

INTERMEDIATION, CONTRACTS AND MICROPAYMENTS IN ELECTRONIC COMMERCE

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Will the electronic marketplace be frictionless and economically efficient or suffer from mundane problems found in physical markets? Some imagine electronic commerce as a perfect market platform supported by computer technologies and process innovations; however, despite the advantages over physical markets, electronic markets may not be blindingly efficient because of the nature of a market. We discuss one reason why this will be the case, and summarize innovative processes to prevent market failure.

The problem is the uncertainty about product quality or an asymmetric information problem which may bring about market failure. In physical markets, various mechanisms—such as advertising, try-outs, reputation, standards and certification—help reduce the uncertainty. While the same mechanisms may be used in electronic commerce, they do not guarantee that the efficiency of electronic markets will be any better than that of physical markets. On the other hand, new processes can be established in electronic markets offering better results. One example is the use of micropayments and smart cards. In conjunction with intermediaries and short-term contracts, micropayments will enhance market efficiency even when sellers or sellers' agents do not provide product information.

QUALITY UNCERTAINTY AND THE MARKET FOR LEMONS

Whether it is a physical or a virtual market, one of the primary reasons why a market fails is asymmetric information: what a seller knows is different from what a buyer knows. For example, the uncertainty in product quality results in a market for lemons (Akerlof 1970). In such a market, sellers do not have a means to convince buyers of the quality of their product. Buyers, therefore, are willing to

pay only the expected, average price, which drives out good products and leaves only bad products (lemons).

Aspects of electronic commerce indicate that the quality uncertainty problem will persist or worsen. Many digital products are experience goods which buyers must consume to learn their quality; however, information product sellers are reluctant to offer product information prior to purchase because product information is often the product itself. Visual inspection will not be effective because all digital products are essentially ones and zeros. Also, information for single-use, short-term consumption may come from small individual vendors who may not have long-term market presence or reputation.

These observations and anecdotal evidence suggest that information offered in millions of personal Web pages is of uncertain quality. According to Nathan

Myhrvold, Microsoft's chief technology officer, the Internet is full of "crap." (Newsweek, August 11, 1997). Under an incomplete analysis that digital products have zero marginal costs, the optimal price for any electronic information is said to be zero as well (The Economist, May 10th, 1997).

The emerging business model here is free information based on advertising. The implication is clearly that only firms established in physical markets will be accepted in the virtual market as well. These firms are striving for market dominance by pushing existing contents and entertainment through broadcast-based models and subscription plans. How would individual producers be allowed to trade their products in the electronic marketplace? The key to promoting diversity in information production and trade is found in intermediaries using short-term contracts and micropayments.

INTERMEDIARIES AND SHORT-TERM CONTRACTS

The need for an intermediary is often dismissed in the direct seller-to-buyer transaction model often envisioned for electronic commerce. For example, traditional wholesalers and retailers provide geographic coverage and access to a certain product. The virtual market has little need for such distributional intermediaries. Intermediaries who invest in product knowledge and testing will also be less important if products in question are unsophisticated and of low-value. Checking and guaranteeing the quality of millions of Web page information will be inefficient and ineffective.

Electronic commerce intermediaries must, therefore, perform as a quality guarantor but without incurring high transaction costs. But, how can an intermediary assure that its suppliers maintain high quality without continuous quality checks and assurance mechanisms? Recent researches in contracting theory have suggested that an electronic commerce intermediary can guarantee high quality at minimal costs.

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In a study of subcontracting systems of the U.S. and Japanese purchasing regimes, Taylor and Wiggins (AER forthcoming) found that the competitive bidding system used in the U.S. was well suited for mass-production facilities with intermittent production runs. In this type of bidding, product quality is specified in detail and inspected fully upon delivery. Japanese's just-in-time purchasing system, on the other hand, accommodates a more flexible production process, where frequent production runs of small quantity require just-in-time supplies with minimal delivery and inspection costs. The just-in-time supply system will be highly relevant for personalized information products sold in electronic commerce. The key element of this system is the open-ended contract with suppliers whose deliveries are not inspected. Rather, the contract will be terminated if the manufacturer encounters many instances of low quality. The reward for high quality is the continued business relationship with the manufacturer.

Such an open-ended, incomplete contract may end up inducing the best outcome (Bernheim and Whinston, AER forthcoming). In a short-term but renewable contract discussed by Bernheim and Whinston, the quality is not verifiable but its result—maintaining high quality—is observable. An incomplete contract rewards such an observable performance by suppliers. In electronic commerce, an intermediary may offer an incomplete contract to individual information producers, who will supply products whenever there is a buyer. The trade occurs under the guarantee of the intermediary who terminates the contract if it receives a certain number of complaints. In a way, this intermediary resembles CNN or the *New York Times* who intermediates its suppliers (reporters and columnists) and customers (readers). These virtual versions of CNN build reputation not by checking each news report or column but by maintaining long-term market presence with short-term incentive contracts with suppliers.

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MICROPAYMENTS AND PRODUCT UNBUNDLING

To allow short-term purchases and offer choices for consumers, an electronic commerce intermediary needs a payment mechanism for individual product pricing. Digital coins and smart cards have received much attention for their cash-like anonymity. A more compelling economic rationale for micropayments, however, is their role in enabling short-term contracts and quality-assured intermediation as we discussed above. Furthermore, information is highly personalized. Product customization means the finest market segmentation. For example, some consumers may want only one or two cable TV channels; others may want different combinations of channels. A flexible and profitable product selection strategy is to allow consumers to match products with their tastes, which enables the firm to charge maximum price.

