Intermediation and Electronic Markets: Aggregation and Pricing in Internet Commerce

by

Joseph P. Bailey
M.S., Stanford University (1993)
B.S., Carnegie Mellon University (1992)

Submitted to the Department of Electrical Engineering and Computer Science
in partial fulfillment of the requirements for the degree of

Doctor of Philosophy in Technology, Management and Policy

at the

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

May 1998
[June 1998]

Signature of Author_____
Technology, Management and Policy Program
Department of Electrical Engineering and Computer Science
May 20, 1998

Certified by_____
Lee W. McKnight
Lecturer, Technology and Policy Program

Certified by_____
Erik Brynjolfsson
Associate Professor, MIT Sloan School of Management

Certified by_____
David D. Clark
Senior Research Scientist, Laboratory for Computer Science

Accepted by_____
Richard de Neufville
Professor and Chairman, Technology, Management and Policy Program

Accepted by_____
Arthur C. Smith
Chairman, Department Committee on Graduate Studies

Intermediation and Electronic Markets:

Aggregation and Pricing in Internet Commerce

by

Joseph P. Bailey

Submitted to the Department of Electrical Engineering and Computer Science
on May 20, 1998, in partial fulfillment of the requirements for the degree of

Doctor of Philosophy in Technology, Management and Policy

Abstract

The Internet continues to grow as a medium to support commerce. Economic analysis of Internet commerce is still in a nascent stage while Internet technology and use has rapidly advanced. The result is an Internet marketplace brimming with entrepreneurs and major corporations experimenting with business strategies and technology advances even though the economics of Internet commerce is not well understood. This thesis responds to this need by exploring how the Internet reduces the market friction common in physical commerce.

The intermediaries who help reduce market friction in physical markets may be eliminated, when suppliers and consumers increasingly rely on the Internet as a transaction medium. An intermediary in any market may reduce transaction costs by performing four roles: aggregation, pricing, search, and trust. The intermediary roles of aggregation and pricing may provide little or no value as the Internet becomes the medium for commerce because the technology, not the intermediary, reduces transaction costs. This thesis examines the possible elimination of aggregation and pricing intermediaries in Internet commerce. It does so by extending the theory of the economics of intermediation and electronic markets; developing a methodology for the analysis of Internet price competition; analyzing exploratory empirical data of the book, compact disc, and software markets to test a subset of this theory; and exploring the public policy implications of Internet price discrimination. The approach is interdisciplinary because this thesis integrates the technology, policy, and economics that underpin the role of aggregation and pricing intermediaries in Internet commerce.

The thesis shows that Internet commerce may not reduce market friction because prices are higher when consumers buy homogeneous products on the Internet, and price dispersion for homogenous products among Internet retailers is greater than the price dispersion among physical retailers. Internet retailers—even those selling homogenous goods—can develop pricing strategies to differentiate themselves from their competitors and to price discriminate. The ability for the Internet to become a medium for price discrimination is an area that requires the attention of public policy makers. While self-regulation of Internet price discrimination may be the most appropriate policy, monitoring by the United States government through the Federal Trade Commission and international organizations such as the World Trade Organization helps establish a trusted transaction environment for future Internet commerce growth.

Thesis Committee:

Lee W. McKnight
Lecturer, Technology and Policy Program

Erik Brynjolfsson
Associate Professor, MIT Sloan School of Management

David D. Clark
Senior Research Scientist, Laboratory for Computer Science

To Wendy

Acknowledgments

This thesis is made possible with the support of many advisors, scholars, friends, and family. My doctoral committee of Erik Brynjolfsson, David Clark, and Lee McKnight impacted the thesis research direction, methodology, and analysis most directly. I thank them for their continued support throughout my MIT career and for their ability to be a source of guidance. While I must share the credit for the strengths of this thesis, all remaining errors and shortcomings are my responsibility only.

Beyond the immediate academic support of my committee, I have had the pleasure to work in an environment that encourages hard work, original thinking, and clarity in communication. While it is impossible to name all scholars in this category, I wish to particularly acknowledge my colleagues, Judy Cardell, Sharon Gillett, Petros Kavassalis, Tom Lee, Suzanne Neil, Russell Rothstein, Marshall van Alstyne, and Mort Webster. Many of these people are affiliated with the MIT Research Program on Communications Policy that has been a great environment for research and networking. I thank all of the RPCP administrative assistants, Gill Cable-Murphy, Julia Malik, and Elizabeth Yoon, and graduate students I have had the pleasure of working with. Furthermore, my research has benefited from the many conferences and workshops including the 1995 Internet Economics Workshop at MIT, the Information Infrastructure and Policy conferences at Harvard, and the Telecommunications Policy Research Conference. My previous academic work at Carnegie Mellon and Stanford well prepared me for my future studies. Carnegie Mellon professors Indira Nair and Marvin Sirbu have been particular sources of support. As I prepare for my future academic work at the University of Maryland's Robert H. Smith School of Business, I thank my colleagues there for helping me transition from my life as a student to my life as a professor.

Some chapters in this thesis have benefited from the contributions of others. Tom Lee gave me detailed comments on Chapters One and Two. The students of the MIT Sloan class 15.967, Electronic Commerce/Marketing and the Internet, and my collaboration with Yannis Bakos helped with Chapter Three. Chapters Four and Five benefited from my collaboration with Erik Brynjolfsson and Mike Smith (Bailey, Brynjolfsson, and Smith 1998) and was also aided by my work as a consultant to the Organisation for Economic Co-Operation and Development (OECD 1998). Robert Angulo, Jeff Chow, Husham Sharifi, Marc Shuster, and Jim Wahl assisted me with the data collection in Chapter Five. Bill Drake and Bill Lehr helped with the substance in Chapter Six. The writing style in all chapters benefited from the copy editing of Elizabeth Yoon and John Nicholson.

The research environment and educational process of earning a Ph.D. was made possible thanks to the sources of funding. My research has benefited from numerous sources over time including DARPA (contract #N00174-93-C-0036), NSF (grant #NCR-9509244), OECD, MIT Center for Coordination Science, and BT. The fellowship from NASA (grant #NGT-51407) for the last three years of my work was particularly helpful.

My family and friends are sources of love and joy in my life. Because Wendy, my wife, and I come from large families, I cannot name all family members I wish to thank. However, I have certainly felt their influence. My parents, Kenneth and Margaret, are my true role models in life and I hope to follow in their example of being both good at life and good at work. My siblings, Patricia and Michael, have also benefited from my parent's love and I know we will always be close friends as well as close siblings. My grandparents, Katherine and Joseph Korb, and Ruth and Stanley Bailey, have always been sources of inspiration for me. Wendy's family has become my family so Ginny Miller, and Marnie, John, Peter, and Anne Nicholson deserve particular thanks. My friends in school and in life are very important to me. Tom Lee, Dragos Maciuca, Jeff Shelton, and Shane Siefer, the groomsmen at my wedding, are true friends and I ask them to accept my thanks on behalf of all my friends.

As I was searching for a Ph.D. program five years ago, I was looking for an advisor to guide me through the rough waters of the doctoral process. I was very lucky to find such and advisor in Lee McKnight. From the very onset he was very enthusiastic about my research. I am very happy to have found such a great advisor and friend in Lee. He and his wife Elaine have been great champions for me in my academic career and I thank them very much.

To my partner in life Wendy, I thank you for your unfailing love and support. You are my best friend and greatest source of inspiration.

Table Of Contents

List of Tables

List of Figures

1. INTRODUCTION

Neoclassical economic analysis often assumes a "frictionless" economy, that is, the ability for all consumers to have perfect information and zero transaction costs. In such a world, consumers could make perfect economic decisions because uncertainty is reduced as much as possible–the uncertainty of knowing exactly what the good is, whom they are transacting with, and if this is the best possible price. In this world, economic theory would describe economic reality.

However, the world is far more complicated and much more uncertain than the world of the "frictionless" economy. In the physical world, consumers are limited in their knowledge of what they want, where to buy, and who to buy from. The difference between the theory explaining the economy and the economy in practice indicates limitations in neoclassical economics to explain the subtleties of the market. These differences are supported by consumers' observations in everyday life. For example, the transaction cost of finding and purchasing a given item at a lower price may be high enough for a consumer to shop instead at a more convenient store, theater, or gasoline station. Consumers may avoid a restaurant they have never been to because they are uncertain of the quality of the food. This consumer may choose an inferior-quality restaurant that they frequently patronize because they have imperfect information. The promise of a frictionless economy is a utopia that seems very far from the grasp of the consumer.

Imperfect information may lead to higher prices. Consumers with misleading or incomplete information often make decisions that do not maximize their utility from a transaction. Adam Smith observed how information could be withheld to maintain high prices when he penned the Wealth of Nations in 1776:

> "When by an increase in the effectual demand, *the market price of some particular commodity happens to rise a good deal above the natural price, those who employ their stocks in supplying that market are generally careful to conceal this change.* If it was commonly known, their great profit would tempt so many new rivals to employ their stocks in the same way, that, the effectual demand being fully supplied, the market price would soon be reduced to the natural prices, and perhaps for some time even below it." (Smith 1776, p. 67) [emphasis added]

The use of information to affect price is exacerbated by the fact that today's global economy is increasingly becoming more dependent on information. Machlup (1962) and Porat (1977) describe the U.S. economy as an "information economy" because most American workers gather, process, or create information.[1]

Information technology can help consumers find information more easily thereby reducing the problems of imperfect information that maintains higher prices. The information can also be delivered in a timely manner because of technology. One of the largest contributors and greatest beneficiaries of the information economy is Bill Gates, Chairman of Microsoft. In his book The Road Ahead, Bill Gates sees the future marketplace living up to the expectations of Adam Smith:

> "Capitalism, demonstrably the greatest of the constructed economic systems, has in the past decade clearly proved its advantages over the alternative systems. The information highway will magnify those advantages. It will allow those who produce goods to see, a lot more efficiently than ever before, what buyers want, and *will allow potential consumers to buy those goods more efficiently. Adam Smith would be pleased. More important, consumers everywhere will enjoy the benefits.*" (Gates 1995, p. 183) [emphasis added]

One particular information technology tool, the Internet, has the potential to shape markets more than any of its predecessors have. Only recently has the Internet become a magnet for entrepreneurs and Fortune 500 companies alike who are looking for opportunities to conduct commerce using this interoperable communications infrastructure. The principles underpinning the Internet are fundamentally different than those on which other global networks such as the public switched telephone network are based. Specifically, the interoperability of the Internet allows for communication among users across heterogeneous systems without information degradation. The result of interoperability is a network that can incorporate change and promote competition. The Internet is still a dynamic technology but the economics of the Internet will shape future markets.

The Internet may lower the static market friction costs of transacting. As information becomes more widely available to consumers and suppliers alike, problems of imperfect information are reduced. Consumers may now be able to make decisions that maximize their utility because information is inexpensive to find and process. These benefits result in lower transaction costs in a market exchange. Furthermore, suppliers may find it more difficult to conceal information from their competitors so that price competition is more likely.

The Internet also increases the dynamic nature of the marketplace. Unlike physical markets where change occurs slowly because of printing and distributing information delays, change occurs very rapidly on the Internet. Information can be globally distributed electronically in seconds. For markets, the Internet is a tool for almost

[1] More recently, Tapscott (1996) uses the term "digital economy" and Vairan (1996) uses the more traditional term "information economy" to describe how the Internet increases the importance of the information sector to the U.S. economy.

instantaneous consumer feedback. Furthermore, this feedback can be processed and acted upon quickly and at a low cost relative to physical markets. For example, prices can be changed dynamically to meet demand because the cost of changing a price—the menu cost—may be lower on the Internet than in physical markets. Dynamic pricing may lead to more price competition among Internet retailers because they can respond to their competitor's actions more quickly. It may also lead to a strategy of Internet price discrimination whereby Internet retailers are able to single out individual consumers to charge them unique prices.

Market structures may change if the Internet reduces market friction. Intermediaries, market participants who enable transactions between suppliers and consumers, may be in an unsustainable position with the introduction of the Internet. Intermediaries exist to coordinate transactions and reduce the overall transaction costs in market exchanges. Unlike Adam Smith's theory that markets existing without coordination because of an "invisible hand," Chandler (1977) describes why the visible hand of management is necessary to coordinate firms within markets. Even though intermediaries are important in physical markets where market friction is significant, their role of reducing transaction costs is threatened when suppliers and consumers use the Internet to transact. The intermediaries who aggregate products and set prices on the Internet may be threatened if they add minimal value to Internet transactions. The impact on market structure may be significant. Intermediaries are major contributors to the U.S. economy. Intermediaries account for over 15% of the U.S. Gross Domestic Product (GDP) with the retail industry accounting for 9.3% and the wholesale industry accounting for 6.5% of the GDP in 1994 (Spulber 1996). If intermediaries disappear, then significant segments of the economy may shrink resulting in unemployment.

This thesis investigates intermediaries that participate in Internet commerce to determine how the Internet reduces market friction and reduces the role of the intermediary. The approach of this thesis is interdisciplinary because it incorporates economics, technology, and policy analysis. This thesis extends existing theory, develops a methodology to analyze price competition on the Internet, and uses an exploratory data set for empirical analysis to test the following hypothesis:

Internet commerce will reduce the market friction of physical market transactions.

Finding evidence to support or refute this hypothesis can help shape future development of Internet commerce. If Internet commerce does reduce market friction, then there may be shifts in the global economy as consumers adopt the Internet as a medium for commerce and intermediaries are removed from the value chain. The economic theory, which describes changes in transaction and menu costs, will be supported by an Internet economy that has less friction than the physical economy. However, data might also indicate that the Internet does not yet live up to the promise of promoting frictionless markets. Transaction costs and menu costs may still be significant enough to warrant the existence of intermediaries to coordinate transactions. The market participants must rely on strategies to make the best use of the Internet for commerce because economic forces may not work perfectly. For example,

Internet market friction may change the shopping behavior of consumers who are trying to maximize their utility and the retailers who are trying to set a price.

Regardless of the thesis findings, it is important to remember that the Internet is still a changing communications infrastructure by design. Therefore, it is too early to predict what applications the Internet will support in twenty years and who will use the Internet to conduct commerce. The businesses that are currently conducting commerce on the Internet will use consumer feedback to change their pricing, marketing, advertising, and product offerings in the future.[2] By addressing the questions of market frictions in Internet commerce in an embryonic stage, future analyses of Internet commerce are possible. Furthermore, the beginnings of empirical research can help identify strengths and weaknesses of the existing theory that describes how information technology such as the Internet and intermediaries reduce market friction.

[2] Bill Rollinson of the Internet Shopping Network claimed that his business strategy "was only valid for a period of a few weeks during a March 1996 presentation to the MIT Electronic Commerce/Marketing and the Internet class. Because there is no "right way" to develop an Internet commerce strategy, Internet Shopping Network experiments constantly and uses the feedback from consumers to help develop its strategy.

2. CONTEXT AND LITERATURE REVIEW

This chapter examines the economics of market friction and market structure, and explains them within the context of the Internet. The introduction of a new technology does not mean that markets depart from their economic principles. Rather, the markets adjust to absorb the new technology to a new equilibrium. The purpose of this chapter is to provide the economic foundation and motivation for examination of the hypothesis of this thesis:

Internet commerce will reduce the market friction of physical market transactions.

The chapter defines market friction and describes the economics of the Internet. Market friction is a general economic concept that describes the forces that shift the equilibrium of the market away from the intersection of supply and demand (i.e. the competitive equilibrium). Section 2.1 describes market friction in a static environment by describing the effect of transaction costs for intermediated and disintermediated market structures. Section 2.2 explores the dynamics of market friction by describing how menu costs may prohibit changes over time to reach the competitive equilibrium. Section 2.3 describes the economics of the Internet and describes why the Internet may reduce market friction.

2.1. Transaction Costs and Intermediation

A static examination of markets indicates that some transactions do not occur at competitive market equilibrium because of transaction costs. Because the exchange of goods or services and monetary wealth is not free, the price of a good that is transacted often reflects costs involved with coordination of the transaction and not the creation of the good. For example, it may only cost $10 to manufacturer a pair of shoes in Taiwan, but it costs money to advertise, package, and distribute the product. None of these additional costs change the physical product, but these costs aid in finding a consumer for the shoes and receiving money for the purchase.

The examination of transaction costs began with efforts to understand why firms are created to organize economic activity. Coase (1937) argued that firms organize themselves to minimize transaction costs so that they can be more

economically efficient.[3] Others have used transaction costs to extend Coase's work to describe why firms are created and what distinguishes the boundary of one firm from the boundary of another (Alchian and Demsetz 1972; Demsetz 1968; Williamson 1979). As argued by Demsetz (1968) and Williamson (1979), procuring a product can be done within the boundary of the firm or done as a market transaction between firms. Whichever organizational model has lower transaction costs is preferred. Transaction costs are the costs incurred when goods or services are exchanged and not the costs associated with creating the good or service. Defining what is a firm and what is the boundary of the firm are ongoing issues in economics. The exploration of transaction costs is only one of many theories. For example, Hart (1989), Varian (1992), and Pindyck and Rubinfeld (1995) describes differences in the methodologies used in neoclassical economics, transaction cost economics, and by economists analyzing the firm as a nexus of contracts or owners of property. While some theories of the firm can give insight into choices of labor versus technology or the cost savings of introducing one technology over another, transaction cost economics is a more appropriate theory for understanding market friction than the alternative approaches.

Transaction costs may decrease when information technology is used to facilitate market exchanges. As transactions become electronic, they may cost less than physical world transactions. Some argue that information technology may lower transaction costs because of lower 1) search costs (Bakos 1997), 2) coordination costs (Malone, Yates, and Benjamin 1987), and 3) payment processing costs (Sirbu and Tyger 1995). If transaction costs decrease within the firm more than they decrease between firms, then there will be an organizational shift from market transactions to intra-firm transactions. If the reverse is true, there will be more market transactions and fewer intra-firm transactions. Because the effect of information technology on transaction costs is far from certain, the further information technology research can explain the factors influencing the increase or reduction of transaction costs. This section investigates the foundation of transaction costs in two market structures: disintermediated and intermediated.

