

# The Bumpy Road of Electronic Commerce

Andrew Odlyzko  
AT&T Labs — Research  
amo@research.att.com

**Abstract:** Electronic commerce is widely expected to promote “friction-free” capitalism, with consumers sending software agents to scour the Net for the best deals. Many distribution chains will indeed be simplified and costs substantially reduced. However, we are also likely to see the creation of artificial barriers in electronic commerce, designed by sellers to extract more value from consumers. Frequent flyer mileage plans and the bundling of software into suites are just two examples of the marketing schemes that are likely to proliferate. It appears that there will be much less a la carte selling of individual items than is commonly expected, and more subscription plans. Therefore many current development plans should be redirected. Electronic commerce is likely to be even more exasperating to consumers than current airline pricing, and will be even further removed from the common conception of a “just price.” As a result, there are likely to be more attempts to introduce government regulation into electronic commerce.

## 1. Introduction

Electronic commerce (or ecommerce for short) is still small, at least if we consider only online consumer transactions, such as ordering a book from amazon.com over the Internet. In a broader sense, ecommerce is much larger, since financial, news, and legal information services such as Bloomberg, Reuters, and Lexis have total revenues in the billions of dollars. In a still broader sense, electronic funds transfers are already huge, with daily transactions in the trillions of dollars. All these types of transactions are expected to grow, and to become part of a much larger and uniform system of electronic transactions. (For a survey of the current state of ecommerce, and expectations for growth, see [Cohen et al. 1996].)

While we are rapidly moving towards the Information Age, food, shelter, and clothing will remain our most important needs. However, their shares of the economy are decreasing, and the information content of their goods is increasing. This is an old trend. Agriculture has moved from being the largest segment of the economy a century and a half ago to a relatively minor industry, dwarfed by the medical sector, for example. Furthermore, the cost of the basic ingredients in cereals and other foods is a small portion of the total price. As a further example of the decreasing value of raw materials and factory labor, a single celebrity is often paid as much for endorsing an athletic shoe model as all the workers in the undeveloped countries who assemble those shoes. We can expect a continuation of this trend, with the work of the “symbolic analysts” (who, in Robert Reich’s terminology, include lawyers, software writers, and advertising executives) increasing its share of the economy.

The main concern of this essay is electronic trade in information goods, such as news, novels, software, music, movies, as well as legal, medical, and credit information. How will these goods be distributed, and how will their production be financed? Esther Dyson [Dyson 1994] predicts that almost all intellectual content will be available for free. In her view, some content production will be supported by outside advertisers (who already pay for most of the cost of newspapers, for example, as well as all the costs of the commercial TV networks). Some content will likely be made available for free, as a form of advertising for other services by the producers (as the Grateful Dead do in encouraging people to tape their performances, in the hope this will bring more people to their concerts). While Dyson’s vision will come true for a large part of the material on the Net, it seems unlikely that it will be universal. Movie studios such as Disney attract large paying audiences to theaters and purchasers to their videotapes through the quality of their products, and are likely to do so in the future. While some novelists make more money from selling movie rights to their plots to Hollywood than from royalties on books, this is rare. Each year, over a hundred times as many books are published as there are movies produced, and books bring in much more money than movie theater tickets. Thus we can expect that content producers will usually want to be paid directly for their work, as that will be the only feasible route to earning a living. Furthermore, Dyson herself

---

<sup>1</sup> This paper incorporates material from an earlier article on electronic publishing, [Odlyzko 1996].

[Dyson 1994] emphasizes that much of the value on the Net “will go to the middlemen and trusted intermediaries who add value - everything from guarantees of authenticity to software support, selection, filtering, interpretation, and analysis.” How will these middlemen be paid? It seems likely that often they will wish to collect payment directly from consumers, just as the online legal information service Westlaw collects fees from attorneys who use it. The basic data in Westlaw is court opinions, which are freely available. What gives Westlaw its lock on the market is the control of its citation system.

Many of Dyson’s predictions are likely to come true. In particular, huge amounts of intellectual property will be available for free. I expect that this will apply to most scholarly publications, since their authors typically do not receive direct financial benefits from their papers, and are interested in maximizing the circulation of their results [Odlyzko 1996]. However, it seems likely that there will also be a flourishing ecommerce sector, with individuals purchasing goods and services. The question is, how will ecommerce be conducted?

The usual expectation is that ecommerce will promote “friction-free capitalism,” (cf. [Gates 1995]), with distribution costs reduced. It is easy to see how this can happen, as the older communication systems such as the post office, the telegraph, the telephone, and the fax have all served to make the economy more efficient. The Internet creates many more possibilities for improving life. Classified ads, for example, bring in a large fraction of the revenues of the newspaper industry, but can be replaced by a much cheaper and more convenient electronic system. Other part of the common vision of ecommerce are more questionable, however, and that is what the rest of this essay will discuss. It is often thought that instead of buying an entire newspaper, readers will pay for those individual stories they are interested in. Someone wishing to purchase a VCR might send an “intelligent agent” into the Internet to collect bids from suppliers for a unit that meets desired specifications, and then select the best choice. While such scenarios will be feasible technically, it is extremely unlikely they will be dominant. Instead, we are likely to see a proliferation of policies such as those of current music CD retailers who sell on the Internet. Most of them do not allow software agents to collect their prices. We are also likely to see a strengthening of the trend towards subscription services and bundling of products, as is done in software suites today. This will often require redirection of development efforts.

