplus enjoyed by buyers. On the other hand, price discrimination enables sellers to service buyers who would otherwise be priced out of the market, an outcome that increases economic efficiency.

These new types of price discovery, such as the ability of buyers to make offers and the ability to conduct electronic negotiations between buyer and seller agents, are changing the “ microstructure” of consumer markets. Financetheory has shown that market microstructure affects both the efficiency of markets and the bargaining power of their participants. The increasing importance of electronic commerce emphasizes the need to carry this type of research analysis to electronic marMarketplaces. It is unclear who the beneficiaup ries of this process will be. The ability to r implement different price discovery mechanisms may result in more efficient marr/2 kets, thus benefiting buyers and hurting inefficient sellers. As menu costs decrease, sellers will move away from fixed pricing, and more prices will become negotiable [7].

While savvy buyers may benefit, the 0 ability to negotiate prices may not be pleasant or result in a good deal, as many visitors to auto dealerships have discovered. Furthermore, when sellers are better informed, they are likely to increase their profits by charging different prices to different buyers. Economic theory predicts that buyers with more bargaining power, typically the more affluent ones, will fare better in this situation. Facilitation. The cost of logistics—the process of transporting products from the seller to the buyer

— has been estimated at more than 10% of the GNP [8]. Electronic marketplaces improve information sharing between buyers and sellers, helping lower the cost of logistics and promoting quick, just-in-time deliveries and reduced inventories.

The distribution of information goods such as newspapers, music, videos and software, is likely to be completely transformed, as the information infrastructure will replace physical distribution systems. Sellers in Internet marketplaces are typically responsible for delivery to their customers, and increasingly contract with third-party providers for direct delivery from the manufacturer to the final consumer, reducing costs and time-to-delivery. Thus, direct sellers like Dell Computer are squeezing out traditional intermediaries such as wholesalers and distributors, while delivery providers such as FedEx and 40 August 1998/Vol. 41, No. 8 COMMUNICATIONS OF THE ACM

UPS are emerging as major Internet intermediaries, because of their logistics expertise and their economies of scale in distribution. Electronic payment systems will further lower transaction costs in Internet marketplaces, and micropayment systems will lower the cost of small transactions, enabling new pricing strategies such as the metering of software use. As face-to-face marketplaces are replaced by electronic ones, there is increasing need to protect market participants from opportunistic behavior. Technologies such as public key cryptography can provide security and authentication of transactions, while intermediaries like Bizrate ([www.bizrate.com](http://www.bizrate.com)) will use information from consumers to keep track of merchants' reputaAs search costs fall from very high to moderate, new markets emerge, and both sellers

and buyers benefit. However, if search costs continue to fall, market prices fall and sellers are made worse off, while buyers benefit from the lower prices and their improved ability to find products that fit their needs.  $r = \frac{2}{4t}$   $r = \frac{2}{t}$  market breakdown buyer search cost Figure 3. The impact of buyer search costs in a differentiated market tions.

Credit bureaus and credit card companies will provide credit information or guarantee payment for consumers. Finally, intermediaries like Verisign ([www.verisign.com](http://www.verisign.com)) are emerging as “certificate authorities” that match legal identities to the possession of cryptographic keys—a public key infrastructure. Internet Marketplaces and Competition Impact of Lower Search Costs. The ability of Internet marketplaces to reduce search costs for price and product information may significantly affect competition. Bakos [4, 5] shows that lower buyer search costs in electronic marketplaces promote price competition among sellers. This effect will be most dramatic in commodity markets, where intensive price competition can eliminate all seller profits. It will also be significant in markets where products are differentiated, reducing the monopoly power enjoyed by sellers, and leading to lower prices and seller profits.

Figure 3 shows the equilibrium prices for a differentiated good with zero marginal cost, which The dynamics of friction-free markets are not attractive for sellers that had previously depended on geography or customer ignorance to insulate them from the low-cost sellers in the market. consumers value at  $r$  and has a degree of differentiation  $t$ . As search costs fall from very high to moderate, new markets emerge, and both sellers and buyers benefit. However, if search costs continue to fall, sellers are made

worse off since buyers can more easily find the lowest-cost seller, while buyers benefit from the lower prices and their improved ability to find products that fit their needs.