2.1.1. Transaction Costs in a Disintermediated Market

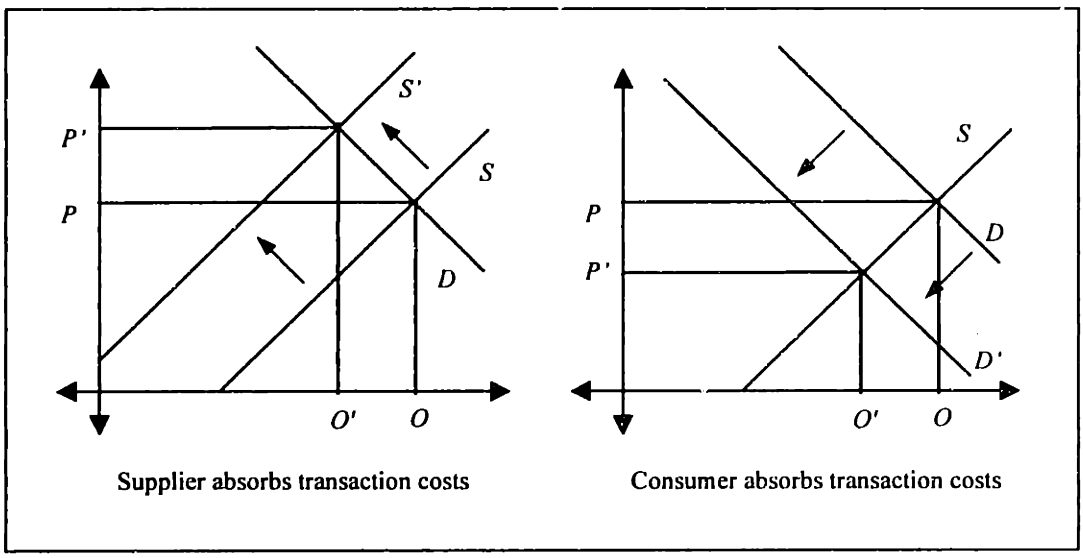
The simplest transaction costs incurred in a direct transaction between a supplier and a consumer. The *supplier* is the firm that produces a product or service being exchanged and competes with other firms whose product can be a substitute. The *consumer* is the end user who derives value from possessing or consuming the product. This direct transaction does not require an outside participant (i.e. an intermediary) to coordinate the exchange between the supplier and consumer. Therefore, this direct exchange is "disintermediated."

The supplier, consumer, or both may incur the transaction costs. Figure 2.1 shows the affect of transaction costs absorbed by the supplier (on the left) and by the consumer (on the right). The effect of the transaction cost is to shift

[3]However, the competitive equilibrium will differ for different initial allocations of goods.

the supply or demand curves, respectively, to the left because of higher transaction costs. Because the market is not frictionless, either party must pay an additional amount to transact the good.

Figure 2.1: Transaction Costs with Disintermediation



Source: Demsetz (1968)

Transaction costs related to imperfect information provide an excellent example to describe shifts in the supply and demand curves in Figure 2.1. A supplier may have the best product on the market at the lowest cost, but they have no sales because no consumer knows about them. Therefore, the supplier can advertise, direct market, or develop a World Wide Web (a.k.a. Web) site for their product to attract consumers to transact with. All costs associated with disseminating information to promote market exchanges with consumers are transaction costs absorbed by the supplier. Conversely, consumers may want to purchase a product, but they do not know if the product exists, or who sells it, or at what price. The consumer must search for information, communicate and negotiate with potential suppliers before they can purchase the product. These costs borne by the consumer are also transaction costs.

The effect of the transaction cost is to decrease the quantity exchanged between supplier and consumer regardless of who absorbs the cost. When a supplier absorbs the transaction cost, there is a class of consumers that would have transacted at P that do not transact at P' because the price is too high. These consumers account for the decreased quantity of $Q - Q'$. Similarly, when a consumer absorbs the transaction costs, there are a class of suppliers that do not transact because P' is too low. Once again, there is a reduction in the quantity exchanged in this market that is $Q - Q'$. The quantity of transactions that did not consummate because of transaction costs is known in economics as deadweight loss. Deadweight loss is regarded as an undesirable outcome, to be minimized whenever possible.

The nature of the product being transacted affects the amount of a transaction cost. Williamson (1979) points out that the transaction costs for goods with low asset specificity (such as commodities) are much lower than goods with higher asset specificity. As an example, a New York Times bestseller has low asset specificity because it is designed to appeal to a mass market and consumers choose to purchase or not purchase such an item at a given price. A power plant serving a factory, on the other hand, has a high degree of asset specificity because it is designed for a particular consumer with specific needs. There are very high production costs, and neither the consumer nor the supplier of the power plant can exit the contract easily because the plant has very little appeal to any other consumer. Because all people have bounded rationality,[4] complex contracts for a transaction may not take into consideration all possible events. As contracts become more complex and less complete, transaction costs increase.

2.1.2. Transaction Costs in an Intermediated Market

Transaction costs can also be absorbed by a third party other than a consumer and a supplier—and intermediary. The *intermediary* is the firm that sells the product but does not create or consume it. Therefore, intermediaries compete with other firms who may sell the exact same product or service. Existing definitions in the economic literature consistently define an intermediary as a firm between the supplier (producer) and consumer (buyer).[5] For example, Spulber (1996) describes an intermediary as "an economic agent that purchases from suppliers for resale to buyers or that helps buyers and sellers meet and transact."[6] Similarly, Cosimano (1996) describes them as an institution "between buyers and sellers."[7] Biglaiser (1993) differentiates the intermediary from the supplier and consumer by examining its objective for participating in a market transaction. He explains that the supplier is the originator of the good through original ownership or creation and the intermediary does not alter the good. Similarly, the intermediary is different than the consumer because unlike the consumer, the intermediary derives no utility from possessing or consuming the good.

The intermediary changes the transaction costs of a market transaction by buying from suppliers at one price and selling to consumers at a different price. The stock market is one example where an intermediary, the broker, does this. In Figure 2.2, the transaction costs are absorbed by an intermediary who has two prices—an ask price and a bid price—for the transaction. The ask price is denoted by A in Figure 2.2 and represents the price that the intermediary sells the good to the consumer. The bid price is denoted by B in Figure 2.2 and represents the price that the

---

[4] Bounded rationality describes the condition that parties cannot plan for all possible future events and they realize this when they make decisions and enter into contracts.

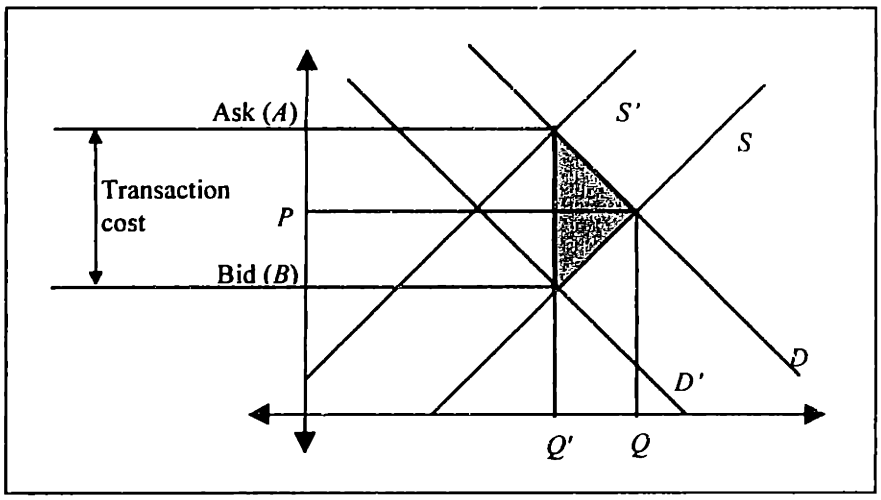
[5] For sake of clarity, this thesis will use consumer instead of buyer and supplier instead of producer, but they can be used interchangeably.

[6] p. 135.

[7] p. 131.

intermediary buys the good. P is the price at the competitive market equilibrium. The difference between A and B in Figure 2.2 is the ask-bid spread and can be thought of as the transaction cost for a market exchange. Demsetz (1968) used Coase's explanation of transaction costs to explain the ask-bid spread in the securities market. Demsetz explained that there is a time that a broker must hold on to the asset before they can sell it. There is a cost associated with this time when the value of that asset may drop in price. Therefore stockbrokers buy at a price less than the market equilibrium price (P) and sell at a price slightly higher than the market equilibrium price. If a market is in greater flux, the ask-bid spread increases Furthermore, as the cost to coordinate the exchange increases, the ask-bid spread increases.

Figure 2.2: Transaction Costs with Intermediation



Source: Demsetz 1968

Intermediaries may be in a better position to lower transaction costs than a supplier or a consumer. Since the intermediary is involved in many repeated transactions, they develop a set of relationships and experience that may lower the transaction cost. Furthermore, the intermediary could invest in technology that requires a large fixed cost, but reduces the marginal cost for additional transactions. The intermediary can then amortize the fixed cost over a larger number of transactions.

Although intermediaries lower transaction costs, it is not clear what roles or what value they provide. The literature agrees that an intermediary is a market participant that coordinates transactions between a consumer and supplier, but more complex definitions detailing the roles of intermediaries are inconsistent. Often the roles of the intermediary are context dependent because they provide different roles for different sets of transactions. Confusion over the role of an intermediary is exemplified by the inconsistency in defining an intermediary from an economic perspective and other perspectives such as marketing (Dwyer, Schurr, and Oh 1987) where the value of an intermediary is very subjective. It is surprising to find a lack of consensus or attention given the intermediary's

importance. Analysis of intermediaries is "largely ignored by the standard theoretical literature."[8] Chapter Three extends existing theory to help define roles of intermediaries and hypothesize how the Internet may change these roles.

There may be multiple intermediaries that separate the supplier from the consumer. Figure 2.3 visualizes the value chain to show how a product is transacted in intermediated and disintermediated markets.[9] In the top case, there are two firms (wholesaler and retailer) that are intermediaries. In the middle case, there is only one intermediary–the broker. In the bottom case there is no intermediary so it is called a "disintermediated" market.

Figure 2.3: Intermediated and Disintermediated Value Chains

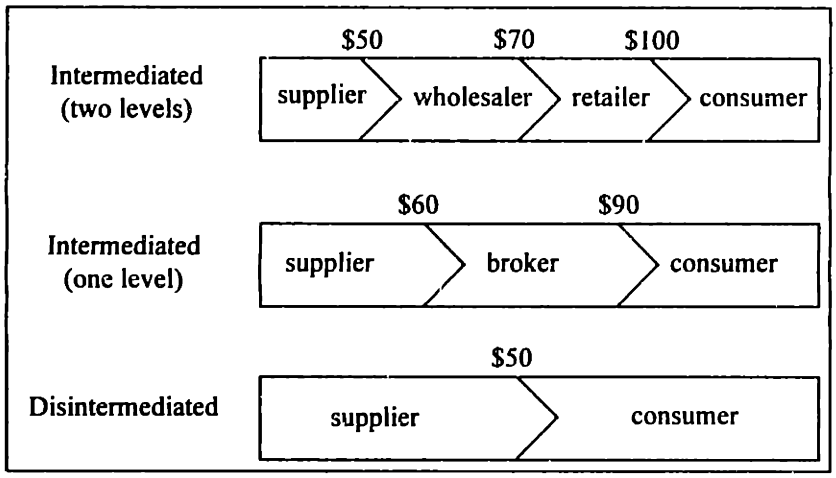


Figure 2.3 shows that the products' price changing when an intermediary processes the transaction from a supplier or other intermediary to a consumer or another intermediary. In the two-level intermediated case, the wholesaler has an ask-bid spread of $20 and the retailer has a spread of $30. When the wholesaler and retailer are vertically integrated, they form the one-level intermediated case where their spread is still $30, and both the supplier and consumer receive an extra $10 of surplus minus their transaction costs. If the supplier and consumer transact directly, they can transact at $50. The $50 price may seem to indicate that the disintermediated case is the most preferred, but the consumer may have $60 of transaction costs in the disintermediated market. If consumer transaction costs are too high, then the consumer may prefer the one-level or two-level intermediated case.

Intermediation and disintermediation describes the addition or removal of elements between the supplier and consumer in the value chain as shown in Figure 2.3. Disintermediation occurs when an intermediary is removed from a transaction. Intermediation occurs when one is added. The disintermediation process does not necessarily

[8] Rubinstein and Wolinsky (1987), p. 581.

[9] This value chain shown in Figure 2.3 is similar to the one used by Benjamin and Wigand (1995).

mean that the result is a disintermediated value chain as shown in Figure 2.3. Disintermediation can also occur as the value chain shifts from *n* layers to *n – 1* layers of intermediation. For example, disintermediation occurs when the market moves from two levels to one level of intermediaries (moving from the top to the middle value chain in Figure 2.3). As was noted earlier in this thesis, the popular assumption is that electronic commerce in general and Internet commerce in particular leads to disintermediation. The theoretical basis for this view, as well as reasons why it may or may not be true, is further developed in the remainder of this chapter and in Chapter Three.

2.2. Menu Costs and Rate of Change

Market friction can also be caused in dynamic markets through such economic factors as menu costs. The costs of changing prices are known as menu costs. Since neoclassical economics often analyzes markets in competitive equilibrium, it is important to understand how long it takes for markets to achieve this equilibrium. Markets with more friction take longer to achieve competitive equilibrium while markets with less fiction take less time. When the market is at competitive equilibrium, prices do not change. Sometimes the costs of changing prices are too high to warrant achieving equilibrium and this increases the time a market spends in a state other than competitive equilibrium.

Menu costs are the economic costs of "printing menus" which contain the prices for the items carried by a supplier or intermediary. Much of the economic exploration of menu costs examines its macroeconomic effects. For example, Sheshinski and Weiss (1993) describe how menu costs affect the setting of prices and often explain non-optimal prices in an economy. In a country with high inflation, it is impossible for every product price to be changed daily even though this may be necessary for optimal pricing. Research on the microeconomics of menu costs is not as well developed. Microeconomic studies such as Levy, et al. (1997) estimate menu costs in a given market. In their study, Levy, et al. find that the menu costs in grocery stores is approximately $0.52 per price change. While this may not be a significant menu costs to stores which sell high-priced items such as cars, $0.52 per price change is significant enough such that supermarkets do not often change the prices on groceries that may be $10 or less.

When there is an exogenous force in the marketplace, prices will change more quickly or more slowly because of menu costs. When menu costs are high, the entry of a competitor or a rise in inflation may not be significant enough to change prices quickly. This is especially true if the response to such an exogenous force (either lowering or increasing prices) fluctuates. However, if the menu costs are low, prices can change quickly because of exogenous forces and fluctuate just as often as the market conditions change.

2.3. Electronic Markets and Internet Commerce

The creation of the Internet as a medium for economic activity is rooted in the technical foundations of the infrastructure. The designers of the Internet may not have envisioned Internet commerce, but they did architect the protocols necessary for new products and services to be developed in the future. The markets that have emerged are overlaid on top of this technical foundation. This foundation affects the Internet's user community, applications, and markets. Because the Internet's core is a minimal set of protocols which allows for heterogeneity and development of new services, Internet commerce is possible.

The Internet infrastructure grew from the foundation of the existing communication modes. Telecommunications has been characterized by common carriers, such as companies that operate telephone and telegraph networks, which provides a conduit between two points. As common carriers, they must publish their prices and offer their services non-discriminatorily (Brock 1981). For some Internet applications, the Internet appears to be a common carrier. For example, applications such as email have similar characteristics to telegraph messages. A different communication mode that also has similarities to the Internet is broadcasting because data can be multicast on the Internet whereby data streams originate at one point but spread to many others. Broadcasters are regulated because electromagnetic spectrum is scarce and, therefore, the government has an interest in making sure the content sent by broadcasters, such as FM/AM radio and television, is consistent with the public interest. The third communication model the Internet parallels are publishers because the Internet allows for publishing information on servers such as Web servers. The publisher model comes from book, newspaper, and magazine publishing.

The Internet is at a point of convergence where previous communication modes come together. Because the Internet may be many different communication modes simultaneously, the Internet is the closest manifestation of the "convergence of modes" described by Pool (1983) and others since then (Brock 1994; Neuman, McKnight, and Solomon 1997). The result of a larger network with greater functions increases the economic value of the Internet (Economides 1994). Therefore the Internet has become a platform for new and novel applications including those related to market transactions (McKnight and Bailey 1997a; 1997b). These modes are not technical categories, but the industry and regulatory paradigms that describe different communication applications and channels. Because the Internet spans these boundaries, it is not clear if the Internet should be regulated in the three communication modes or whether it is a separate entity.

As telecommunication services become more liberalized, more consumers have access to the Internet infrastructure. Internet growth and some users' Internet access are dependent on the public switched telephone network. As the telecommunications industry changes, so does Internet development. Agreements, such as The 1997 Group on Basic Telecommunications agreement, liberalize the international telecommunications market. Therefore, the global telecommunications market may become less monopolistic and more open to Internet development. However, it is

yet to be seen if this agreement is just confirming an existing movement or a policy which will have widespread consequences as Drake and Noam (1997) debate.

Historically, the technology and policy of the Internet has affected its economic development. Internet development is rooted in computer science's quest to build a global computer network that is designed for the transportation of digital bits through computers regardless of the appliance or application. This design philosophy of the Internet (Clark 1988) is well rooted in technology development and not the creation of wealth that typifies other developments such as telephony in the telecommunications industry (Brock 1981). As the technical robustness on the network to provide simple applications progressed, computer scientists have built on the core Internet protocols for further developments such as network security for commerce (Camp and Sirbu 1997)[10] and adaptability to congestion.