This essay is devoted largely to an explanation of the economic reasons that are likely to lead to the creation of “bumps” on the electronic superhighway. These reasons operate already in the current economy, and are responsible, for example, for the U.S. airline pricing system, which is a source of frequent frustration and complaints. In ecommerce, frustration and complaints are likely to be even more frequent. The reasons for this are twofold. On one hand, the economic incentives to create artificial barriers will be greater in ecommerce than today, since essentially all costs will be the “first-copy” costs of creating goods, and distribution will be practically free. On the other hand, it will be much more transparent that the barriers are artificial. This will often collide with popular notions of what is fair, and is likely to lead to attempts at much more intrusive government regulations than we have seen so far. In the past governments have been involved primarily in security issues of the Net, and more recently have gotten concerned about pornography. However, in the future they are likely to attempt to regulate the conduct of business on the Net as well.

If the predictions of this essay come true, then some of the current development efforts will turn out to be misdirected. Many systems are planned under the assumption that ecommerce will operate through ubiquitous micro-payment schemes, with information goods sold in small units at extremely low prices. Certainly some products will be sold this way, but the arguments in this essay show that much information will be sold via subscription and other more complex marketing mechanisms. This will require different business cases and distribution mechanisms. These arguments also suggest that it will be necessary to prepare to comply with edicts from various governments, edicts that will be changing and will often be inconsistent.

## **2. Natural and Artificial Barriers in Commerce**

Capitalism is excellent at inducing people to reduce barriers to commercial activities. However, it also produces incentives to create artificial barriers. Some of the barriers are created by government action, such as those of patent and copyright laws, which give owners of intellectual property a limited legal monopoly on the uses of their creations. Other barriers are created by merchants. It is common for an airline passenger to have paid 5 times as much as the person in an adjacent seat, with the only difference between the two being that the first one is not

away from home on a Saturday night. The airlines would like to charge the business travelers (who are presumed to be able and willing to pay) more than vacationers (who might drive a car instead or not travel at all), but do not have a direct way to do so. Therefore they impose the Saturday night stopover restrictions to distinguish between those two classes of customers. There have been several attempts by airlines to move towards a simpler system of uniform pricing (sometimes by newcomers, such as People Express, sometimes by established carriers), but they all collapsed. This suggests that there is an underlying economic logic behind this system, however exasperating the results might be. If that is correct, though, we can expect similar moves in ecommerce.

The general tendency in the marketplace is to avoid “commoditization,” in which there are many almost equivalent products and services, and where price is the only consideration. Ford does not compete with Honda in producing the most inexpensive Accord. Instead, it offers the Taurus as an alternative, and there are many features in which the Accord and Taurus differ. Sometimes commoditization is hard to resist. In some cases this happens because consumers learn there is little to differentiate products. Oil companies have pretty much given up on trying to convince people that gasoline differs in anything other than octane ratings. In other cases, commoditization is forced on an industry by government edict or effective private monopoly. Intel and Microsoft have reduced the IBM-compatible PC industry to a commodity business, in which they collect almost all the profits, and the other players scramble to find a niche that will enable them to do more than just break even. However, those are the exceptions. The general ecological principle is towards evolution of species that fill different roles. Zebras do not attempt to compete with giraffes, but exploit a different part of the ecosystem, and evolution does not lead to a convergence of those two species. Similarly, in the world of business, companies try to differentiate their products. Workstation producers could never in the past agree on a common version of Unix, even under the threat of being overwhelmed by PCs, since that would have required giving up the distinctive features that bound them to their customers. Even airlines, which are basically in the commodity business of moving people from one city to another, try to differentiate themselves through frequent flier plans and special pricing schemes.

Ecommerce is likely to lead to a proliferation of pricing plans that will seem to most people to be much more frustrating and less rational than even today’s U.S. airlines. There will probably be a niche market for people who care most about their convenience, and will use their intelligent agents to do their shopping for them. However, what Sony, for example, might do is sell to that market only models of VCRs that are not available elsewhere, and are hard to compare to those sold in other places. Stores that have physical buildings are likely to serve a different clientele, and might also take further steps to differentiate themselves to prevent comparison shopping, which will be much easier with many people sharing their experiences on the Internet. There is likely to be a proliferation of frequent-shopper plans. Further, Sony VCRs sold in Sears stores might be slightly different from those sold in WalMart, and model numbers and features might change rapidly to inhibit consumer rating services (such as Consumer Reports, or various Internet-based group-rating schemes that are beginning to develop). There are already artificial barriers to free information flow. Grocery stores routinely bar employees of other stores from collecting extensive data on prices. The policy of Internet CD stores of preventing software agents from collecting prices for comparison shopping is just an extension of such barriers to free information flow to ecommerce. We can expect more such barriers.

While barriers to commerce of the type discussed above are usually perceived as unfair (an issue that I will deal with more extensively in the last section), they can increase not just the producers’ wealth, but economic efficiency and social welfare. As a simple example, consider an independent consultant who can produce a technical report that two different customers might be willing to pay \$3,000, and \$2,000 for, respectively. If she has to charge a uniform price to the two customers, the most she can get is \$4,000, obtained by pricing the report at \$2,000. However, if she charges the first customer \$3,000, and the other \$2,000, she will earn \$5,000. If the consultant’s time and expenses to prepare the report are worth \$4,500, she will not undertake the effort if a uniform price is required. From an economic viewpoint it is therefore advantageous to allow her to charge different prices to different customers. However, the customer who pays \$3,000 is likely to resent it if somebody else obtains the same product for \$2,000, and often will not agree to the deal if all conditions are publicly known. This is caused by a conflict between notions of economic efficiency and fairness.