The dynamics of friction-free markets are not attractive for sellers that had previously depended on geography or customer ignorance to insulate them from the low-cost sellers in the market. As geography becomes less important, new sources of product differentiation, such as customized features or service or innovation, will become more important, at least for those sellers who don't have the lowest cost of production. Also, like an arms race in which both sides develop increasingly powerful weapons, sellers can exploit the reduction in menu costs to compensate for the lower search costs in electronic marketplaces. Specifically, sellers can make it difficult to compare the price of alternative product offerings, and they can attempt to collect information about buyers that allows more effective price discrimination.

Airlines, for example, have implemented extremely complicated and ever-changing fare structures, flight restrictions, and ticket availability, sometimes offering hundreds of fares for travel between certain pairs of destinations. It is also interesting to note that when informational inefficiencies prevail, a large number of sellers does not necessarily result in a competitive and efficient market. If search costs are high, individual sellers do not have a strong incentive to lower their prices because few buyers would discover them. As the number of sellers increases, it becomes more difficult for buyers to locate discounters, and thus the market may become more monopolistic as the number of sellers increases!



This behavior is likely in certain markets with little or no advertising, such as some markets for professional legal and medical services. Internet marketplaces could provide price cutters with the means to reach a larger fraction of the buyers, and thus undermine the monopolistic nature of these markets. While there is much speculation about the effect that electronic marketplaces have on prices, thus far there has been little systematic analysis. One exploratory study by Bailey and Brynjolfsson [3] did not find much evidence that prices on the Internet were lower than prices for the same goods sold via traditional retail channels. Their analysis was based on data from 52 Internet and conventional retailers for 337 distinct titles of books, music compact discs, and software.

Bailey and Brynjolfsson provide several possible explanations for their unexpected findings, including the possibility that searching on the Internet during the sample period was not as easy as is sometimes assumed, that the demographics of the typical Internet user encouraged a higher price equilibrium, that many of the Internet retailers were still experimenting with pricing strategies, and that Internet retailers were differentiating their products (for example, via delivery options or customized recommendations). Clearly, more empirical research is needed in this area.

**Increasing Differentiation and Lowering the Cost of Product Information.** A higher degree of product differentiation leads to an increase in seller profits, which may partially or completely offset the decrease caused by lower search costs. Sellers in electronic markets will thus want increasingly to differentiate their products, possibly utilizing the personalization and customization technologies discussed earlier.

Buyers in a differentiated market face two types of search costs: the cost of obtaining price information and the cost of obtaining information about the product characteristics of a seller's offering. If sellers can control the type of electronic market introduced, they should favor a system emphasizing product information rather than price-shopping. COMMUNICATIONS OF THE ACM August 1998/Vol. 41, No. 8 41 A key variable for such a system is the cost of product information relative to the cost of price information about the product. For instance, an electronic marketplace designed to promote priceshopping makes it easy to compare price information, but might still require a higher-cost inquiry (such as a visit) to obtain detailed product information.

For example, a buyer looking for a computer monitor on the Internet can easily compare prices from a large number of sellers, but then must obtain and evaluate the monitors' specifications, assess the sellers' reputations and return policies, and ideally locate a display model at a showroom or at a colleague's office. By contrast, an electronic marketplace can be designed to promote competition based on product features. For example, high-quality multimedia product descriptions in standardized formats could help identify product offerings matching the buyer's preferences, while price information could be left out of these descriptions or could be obscured by offering a large number of prices and making it difficult for the buyers to figure out which price actually applies. tained as electronic intermediaries gain a significant market share. Instead, the physical experience component might be unbundled to a physical intermediary.

Auto-by-Tel, for example, may pay a fee to the intermediary where the test drive took place, a service that could be provided by a traditional dealership, but also by a specialized showroom or a car rental company. Internet-based electronic marketplaces are still at a formative stage, and it is hard to fully predict their impact on the structure of markets. However it is becoming clear that they will promote greater economic efficiency, and help sustain economic growth. In the process, they are creating major transformations, full of strategic opportunities for intermediaries ready to compete by adding value for buyers and sellers rather than by exploiting information asymmetries.

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