Much of the attention on the economics of the Internet has been focused on the infrastructure. As the Internet was privatized—which occurred when the National Science Foundation's backbone[11] was dismantled—there were so many misconceptions about the economics of the Internet that MacKie-Mason and Varian (1994) documented the frequently asked questions of how and why the Internet market worked. Unlike circuit-switched networks, Internet bandwidth is statistically shared so users have a dynamically allocated bandwidth regardless of the price they are willing to pay. While this works well for asynchronous traffic such as email, statistical sharing is problematic for services that require better qualities of service. By pricing bandwidth, Internet resource allocation changes to reflect users' heterogeneous demand. Wang, Peha, and Sirbu (1997) and Gupta, Stahl, and Whinston (1997) both propose that pricing bandwidth may increase the aggregate benefits of Internet service. While these proposals are attractive to the economist, computer scientists may find them too difficult to implement. For example, the MacKie-Mason and Varian (1995) proposal to price each packet whereby auctions would be held at Internet routers to determine queuing causes tremendous router overhead and would subvert the robust flow control built into the Transmission Control Protocol (TCP). Extensions of Internet standards and technology to support a variety of service classes and economic models is ongoing, but a more thorough review of the literature and the evolving theoretical and empirical basis of Internet economics is beyond the cope of this thesis, which focuses on Internet commerce and the role of intermediaries.

---

[10] Making Internet commerce more secure increases its ability to support financial transactions. The Internet may become a mechanism to support transactions of very small monetary magnitude called micropayments. The impact of micropayments may greatly affect the way consumers purchase and use software. For example, Cox (1996) describes a "superdistribution" as a way to distribute software and then use micropayment to pay for the marginal use of that software..

[11] The Internet was just a portion of an overall policy effort to build a National Information Infrastructure (NII) in the early to mid-1990s. However, the Internet has become the focus of NII development lately. Both Kahin (1995) and Kalil (1995) point out that the initiative is and will be funded by the private sector, but that the government can help play an important part of its development through such actions as funding research and development and developing telecommunications policy.

Even though the Internet is a convergence of modes, the Internet enables interoperability more effectively than other communication modes. The Internet, a "network of networks," integrates many different data networks (Bertsekas and Gallager 1992) into a larger network without requiring complete conformity to one standard. As Clark (1988) explains, the Internet protocols were designed to meet the needs of communication between computers in a distributed and heterogeneous environment.[12] Because of the Internet's design philosophy, the Internet protocols enable interoperability. Bailey, McKnight, and Bosco (1996) show that interoperability is different than compatibility or interconnection because interoperability enables the successful communication across heterogeneous systems and not within a system (compatibility) or between homogenous systems (interconnection). To accomplish the goal of interoperability, the Internet uses a minimal set of standards or "spanning layer" (Clark 1994; NRC 1994; NRC 1996; Kavassalis, Lee, and Bailey 1997), such as the Internet Protocol (IP), to support interoperable data communication.

Increased interoperability of infrastructure elements can increase benefits for all network users because of network externalities. A network externality (sometimes called a "network effect") is the cost or benefit that incumbent users get from an additional member joining the network. Katz and Shapiro (1985; 1994) outline many of these benefits. This benefit or cost can be direct (such as the benefit from having one more person to talk with or exchange email) or indirect (from a larger network of users encouraging greater investment in network resources). The telephone system evolved from a network with very little or niche benefit to one of business ubiquity because it is a product with network externalities. While businesses often perform a cost-benefit analysis when contemplating Internet connections for their employees, this same company will most likely not undergo an analysis for a telephone system. As the Internet's network externalities grow, the Internet's value may increase to such an extent that businesses will no longer contemplate whether or not they should have an Internet connection. Rather, the Internet will become as much of a business necessity as the telephone. As more consumers are drawn to the Internet to conduct business because of word-of-mouth recommendations and advertising, network externalities not only increase the value of the Internet but can also be used as a competitive tool. For example, Amazon.com solicits book reviews from their consumers and uses this information to help other consumers with book recommendations.

The Internet's interoperability allows for the emergence of transactions and the creation of market relationships. Interoperability is important to the working of electronic commerce as pointed out by Petreley (1997):

> "When electronic commerce becomes the standard conduit for business transactions, the dependability and interoperability of your machines and your business-partners' machines could mean the difference between success and bankruptcy."

[12] One result of designing the Internet to be a distributed network is that the Internet governance structure is very self-governing (Gillett and Kapor, 1997).

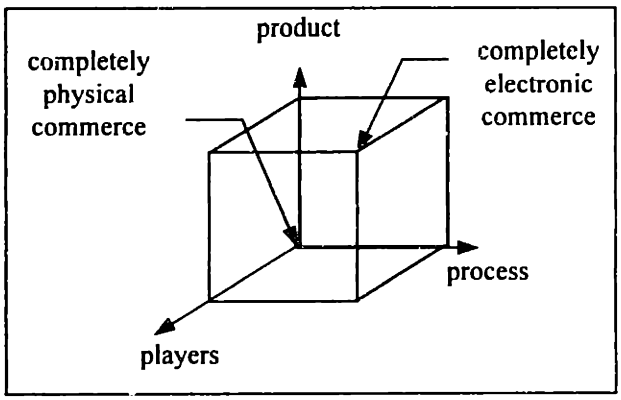
For Internet commerce applications to function effectively, the interoperability of the spanning layer, middleware, and applications must exist. Because the Internet was designed for interoperability, the Internet may be better suited as a medium for electronic commerce transactions than other media.

Electronic commerce is the set of market transactions that are facilitated by an electronic medium.[13] Because there are many electronic media and many forms of market transactions, electronic commerce is a term that is used to describe many different forms of transactions that use information technology. Therefore it is important to distinguish the forms of electronic commerce as suggested by Wigand (1997). There are varying degrees of "electronic" in electronic commerce. As Choi, Stahl, and Whinston (1997) describe, electronic commerce has been around since the beginning of electronic communication–the telegraph. Sears Roebuck was able to sell items from its catalog and use electronic telegraph communication to receive and process orders. However, the Internet is more advanced than this early form of electronic commerce because the Internet is interoperable while the telegraph is slow and not very accessible. Telephone-enabled commerce aided the process of making commerce increasingly electronic and the Internet continues this process. Figure 2.4 shows the different axes of movement of electronic commerce: process, product, and players. At the origin is physical commerce and at the point farthest from the origin on the cube is completely electronic commerce.

Electronic commerce initiatives stem from many technologies and computing developments. Companies such as Books.com have used Internet applications such as telnet to conduct commerce on the Internet before the Web was fully-developed (Gardner 1998). In France, the Minitel computer and communications network has supported electronic commerce for more than fifteen years (Hill 1997). The use of Electronic Data Interchange (EDI) for electronic document transfer and transaction sets was, perhaps, the most successful use of information technology in business-to-business transactions prior to the emergence of the Internet. However, the multibillion-dollar EDI industry is experiencing slower growth than commerce conducted over the Internet. One reason for slow EDI growth is that EDI transactions are limited to partners who have an established set of relationships and have a highly standardized way of communicating. Therefore, once partners have the infrastructure in place, there is less room to solicit new consumers or to have communication outside of the a priori set of standards. The Internet, on the other hand, does a better job of identifying the ad hoc communication channels necessary to go beyond the scope of standardized transactions. In fact, electronic commerce that takes the EDI and Internet capabilities can be very complementary (Kalakota and Whinston 1997a) and EDI transactions can now be sent over the Internet (ANX 1996; Houser, Griffin, and Hage 1996).

[13] Dictionaries define "electronic" as anything relating to the conduction of electrons. An electronic medium is any conduit that transfers electrons to convey information.

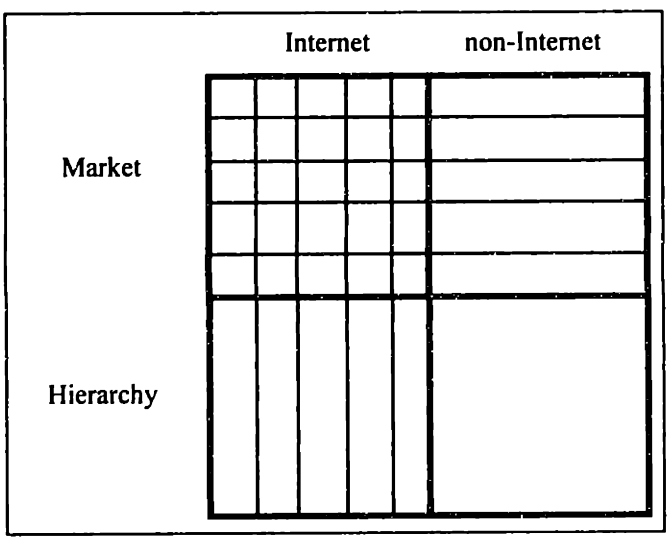
Figure 2.4: Product, Process, and Player "Degrees" of Electronic Commerce



Source: Choi, Stahl, and Whinston (1997)

The Internet makes commerce more electronic on the process and players axes in Figure 2.4. The Internet can be used to distribute electronic products such as software, music, and information. The Internet also creates electronic players with the introduction of electronic storefronts. These storefronts often take the form of a Web page that has product and price information. The Web site may also process and clear payment transactions. Electronic mail can keep a consumer up to date on the status of their order just as a good salesperson would do. One of the benefits of having electronic players in commerce is that the electronic player is infinitely patient. For example, some people who buy airline tickets on the Web can try out a large number of permutations of flight travel routes while a human travel agent must reduce this number to service other clients. Figure 2.5 shows the vertical distinction of electronic commerce into Internet and non-Internet supported commerce.

Figure 2.5: Defining Internet Commerce and Electronic Markets



The horizontal space defined in Figure 2.5 can be split into the two organizational parts of markets and hierarchies. The definition of each comes from Williamson (1975) and is expanded upon by Malone, Yates, and Benjamin

(1987) to cases where the market exists in an electronic environment.[14] A market requires little or no coordination between transacting parties because the good being transacted is widely available from competitors. These goods are said to have low asset specificity. Market transactions require very little information to be exchanged between transacting parties because the consumer's options are either to buy at a specified price or not to buy. When a transaction goes sour, the consumer tries to find anther supplier and the supplier finds another consumer. A hierarchy requires much more coordination. More coordination may be necessary because the supplier and consumer transact often, or the product being transacted is unique. The prices for transactions in a hierarchy are usually negotiated and exiting the contractual relationship of a hierarchy is often difficult. This thesis explores the upper right-hand quadrant in Figure 2.5 where "Internet" and "Market" intersect within the electronic commerce space. The transactions in this quadrant require little coordination because products have low asset specificity and are transacted through the Internet.

2.3.1. The Nascent Stage of Internet Commerce

While electronic commerce on the Internet is still in its nascent stage, firms seeking to do business on the Internet face great opportunities and equally great challenges. Internet commerce transactions at the time of this thesis' writing are small relative to its potential. According to the Baruch College-Harris Poll (Cortese 1997) 1% of all Internet users often shop on the Internet, 9% sometimes shop, 26% rarely shop, and 64% never shop as of late 1996. 24% of Internet users have actually made a purchase while 76% have not. These numbers are small relative to the number of people who use the Web. There are approximately 40 million U.S. users of the Web and the Internet (Cortese 1997).[15] Because the U.S. accounts for approximately 66% of the Internet users worldwide (Economist 1997), then approximately 60.6 million people access the Web a year–a number that has been doubling every year. The growth can be explained by an increasing number of items for sale on the Internet, more users, and technology development. The amount of Internet sales may also be small because some users gather information on the Internet but shop in physical stores. As a CommerceNet survey indicates, already 39% of Internet users used the Internet to get information about a purchase while 15% of Internet users actually purchased something. As the Web and the Internet evolves, transaction fulfillment will become more accessible to those who also find information about products on the Internet.

Even though Internet commerce transactions were worth only $500 million to $600 million in 1996 (Economist 1997) they are forecast to increase quickly. This number will likely grow again approximately ten times this figure

---

[14] When businesses use electronic commerce to transact, they usually require more coordination between the businesses. Therefore, businesses in electronic hierarchies often use tools to reduce coordination costs like Electronic Data Interchange (EDI) which are very standardized. Less standardized transaction media such as the Internet may be more suitable to markets which require less coordination.

[15] According to IDC (1997), there were 27.6 million users of the Web worldwide in 1996 and 50 million in 1997. IDC (1997) estimates the number of worldwide Web users will grow to an estimated 126 million by the year 2001.

for consumer industries by the year 2000.[16] Jaffray (1997) estimates that by 2001 purchases on the Web will total $228 billion in both the consumer and business-to-business markets. Jaffray (1997) estimates that only 11% of Internet commerce, or $25 billion, will be in the consumer market by the year 2001 which is fifty times current estimates. Even though this is still a small percentage of the global economy, the growth is substantial enough to be noticed even by the largest nations of the world. It is important to note again at this time that the focus of this thesis is on retail Internet commerce, rather than the wholesale or business-to-business transactions. Elucidation of the early development of Internet commerce in the business-to-business sector, and the role of intermediaries in particular in that sector is beyond the scope of this thesis.

It appears as though consumers are still experimenting with the new medium for commerce. By dividing the number of Internet users in 1996 (60.6 million)[17] by the total worth of Internet commerce transactions on the Internet ($500 million to $600 million according to the Economist 1997), Internet users spend $8.25 to $9.90 per year on average. If the number of Internet users does doubles by the year 2000, then 969.6 million users will account for the $4 billion to $10 billion of commerce per year as reported by The Economist (1997). This is only $4.13 to $10.31 per user per year. These numbers indicate that Internet users are still experimenting with the Internet commerce transactions.

However, consumers who join the Internet commerce foray may no longer be testing the waters in the year 2000. To them, Internet commerce becomes a viable medium for serious commercial transactions. If an estimated 60.6 million Internet users today increase their spending from $10/year to $100 per year by 2000, then over $6 billion will be spent by existing Internet users in the year 2000. This does not include the other Internet users (969.6 million minus 60.6 million) who will undoubtedly account for a sizable percentage of Internet commerce.[18] If the remainder of the Internet users only spent $10/year, then Internet commerce would be approximately $15 billion/year by 2000 making the higher estimates seem low. In an industry that experiences double-digit annual growth there is bound to be creativity and experimentation with business strategy (Kambil 1995; 1997). Because Internet commerce is and will be experiencing triple-digit annual growth, this creativity and market entry is likely to be even more prolific.

---

[16] The actual increase is debated by different forecasters, but the most conservative, Cowies/SMBA estimates a $4 billion/year market by 2000 while Yankee Group estimate $10 billion/year (Economist 1997). Other estimates fall between these high and low values. Forrester, IDC, Jupiter, and the Multimedia Research group estimate that electronic commerce will grow to approximately $7 billion/year in 2000. These estimates appear to be small because the latest numbers from 1997 indicate that Internet commerce is now worth $7.8 billion (according to discussions with Lee McKnight on February 25, 198).

[17] The estimate of 60.6 million Web users is determined by extrapolating the number of U.S. Web users to the global Internet. There are approximately 40 million U.S. users of the Web and the Internet (Cortese 1997). Since the U.S. accounts for approximately 66% of the Internet users worldwide (Economist 1997), approximately 60.6 million people access the Web a year.

[18] This section estimates almost 1 billion users by the year 2000 for the calculations. Other estimates are more conservative because they estimate the number of Internet users to be less than half a billion.

The Internet marketplace may never replace the physical marketplace, but it may have far-reaching effects on it. Because the Internet is fundamentally an infrastructure to support communication, it can be used at many different points during an exchange in the physical world, and may introduce a variety of changes to the traditional physical marketplace transaction. Only at the limit, when the Internet channels of communication substitute fully for physical channels of communication, does Internet commerce threaten the existence of physical retailers. Starting from the first principle that Internet and physical commerce will co-exist and, in many ways, be complementary and integrated to transactions, this section explores why the Internet changes market friction.

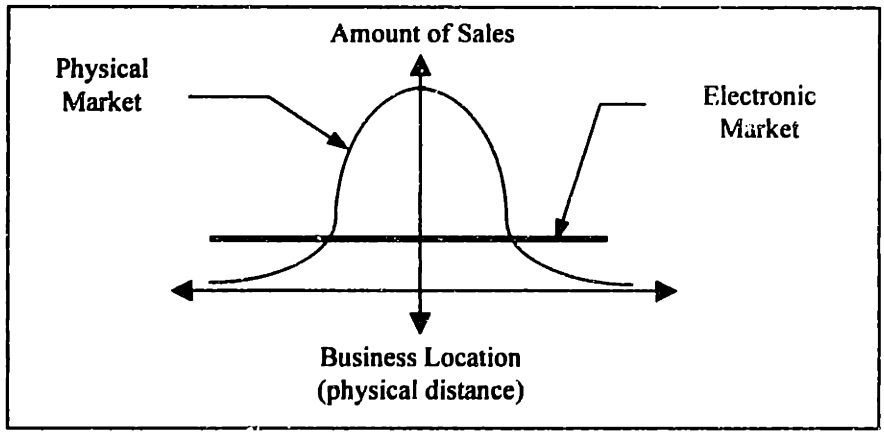
2.3.2. Transaction Costs and the Internet

Transaction costs include the fixed costs necessary to support market exchanges. As explained earlier in this chapter, these costs do not change the product but aid in clearing the market. In physical markets these costs range from the property necessary to showcase inventory to consumers to the cost of advertising. While advertising costs may still be present, retailers do not need physical locations to showcase their inventory. However, there are some other fixed costs that are necessary for Internet retailers to support market exchanges on the Internet. The cost of providing Web sites and Internet connections are two such costs.

The fixed cost to create an Internet presence may be lower than the costs to create a physical presence. While a physical presence requires selection of a proper location with the facilities necessary to serve consumers, an Internet server can be in a very remote location and even may be shared with other suppliers and intermediaries. The "look and feel" of shopping is different, but the cost to create that atmosphere is lower. The impact on competition is a lower fixed cost of entry that encourages market entry and competition. The result is that consumers are going to have a greater choice of suppliers (and, therefore, they have a greater need for intermediation) and product selection. The suppliers have the benefit of lower fixed costs that increase the average cost of products it sells. If it keeps prices the same between physical and Internet, then it has a greater profit margin. If it lowers the price and can keep the profit margin the same, it can increase sales.