There are many examples in the marketplace of behavior that appears even less fair. For example, in 1990, IBM introduced the LaserPrinter E, a lower cost version of its LaserPrinter. The two version were identical, except that the E version printed 5 pages per minute instead of 10 for the regular one. This was achieved (as was found by independent testers, and was not advertised by IBM) through the addition of additional chips to the E version that

did nothing but slow down processing. Thus the E model cost more to produce, sold for less, and was less useful. However, as Deneckere and McAfee show in their paper [Deneckere & McAfee 1996], which contains many more examples of this type (referred to as "damaged goods"), it can be better for all classes of consumers to allow such behavior, however offensive it might be to the general notions of fairness. Consumers who do not need to print much, and are not willing to pay for the more expensive version, do obtain a laser printer. Consumers who do need high capacity obtain a lower price than they might otherwise have to pay, since the manufacturer's fixed costs are spread over more units.

Barriers in commerce are an essential part of the current marketplace. Consider the book trade. Although people do not think of it this way, current practices involve charging different prices to different users, and thus maximizing revenues. A novel is typically published in hard cover first, with the aim of extracting high prices from those willing to pay more to read it right away. Once that market is fully exploited, a somewhat cheaper trade paperback edition is made available, to collect revenue from those not willing to pay for the hardbound copy. Finally, a regular paperback edition is published at an even lower price. The used book market develops in parallel, for those willing to read books marked up by previous owners, and so on.

How will ecommerce affect book publishing? Eventually we can expect that all books will be available electronically (and will evolve towards new forms, made possible by digital communications). Costs of publishing will come down, and this is going to increase the supply, and lead to many works distributed for free, by aspiring authors hungry for the recognition that might lead to fortune. What about those electronic books that people will be willing to pay for? With publishing costs reduced, we can expect that the authors' share of the revenues will rise, say from the current 15% or so royalty rate to 50% or more, and so in effect the authors might become much more influential than the publishers (or might become the publishers themselves). However, since publishers obviously benefit from the present system of differential pricing, they (and the authors) are likely to have an incentive to institute a similar system in the digital arena. The issue is how to do this. Bits are bits, after all, and are easy to copy.

If we make only simple extensions of current copyright laws, we are likely to see a great change in the marketplace for information goods. When I buy a book, I cannot make a copy of it and sell that copy to somebody else. On the other hand, I can sell, rent, or give away the book I purchased to anyone I wish. Suppose we carry over exactly the same rights to the digital world, with some combination of cryptographic techniques and laws guaranteeing that unauthorized copies of digital "books" cannot be made. The ease of transactions on the Net (which is what leads to the dreams of "frictionless capitalism") would then force major changes. With physical volumes, there are substantial barriers to trade in books. Most people do not like reading books that are tattered or marked up by others. They take their time reading books, and (especially for the ones they enjoy) like to retain them in their libraries to be reread any time they wish. As a result of these natural barriers, a single copy is usually read by only a few people. The economics of the present book publishing business depend on this phenomenon. In the digital world, though, with high bandwidth networks and efficient intermediaries, I could buy a copy of a book an hour before bedtime, read a new chapter, and then, just before turning off the lights, send that copy off for resale. Instead of a million copies of a printed book, a thousand electronic copies might suffice. This would force a dramatic change in the structure of the book publishing industry, and explains why there is an intense interest in the creation of artificial barriers to ecommerce, either through revisions to copyright laws or through technological methods.

### **3. The Bumps on the Electronic Highway**

Some types of barriers to commerce are accepted as natural when dealing with physical goods. It would be prohibitively expensive for the New York Times, say, to distribute 100 little sheets each day, each one with a separate story, and having readers buy just the ones they were interested in. The accepted wisdom is that ecommerce will lead to the electronic equivalent of just that, with readers selecting and paying for individual stories. It will certainly be possible to do so, as micropayment systems are being developed that will allow for processing of tiny transactions, such as payment for a single story in the New York Times, or a "hit" on some aspiring poet's Web page. However, the economic argument is that while such schemes might exist, and may be used in some situations, they will not be dominant. The example of book publishing in the previous section shows why producers of information goods benefit from the natural barriers that exist in the physical world. Their incentives to create

artificial barriers in the digital world will be even stronger. It will be harder to distinguish between consumers, since transactions will tend to be impersonal, and arbitrage will be easy. Most important, distribution costs will be negligible, so that only the “first copy” cost of creating a work will matter. Hence traditional, commodity-market type of competition, in which the market price equals the marginal cost, will have to be avoided, since marginal prices will be essentially zero. The incentive that low marginal costs provide to create barriers in commerce can already be seen in many high technology fields. The “damaged goods” studied in [Deneckere & McAfee 1996] come primarily from such areas. The pharmaceutical industry is notorious for selling products for hundreds of times more than the cost of producing them, and for selling the same chemicals for human use for ten times the price charged for veterinary purposes.

While the incentives to erect artificial barriers will be large in ecommerce, there will also be novel possibilities created by the electronic medium. What kinds of barriers are we likely to encounter in ecommerce? The four most important ones will probably be bundling, differential pricing, subscriptions, and site licensing. That they are likely to be prominent in ecommerce has been pointed out before, especially by Hal Varian [Varian 1995a], [Varian 1995b]. In the rest of this section I will explain how they operate, and why they are attractive to content producers. There are additional arguments in favor of subscription and site licensing plans. For example, security problems are likely to be easier to solve in those cases. However, this essay will deal only with the economic arguments.

The basic assumption in the economic analyses below is that for each information good, an individual consumer will purchase it only if the price is below some threshold (that consumer’s valuation of the good). For simplicity, I will only consider items that are independent of each other (such as stories in a newspaper). Much of the economic literature cited below is concerned with goods that are related in one way or another. (For example, if I buy a spreadsheet from Corel, I am unlikely to purchase another one from Microsoft. On the other hand, if I buy a presentation package, I am more likely to buy a CD-ROM of pictures than I would otherwise.) I will not take these factors into consideration, to keep the presentation simple, and bring out only the main factors that are likely to influence the development of ecommerce. I will also assume, as is standard, that producers cannot in general find out what an individual is willing to pay for a product, but can, through test marketing, say, obtain an accurate statistical description of the valuations that the whole population of potential buyers place on that product.