The primary argument against micro-payments is based on the observation that people seem to prefer subscription and bundling as evidenced in newspapers and cable programming. However, the reasons for this preference are more technological than economic. Cable system operators have not invested in an elaborate billing system as have telephone companies, being content with charging monthly fees for a given number of channels—a take-it-or-leave-it marketing. To implement consumer choices, the required investment in billing and accounting system and network delivery hardware has become prohibitive. If cable operators had invested in these technologies and equipment, they would have been well prepared to offer more choices to their subscribers beyond a few tiers. Even with a few tiers, an empirical test shows that two-tier cable systems charge 15% to 20% more for the same cable service than one-tier systems. The increased price and profit comes from market segmentation (Choi 1996). Profits increase as the segmentation becomes finer. If technologies were permitting, we would see finer differentiation and market segmentation even in newspaper production and delivery.

Despite this clear trend toward unbundling, microtransactions and micropayments are dismissed in the digital marketplace in favor of selling large bundles in aggregated bills without encouraging a market for information on demand, small applets or your personal columns. Large digital content providers are engaged in a two-pronged strategy for electronic commerce. On the one hand, they don't see any commercial value in the exploding information offered via millions of World Wide Web homepages. That's a bad news for those individuals who wish to cash in by selling bits of information. On the other hand, these large companies are developing technologies to measure and control usage so that every bit of use will be metered and billed for their software and information products. If you are a small player and have no links to large payment clearing service pro-

viders, there will be no way of billing visitors to your homepage. In this game, free speech advocates and big businesses have become strange bed fellows arguing against micropayments. Contrary to common belief, however, efficient intermediaries and micropayments may very well be the savior of the free speech and free information in the digital age.

CONCLUDING REMARKS

Although it is well understood that the Internet presents an exciting opportunities to reduce transaction costs, its future may depend on how non-technological but fundamentally economic issues such as the lemons problem are solved. A market where buyers and sellers trade goods electronically lacks many of the conventional ways to assess the quality of a product. We have explored how intermediaries using short-term contracts and microtransactions can reduce transaction costs for verifying quality. Organizing and managing such an information intermediary is being experimented in a project by the CREC (<http://cism.bus.utexas.edu>). Furthermore, any little bit of information should find a market to trade in if electronic commerce were to ferment a truly informational age. Micropayments and intermediaries in electronic commerce will play an important role toward that goal.

AGENTS AS MEDIATORS IN ELECTRONIC COMMERCE

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ABSTRACT

Software agents help automate a variety of tasks including those involved in buying and selling products over the Internet. This paper surveys several of these agent-mediated electronic commerce systems by describing their roles in the context of a Consumer Buying Behavior (CBB) model. The CBB model we present augments traditional marketing models with concepts from Software Agents research to accommodate electronic markets.

INTRODUCTION

Software agents are programs to which one can delegate (aspects of) a task. They differ from "traditional" software in that they are personalized, continuously running and semi-autonomous. These qualities make agents useful for a wide variety of information and process management tasks [1]. It should come as no surprise that these same qualities are particularly useful for the information-rich and process-rich environment of electronic commerce.

Electronic commerce encompasses a broad range of issues including security, trust, reputation, law, payment mechanisms, advertising, ontologies, electronic product catalogs (EPCs), intermediaries, multimedia shopping experiences, and back-office management. Agent technologies can be applied to any of these areas where a personalized, continuously running semi-autonomous behavior is desirable. However, certain characteristics will determine to what extent agent technologies are appropriate.

For example, how much time or money could be saved if a certain process was partially automated (e.g., comparing products from multiple merchants)? How easy is it to express your preferences for the task (e.g., shopping for a gift)? What are the risks of an agent making a sub-opti-

mal transaction decision (e.g., making stock market buying and selling decisions or buying a car)? What are the consequences for missed opportunities (e.g., not being able to effectively monitor new job postings)?

Generally, the more time and money that can be saved through automation, the easier it is to express preferences, the lesser the risks of making sub-optimal transaction decisions, and the greater the loss for missed opportunities, the more appropriate it is to employ agent technologies in electronic commerce.

ROLES OF AGENTS AS MEDIATORS IN ELECTRONIC COMMERCE

It is useful to explore the roles of agents as mediators in electronic commerce in the context of a common model. The model we present stems from traditional marketing Consumer Buying Behavior (CBB) research and comprises the actions and decisions involved in buying and using goods and services. However, we augment traditional CBB models with concepts from Software Agents research to accommodate electronic markets.

Although CBB research covers many areas, it is important to recognize its limitations up-front. For example, CBB research focuses primarily on retail markets (although many CBB concepts pertain to business-to-business and consumer-to-consumer markets as well) [2, 3]. Even within retail, not all shopping behaviors are captured (e.g., impulse purchasing). Also, as mentioned earlier, electronic commerce covers a broad range of issues, some of which are beyond the scope of a CBB model (e.g., back-office management and other merchant issues). Nevertheless, the CBB model is a powerful tool to help us understand the roles of agents as mediators in electronic commerce.