Physical market transactions are limited by geography. Within that space Internet suppliers or intermediaries can expect to attract a particular consumer who has a limited set of choices because search costs are high. When markets transition from a physical environment to the Internet, there may be greater competition and greater choice for consumers now that local monopolies are threatened by the competitors across the globe. Therefore, a business making a decision will decide to accept more competition because the business then competes in a larger marketplace. The physical market has a correlation between sales and geography, as seen in Figure 2.6 and consistent with Hotelling's (1929) "linear city":

Figure 2.6: Correlation between Business Location and Sales



The difference between physical and Internet market transactions is that Internet transactions have no intrinsic correlation between physical location and sales. In this marketplace, the distribution would more closely follow the flat line in Figure 2.6.[19] The result of the changes in economics is one of greater competition but greater scope. The geographic monopoly is challenged by the Internet retailer who provides a reasonable alternative by taking advantage of the breadth of their Internet presence. A larger geographic scope also enables suppliers to enter the market who would otherwise face costs too large and a geographic scope too small to support the economics of physical market entry.

No longer can local monopolies be sustained by geographic separation from their competitors. The best product or service can appeal to the consumer without regard to proximity to the consumer. This, coupled with the fact that there is increasing global competition, results in suppliers needing to use their comparative advantage to provider a better product or service (or the same product or service at a lower price) to consumers. It is the comparative advantage that wins consumers and not their physical location. This is especially important in markets where there are large differences in prices of the same good. For example, the price of a compact disc in Europe is much higher than the price in the U.S. Because U.S. suppliers and intermediaries sell at a price competitive with the physical stores in the U.S., they have a large advantage when competing with the local European retailers. While shipping delay and costs are important elements in the overall price difference between local and remote retailers, this price can be amortized over many products (if an order is aggregated) and is often only a fraction of the total cost. Therefore, it is unlikely that European retailers can maintain significantly higher prices than U.S. retailers can in markets such as compact discs. The price for many goods may never be the same as a good bought on the Internet, but the cost differential will decrease. With a wider reach, a more-rapid speed, and lower cost of transacting in the Internet marketplace, there is greater competition among suppliers. The advantage that suppliers previously had–a

[19] The cost of shipping and physical delivery of goods ordered via the Internet will be a factor in certain cases. For example, grocery delivery services or theatre tickets cater to geographic areas. However, in many cases, the consumer may neither no nor care where the Internet commerce server is physically located.

local environment to attract consumers–is no longer a comparative advantage. Now advantages in product or service design will dominate proximity to the consumer as a differentiating feature of suppliers.

Geography no longer puts constraints on the ability to form relationships. As the Economist (1997a) describes, the telecommunications industry is growing increasingly competitive, connecting more users, and providing more services than ever. This results in a "connected world" of suppliers and consumers around the globe. The idea of a local supplier may no longer mean geographically local, but local to the community of interest a consumer has. This change is amplified because search tools can help the consumer help identify and find the best product for their needs. The corollary to this consumer benefit is the benefit to the supplier and/or intermediary. The Internet commerce supplier or intermediary can design their business to reach consumers in a global market. Because there may only be a handful of people in a town who are potential consumers, it does not make economic sense for a supplier or intermediary to set up shop in this town. Specifically, the service can be sustained because it has the ability to reach a great number of potential consumers. The move towards global markets is evident in the article by Reich (1990) that explains the difficulty in determining the origin of a product or service because the components of this product or service increasingly come from many countries.

Once in the electronic commerce environment, the strategies developed by businesses better reflects the new communication channel. Because relationships can be developed in an ad hoc manner using a global network of resources a project team is no longer constrained to a corporate location or full-time employees. The rise of consultants to perform a particular task resembles an object in computer science that is introduced into the action plan when necessary (Cox 1996). The presence created by businesses is often reflected in how it designs its technology. How a manager designs its Internet security and technology (Kalakota and Whinston 1996; 1997b) is important to reach consumers. Also, the design of the Web site itself (Schwartz 1997) can also convey the business presence and service to consumers. Because consumers cannot touch and feel the products they are buying they must trust the image portrayed by its potential supplier. Therefore, image is everything. In fact, the use of an intermediary can help consumers get behind the facade of the Web site and increase consumer confidence.

The impact of potentially reduced transaction costs from Internet commerce to change organizations is to be determined but existing theory can give some insight into the question. Information technology may lead to organizational change because of lower transaction costs is a research area with much depth. Many studies have been done regarding the impact of some information technologies, such as the phone (Pool 1977), computer (Ferguson and Morris 1993), and software (Brynjolfsson and Kemerer 1994). Other studies explore how information technology effects productivity (Nohria and Eccles 1992; Brynjolfsson and Hitt 1994 and 1996; Hitt and Brynjolfsson 1994) and business-to-business relationships (Bakos and Brynjolfsson 1993a; 1993b). Of growing importance and an important extension to this prior work is the impact the Internet has on organizations (van Alstyne 1996). While the motivating hypothesis of information technology lowering transaction costs and changing organizational structure is fairly straightforward, the results from such a change are difficult to predict. It is difficult

to quantify the benefits of information technology adoption. While there is a large body of theoretical literature supporting lower transaction costs with information technology adoption, there is little empirical work. Markus and Robey (1988) address the question of whether information technology causes organizational change or whether organizations change the technology. The thesis now turns to menu costs to focus on the dynamic aspects of market friction and the emergence of Internet commerce.

2.3.3. Menu Costs and the Internet

The introduction of the Internet may reduce menu costs significantly. As the creation of "menus" becomes electronic, the only cost associated with changing this price is the marginal cost of someone entering in a new number. Menu costs can be even lower if an algorithm can automatically render a price. For example, a retailer may sell a given book at 30% off the list price where the list price is an exogenous variable. If the publisher changes the list price, the retailer does not have to change their algorithm and the price will automatically be adjusted. Reduced menu costs can also lead to phenomena such as price discrimination, for example, which is described in Chapter Six.

Rapidly changing markets and instantaneous consumer feedback is a feature of Internet commerce. This presents challenges for firms as they generate business plans and try to develop relationships with their consumers. Rapid changes in Internet markets mean that today's business plan may be obsolete tomorrow. For example, the feedback received from consumers for newspaper and magazine ads is usually measured in days, weeks, or months. Internet advertising can change in minutes or seconds because the responses from consumers can be processed almost instantaneously and information can be dynamically changed. As Iansiti and MacCormack (1997) point out, the Internet allows for fast consumer feedback that allows companies with flexible product development processes to respond to consumer needs very quickly. In microeconomics terms, the "short run" menu cost for Internet commerce is much shorter than the "short run" menu cost for physical markets.

The acceleration of feedback and ability to dynamically change offerings and appearance also affects competition. The ability for a supplier or intermediary to react and respond to their competitor is much faster. Once an offering is made over the Internet it is available for consumers and competitor alike. Because the competitors can dynamically change, they can match their competitor's offering. For example, a price change by a competitor can be immediately recognized and a response can happen quickly because of the Internet's reduced menu costs.

In the electronic commerce environment, business strategies can be more flexible and modular. For instance, relationships can be developed in an ad hoc manner using a global network of resources. In some ways, the rise of consultants to perform a particular task resembles the object-oriented approach to software development (Cox 1996). The result of flexible and modular business strategies is that products and services that can be tailored to the needs

of individual consumers through supplier-consumer relationships. The result may be products that are "mass customized" to the individual needs of the consumer as described by Pine, Peppers, and Rogers (1995).[20]

Likewise, instantaneous consumer feedback may change how firms develop relationships with their consumers. Information technology holds promise to enrich the bonds of communication between buyer and seller (Bakos and Brynjolfsson 1993a), and some firms are already taking advantage of this capability. This relationship development is a growing concern in the marketing literature (Dwyer, Schurr, and Oh 1987) and marketing on the Internet. Information technology such as the Internet changes marketing strategies to stress quality of consumer interaction (Hoffman and Novak 1996). The introduction of information technology to the market may increase the number of relationships and reduce consumer loyalty because new marketplaces can develop or it may strengthen the bonds of existing relationships. In the review of the literature, Steinfield, Kraut, and Plummer (1995) discover that the latter is more likely. Bakos and Brynjolfsson (1993a; 1993b) find that information technology increases the bonds of communication and can bring the buyer and seller in closer contact so their relationship strengthens over time. The ability to develop communities of interest and trust in relationships is part of the goal of Internet retailers to attract new sales and promote repeated sales (Hodges 1997).

The following chapters explore the ability of the Internet to reduce market friction and determine what impact possible reduced market friction has on markets. It does so by exploring the roles of intermediaries, introducing a methodology to analyze Internet price competition, and the presentation of results from an exploratory empirical analysis. An interdisciplinary approach is used to integrate the issues of Internet technology, economics, and policy. Interdisciplinary analysis is not a new approach to academic analysis, but is becoming increasingly important. As de Neufville (1988) points out, decisions are often laden with the interrelationships between technology, management, and policy and cannot be solved independently. Therefore, interdisciplinary methodologies try to examine decisions and model the interrelationships of variables to ensure a balance of interests are met. This will, hopefully, ensure that good technology developments are not implemented for its inability to address business and/or policy concerns. As Clark (1994) points out with regard to network layers and standards, markets cannot explore what technology has precluded.

[20] Hagel and Armstrong (1997) describe how mass customization concepts can be used in electronic media.

3. INTERMEDIARY ROLES AND THE INTERNET

This chapter explores intermediation in Internet commerce. While an Internet retailer participates in market transactions to provide a variety of intermediary roles, this chapter describes the aggregation and pricing roles of the intermediary and examines how the Internet may enhance this role. Section 3.1 builds a framework for intermediation to identify four roles of intermediaries: aggregation, pricing, search, and trust. Section 3.2 develops an analytical model to describe what market structures (disintermediated, markets, or hierarchies) will minimize transaction costs. Finally, Section 3.3 uses the model and examples to describe how the Internet marketplace may take on these different market structures and how the Internet affects intermediary roles.

3.1. Intermediary Roles

The contribution of this section to the thesis is the identification of four intermediary roles: aggregation, pricing, search, and trust. This section accomplishes the identification of the four roles by examining existing economic literature on intermediaries, creating an exhaustive list of intermediary functions identified by this literature, and then grouping these functions into the four roles. Then, this section explores the process by which a consumer purchases an item and explains why the four roles are appropriate. The discussion distinguishes each role from the others and finds a lack of depth in exploring the aggregation and pricing roles of an intermediary. The discussion is not specific to the Internet and Internet commerce.

The roles of the intermediaries identified in this section explore the role of the intermediary as a coordinator of information only. As with the economic literature and the consumer search process described by Bakos (1997), Diamond (1985), and others, this analysis will not explore the logistics and transportation elements of a transaction. For a transaction to be fully completed, the transfer of money for goods is necessary. For example, this analysis will not explore the role of the intermediary to support payments on the Internet which is examined elsewhere (Cox 1996; and Sirbu and Tygar 1995). Some elements of the logistics and transportation process may be integrated with the flow of information that leads to the consumer and supplier's decision to transact.

Grouping the roles of intermediaries as identified by existing literature on intermediation results in the four roles in Table 3.1 Even though there may be acknowledgment of the other roles, the depth to which these roles are

examined varies from article to article. By taking the literature as a whole, the articles of varying depth complement each other to form a more complete composite of intermediary roles. Table 3.1 lists ten articles that describe functions of intermediaries and how these functions map into the four roles. This subsection describes the characteristics of each of the four roles to distinguish them from each other. This discussion serves as a summary of the existing literature and describes how Table 3.1 was derived. This material is not original, but the grouping of the material into the four roles is. Section 3.2 develops an analytical model to describe when intermediaries are preferred in market structures. Finally, since Sections 3.1 and 3.2 are not specific to the Internet, Section 3.3 discusses how the four intermediary roles vary with the introduction of the Internet.

Table 3.1: Identified Roles of Intermediation

Article	*Aggregation*	*Pricing*	*Search*	*Trust*
Croson (1995)	economies of scale and scope		expert screeners	delegated monitoring reputation store
Resnick, Zeckhauser, and Avery (1995)		pricing inefficiencies	search costs incomplete information	lack of privacy contracting risk
Sarkar, Butler, and Steinfield (1995)[21]	transaction economies of scale	purchase influence[22]	search and evaluation needs assessment and product matching position of consumer information integration of consumer and producer needs[23]	consumer risk management producer risk management
Bailey and Bakos (1997)	aggregation		matching facilitation	trust
Gehrig (1993)			**search**	
Biglaiser (1993)			**experts**	
Biglaiser and Friedman (1994)				**quality**
Lu (1997)		Pricing	Indexing and Searching Filtering Matching	Identity Verifying Quality Guaranteeing
Cosimano (1996)			**Matching**	
Spulber (1996)		Price Setting and Market Clearing	Matching and Searching Providing Liquidity and Immediacy	Guaranteeing and Monitoring

Note: Boldface indicates that the role is explored in greater depth in this article.

The label the intermediary has usually connotes its role in the marketplace. For example, intermediaries are often referred to as middlemen (Rubinstein and Wolinsky 1987; Lu 1997a; Lu 1997b; Biglaiser 1993; and Yavas 1992).[24] Yavas (1992) describes some intermediaries as marketmakers or matchmakers depending upon the intermediary's role in a transaction. A marketmaker searches for places to intermediate exchanges whereas an intermediary acts as

[21] Sarkar, Butler, and Steinfield (1995) also list product distribution as an intermediary role, but this thesis will not look at the product distribution and only at the information leading up to a contract.

[22] Sarkar, Butler, and Steinfield (1995) describe "purchase influence" as the ability to market a product through product placement and pricing. This is listed as part of an intermediary's pricing role because the intermediary chooses the product's price.

[23] It is difficult to characterize this role because this intermediary role involves conveying information to the needs of the consumer and the supplier. Because it reduces the time needed to process and filter information for the different market players, it is a tool to help matching and search.

[24] It appears from reading the articles that intermediaries and middlemen are used fairly interchangeably so the fact that they are not distinguishable may not change their analysis or conclusions.

a matchmaker when consumers or suppliers ask them to find a suitable partner. Sarkar, Butler and Steinfield (1995; 1996) use the term cybermediaries to distinguish intermediation in electronic markets from those in physical markets. Finally, when an intermediary does not take ownership of the good transacted, the term broker (Resnick, Zeckhauser, and Avery 1996) or agent is used.

3.1.1. Aggregation

Intermediaries can aggregate products among suppliers to reduce transaction costs. Instead of a market where each consumer has to negotiate individually with an appropriate supplier, and each supplier will have to negotiate terms and fill the orders of individual consumers, the intermediary can aggregate the demand of many consumers or the products of many suppliers. The intermediary is able to offer products that originate from different suppliers that may be substitutes or complements. For example, if the intermediary is a convenience store, it would be important for them to have food and beverages–compliments. If the intermediary is an electronics "superstore," they can provide a wide selection of televisions that the consumer can choose from–substitutes. This helps consumers compare prices and product features by aggregating products in one location. The ability of the intermediary to have product information in one location allows for a side-by-side comparison of product features.

Aggregation of products can help intermediaries realize economies of scale and scope. By having more of the same product, the economies of scale will share the fixed cost of transacting over a greater number of items thereby reducing the average cost. By having a greater variety of products, the fixed costs can be spread over different products. Economies of scale and scope are identified as an intermediary role through the work of Demsetz (1968) and Resnick, Zeckhauser, and Avery (1995), for example. This is one reason why some retailers choose to carry a very large selection of products–the marginal cost of carrying an additional product is small. For example, Buxmann, Rose, and Konig (1997) describe how an aggregation intermediary is important in software exchange. In their paper, they describe a repository for Java software elements so that many developers can store their software code on one server as opposed to a distributed Web of servers. The benefit to consumers of the software elements is that they only need to visit one server to get a bundle of elements previously stored on multiple servers.

Aggregation of products can also lead to setting a price for a bundle of products. An example of bundled information is a newspaper or a magazine, which takes information from different authors and bundles it together and sells it at one price. Digital information goods, such as a news article, a digital image or a song, allow perfect copies to be created and distributed almost without cost via the Internet. Cable TV is also an example of digital information where the Cable TV provider bundles programming. As shown by Bakos and Brynjolfsson (1997), a strategy of selling a bundle of many distinct information goods for a single price often yields higher profits and greater efficiency than selling the same goods separately. In other words, the nature of information goods and the emergence of a market that allows their efficient distribution, create new roles for content aggregating intermediaries that will bundle large numbers of information goods. In markets other than information goods,

bundling to set one price can be important as seen in computer sales. Computers are often sold with software packages and peripherals to make the product more valuable to the consumer.

Intermediaries can also aggregate consumers. When an intermediary, such as a retailer, is dependent upon one supplier for its goods, the supplier can be a very tough bargainer when setting prices and delivery dates, for example. However, once this intermediary carries products from the supplier's competitors, the supplier no longer has this bargaining power over the intermediary because the intermediary has aggregated products over a larger number of suppliers and is not depending on any one supplier. This is similar to the vulnerability cost identified by Malone, Yates, and Benjamin (1987) where the inability to complete a transaction between a supplier and an intermediary does not leave the intermediary in a more vulnerable position when the intermediary aggregates products from other suppliers a well. Aggregating consumers reduces the bargaining asymmetry of disintermediated markets as examined by Williamson (1975).

3.1.2. Pricing

The intermediary provides an important role in setting a price for a good or service because it is the price that helps clear markets. While the microeconomic theory indicates that price should be set where supply equals demand, the ability to measure supply and demand in an actual market is a difficult task. Therefore, the intermediary determines a price for a good based upon the perceived demand and the supply for a good. If the price is set too high, the intermediary may be left with a large inventory of unsold products. If the price is set too low, products might not be available after they sell out to the first consumers and the intermediary looses revenue. By setting a price, the intermediary acts as a Walrasian auctioneer–an important function in microeconomics of setting a price so that a market equilibrium can be achieved. Of course the intermediary does not set prices in a vacuum. The intermediary is able to examine what its competitors are doing and it can track sales to determine if it should change prices over time.