### **3.1. Bundling**

Bundling consists of offering several goods together in a single package, such as combining a word processor, a spreadsheet, and a presentation program in a software suite (such as Microsoft Office), or else printing many stories in a single newspaper. Bundling is common, and often seems natural. For example, right shoes and left shoes are invariably sold together, and just about the only time anyone might regret this is when a dog chews up one of a new pair of shoes. I will concentrate on bundling of goods that are almost unrelated, such as a word processor and a spreadsheet program. Why should the pair of them together sell for much less than the sum of their separate prices? It is useful to have seamless integration of the two, to make it easier to move material between them, to have common command structure and icon layouts, and so on. That seems to argue for charging more for the bundle than for the pieces! However, bundling, with a lower price for the bundle than for the components, or even without any possibility for purchasing the components separately, is common. The reason is that it allows the producer to increase revenues by capturing more of the “consumer surplus” that arises when customers pay less than they are willing to do. Since in general prices have to be the same for all customers, bundling can be used to smooth out the uneven preferences people have for different goods and services. For example, suppose we were dealing with a proposal to start a newspaper that would have two sections, a business page and a sports page. Suppose also that there were just two potential readers, Alice and Bob. Suppose also that Alice needs to keep up with the financial world, and so is willing to pay \$0.50 for the business page, but only \$0.20 for the sports page, since she does not particularly care about sports, but might like to keep up with lunchtime conversations. Suppose that Bob’s preferences are reversed, in that he is an eager sports fan, willing to pay \$0.50 for the sports page, but only \$0.20 for the business page, since all he cares about is occasionally checking on his retirement fund. Under those conditions, how should the proposed newspaper be priced? If each section is sold separately, then a price of \$0.20 for each will induce both Alice and Bob to buy both sections, for total revenues of \$0.80. If the price is set at \$0.50 for each section, then Alice will buy only the business page, and Bob only the sports page, for total revenue of \$1.00. On the other hand, if the two sections are bundled together, then a price for both of \$0.70 will induce

both Alice and Bob to purchase the newspaper, and will produce total revenues of \$1.40. Thus the economically rational step is not to offer the two sections separately, but only bundled together.

Bundling has been studied extensively in the literature, starting with the paper of Burnstein [Burnstein 1960]. A few other references are [Adams & Yelen 1976], [Bowman 1967], [Economides 1993], [Krishna et al. 1996], [Schmalensee 1982], [Stigler 1963], [Varian 1989], [Wilson 1993], [Wilson 1996]. Unfortunately there is no simple prescription that can be given as to when bundling is better than selling items separately. Depending on the distribution of consumer preferences, bundling can be either more or less profitable for the producer, as was already shown by Adams and Yellen [Adams & Yelen 1976]. However, there are some general guidelines. One is that bundling becomes more profitable as marginal costs decrease. (This may partially explain why software suites spread at about the same time as unpaid support provided to users by software houses decreased.) Another is that bundling becomes more attractive when consumer preferences are negatively correlated (as in the example above, where Alice and Bob had almost opposite tastes). However, negative correlation in valuations is not necessary for bundling to be profitable, as was first pointed out by Schmalensee [Schmalensee 1982], and as will be shown in the example below. Random variations in preferences are sufficient as a result of the law of large numbers.

How much of a difference can bundling make to a producer's bottom line? Unfortunately the published literature is practically silent on this point, for reasons I will discuss later. (There is one intriguing computation in [Stigler 1963], based on reported revenues of movie theaters in different cities.) Let us therefore consider some artificial examples, a bit more realistic than the Alice and Bob one presented above. Consider two books, A and B, say "The Tannu-Tuva Cookbook" and "Sherlock Holmes in Antarctica." Suppose that among one million potential customers, book A is valued at \$1 by 100,000, at \$2 by another 100,000, and so on, up to \$10 by 100,000, and suppose the same distribution of valuations applies to book B. Suppose further that the valuations of the two books are independent. Thus there are about 10,000 customers who value book A at \$3 and simultaneously book B at \$5, and similarly about 10,000 customers who place values \$9 and \$2 on A and B, respectively. Under these conditions, if the publisher is to sell these books separately, revenue will be maximized when the price of each is set at \$5. About 600,000 people will purchase each book, for total revenue from sales of both books of \$6,000,000. (This maximum is not unique, as the same revenue can be achieved by pricing each book at \$6, in which case about 500,000 people will buy each.) However, if the two books are sold together, revenue can be made much higher. Since there are 10,000 people who value the bundle at \$2 (exactly the 10,000 who value each book at \$1), while there are 90,000 who value it at \$10, a short calculation shows that the revenue-maximizing price is \$9. At the price of \$9 per bundle, 720,000 people will purchase it, for total revenue of \$6,480,000, exactly 8% higher than if the books were sold separately. Since profits are the revenues minus the fixed costs of producing the books, they would increase much more dramatically.

What weakens the case for bundling is that most people have no interest in most goods. In the example of the books "Sherlock Holmes in Antarctica" and "The Tannu-Tuva Cookbook," a more realistic assessment would be that in a population of 1,000,000, each book would be valued at zero by 90% of the population, with 10,000 valuing it at \$1, 10,000 at \$2, and so on. If the 100,000 people who do place a positive value on book A are distributed independently of those who value book B at \$1 or more, then there are only 10,000 people who place positive values on both A and B. Bundling under these conditions does not produce much benefit. However, even in cases of extreme indifference, bundling can be profitable if there are enough goods. Consider an information service with 1,000 items (news stories, pictures, or songs). Suppose that in a large population, each individual is totally uninterested in 900 of the items, and values 10 at \$0.01 each, 10 at \$0.02 each, and so on, with 10 valued at \$0.10 each. If the items are to be sold individually, a revenue-maximizing policy is to charge \$0.05 for each. Each customer will then purchase 60 items for a total of \$3.00. However, if the collection is sold as a whole (which involves no extra cost to producers in case of information goods, and also no cost of tossing out mounds of unwanted boxes to consumers), then a price of \$5.50 will induce each person to buy, for a gain of 83% in revenues (and more in profits).

So far we have compared only sales of unbundled products (pure unbundling) to those of bundles (pure bundling). However, it is often advantageous to use mixed bundling, where both bundles and separate goods are offered. In the example of the books "Sherlock Holmes in Antarctica" and "The Tannu-Tuva Cookbook," with the distribution of valuations assumed above, a price of \$10 for the bundle and \$5 for each book separately would produce revenue of \$7,400,000, about 14% higher than pure bundling, and over 23% higher than pricing the books separately. (Note that the optimal combination above has the paradoxical property that the price of the bundle is exactly the price of

the pieces. Under the assumption of the model, people who value book A at \$7 and book B at \$3 will purchase the bundle, but if the bundle is not available, will only purchase A.) Adams and Yellen [Adams & Yelen 1976] have shown that mixed bundling is always more advantageous to the producer than pure bundling.

Toy models like the one above are amusing to play with, and help illustrate the advantages to producers of bundling. If the distribution of consumer valuations is known, one can determine numerically what the optimal policy is for the producer [Wilson 1993], [Wilson 1996]. Unfortunately the basic assumption that consumers know what value they place on various goods, and purchase them precisely when the price is below their value, is questionable. In practice people behave in much more complicated ways. An old joke illustrates this:

Waiter: And for dessert, we have chocolate mousse, apple pie, and ice cream.

Customer: I will have apple pie.

Waiter: Oh, I forgot to mention that we also have Peach Melba.

Customer: In that case I will have mousse.

While this is a joke, actual behavior is often just as paradoxical. Catalog merchants have learned that the attractiveness of an item is affected strongly not just by its price and description, but also by its placement among other offers. Consumer choices are complicated. Some of the seemingly irrational behavior can be explained on the basis of different consumers having different sensitivities to prices. For example, the phenomenon of regular sales has been modeled successfully this way in [Varian 1980] and later papers. Other interesting phenomena emerge if one assumes that consumers do respond to price signals in an economically rational way, but with some delay (see [Richardson & Radner 1996], for example). However, there is no complete theory. Experimental economics has shown that in economically optimal solutions can be attained even with small groups of agents, provided they are working in a constrained environment and are trying to optimize their wealth, although even there paradoxes abound (cf. [Cook & Levi 1990], [Hagel & Roth 1995]). In general settings, though, human behavior is hard to model. There are nontransitivities in preferences, choices are determined by behavior of others (so a person is more likely to see a movie that colleagues have seen to have something to talk to them about as well as because that person is likely to trust their judgement), and so on. Companies collect extensive data from test marketing, but that data is noisy, and typically involves only small variations in test parameters. There seems to be no unambiguous empirical demonstration that a well defined demand curve exists. Thus economic models discussed above do indicate that bundling is likely to be advantageous to producers, but do not prove this.

What happens in the real marketplace, with a variety of customers and competitors, and where there is already much experience with a variety of marketing plans? What we see there is extensive evidence of bundling, which confirms the prediction of the economic models. In many situations, such as that of physical newspapers, there is an obvious motivation for bundling to reduce costs. However, there is also evidence of bundling's success when there are practically no physical costs involved. Software suites such as Microsoft Office are just one example. Cable TV does not charge for each channel separately, but for packages (bundles) of them. Finally, the big and profitable online information services in the financial and legal arena, such as Reuters, Bloomberg, and Lexis, all operate on a subscription basis or appear to be moving in that direction. (The "pay-per-view" approach made more sense when the computing infrastructure for online access was expensive, and therefore there were high marginal costs of providing access.) All this evidence confirms that bundling is likely to be common in ecommerce.

### **3.2. Differential Pricing**

Charging different prices to different consumers is already common. Various senior citizen or student discount programs are just some of the most widely spread practices. Scholarly journals typically charge much higher prices to libraries than to individuals, sometimes 10 times higher. For a thorough discussion of such price discrimination and its economic and legal status, see the survey [Varian 1989]. A producer would like to charge according to the consumer's willingness to pay, but the consumer will usually be reluctant to reveal such information. However, it is sometimes possible to correlate willingness to pay with other features. Airlines offer much cheaper tickets for those willing to be away from home on Saturday night. The theory is that business travelers, who are willing to

pay a lot, will not be willing to put up with such inconvenience. In information services, online services such as Prodigy and CompuServe offer stock market quotes that are delayed by 15 or 20 minutes for no extra cost, beyond the basic subscription. Real-time quotes uniformly cost extra, on the theory that those who need them for their trading will pay more.