When an intermediary determines a price, they can manage the balance of producer and consumer surplus in a transaction. The sum of this surplus is the overall social welfare in a transaction. Social welfare is increased when there are more transactions between parties and either the supplier, consumer, or both have positive surplus. The reason some markets do not have these transactions is the transaction cost (Coase 1937; Williamson 1979) associated with finding information and parties to transact with. The role of intermediaries to match buyers and sellers is often addressed by the literature on electronic markets (Malone, Yates, and Benjamin 1987; Resnick, Zeckhauser, and Avery 1995) and intermediation (Cosimano 1996; Biglaiser 1993); and Yavas 1992).

The intermediary can also become an agent for price discrimination. Price discrimination is a tool to set different prices for the same (or similar) good to separate users. By setting a higher price when the product is sold to consumers who are willing to pay more, the intermediary is able to realize a greater profit. Also, by giving

discounts to other users (through coupons or student discounts, for example) they can charge a lower price for other consumers who are not willing to pay more in order to increase sales. Microeconomics views price discrimination as a tool to reduce consumer surplus and increase producer surplus. Because the intermediary is able to set prices and aggregate products, they can perform a variety of price and product bundles to appeal to these different classes of users.

3.1.3. Search

Because the intermediaries are repositories of information, the intermediary can make information more accessible to consumers thereby reducing consumer search costs. Information transfer between organizations is costly, especially when it involves "implicit" or contextual knowledge that cannot be easily articulated. In these instances, an intermediary can facilitate the exchange of information by coordinating the process and translating the information that is sent between the supplier and the consumer. More than just having information, the intermediary can also process and handle this information to make it accessible to the consumers and suppliers. For example, consumers can use the Internet to schedule travel plans, however many still use travel agents because travel agents can help organize and filter information. They do so by providing information on several travel alternatives, as well as processing payments, and printing tickets, invoices, and itineraries. Intermediaries can help prevent misinformation from being gathered by the consumer. Because the intermediary is a repository of information (Croson 1995) and receives feedback from consumers and suppliers about this information, the intermediary can insure that the information it stores is accurate. The intermediary is more objective than the supplier is especially when the intermediary aggregates products from across suppliers. The comparison shopping at an intermediary includes this assessment of product features for products manufactured by multiple suppliers.

The search intermediary can help consumers find a product that is best suited to the consumer's preferences. There are two types of search for consumers: price search and features search. Both types of search require gathering and processing information but address different aspects of their shopping experience. When looking for the best product, a consumer performs a features search while a search for the best price is a price search. Search intermediaries help with both types of searches. For example, one type of search intermediary is a direct marketing firm. A direct marketer collects information about consumers and tries to determine to which set of consumers they should target their advertising in order to maximize the potential for sales. Because new supplier entrants have no interactions with the consumers they are trying to reach, they depend on an intermediary or another supplier to get consumer information. Because another supplier is probably a competitor, it is unlikely that they are willing to share consumer information with them. However, the intermediary would not only be more inclined to share this information, they may have a richer information source because their data can span markets and supplier transactions.

Information asymmetries are one reason why an intermediary can help with search and matching similarly to the way an arbiter works with parties trying to negotiate. The intermediary can know information about the consumer and the supplier that neither knows about each other–an information asymmetry. The intermediary is able to take advantage of information revealed by the consumer and the supplier to enhance the value of the transaction without revealing the information to the other party. By keeping information to themselves, the intermediaries are able to filter through the unnecessary consumer or supplier information and only reveal what is important to making that party satisfied with the transaction.

3.1.4. Trust

Opportunistic behavior by suppliers and buyers can be monitored and prevented by an intermediary. In neoclassical economics, suppliers and consumers are maximizing their utility even if that means reducing the utility of the other party. While this often happens in negotiations for a mutually agreeable outcome, either the consumer or supplier may supply misinformation to increase their utility even more. The trust role taken on by some intermediaries is there to protect consumers and seller from the opportunistic behavior of other participants in a market (Williamson 1975). Because of their long-term participation in the market, intermediaries have high incentives to ensure that market transactions are completed, and that each party involved–the supplier and consumer–lives up to their end of the bargain. Because the parties in a transaction may need to interact with the intermediary in the future even if the supplier and consumer never do business with each other again, the intermediary may be in a better position to prevent opportunistic behavior, compared to other market participants.

The repeated nature of intermediary relationships makes them more trusted. By having an intermediary in the middle of an exchange, the intermediaries are able to witness the actions of suppliers and consumer. With the repeated exchange through these intermediaries, Croson (1995) argues that these intermediaries can help determine future performance based on past. Because the intermediary is trying to develop a reputation, it avoids selling flawed products sold by suppliers. Croson (1995) further explains that protecting ones reputation is far more important when the repetition of transactions is fundamental to future profits. Because of this, the intermediary will be more concerned about its reputation than a supplier and therefore promotes trust.

Intermediaries act as trusted third parties by assessing suppliers and products and granting a seal of quality to some. For example, *Consumer Reports* is a trusted third party for many consumer goods because it provides an objective analysis of products using metrics that many consumers are comfortable with. In the Internet, a non-profit organization TRUSTe (www.truste.org) gives such seals of approval to Web sites that have proven they protect a consumer's privacy. Other trusted third parties help rate content on the Internet such as the Recreational Software Advisory Council.

The trust intermediary can help prevent the market for lemons. Ackerlof (1970) describes the ability of suppliers to produce flawed products or "lemons" and find a suitable market for them. However, the intermediary can reduce the sale of lemons as Lu (1997a) points out because it is trying to protect its reputation as an intermediary and counts on its reputation when competing with other intermediaries. Furthermore, because the intermediary oversees a greater volume of sales, consumer complaints to the intermediary can influence the information the intermediary gives consumers gathering information. Clemons and Weber (1997) argue that the introduction of information technology will reduce transaction costs for the intermediary and, therefore, the intermediary assumes a greater role as risk-manager.

3.2. Intermediaries in Markets and Hierarchies

This section introduces a model that merges consumer search costs and market structure theory. This model describes market structures in order to describe how intermediaries can reduce transaction costs. The goal of the model is to describe why some market structures are preferred when the intermediary provides an aggregation and pricing role. The insight of the analytical model is the realization that disintermediated markets work well with very few suppliers, hierarchies work well with a large number of suppliers, and markets work well for cases in-between. While the model is not Internet specific, the market structure theory it builds on comes from a discussion of electronic markets and not physical markets (Malone and Smith 1988; Malone, Yates, and Benjamin 1988; and Bakos 1997).

Similar to the work of Cosimano (1996), this section focuses on the choice between disintermediated and intermediated markets. As the previous section describes, these two markets underlie many debates about how the value chain changes with the introduction of markets. Unlike Cosimano (1996), the model presented here will address the aggregation and pricing intermediary and not the matching and search intermediary. Furthermore, the approach taken by the model introduced here is rooted in transaction cost economics and not game theory.

Estimation of the transaction cost involves enumerating the channels of communication between all parties involved in the market structure. Similar to the methods of measuring transaction costs used by Malone and Smith (1988) and Baligh and Richartz[25] (1967), the model introduced in this section assumes a fixed transaction cost for each communication channel. As the number of communication channels increases, transaction costs increase. For example, if a consumer decides to search two retailers to compare prices and product features, then they have double the transaction costs of a consumer who only searches one retailer. In this example, the former consumer has two communication channels while the latter has only one communication channel. Addition of suppliers, consumers,

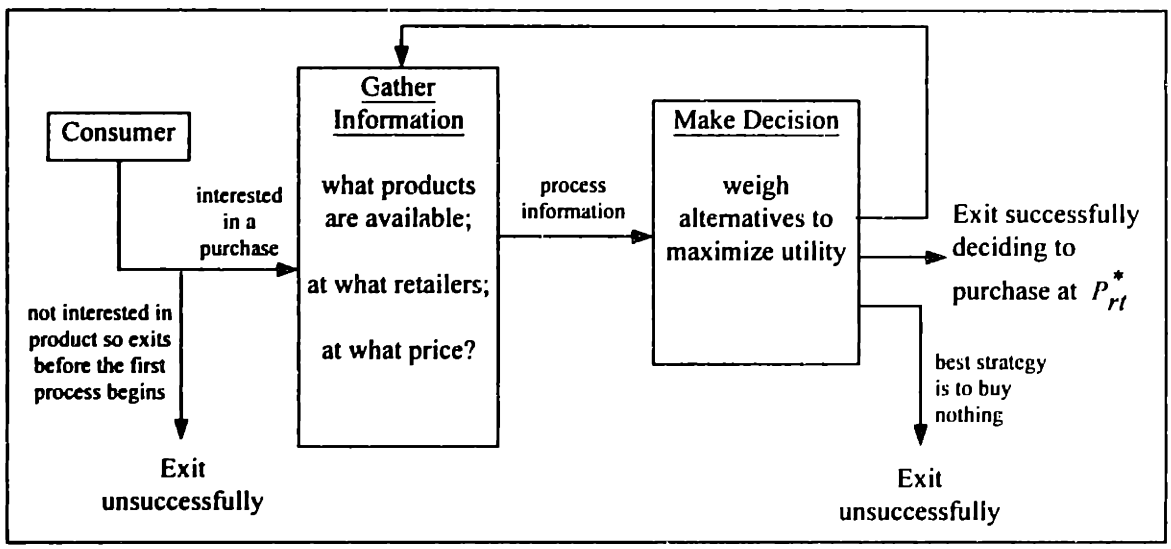
[25] Baligh and Richartz (1967) described the number of relationships being reduced from $m * n$ to $m + n$ when a single intermediary was introduced to coordinate market transactions.

and intermediaries to the market structure may increase or decrease the number of communication channels and, therefore, change the transaction costs.

Some of the communication channels are developed when consumers search for products and features to determine what to purchase and where to purchase it. By approaching the same problem from the consumer perspective these two functions are not completely separate because the consumer may be willing to sacrifice some product features for a better price. Consumers search for a product that has the greatest net benefit (utility minus price).

Consumers have two distinct tasks when trying to find what product they will buy and whom they will buy it from: 1) gathering information and 2) processing the information to make a decision. While these processes are iterative and interdependent, the separation of the two tasks is consistent with a separation in the academic literature. The first task of consumer information is consistent with the Bayesian search models that are often used in the economics literature. In this literature, models describe how consumers update their prior knowledge (priors) to posteriors after they gather information (Diamond 1985; Stiglitz 1989; and Bakos 1997). A limitation of the Bayesian search models is that they only focus on consumer search and not other search mechanisms such as advertising by suppliers. The second task of processing information to make a decision may be modeled with techniques such as decision analysis. Figure 3.1 shows a diagram of how a consumer can exit the search process before gathering information, or iterate the information gathering process if they do not have enough information, or decide to complete a transaction for a given product at a given price and sold by a selected retailer. The consumer exits, either successfully or unsuccessfully, when they believe the marginal cost of gathering more information is less than the marginal benefit of searching.

Figure 3.1: Consumer Search Framework



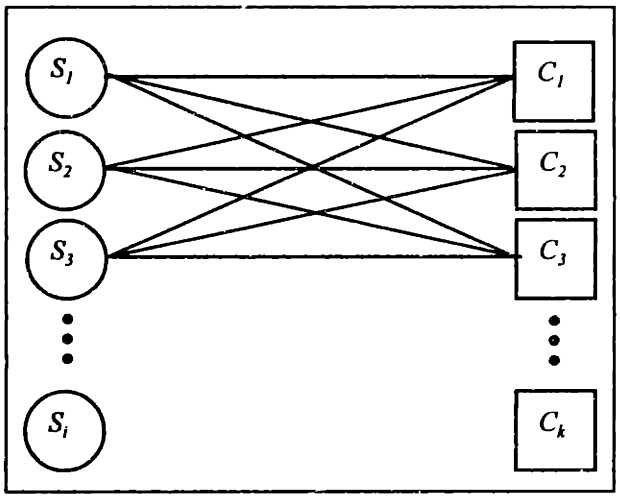
The consumer initially has no information about product features or prices. The consumer's prior is said to be the null set in Bayesian economic terms. The consumer then undergoes a search process very similar to the one shown in Figure 3.1 to gather information. Because the aggregation and pricing intermediary aids the consumer with the information gathering process and not the decision process, the model only examine the information gathering process. The model assumes that there is no misinformation given to consumers (i.e. the intermediaries can be trusted). Therefore, the consumer will want to gather as much information as possible about all possible products and if search costs are low enough, the entire marketspace of products is searched. However, the consumer may not want to search every intermediary to determine every price because that does not help them in determining what to buy, only where to buy it.

The model variables are used throughout the different market structures. There are three types of market players: intermediaries *(I)*, suppliers *(S)*, and consumers *(C)*. Any communication between these parties has a fixed transaction cost C of a consumer to search an intermediary or supplier (part of the consumer's transaction cost) to obtain the price of the title.[26] The model assumes this cost is constant if the consumer is searching for price or features. In other words, the cost is the same if the consumer searches for a new product (feature search) or if they are get an additional price for a product already know the features of (price search). Furthermore, there is a fixed cost for the intermediary to transact with the supplier and this cost does not vary based on the quantity of products transacted. Therefore, an intermediary that receives 100 products from a supplier will have the same transaction cost C as an intermediary who receives 100,000 titles. This may not be completely accurate, but keeping the model simple is important before some of these assumptions are relaxed.

The disintermediated market involves direct communication between the suppliers and consumers. Each supplier sells the products they manufacturer and do not resell any of their competitor's products (otherwise they would be an intermediary for the products they resell). With this market structure and uniform transaction costs C, consumers must have a communication channel with every supplier to determine the full set of products. Each product has only one price because every product is only available from one supplier. It may be difficult for the consumers to know what suppliers to search, therefore the model assumes that consumers have already determined a set of i suppliers that sell competing products. By using lines to draw the transaction cost in a market with i suppliers and k consumers, the total number of transactions is shown in Figure 3.2 each one having a cost C. Therefore, the total transaction costs for the disintermediated case (defined as T_d) is $T_d = Cik$

[26] This fixed transaction cost is similar to the fixed transaction cost used by Townsend (1978). In his paper, Townsend described that a simple case of three players with a fixed transaction cost α. The intermediated case has a transaction cost of 4α while the disintermediated market has a transaction cost of 6α. The intermediated case has a saving of 2α.

Figure 3.2: Disintermediated Transactions



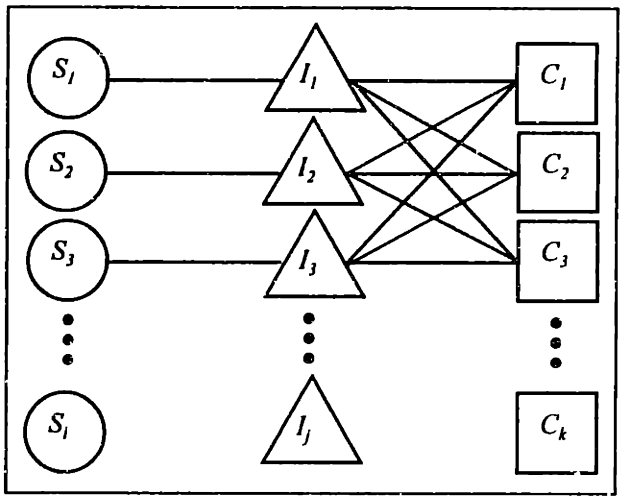
An example of this type of market is a craft fair. All products are hand-made and all suppliers set the price for the products they make. The consumer must browse all suppliers to find all product features available for purchase. The number of suppliers may be fixed but manageable just as a craft fair has limited space to attract suppliers. As consumers use communication channels to gather feature information, they are also collecting price information.

The disintermediated market structure may be too cumbersome for some consumers searching for product features so the introduction of an intermediary can reduce this transaction cost. In the craft fair example, an intermediary may form relationships with some of the craftspeople to carry their products in a retail store. The intermediary in this case (the retailer) aggregates products from the suppliers and sells the products to their consumers who can use one communication channel (the channel with the intermediary) to search product features. The intermediary can develop unique communication channels with the suppliers to form hierarchies (Williamson 1975) or electronic hierarchies (Malone and Smith 1988) if the communication is electronic. The suppliers can also sell to more than one intermediary to form markets (Williamson 1975) or electronic markets (Malone and Smith 1988) if the communication is electronic. Both the hierarchy and market cases are modeled below.

In the hierarchy case, the intermediaries each sell products with different features. The intermediaries perform little or no aggregation because each supplier chooses an intermediary to form a hierarchy (Malone, Yates, and Benjamin 1987). This is similar to the craftspeople choosing one retail location to sell their products. If an intermediary has no transactions with a supplier, then they carry no products so it is safe to assume that they also have no transactions with consumers. The transactions for the hierarchy case with i suppliers, j intermediaries, and k consumers is shown in Figure 3.3. When $i = j$, each intermediary only carries the products from one supplier. If $i < j$, then there are more intermediaries than suppliers and some intermediaries carry no products. This case is unlikely and complicates the analysis so it is assumed that $i \geq j$. When $i > j$, the intermediary does play a limited aggregation role but no two

intermediaries carry the same product. Therefore, with a uniform transaction cost C, the total transaction costs for the hierarchy is $C(i + jk) \equiv T_h$.