The software industry relies on differential pricing in many products. Student or demo versions typically are the same as the main packages, except for artificial limitations on what they can do. They either cannot produce large executables, or cannot handle large files, or cannot use extended precision. We are likely to see many more examples of such differential pricing. Electronic publications may offer a high-resolution version at one price, a lower-resolution version at a lower one, and sometimes might offer a fax-quality version at no charge. There are already interesting experiments in book distribution, with authors making some parts of their manuscripts freely available on the Internet, to advertise their work, to update it with lists of current errata, and to make available features that draw on the unique capabilities of the electronic medium. There are also likely to be differentials based on timeliness, as with stock market quotes; old issues might be offered at low or no charge. There might be extra charges for links to cited works or other desirable features.

Differences in quality of offered products might be the only way to preserve some of the features of public libraries. In the digital realm, without some artificial barriers, there would be practically no difference between buying and borrowing. Hence the traditional library policy of unrestricted lending is not compatible with ecommerce, and we are likely to see artificial barriers. Databases might be available to library customers but only inside the library, at special terminals, for example. Librarians would then become gatekeepers, restricting access to material more than making it freely available.

### **3.3. Subscription vs. Pay-Per-View**

Offering access to a database or a movie channel on a subscription basis is a form a bundling. The alternative is to charge for each movie, or each download of a Web page. There is much discussion of how such “a la carte” shopping might become prevalent. One attraction of programs consisting of small applets that can be downloaded on demand appears to be the perception that this would allow producers to charge according to how frequently the software is used. However, past experience with pay-per-view systems has been discouraging. Except for a few events, such as championship boxing matches, they have not succeeded in attracting much revenue. All the arguments in favor of bundling apply, and suggest that pay-per-view systems will not be common. Furthermore, there are additional arguments, supported by empirical data on consumer behavior, that argue against pay-per-view schemes. Consumers appear to have a strong predilection for reducing risk, even when this predilection results in lower than optimal expected financial payoff. A certain \$10 gain is usually preferred to a wager with a 90% chance of winning \$15, and a 10% chance of losing \$20, even though the latter has expected payoff of \$11.50. People also tend to use small deductibles when purchasing fire or casualty insurance, even when they could easily bear the loss from a larger deductible. (Since few insurance companies operate with an overhead of less than 30%, a larger deductible would almost surely lead to savings in the long run.)

Similarly, consumers appear to have a strong preference for subscription services. To a large extent this is probably explainable by general risk aversion. I may prefer to pay a higher price for a word processor now, even if I do not need it much, to have free use of it when I lose my job, and need to send out lots of job applications, but will not be able to afford extra charges. This preference for subscription services is present even among librarians, who are not spending their own money, and with a large number of users of their resources might be expected to have a stable and predictable usage pattern. Even so, they have often expressed their unease about paying “a la carte” for access to databases, since they feared they could not predict what this would do to their budgets. It is difficult to quantify the strength of this preference for subscription services, but it exists and is strong. In the 1970s, the Bell System experimented with charging for local calls. Typically, customers were given a choice of the traditional flat rate option, which might cost \$7.50 per month, and allow unlimited local calling, and of a measured rate option, which might cost \$5.00 per month, allow for 50 calls at no extra charge, and then cost \$0.05 per call. Anyone making fewer than 100 local calls per month was better off with the measured rate option. Careful studies of consumer behavior were carried out by Bill Infosino, Gerry Ramage, John Rotondo, and others at AT&T. They observed that typically around 50% of the customers who were making almost no local calls at all, and thus would have



benefited from measured rate service, still stayed with the more expensive flat rate service. The preference for flat rate pricing for Internet access is another example of this phenomenon.

The main conclusion to be drawn from this discussion is that subscription services do offer substantial value to consumers, even if that value may seem to be irrational. As a corollary, they also offer value to producers. People are willing to pay a lot just to be able to occasionally use certain features. Software producers complain about all the heavy users of their products who do not pay for their high usage. However, these producers benefit from the many users who hardly ever use their system. I seldom use Microsoft Word, but when I do use it (typically because somebody sends me a Word document), I do need it, and so am willing to purchase it for just such occasions. Hence we can expect that even if large systems consisting of downloadable applets do become practical, they will be available on a subscription, and not on a per-use basis.

### **3.4. Site Licensing**

Site licensing, in which a company or a university pays a flat fee to allow everyone in that institution to use some program or access a database, is very common in the computer and online information industries. In some forms, it has been present for a long time in other areas as well. For example, scholarly publishing can be thought of as an example of site licensing. Typically a university will buy a single copy of an esoteric journal, which is then placed in a library, to be consulted by anyone on campus.

In software, site licensing has many attractive features. It simplifies the enforcement problem (which is nontrivial, since many corporations report they spend more on policing software use than on the purchase of that software). It also encourages new users to try out a package, and thus stimulates more usage. In addition, though, site licensing has a strong direct economic argument behind it. We can think of site licensing as a variant of bundling. In ordinary bundling, a producer assembles together several goods into a bundle, to smooth out the differences in valuations that individual consumers place on those goods. In site licensing, a producer assembles together a group of consumers to smooth out the differences in valuations that different people place on a single product. As an example, suppose that in a company of 1,000 employees, 900 are totally uninterested in a software package, but 10 feel it is worth paying \$10 for it, 10 feel it is worth \$20, and so on, up to 10 who feel it is worth \$100. If the software manufacturer had to sell copies of the package to individuals, the best price would be either \$50 or \$60 for a copy, and the revenue in either case would be \$3,000. However, if the management of the company has an accurate estimate of how much the employees value the product, it should be willing to pay \$5,500 for a site license. This would be a much better deal for the producer, even though it would bring in only \$5.50 for each person entitled to use the product. Hence we can expect further spread of site licensing. (For some other aspects of site licensing, see [Varian 1995b].)

## **4. Fairness, Legality, and Efficiency**

Economic arguments show that there is value to many of the artificial barriers in commerce. It is value not just to producers of the goods and services, but to society. Moreover, the incentives to create such barriers apply to individuals as well as large corporations. If Alice plays the piano, and Bob performs magic tricks, they might be able to obtain a higher total income by bundling their services through offering a combined act to nightclubs. The result might be the difference between starvation and relative comfort. In ecommerce, a group of budding poets might collect larger revenues if they sell access to their combined works, instead of acting individually.

While economics will lead to the creation of barriers in ecommerce, this will frequently clash with popular notions of what is fair. There is already much grumbling about airline pricing and senior citizen discounts. Moreover, many of the grumbles result in laws restricting commerce. Several cities in the United States have passed laws decreeing that women's shirts should not cost more to launder than men's. There is a general perception of what is fair, often codified into laws. Some is based on ideas of non-discriminatory treatment (as with laundry pricing practices). Some goes back to the ancient notion of a "just price," which is supposed to reflect a modest markup over the producer's costs. However, in ecommerce, even more than in the modern physical economy, cost is a poorly defined concept.

In ecommerce, the concepts of “increasing returns” [Arthur 1994], in which producer profits increase as usage increases, and customer lock-in, in which someone trained in using a particular spreadsheet faces a major barrier of retraining in switching to another one, are among the ruling ones. This means that the many traditional tests of illegal monopolistic behavior do not apply. It can make excellent sense to give away a software package, since the major benefit to the producer will come from sales of upgrades. Other examples of economically sensible behavior that is not accepted by society exist. U. S. courts stopped IBM from requiring users of its tabulating machines to purchase their punched cards from IBM [US 1936]. Today, most economists would argue that this decision was a mistake, since in effect what IBM was attempting to do was to charge the heavy users more than the light ones, to enlarge the market. (See [Stigler 1963] for economic arguments against another decision, [US 1962], which barred movie distributors from requiring movie theaters to book whole series of movies instead of selecting them individually.) While the general issue of what practices are legal is at best murky (cf. [Bork 1993], [Bowman 1967], [Varian 1989]), there may be legal problems with some of the barriers that are likely to be erected. Even when there is no legal difficulty, there can be extensive public action, as in recent protests against pharmaceutical firms’ pricing, and against use of child labor in less developed countries. (With reputations, whether of celebrity endorsers or producers themselves, becoming increasingly important, public protests can be powerful weapons.) Issues of fairness (see [Zajac 1995] for extensive discussions of their influence on public policy) are likely to be much more pronounced than in the past. One reason is that the barriers on the electronic superhighway are likely to be frequent. Another is that those barriers will be much more visible as artificial. In print book publishing, most people seem to think that hardcover books sell for more than paperbacks because they cost more to produce. However, the differences in costs are minor, and the price difference is just a form of price discrimination. On the Web, it will be clear that a low resolution version of a work is just a degraded version of the high resolution one. It will also be much easier to organize protest movements than in the past.

Public perceptions of what is fair depend on culture, are often inconsistent, and do often clash with economic incentives. Furthermore, the rapid evolution of technology, markets, and laws, will lead to a continuation of the unstable situation we have. There may be serious protests against the “winner-take-all” society [Frank & Cook 1995] that electronic commerce might be seen to promote, where millions of aspiring novelists work hard to catch the public’s attention, but a small handful manage to catch all the material rewards. Even without general protests, there will be increasing temptation to ask governments to intervene, and that will produce serious difficulties for ecommerce. Barlow’s “independence declaration” [Barlow 1996] might appeal to many, but is totally unrealistic. Government has been involved in setting up the Internet, and is getting more involved all the time, through issues such as the fair use of Scientology documents on the Net, assignments of names, and provision of wide access to the Net. The U. S. Telecommunications Act of 1996, which nominally deregulated telecommunications, also brought in extremely intrusive government regulations, to deal with thorny issues of setting up a “level playing field.” We should be prepared for more intervention of this type, whether they are successful or not.

Many issues will be complex. As an example, only a tiny fraction of the public understood any of the arguments about the U. S. telecommunications deregulation debate, with its technical points about access to local wires. Also, few people follow the details of the debate about revisions to copyright laws. As was argued in an earlier section, ecommerce requires some revision. However, there are a variety of ways to do this, and the precise ways in which different proposals affect different players is not clear to the public. (See the discussions by Samuelson [Samuelson 1996a], [Samuelson 1996b] of the proposed revisions to U. S. copyright law [USPTO 1995], as well as the survey paper [Okerson 1996] and the book [Patterson & Lindberg 1991].) Therefore we can expect an increased demand for lobbyists, lawyers, and public relations experts. Even in the non-governmental arena, it is reported, for example, that “in preparing a commemorative CD-ROM for the 500th anniversary of the first Columbus voyage to America, IBM spent over \$1M clearing rights, of which only about \$10K went to the rights holders; everything else went into administrative and legal fees” [Lesk 1995]. Although systems are being developed for automatic tracking of rights to copyrighted material and the automatic payment of fees, it is unlikely that such systems will see wide usage. Content owners will probably be reluctant to rely on them, and possibly let valuable rights slip away.

The conclusion to be drawn from this essay is that electronic commerce will increase the efficiency of the economy. However, it will also create artificial barriers, and we will have to learn to live with them.