Figure 3.3: Transactions in a Hierarchy



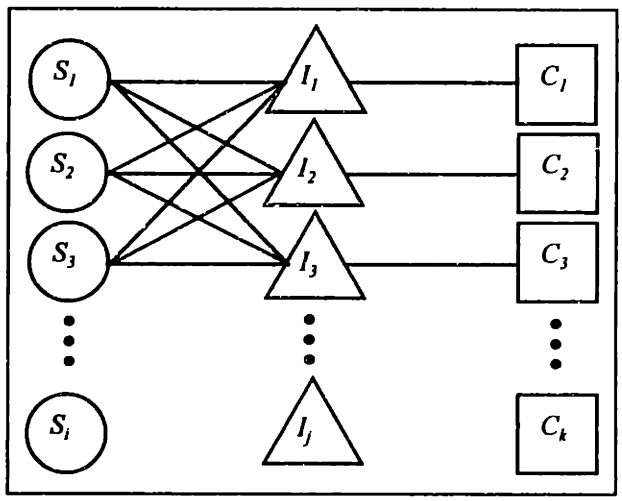
The hierarchy has certain advantages and disadvantages to all parties. The consumer must search all retailers to find the features for all products being sold just as they did in the disintermediated case. As the consumer searches the intermediaries, they also gather price information. The supplier is able to minimize their transaction cost by only having one communication channel to sell their products. The intermediary is able to make sure that other intermediaries they compete with do not sell the same product so they are not price competing with them. This type of market structure is appropriate when intermediaries, such as retailers, want to sell customized products at their stores that no other retail store can offer.

While the aggregation role of the intermediaries in the hierarchy is important, the aggregation of products is limited. Aggregation helps consumer compare products side-by-side to compare product features at a price set by the intermediary. In many respects the intermediary must be trustworthy so the consumer believes the information they receive. Information conveyed by a salesperson not trusted by the consumer may not affect the consumer's decision. The consumer comparisons look at how one product can be an imperfect substitute for another product because the same product is available nowhere else. However, if the suppliers sell to more than one intermediary, these retailers may compete solely on price because they sell the same product. This is the market case.

The introduction of the intermediary in a market shifts the transaction costs from the consumer to the intermediary. With i suppliers, j intermediaries, and k consumers, the market transaction costs as shown by a line between the parties is shown in Figure 3.4. Each intermediary now carries all products from all suppliers and the consumer now only needs to visit one intermediary who aggregates and determines a price for these products. Because the consumer knows one intermediary will have all products, they only need to incur a transaction cost of C to gather all

product information. In this case, the consumers choose one intermediary and the number of intermediaries is not greater than the number of consumers, $j \leq k$. If the intermediary has no transactions with consumers, then they are not part of the set of j intermediaries in the model. In this case, when the intermediary provides a full aggregation role, with a uniform transaction cost is $C(ij + k) \equiv T_m$.

Figure 3.4: Transactions in a Market



The consumer can now find the same product at the multiple intermediaries so they do not have to search all intermediaries for feature information. This is because the supplier sells through a non-monopoly channel to multiple intermediaries. While it may be necessary for the consumer to visit more than one intermediary for price searching, the question of what to buy can be answered by browsing the selection at any one intermediary. Because multiple intermediaries now sell the exact same product, they must be wary of price competition with other intermediaries. The suppliers have more communication channels, but they benefit through increased channels of distribution for their products at potentially lower prices.

The model that minimizes the transaction costs is dependent upon the number of suppliers and the number of intermediaries in a given market. The following equations show the conditions necessary for the different markets minimize transaction costs:

Disintermediated: $T_d < T_h$ *and* $T_d < T_m$

Hierarchy: $T_h < T_d$ *and* $T_h < T_m$

Market: $T_m < T_d$ *and* $T_m < T_h$

The equations still vary in three dimensions: i, j, and k. To simplify the analysis, one of these dimensions can be eliminated by asking which variable is most likely to remain constant, the number of suppliers, intermediaries, or consumers? Because this thesis focuses on Internet retailers who sell products with low asset specificity, it makes

the most sense to keep the number of consumers constant and large relative to the number of suppliers and intermediaries. Therefore, by keeping the number of consumers constant, the additional transaction cost for adding an intermediary is found by taking the derivative with respect to *i*:

$$\text{Disintermediated: } \frac{\partial T_d}{\partial i} = Ck$$

$$\text{Hierarchy: } \frac{\partial T_h}{\partial i} = C$$

$$\text{Market: } \frac{\partial T_m}{\partial i} = Cj$$

These equations show the marginal transaction cost for adding an additional supplier, while holding the number of consumers and intermediaries constant. What these equations show is the marginal cost is highest in the disintermediated case (because $k<j$), lower in the market case, and lowest in the hierarchy. The values correspond to the slope of the line as the number of suppliers increases. To graph this solution, the y-intercept for the three cases is also needed. They are: $T_d\ (i=0) = 0$ (disintermediated), $T_h\ (i=0) = Cjk$ (hierarchy), and $T_m\ (i=0) = Ck$ (market). Therefore, the graph can be created by taking the slopes of the line with the y-intercepts as shown in Figure 3.5.

Figure 3.5: Comparison of Market Structure versus Transaction Costs

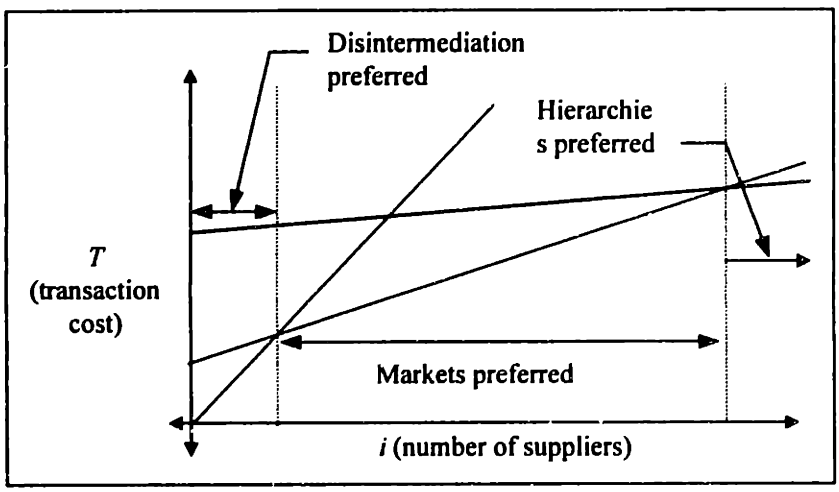


Figure 3.5 is the main insight the analytical model contributes. This graph says that the preferred market structure to minimize transaction costs is dependent upon the number of suppliers. If the number is very small, a disintermediated market is preferred. As the number of suppliers increases, the market is preferred. Finally, after a point when the suppliers become very numerous, the hierarchy is preferred. An example of the shift from disintermediation to markets to hierarchies is described in Section 3.3 in an Internet context.

The indifference points on the graph occur when the transaction costs are the same for both market structures. For the graph above, disintermediation is preferred until $T_d = T_m$ which is when $Cij = C(i + jk)$ simplified to $i = \frac{jk}{(j-1)}$. markets are preferred until the transition to hierarchies when $T_m = T_h$ which is when $C(i + jk) = C(ij + k)$ simplified to $i = k$. Because the number of suppliers is almost always less than the number of consumers, markets dominate the preferred market structure.

Associating number with the variables helps show the dominance of the intermediary as an aggregator. Different values for *i, j,* and *k* are selected to show which market structure minimizes the transaction costs in Table 3.2.

Table 3.2: Transaction Cost Estimates for Market Structures

(i, j, k)	*Disintermediated*	*Hierarchy*	*Market*
1,10,1000	**1,000**	10,001	1,010
100, 10,1000	100,000	10,100	**2,000**
1100, 10, 1000	1,100,000	**11,100**	12,000

Note: Boldface type indicates the minimum transaction cost.

Now that the simple model is introduced, certain assumptions are relaxed so that the model gets more complicated but the model more closely resembles reality. The simple model does explain why intermediaries are important to aggregate products to save transaction costs, but a few assumptions do not seem to model reality all that well. To increase the model's applicability, three of the assumptions are relaxed in order of importance: consumers shop for a better price, the transaction cost for a hierarchy is the same as the transaction cost for a market, and intermediaries carry the products produced by all suppliers in markets. As these models are relaxed, the market structure gets more complicated than the market and hierarchy. As the number of transactions shift from the hierarchy (transactions between suppliers and intermediaries) to market side (transactions between consumers and intermediaries), the new market structure lies in-between the extremes of markets and hierarchies.

The result of relaxing these assumptions is that the area where markets are preferred in Figure 3.5 is reduced. This simple model over-estimates the area where markets are preferred because of the modeling assumptions. The assumption that communication between consumers and intermediaries yields the same transaction cost as supplier-intermediary communications favors markets over hierarchies. The assumption that consumers in markets only search one intermediary is also not likely because consumers must search more than one intermediary to do price searching. The result of a relaxation of this assumption also shifts the point where hierarchies are preferred over markets to the left in Figure 3.5. The analytic analysis changes when these two assumptions are relaxed.

The first assumption the model relaxes is that consumers do not engage in price competition. Price competition is one of the important roles the intermediaries play and an essential element to the consumer search model Therefore,

as the consumer is searching for information about products, they are also comparing how to compromise the product's price for the product's features. Also, the consumer may be able to find a better price for the same good at a different retailer. As consumers do more price searching, the transaction costs in the market increase. Therefore, the area in Figure 3.5 where markets are preferred shrinks. This last type of search does not occur in the disintermediated market because the supplier is the only one carrying a product with a unique set of features. The supplier owns the intellectual property and can command a higher price.

The price-searching consumer can be modeled by altering the market case to include multiple transactions between consumers and intermediaries. While the number of transactions that occur between the two depend on the consumer and the market. A greater number of intermediaries are searched when the type of product being bought varies. For example, a consumer buying a house may spend more time searching than a consumer buying a paperback novel may. More intermediaries are searched where there are better search tools available. For example, searching may be easier on the Internet as Bakos (1997) points out because of the search engines. Finally, the preferences of the consumer also affect the amount of search costs incurred by a consumer. For example, consumers who have no time but plenty of money will search less than those with the opposite preferences will. Assigning a variable N as the average number of retailers visited by consumers for price comparison is necessary to model the transaction costs for the three markets. These transaction costs are shown in the following equations:

Disintermediated: $T_d = Cik$

Hierarchy: $T_h = C(i + jk)$

Market: $T_m = C(ij + Nk)$

Notice that the only market structure that sees an increase in price is the market because only that market allows for price comparison for the same product. In other cases, there is only one place to purchase the product–either the supplier (in the disintermediated case) or the intermediary (in the hierarchy case).

By increasing the number of intermediaries searched, the transaction costs for markets goes up as well. In the case where $N = j$, which is when all consumers search all intermediaries for the best possible price, the total market transaction costs, T_m, becomes $C(ij + jk)$ which is greater than the transaction costs in the hierarchy. As N varies, the region where a market is the market structure that minimizes the transaction cost decreases.

The next assumption that is relaxed is that hierarchies and markets have the same transaction costs. The one variable C is used in the model above to describe all transactions when, in fact, transactions are very unique and costs may vary. The cost of a transaction between a supplier and an intermediary is not the same as the transaction costs between the consumer and intermediary. The communication channel between the supplier and intermediary (in the hierarchy) requires more coordination than the communication channel between the intermediary and consumer (in the market). Therefore, there are higher transaction costs in the hierarchy than in the market. For example, the hierarchy may have higher transaction costs because intermediaries purchase larger quantities of products from the supplier with greater repetition than a consumer would. Therefore the model above

underestimates the transaction costs in the hierarchy because the transaction costs are held at a constant transaction cost, C. To account for their differences, the model is extended to differentiate the transaction cost C into C_h for transaction costs in the hierarchy and C_m for transaction costs in the market where $C_h > C_m$. This changes the total transaction costs for the three different cases as shown in the following equations:

$$\text{Disintermediated: } T_d = C_m ik$$

$$\text{Hierarchy: } T_h = C_h i + C_m jk$$

$$\text{Market: } T_m = C_h ij + C_m(ij + Nk)$$

This change in the model affects the market transaction costs to a greater degree than the other market structures. The market has an increase of costs which is multiplied by the product of the number of suppliers and the number of intermediaries. The disintermediated case is not affected by C_h and the hierarchy only multiplies the number of suppliers with this cost. The affect is a still-further reduction of the region where markets reduce the overall transaction costs.

The last assumption to be relaxed in this model is the one that requires suppliers in the market to supply its product to all intermediaries. In practice, suppliers do share goods with more than one intermediary, and intermediaries still aggregate goods from different suppliers, but even the largest retailer cannot carry products from all suppliers. To model suppliers that share goods with some intermediaries and not others, the costs in both the hierarchy and market portions of the intermediated markets are changed. If the supplier interacts with M intermediaries, then the consumer must interact with all but $j - (M - 1)$ intermediaries to ensure they are examining the entire product space. The resulting transaction costs are given by the following equations:

$$\text{Disintermediated: } T_d = C_m ik$$

$$\text{Hierarchy: } T_h = C_h Mi + C_m jk$$

$$\text{Market: } T_m = C_h Mi + C_m j(ij + k(j - (m - 1))$$

Once again, the change in the model increases the transaction costs in a market even more than the costs in a hierarchy while there is no affect with the disintermediated case. As the model becomes more complicated, intermediaries as product aggregators and price setters still play an important role in the value chain, but their benefit decreases.

There are different degrees of price competition in the three markets modeled. The disintermediation and hierarchy markets have price competition through substitution only. Prices are kept low because of the consumers' ability to buy an alternative product at a different price. Only the market has a larger degree of price competition because different intermediaries may offer identical goods to the consumer. While there may be other roles the intermediary plays so that the consumer is willing to pay a higher price at one intermediary over another, greater amount of price competition is likely.

3.3. Intermediation and the Internet

With the introduction of the Internet to global markets, some have predicted that the Internet will lower transaction costs and thereby promote disintermediation of some markets and lower product prices. Wigand and Benjamin (1996) hypothesize that disintermediation will be one of four elements that will increase consumer welfare.[27] Others in the Internet business community would agree with this hypothesis. For example, industry pundits such as Shinkhar Ghosh, George Gilder[28], and Bill Gates[29] agree that the Internet will result in disintermediation. Many articles in business publications also point to the potential of the Internet to disintermediate markets (Hoffman 1996; Imparato and Harari 1995; and Schiller 1994). Shinkhar Ghosh was quoted as saying:

> "Just as the Industrial Revolution changed manufacturing capacity, the Internet will change distribution. Middle men and middle-level companies will be eliminated, and most companies in an industrial economy are middle-level." (Morgan 1997)

There are some Internet markets where the disintermediation hypothesis appears to be true. Gellman (1996) explained that the library and publishing community has already seen examples of disintermediation with the ability for authors to reach a large audience by sending or posting documents on the Internet. In the distribution of information from author to reader there are many intermediaries who do not seem to add much value to the message. The publisher, wholesaler, distributor, and retailer do not change the words the author selects; they only get that message from the author to the reader. The physical infrastructure is limited in what it can do so all of these intermediaries are needed to compensate for infrastructure inadequacies. When published information is time-sensitive, a disintermediated market structure may be more appropriate to increase the value to suppliers and consumers. Another example of where disintermediation is possible is where intermediaries keep high ask-bid spreads. Spring Street Brewing faced very high costs to enter the stock market because they would hire an investment banker, write and distribute a prospectus, and pay the fees to be listed on the stock exchange. By using the Internet, they avoided these intermediation fees.

However, while some are predicting that the Internet disintermediates the market, others believe just the opposite because transaction costs may not be as small as predicted. Most agree that the introduction of the Internet does change what is possible, but does not mean there is no longer a need of intermediaries. For example,

---

[27] They are: disintermediation to reduce product mark-ups, lower cost of production and distribution, lower profit margins of suppliers, and lower search costs.

[28] He claimed this will happen at a April 1997 meeting of Brookings and Cato in Washington, DC called "Regulation in the Digital Age" where Gilder was the keynote speaker.

[29] Professor Dertouzos said that he thought intermediation is still important while Bill Gates did not during a March 1997 seminar at MIT (Dertouzos 1997a). He had just returned from a European conference about the future of markets and technology and he had an opportunity to debate this issue with the chairman of Microsoft, Bill Gates.

> "Clearly, many opportunities exist for intermediaries who process and add value to information along the transactional chain...intermediaries comprise a significant portion of the online economy." (Kalakota and Whinston 1997a)

As this quote indicates, intermediaries can add value to Internet commerce even though commerce moves from the physical to electronic markets. In fact, Bollier (1996) points out:

> "The growth of electronic commerce will not only disrupt many of these traditional intermediaries, it will propel the creation of entirely new kinds of intermediaries." (page 16) "...the precise character of these intermediaries remains highly speculative..." (p. 17).

Lu (1997a; 1997b), Crowston (1996), Resnick, Zeckhauser, and Avery (1995), and Sarkar, Butler, and Steinfield (1995) have all examined the impact electronic communication has on the value chain and all have found evidence or have created models that explain why Internet commerce still requires intermediaries. The debate between intermediation and disintermediation has drawn the attention of many academics.

It may be likely that both intermediation and disintermediation hypotheses are correct. Figure 2.3 shows, there are different levels of intermediation so the Internet may only reduce the number intermediaries but not eliminate them altogether. As some intermediaries are eliminated because they provide little or no value, new intermediaries designed to take advantage of Internet tools may thrive. The issue becomes less an issue of intermediation verses disintermediation and more of an issue of which roles intermediaries have in markets and how these roles will change with the introduction of the Internet.

The model in Section 3.2 helps explain the market structure dynamics that may change the Internet commerce marketplace structure. As the number of suppliers, *i*, increases, the model indicates that there will be a shift from disintermediation, to markets, to hierarchies. To relate this model to the introduction of the Internet, this section presents examples of the transition from disintermediation, to *electronic* markets, to *electronic* hierarchies. Table 3.3 presents an example of a product for each marketplace structure and describes how consumers' product and price searches differ as a result of the number of suppliers. Each example is described in detail in the paragraphs that follow Table 3.3.