## 5. References

- [Adams & Yellen 1976] Adams, W. J., & Yellen, J. L. (1976). Commodity bundling and the burden of monopoly, *Quart. J. Economics*, 90, 475-498.
- [Arthur 1994] Arthur, W. B. (1994). *Increasing Returns and Path Dependence in the Economy*, U. Michigan Press.
- [Barlow 1996] Barlow, J. P. (1996). A cyberspace independence declaration, email broadcast message of Feb. 9, 1996, available at URL <http://syninfo.com/IAN/02136002.htm> and many other Net sites.
- [Bork 1993] Bork, R. (1993). *The Antitrust Paradox*, 2nd ed., Free Press.
- [Bowman 1967] Bowman, W. S., Jr. (Nov. 1967). Tying arrangements and the leverage problem, *Yale Law J.*, 67, 19-36.
- [Burnstein 1960] Burnstein, M. L. (1960). The economics of tie-in sales, *Rev. Economics and Statistics*, 42, 68-73.
- [Cook & Levi 1990] Cook, K. S., & Levi, M., eds., (1990). *The Limits of Rationality*, Univ. Chicago Press.
- [Deneckere & McAfee 1996] Deneckere, R. J., & McAfee, R. P. Damaged goods, *J. Economics and Management Strategy*, to appear.
- [Dyson 1994] Dyson, E. (1994). Intellectual value, first published in Dec. 1994 in Release 1.0, republished (in an abbreviated form) in *Wired*, July 1995, and available at URL <http://www.hotwired.com/wired/3.07/features/dyson.html>
- [Economides 1993] Economides, N. (1993). Mixed bundling in duopoly, working paper, available at URL <http://edgar.stern.nyu.edu/networks/cvnoref.html>
- [Economides 1996] Economides, N. The economics of networks, *Intern. J. Industrial Organization*, to appear. Available at URL <http://edgar.stern.nyu.edu/networks/cvnoref.html>
- [Frank & Cook 1995] Frank, R. H., & Cook, P. J. (1995). *The Winner-Take-All Society*, Free Press.
- [Gates 1995] Gates, B., Myhrvold, N., & Rinearson, P. (1995). *The Road Ahead*, Viking.
- [Hagel & Roth 1995] Hagel, J. H., & Roth, A. E., eds. (1995). *The Handbook of Experimental Economics*, Princeton Univ. Press.
- [Krishna et al. 1996] Krishna, A., Kopalle, P. K., & Assuncao, J. L. Bundling of complementary goods: The impact of competition, brand preference, and price sensitivity, in preparation.
- [Lesk 1995] Lesk, M. (1995). The seven ages of information retrieval, to be published.
- [Odlyzko 1996] Odlyzko, A. M. (June 1996). On the road to electronic publishing, *Euromath Bulletin*, 2(1), to appear, and to be available at URL <http://www.math.ethz.ch/shared/emb> Available electronically at URL <http://netlib.att.com/netlib/att/math/odlyzko/index.html> and via email by sending the message send [publishing.road.txt](mailto:publishing.road.txt) from [att/math/odlyzko](mailto:att/math/odlyzko) to [netlib@research.att.com](mailto:netlib@research.att.com).

[Okerson 1996] Okerson, A. S. (July 1996). Who owns digital works?, *Scientific American*, 275, 64-68. Text available electronically at URL <http://www.sciam.com/WEB/0796issue/0796okerson.html>

[Patterson & Lindberg 1991] Patterson, L. R., & Lindberg, S. W. (1991). *The Nature of Copyright: A Law of Users' Rights*, Univ. Georgia Press.

[Richardson & Radner 1996] Richardson, T. J., & Radner, R. Monopolists and viscous demand, to be published.

[Samuelson 1996a] Samuelson, P. (1996). Intellectual property rights and the global information economy, *Comm. ACM* 39, 23-28.

[Samuelson 1996b] Samuelson, P. Technological protection for copyrighted works, *Emory Law J.*, to appear.

[Schmalensee 1982] Schmalensee, R. (1982). Pricing of product bundles, *J. Business*, 57, S211-S230. Comments on S231-S246.

[Stigler 1963] Stigler, G. (1963). *United States v. Loew's Inc.*: A note on block booking, *Supreme Court Review*, 152, 152-157.

[US 1936] *International Business Machines Corp. v. United States*, 298 U.S. 131 (1936).

[US 1962] *Loew's Inc. v. United States*, 371 U.S. 38, 52 (1962).

[USPTO 1995] *Intellectual Property and the National Information Infrastructure, The Report of the Working Group on Intellectual Property Rights*, B. A. Lehman, Chair, U. S. Patent and Trademark Office, Sept. 1995. Available at URL <http://www.uspto.gov/web/ipnii/>

[Varian 1980] Varian, H. R. (1980). A model of sales, *Am. Economic Review*, 70, 651-659. Erratum on p. 517 of vol. 71 (1981).

[Varian 1989] Varian, H. R. (1989). Price discrimination, 597-654 in *Handbook of Industrial Organization*, vol. I, R. Schmalensee and R. D. Willing, eds., Elsevier.

[Varian 1995a] Varian, H. R. Pricing information goods, available at URL <http://www.sims.berkeley.edu/hal/people/hal/papers.html>.

[Varian 1995b] Varian, H. R. Buying, renting and sharing information goods, available at URL <http://www.sims.berkeley.edu/hal/people/hal/papers.html>.

[Wilson 1993] Wilson, R. (1993). *Nonlinear Pricing*, Oxford Univ. Press.

[Wilson 1996] Wilson, R. (1996). Nonlinear pricing and mechanism design, 249-289 in *Handbook of Computational Economics*, vol. I, H. M. Amman, D. A. Kendrick, and J. Rust, eds., Elsevier.

[Zajac 1995] Zajac, E. E. (1995). *Political Economy of Fairness*, MIT Press.

## **Acknowledgements**

I thank Stevan Harnard, Hsueh-Ling Huynh, Bill Infosino, Steve Lanning, Peter Linhart, Gerry Ramage, Ryan Siders, Hal Varian, and Ed Zajac for their comments and the information they provided.