Table 3.3: Examples of Electronic Market Organizations and Consumer Search

	Disintermediation	*Electronic Markets*	*Electronic Hierarchies*
Feature Search	Consumers approach suppliers directly for product information.	Consumers find the same products at different retailers so they do not need to visit as many to compare product features.	As retailers aggregate a larger number of consumers, they are able to influence product design.
Price Search	Many differentiated products make consumers less sensitive to price.	As retailers aggregate a larger number of consumers, they are able to get volume discounts or negotiate a better price and retailers compete on price.	Because product features are unique to retailers, consumers are less sensitive to price.
Example	Bose Wave Radio	Compact Discs	Retail clothing

An example can illustrate how a disintermediated structure is preferred when the number of suppliers is small. Bose Wave Radio is a unique product that is sold directly from the manufacturer. The consumer must approach each supplier directly to determine product features and price. There will probably be a wide range of prices and product features to choose from. However, as other companies begin to manufacturer radios similar to the Wave Radio, the number of retailers (i) in the market increases and, as the model indicates, the transaction costs become too high for consumers to price and feature search all suppliers. Therefore, the electronic market becomes a more attractive market structure. As the Internet changes the scope of commerce from a small number of geographically local suppliers to a large number of suppliers, disintermediation seems an unlikely market structure.

Another example with a larger number of suppliers describes why an electronic market has lower transaction costs than a disintermediated structure. Compact disc sales have a larger number of retailers where intermediaries can aggregate goods from many suppliers and sell them in a price-competitive marketplace. These CD retailers often carry a large aggregation of products and their competitors often offer a similar aggregation of products. A consumer only needs to go to one CD store for a feature search and may go to two CD stores for a price search. However, it is unlikely (and too costly) for the consumer to search all retail locations for the best possible price. If there is enough price competition among the retailers, retailers must keep their prices competitive. Therefore, even if the consumer only visited one retail store, they would still benefit from the electronic market structure. The reduced market friction of Internet commerce accentuates this price competition. As consumers can search for prices more easily, the retailers who are selling the same products enter into more price competition. Also, as the number of suppliers increases, the electronic markets may not be the optimal market structure. As the model predicts, the electronic hierarchy becomes more attractive as additional suppliers are added to an existing electronic market.

Finally, an example where products become customer-specific illustrates the movement from electronic markets to electronic hierarchies. Clothing has an almost infinite range of features and the number of suppliers is very large. The retail stores in the clothing market often have a niche market strategy so they are in the best position to enter into electronic hierarchies. "Big & Tall" stores, for example, carry products with features that match the preferences of their consumers. If such a product is not available, the retailer can use its role as an aggregator of consumers to influence product design. As suppliers begin to manufacturer products specifically for retailers, their relationship with the intermediary becomes hierarchical. This also helps the position of the retailer to prevent price competition because the products they sell have features no other retailer has. Because the electronic hierarchy is the preferred market structure as the number of suppliers grows, it is unlikely that Internet commerce will shift the market structure of any electronic hierarchies.

As the examples above indicate, aggregation is an important role of intermediaries on the Internet but difficult to sustain with competition from other intermediaries. Aggregation intermediaries may not help with side-by side comparisons because consumers can locate all product offerings without relying on the one-stop shopping benefit an aggregation intermediary adds. The aggregation intermediary still represents the interests of groups of consumers, but their competitors can offer similar aggregation value. For example, both Amazon.com and Barnes & Noble sell millions of book titles from one Web site. The consumer benefits from the intermediary having such a large aggregation of titles, but enjoys the same benefit regardless of which Web site they choose.

Pricing is still an important intermediary role but the nature of the role greatly depends on the level of competition and the nature of the product. When products are homogenous, the intermediary may risk loosing sales by trying to set a price higher than their competitor. If a product is more heterogeneous, they can enjoy larger price mark-ups because a competitor may not be selling the same product. Rather, the intermediaries compete on product features not price.

Search is the most likely intermediary role to be devalued with the introduction of the Internet. The introduction of the Internet may substantially reduce search costs, as is proposed by Bakos (1997). New search tools such as Web search engines can make greater information available. Unfortunately, with Internet growth, there may be too much information available to the consumer and supplier. These two forces are simultaneously reducing and increasing search costs on the Internet as indicated by Bailey and Bakos (1997), which suggests that the affect of the Internet on search and matching intermediaries is ambiguous. While the search and matching intermediaries may have a challenge to continue providing value with the Internet, some intermediaries such as collaborative filters[30] do provide a value when the amount of information is overwhelming. Therefore, in markets with many choices the

[30] A collaborative filter is a technology that helps correlate user likes and dislikes with other users to help with a feature search. For example, once two or more people are determined to have similar music tastes, then they can suggest new artists to each other. An example of a collaborative filter is Firefly (www.firefly.com).

intermediary who filters information to save on consumer search cost may become more valuable while other markets with less information can use Internet search technologies.

The intermediary's search role is dependent upon the nature of the product. Barua, Ravindran, and Whinston (1997) describes that consumer search depends on both the nature of the product and the transaction medium. When searching moves from traditional channels to a digital medium, the nature of the search and, hence, the search costs become much different. While a producer incurs a portion of the search cost, search cost theory is modeled from the consumer's perspective–a limitation of this prior work. The assumption is that the consumer of the good or service will search if they believe they can find a lower price. While the Internet may lower search costs as Bakos (1997) and Wigand and Benjamin (1996) predict, the search costs may not be as small as predicted. This may be true because there is too much information on the Internet (van Alstyne 1997), businesses deliberately increase consumer search costs to increase profits (Zettelmeyer 1995), search agents may be ineffective (Crowston 1996), or businesses may use the electronic medium for other strategic uses (Bakos 1991). The intermediary helps to reduce this search cost. Another method to reduce search costs is to increase the number of products and/or the amount of information about products located at a given retailer

Trust is one area where intermediaries are still important, but the value of this role is also dependent on the nature of the product. Lu (1997a) describes markets as problematic because there is an identity insecurity problem. A consumer may not know whom they are transacting with. Chapter Two in this thesis points out that the scope of the Internet is global and, therefore, transactions are occurring with less face-to-face contact. Therefore, the mechanisms use to promote trust in physical markets may become more important in electronic markets. However, when the consumer trusts the product and not the intermediary, trust matters less. For example, when two competing retailers sell a homogenous good such as a book, the consumer receives the same item without the risk of acquiring a "lemon."

Authentication, the ability to guarantee a transacting party is who they say they are, is one trust issue not related to the characteristics of the product and therefore may still provide opportunities for intermediaries to provide value. Authentication in Internet commerce is complicated by the fact that because legal systems may not provide adequate protection as discussed by Lu (1997a). In the exploratory survey by Bailey and Bakos (1997), the thirteen market participants in their survey all placed increasing value on electronic authentication markets, while a relative decrease in their reliance on legal contracts. The ability to falsify electronic documents or create an electronic presence increases the importance of the trust role of electronic intermediaries, as is argued by Froomkin (1996). The legal system is limited in promoting trust in markets because of jurisdictional uncertainty with the Internet. Which code of laws applies begins by identifying the jurisdiction of the lawmakers and law enforcers.

With so many roles of intermediaries dependent upon the nature of the product, the remainder of the thesis will explore the roles of intermediaries in markets transacting homogenous goods. Because the goods are homogenous,

the trust role of the intermediaries should not be an important role. The intermediary's search role value may be decreased if the Internet reduces consumer search costs. What is left is the aggregation and pricing roles of intermediaries. Chapters Four and Five will describe how the Internet may change the nature of market friction within markets where aggregation and pricing intermediaries are trying to compete. If these intermediaries only provide the roles of aggregation and pricing, their ability to sustain higher ask-bid spreads may decrease.

4. INTERNET PRICE COMPETITION METHODOLOGY

This chapter presents a methodology to study empirical price data that compares prices on the Internet and prices in the physical marketplace. The goal is to determine if the introduction of the "frictionless" Internet marketplace results in pure price competition among the aggregation and pricing intermediaries selling homogenous goods. In particular, the methodology is developed to explore how different intermediaries (retailers) can set prices different than their competitors with Internet commerce. The methodology is presented as an original contribution to the field and extends the prior work of Shepard (1991) and Preston and Hertford (1962) who gathered retail prices to determine competition in the consumer market. The extension is the separation of prices observed by consumers purchasing products over the Internet versus physical markets, and how the transaction environment changes price competition.

This methodology is developed to understand how price competition changes consumer choice and retailer strategy when the Internet marketplace substitutes for the "traditional" or physical marketplace. If the Internet does promote friction-free commercial transactions, then consumers can search prices from all retailers on the Internet to find the lowest price. From the retailer's perspective, they will only have sales of a given product in this friction-free market if they have the lowest price. Therefore, the aggregation and pricing intermediaries enter into a pure price competition model called Bertrand competition that is explained in Chapter Two.

While the Internet is still in a very dynamic stage of development, this methodology can analyze Internet commerce as the market emerges. The Internet has only started to show global marketplace potential, so analysis of early data is of an exploratory nature such as the analysis in Chapter Five. However, there is an opportunity to gather and analyze price data in this early stage and apply a consistent methodology as the Internet marketplace emerges. Therefore, the exploratory data and analysis becomes a baseline for future analyses.

The significance of developing this methodology is timely because there is much speculation about the effect that the Internet will have on prices. Thus far, there has been virtually no systematic evidence or analysis even though the theory is more mature as shown in Chapters Two and Three. The methodology presented in this chapter is a tool to collect and analyze data to test these theories. By collecting and analyzing Internet price data in homogenous product markets, the methodology will help researchers examine how the Internet affects consumer prices and retailer strategy in both a static and temporal manner. Confirmation of these theories solidifies their significance

while lack of evidence indicates that future research and new theory to describe the Internet marketplace is necessary.

This chapter develops this methodology to test the differences between the Internet and physical marketplace while using the capabilities of the Internet for information gathering. Section 4.1 describes the hypotheses that are developed in the literature and may be tested with empirical evidence. All of the theories presented with this methodology distinguish differences between the Internet and physical marketplaces. Section 4.2 details the data gathering process using the Internet as a tool for temporal data collection. Finally, section 4.3 presents the formulas used to analyze collected data to test the hypotheses presented in section 4.1. Because this methodology must work in practice, Chapter Five uses the methodology presented in this chapter with exploratory data to determine if they hypotheses are proven with the data.

4.1. Hypotheses Development

The exploration of friction in markets must be operationalized to test the theory with empirical data. Separation of market friction into a static examination of transaction costs and a dynamic examination of menu costs is an important step in formulating testable hypotheses. This section will develop four testable hypotheses as part of a methodology to understand price competition on the Internet.

Aggregation and pricing intermediaries may be unable to keep large price mark-ups because of reductions in transaction costs. As Chapter Two described, intermediaries are in a better position to reduce transaction costs than suppliers and consumers. If suppliers and consumers can use the Internet to lower their transaction costs, intermediaries will not be able to keep a large ask-bid spread differential. Furthermore, intermediaries who do not provide search and trust roles—such as those who participate in Internet commerce for homogenous product markets—are in a difficult position to command large ask-bid spreads. The ability for the ask-bid spread to be large or small depends on the aggregation and pricing intermediary's ability to charge prices different than their competitors. The intermediary may not be able to charge different prices because they loose much of their sales. The result is a pure-price competition described by the Bertrand competition model.

4.1.1. Bertrand Competition

Bertrand competition models competition between parties selling the same product (a homogenous good) with unlimited supply. If there is no market friction, consumers purchase the product from the seller with the lowest price. This results in pure price competition where the firm with the lowest price makes all sales. If firms have the same marginal cost, price is reduced to marginal cost. If one firm has a lower marginal cost than the others do, the

firms with the higher marginal costs will exit instead of making negative profit on sales and the equilibrium price will be the marginal cost of the last firm to exit.

Bertrand competition does not exist in physical markets because of high search costs. Consumers unable to transact with all possible intermediaries must search the space of alternatives and absorb search costs in the process. Diamond (1985) describes a model to explain how search costs affect consumer behavior. The model uses Bayesian economics of updating consumer's a prior information to posteriors when new information is gathered. The model assumes that a user chooses to search if the expected increase in utility from the next search is greater than the cost of the search. Diamond's model assumes that a consumer cannot return to the previous store without incurring a search cost. This is model is similar to consumers who drive from store to store to find an item desired. They may have liked an item at the first store they went to, but because they searched all other stores, they must travel back to the first store to purchase the item. The equation below from Diamond (1985, p. 4) shows the gain from searching for Seller Two while located at Seller One, given a subjective measure of the distribution of prices $F(p)$ and the consumer's utility function, $U(p)$, location). The search cost then is subtracted from the right-hand side of this equation, when consumers assess whether or not to look at the second location. For example, the gain in moving from location One to Two may be greater than zero, but not worthwhile if that gain is less than the search cost.

$$g(p_1,0) = \int U(p, 2)\, dF(p) - U(p_1, 1)$$

Bakos (1997) extends the work of Diamond (1985) to describe how consumers alter their search when physical markets become electronic markets. Bakos suggests that with zero search cost, by using an infrastructure such as the Internet, consumers will be able to explore the entire search space of possibilities. When the consumer obtains perfect information, they can seek the best match. In markets where the product is exactly the same from a number of different suppliers (i.e. the good is homogenous) then price becomes the only differentiating characteristic. In a homogenous product market, presuming a supplier can service all demand and is not a price-taker (which is similar to Cournot competition), this market can be analyzed with the Bertrand competition model. The Bertrand model as explained by Varian (1992) involves competitors setting a price for the homogenous product and then consumers buying the product from the firm with the lowest price. This model comes from the game-theory equilibrium of competition between two suppliers providing identical product, assuming each supplier can service the whole market. Whoever has the lowest price for the item captures the entire market share. The suppliers with higher prices get no market share. Because suppliers can set the price, they choose a price to satisfy the objective of maximizing their profit in response to all competitors' prices. The equilibrium point of this game occurs when the firm with the lowest marginal cost captures the entire market. The price of the good is the marginal cost of their closest competitor (the one that exited because the only way to satisfy demand is by setting a price below their marginal cost).[31] The ultimate outcome of a Bertrand competition model, made possible by information technology

[31] For a more detailed description and a formal analysis of Bertrand and Cornout game-theory models, see Gibbons (1992).

to remove the price differentiation based on locality, may ultimately lead to the "winner-take-all" scenario described by Frank and Cook (1997).

This setting generates two interesting predictions for how search costs effect price competition. First, Bakos finds that if producers are randomly located in the product space, and they can observe their rivals' prices, the resulting equilibrium prices will not be symmetric. Higher prices and margins will result in regions where there is less competition. However, as search costs decrease, the spread of prices across retailers will decrease toward a common price.

Second, Bakos finds that in the presence of search costs, producers will set prices above marginal cost. As search costs decrease, prices will decrease toward the Bertrand marginal cost equilibrium. Specifically, Bakos shows that consumers will choose to search when their expected gain to searching $g(S, D)$ exceeds their search cost c:

$$g(S,D) = 2 \int_{x=0}^{D+\frac{S}{t}} \int_{p=0}^{S+Dt-xt} F(p)dpdx > c$$

where $F(p)$ is the buyer's prior beliefs about prices, D is the location of the current product along the unit circle, S is the price of the current product, t is the fit cost of a nonoptimal product, and x is the distance searched for a better product along the unit circle. Without loss of generality, marginal costs are assumed to be zero.

Taking consumers' strategies into account, producers set prices p_i^* to maximize profits, with the other sellers' prices $p_{j \neq i}^*$ taken as given:

$$p_i^* = \underset{p_i}{argmax}\ (p_i Q_i(p_i, p_{j \neq i}^*))$$

The resulting equilibrium price is of the form $p^* = \sqrt{ct}$ showing that equilibrium prices decline as the square root of search costs.

If one assumes that the electronic markets such as the Internet will reduce buyer search costs, Bakos' findings yield two predictions about equilibrium pricing on the Internet: 1) Internet markets will have lower prices than physical markets for the same goods, and 2) price variation on the Internet will be less than comparable physical markets.

The benefit of electronic markets proposed by Bakos (1997) is that the cost per distance to search, t, approaches zero. The effect is to produce a perfect match between consumer and product for the lowest price. In other words, the retailer who is selling for the lowest price on the Internet would capture all the business because the consumer would be able to search all retailers and get the item for the lowest price. This results in Bertrand price competition– competitors compete solely on price and the firm with the lowest price has sales while their competitors have no sales. Therefore, for multiple competitors to survive in the market, they must have the same price.

How electronic markets and pricing differs from traditional markets is an area of academic debate that spans economics, information technology, and organizational studies. While the changing world of commercial transactions may appear very different when conducted on the Internet, the principles of markets and transactions still apply.

If Bertrand competition is likely, competitors in the market may develop strategies to combat pure price competition or else they may see a decline in their profit margins. For example, product differentiation can make consumer search more difficult can costs. Increasing search costs, as described by Zettelmeyer (1995), is another way to prevent Bertrand competition. Even for services or products that seem like they should be homogenous (such as long distance telephone service) different pricing plans and consumer service options differentiate the service and avoids the Bertrand competition equilibrium. Search costs can also be kept artificially high by changing the names of products to make comparison-shopping more difficult. For example, Virtual Vineyards sells wine through their Web site not available at their competitor's store, therefore pure price competition is not possible because consumers do not think the product is homogenous. Virtual Vineyards is able to sell exclusive labels even though the contents of the wine are exactly the same as a store-bough bottle with a different label. Versioning of software is one example how supplier can differentiate their products and practice price discrimination simultaneously (Varian 1997).

If Internet commerce reduces market friction, then it is may be described by a Bertrand competition model. There are four assumptions with Bertrand competition:

Assumption 1 (A1) Firms choose a price and not the quantity they wish to sell.

Assumption 2 (A2): The products being sold are homogenous (i.e. a product is an exact substitute for another)

Assumption 3 (A3): Consumers prefer the lowest price and do not care who they buy from (i.e. consumers compare product prices and not product features).

Assumption 4 (A4): Any one supplier can serve the whole market.

The outcome from Bertrand competition is that the price equals the marginal cost. It is likely that Internet retailers have an even lower cost structure, but not likely that they have higher marginal costs. When comparing the marginal cost for an Internet retailer to a physical retailer we assume:

Assumption 5 (A5): Internet and Physical retailers have the same cost structure.

The theory suggests that there will be a greater degree of price competition among electronic market retailers. This would lead to lower prices because the price approaches marginal cost–a lower marginal cost in electronic markets relative to physical markets because of lower transaction costs. This would also lead to less spread of prices across retailers, because retailers would converge on the market equilibrium (otherwise they receive no business).

As the empirical evidence in Chapter Five demonstrates, there are varying prices for the same product. Therefore, one explanation is that Internet is far from this perfect market. In fact, the cost per distance, t, in Bakos' model when used to describe the Internet market may be nonzero. What increases the search costs is the consumer's inability to know where to look–especially with so much information that exists. Van Alstyne (1996) discusses some of the problems with information overload. Similar to this, the work of Simon (1971) explains how computers and communications can help reduce information problems but cannot eliminate them. Using this core theory, this section now builds a model of intermediation that will explain in greater detail how transaction costs, no matter how small they may be, may be reduced by the introduction of an intermediary.

Chapter Two develops three differences between what would be different between physical and Internet markets that can be more formally introduced as hypotheses in the methodology. The changing scope, costs, and rate of change associated with Internet commerce indicate that there should be a difference between the nature of competition among Internet firms and the nature of physical firms. In particular, by examining the prices for the same products across physical and Internet retailers, this section will develop four hypotheses to be tested with empirical data.

Collecting the price of a given product sold by a given retailer at a given point allows for an empirical assessment of Bertrand competition. This chapter uses the notation P_{irt} for a unique data point where P is the observed price for i the title, r is the retailer, and t is the time.[32] The titles observed may be in different markets (M_1, M_2, ...). Because the methodology tests the pricing strategies used by different aggregation and pricing intermediaries–the Internet and physical retailers–the retailers r are characterized as physical or Internet based. For the methodology the retailers fall into two sets: $r \in H$ (physical retailer) or $r \in N$ (Internet retailer).

[32] The notation used throughout Chapters Four and Five is consistent in these two chapters but the notation is not related to the model in Chapter Three.

This separation of firms into two categories "Internet retailer" and "physical retailer" is fundamental to the analysis. While retailers often have varying degrees of Internet and physical presence along a spectrum of possibilities, separation of retailers in these two categories is important to test the four hypotheses introduced later in this chapter. What separates an Internet retailer from a physical retailer? Physical retailers have adopted varying strategies to include or exclude the Internet in their business. Some physical retailers have made little or no investment in their Internet strategy because of the Internet's immaturity or little received benefit. However, even these firms cannot prevent a minor Internet presence as a growing number of directories list their location, phone number, and hours of operation on the Web. Other physical retailers have made larger Internet investment through Web sites that list their products and process orders. Finally, a large subgroup of physical retailers have a strategy in between: they have created a small Internet presence by posting price lists and encouraging shoppers to come to their physical retail location to make actual purchases.

There is no straightforward answer to the difficult question (but one of the most important) of how to characterize an intermediary as a retailer is a "physical retailer" or an "Internet retailer." Because the hypotheses examine the differences between commerce in the physical marketplace and the Internet marketplace, the relative savings of purchasing a product via the Internet is compared to purchasing the product in the physical marketplace (Lee 1998). Similarly, the spread of prices across Internet retailers is compared to physical retailers to determine if there is a greater degree of price competition, as the theory suggests. The difficulty of determining whether or not a retailer is "physical" or "Internet" stems from the fact that there is actually a spectrum ranging from completely physical to completely Internet.

The all-physical retailer is characterized by their lack of participation on the Internet. They do not have electronic mail, a Web site, or Internet transactions. While it is unlikely to be listed nowhere on the Internet because many white- and yellow-page directories are on the Internet, it is possible to have a very minimal presence. As the all-physical retailers adopt a more significant Internet presence, they move towards the middle of the spectrum—becoming both a physical and Internet retailer. On the other end of the spectrum are firms that began with physical stores and are deriving most of their sales through the Internet marketplace. While their Web sites may look very similar to those of Internet retailers, their corporate cultures, cost structures and dominant strategies stems from the origin of the physical marketplace. These retailers are classified as "physical retailers" in the remainder of this chapter.

All-Internet retailers have no transactions supported by retail locations. While they may have physical warehouses, computer centers, and administrative offices, they only process transactions that are sent to them via the Internet. If, after creating their Internet presence, the retailer opens physical retail locations or partners with physical retailers, they embody more elements of the all-physical retailer and become a dual physical and Internet retailer. The retailer that began with an Internet strategy may be opening physical retail locations, but the Internet dominates their

corporate culture, origin, and cost structure. This chapter classifies this retailer as an "Internet retailer" in the remainder of this chapter.

In between the completely physical and all-Internet retailers are firms that have a dual strategy of supporting Internet transactions while pursuing physical retail store transactions. There are some benefits to this dual strategy, even though costs appear higher than the completely physical or all-Internet. One benefit is the ability for the one medium to complement the other by having consumers choose which medium is more convenient for them—given their demand for a given product and how timely they would like order fulfillment. Another benefit is the brand name recognition that spans the two environments. Also, there is the ability to use price discrimination to separate parts of the consumer base, similar to the strategy described by Shepard (1991).

There are also retailers that come from catalog sales (i.e. non-physical as well as non-Internet) and are now experimenting with the Internet. These firms are similar to physical stores because they distribute physical catalogs of their products to potential consumers and do not have an electronic background. However, they are similar to Internet retailers because they have relied on electronic communication–traditionally by telephone–to obtain and process orders from consumers. The benefit described by these catalog retailers of using Internet is the lower cost in disseminating the catalog, the ability to have more frequent updates, and capacity to reach new consumers. Catalog retailers also have varying degrees of Internet and physical presence. For the formulation of the analysis in this chapter and the empirical analysis in the next, the catalog retailer is not distinguished from other retailers. Catalog retailers are classified as "physical" or "Internet" based upon their initial strategy for competition.

The separation of physical and Internet retailers is used to develop the following four hypotheses. Each hypothesis compares the group of physical retailers to the group of Internet retailers selling the same product at the same time or between time periods. All hypotheses are rooted in the core question of this thesis of whether the Internet reduces the friction of physical market transactions. If the answer is yes, then the following four hypotheses could be proven.

As the four hypotheses are introduced, the analysis will focus on price as a dependent variable but sales or user data could also be use to extend the formulation of the methodology. Because this thesis explores the aggregation and pricing role of intermediaries, price is the most important dependent variable to track. The fact that a retailer chooses to sell a given title at a given price is evidence of the degree of price competition. However, sales data could be used in conjunction with the price data as is explained for each hypothesis.

The low cost of developing a market presence on the Internet may create competitive challenges for firms. The competitive environment to buy Internet access and the cost of computing have reduced to such a point that

developing an Internet presence is relatively cheap.[33] Low entry costs may invite increased market entry; and economic theory predicts that increased market entry will, in turn, lower the price margins sustainable by firms (Bresnahan and Reiss 1991). Economic theory and its implications for pricing and competition in Internet commerce are discussed in the next section.

It has been argued that the Internet lowers search costs and makes physical location increasingly irrelevant, so that retailers of homogenous products should be more likely to face Bertrand price competition to determine who will dominate the market.[34] Low (marginal cost) prices and minimal price dispersion typically characterize Bertrand price competition. However, it is important to note that Bertrand competition predicts that prices will fall to marginal cost within a market *regardless* of the benefit received by individual consumers. Thus, for Bertrand competition to exist in the Internet market and for the price of the good on the Internet to be more expensive, the marginal cost of selling via the Internet must be larger than the marginal cost for sales through physical stores. Even though the actual books, CDs and software packages are, by design, identical, the handling costs or economies of scale may differ between the two markets. Even in the presence of uniformly increased handling costs or production costs, a characteristic of pure Bertrand competition is the law of one price. In a homogenous good market with no search costs and no capacity constraints, the retailer with the lowest price makes all sales.

The global scope of competition also promotes lower prices on the Internet. When a firm is the monopoly provider, they can set their prices at will without the threat of consumers purchasing from a competitor. Neoclassical economics explains that monopolist sets a price where they can maximize profit that is often above the competitive, market equilibrium. Once competition is introduced, then the price cannot be set at will. Because the Internet has a global scope, it is unlikely that any monopoly will exist. The monopoly that may exist in the physical market because of its geographic location (i.e. "the only show in town") is unlikely because competitors can come from around the globe. This global scope contributes to a larger number of competitors and, therefore, a larger number of firms where consumers can choose to purchase products at a lower price.

Hypothesis 1 (H1): The price for an item sold on the Internet will be lower than the price for the same item sold in the physical marketplace. When comparing the price of titles across the two groups of retailers over time, less friction in the market would promote price competition. The less friction promotes lower prices through lower cost of entry, lower search costs, and global scope.

---

[33] There are several places which will host a Web site for free so, arguably, the cost of creating a presence is virtually zero. See Geocities (www.geocities.com) as an example.

[34] When products are not homogenous, setting a price becomes more difficult. If a product is unique, a pricing mechanism such as an auction may be more appropriate. Two recent publications empirically explore auctions on the Internet. Reiley (1996) describes empirical evidence from auctioning Magic playing cards on the Internet via the Usenet. Lee (1997) investigates the auctioning of used cars via the Web. In both of these cases, the price of the auctioned products can increase when sold on the Internet because the number of participants increases resulting in greater competitive bidding.

The formulation of this hypothesis involves comparing prices among physical and Internet retailers. Specifically, the price for a given product at a given time should be lower on the Internet than in the physical marketplace if they hypothesis is true. From the consumer's perspective, they would expect to pay less on the Internet than in a physical store. Therefore, the following equation uses the expectation of price:

$$[E(P_{it} \mid r \in H) > E(P_{it} \mid r \in N)] \mid i, t$$

Sales data may be added to this formulation but is not necessary for this hypothesis. As a dependent variable, sales data could ensure that there is more price competition on the Internet. If prices other than the lowest price are found, Bertrand competition might be taking place only if the higher priced goods have no sales. The difference is that competitors have not yet responded to zero sales. While prices may converge in the long run, retailers with prices above the lowest price would have zero sales in the short run.

Price competition among Internet firms increases as the scope of Internet commerce becomes global and the fixed cost of entry decreases. The retailers have no choice but to match the lowest price for the same product or they will have no sales of that product. While the equilibrium is reached when all prices are the same, as explained in Chapter Two, the competition leading to this equilibrium should show changes in prices converging to the equilibrium. Because this rate of change is faster, the spread of prices across Internet retailers for a given title at a given time should be less than the spread of prices across physical retailers at the same time.

The result of less friction and greater competition promotes the "law of one price." When prices remain inflated for short periods of time and price deviations are reduced the lowest price wins. Sometimes called the "law of one price,"[35] the result of frictionless price competition is one price for a product. This indicates that the spread of prices around the one price becomes zero as retailers change their prices to match the lowest price.

Hypothesis 2 (H2): For a given homogenous product, the price dispersion among Internet retailers will be smaller than the price dispersion among physical retailers. Less friction in the Internet marketplace would not allow for very high or low prices to exist. Price variation is reduced because a retailer would have no sales if they tried to maintain high prices. Low prices would become the market price leader and other retailers must match the price or they will have no sales. Similar to the reasons for lower prices discussed for Hypothesis 1, this hypothesis builds on increased competition and the law of one price (Daniel 1992; Isard 1977).

[35] Daniel (1992), for example, describes why some markets exhibit the "law of one price."

Formulation of this hypothesis requires examination of the standard deviation of prices for titles. For a given title at a given time, the spread (as measured by the standard deviation) of prices should be lower on the Internet than in the physical market. The inequality can be written as follows.

$$[\text{S.D.}(P_{it} \mid r \in H) > \text{S.D.}(P_{it} \mid r \in N)] \mid i, t$$

Sales data could be used to give increased importance to prices that have higher volumes. In the equation above, a price that is high above the mean might skew the standard deviation even though there are fewer sales for the title at a higher price. A very low price would contribute very little to the standard deviation although it is likely that the lower price will generate more sales. Therefore, by assessing a weight to the different prices consistent with the sales data, the formulation could better model the standard deviation in the physical and Internet marketplace. However, this is not necessary to prove or disprove Hypothesis 2.

The next hypothesis follows from the assumptions that underlie the Bertrand competition model. The Bertrand model does not stipulate that markets or products must have specific characteristics. As long as the product is homogenous, and as long as the retailers are able to absorb greater sales, the same level of competition should be seen with the Internet retail competition regardless of the product being sold. Because this methodology explores homogenous products which low asset specificity, what differentiates one market from another is of no significance.[36]

Hypothesis 3 (H3): Product and market characteristics have no effect on the prices and pricing dynamics for homogenous goods sold on the Internet. The exogenous force of the Internet reducing market friction should impact all markets the same. This follows from the fact that market differences do not affect the theory of price competition. Therefore, product characteristics, differences in consumers, and the industrial organization of the market should not matter when setting a price.

The formulation of this hypothesis involves integration of the previous two hypotheses with a comparison between markets. In other words, the results should hold for all markets that are examined as long as those markets are for homogenous products. Therefore, the formulation for the previous two hypothesis are used and integrated for titles that belong to different markets (i.e. $i \in M_1$ or $i \in M_2$ or ...). This is formulated as follows:

$$\begin{array}{l} [\text{S.D.}(P_{it} \mid r \in H) < \text{S.D.}(Pit \mid r \in N)] \mid i \in M_n, t \quad \mid \\ [\text{p}(P_{ir(t-1)} = P_{irt} \mid r \in H) < \text{p}(P_{ir(t-1)} = P_{irt} \mid r \in N)] \mid i \in M_n) \quad \mid \quad \forall M_n \end{array}$$

[36] Asset specificity as the degree to which the product has been manufactured for a particular consumer or group of consumer where these consumers can use their buying power, in concert, to influence the price of the good. Because the markets explored in Chapter Five (books, compact discs, and software)are all commercial, off-the-shelf products and not custom-made products, all markets have minimal asset specificity.

The result of Bertrand competition and reduced menu costs may offset themselves. Prices should not change more quickly on the Internet because they should operate at a point of equilibrium. However, prices should change more quickly because of reduced menu costs. Therefore, when prices do change, they change quickly. An exogenous force may be the catalyst for the price change. Most of the time prices should operate at equilibrium so prices do not change quickly.

4.1.2. Price Changes: Signaling and Response

A hypothesis to test the dynamic nature of market friction in Internet commerce relates directly to the propositions in Chapter Two about price changes on the Internet. Because the rate of change is faster on the Internet than in the physical marketplace, prices change more quickly. When one price changes, Internet retailers should be able to respond to their competitor's actions and changes in the marketplace sooner than the physical retailers. These price changes are also related to the faster cycle of Internet technology diffusion where the number of users and network traffic seems to double every year.

Hypothesis 4 (H4): Prices change more rapidly on the Internet than in the physical marketplace to the Bertrand equilibrium but otherwise remain constant. Less friction in the marketplace allows the dynamics of price setting and price changes to occur more quickly. When a competitor lowers their prices, a retailer may have no choice than lowering their prices to ensure sales. Because the price for the retailer and competitor is published on a dynamic medium, the Web, both signaling and response can occur quickly. For example, if a retailer lowers the price on a title, this change is immediately evident to their competitor who is tracking Internet prices. Their response requires very little change in their electronic storefront–only a change in their database is necessary. If there is no perturbation in the market and price is at the Bertrand competition price, then prices are not expected to change.

The formulation of this hypothesis uses the temporal element of the data collected by estimating the probably of a price change in the next time period. Specifically, a price is examined at t and $t - 1$ for a unique title/retailer pairing. When physical retailers are analyzed, the probably of the prices being the different should be lower than the same examination for Internet retailers. If the price is equal to the Bertrand competition equilibrium price, then this formulation does not hold, because firms would not change prices even though they have small menu costs. This is written as an inequality as follows:

$$[p(P_{ir(t-1)} = P_{irt} \mid r \in H) < p(P_{ir(t-1)} = P_{irt} \mid r \in N)] \mid i$$

Temporal sales data could be integrated with the changing prices to determine if the price change had any effect on consumer behavior. In particular, sales should increase when the price decrease and sales should decrease when prices increase. Just how much of an increase or decrease would give some indication of how elastic the market is.

If the Bertrand competition model holds and the Internet marketplace is indeed frictionless, the demand should be completely elastic and the change in sales should indicate that.

4.2. Analyzing the Data

This section develops the formulas to use to test the hypotheses presented in Section 4.1 with the data collected from Section 4.2. While there are many ways to analyze the abundant data, an analysis method should be selected that can be used as the scope and size of the data collected increases. An analysis method should be chosen that would make the fewest assumptions about the distribution of the underlying data. Therefore, this section begins with a straightforward statistical analysis method assuming a normal distribution of prices, which is the only dependent variable in the analysis. If other dependent variables were collected (such as sales data) then a more detailed econometric study using the tools defined by Berndt (1991) is applicable. The section then details a nonparametric method, which does not make the normal distribution assumption, and finally relaxes the consumer homogeneity assumption to detail different prices seen by different types of consumers.

4.2.1. Statistical Data Analysis with Normal Distribution

A basic statistical data analysis approach assuming a normal distribution of prices is easy to compute and can give great insight into the distribution of prices for physical and Internet retailers. Calculation of these statistics focuses on the average price for a given product and the spread of prices for that product. The assumption is that there is a distribution of prices similar to a normal distribution where a number of retailers sell at a price close to the average (the mean) and a fewer number of retailers sell at prices as the price moves farther away from the mean.

The mean and standard deviation are used to characterize the average and spread of data for a normal distribution. The general formulae for the mean and standard deviation are as follows (where x is an observation, and n is the number of observations):

$$\text{mean} = \mu = \frac{\sum x}{n}$$

$$\text{Standard Deviation} = \text{S.D.} = \sigma = \sqrt{\frac{n\sum x^2 - (\sum x)^2}{n(n-1)}}$$

Given the data, it is relatively easy to develop formulas to describe the average, minimum, and standard deviation of prices as shown by the equations in Table 4.1. Because P_{irt} describes each data point, where i is the title, r is the

retailer, and t is the time, each data point can be compared with prices with different *irt* combinations. Beginning with a static test, the average price for a given title at a given time depends on whether the item is being bought in a physical (H) or Internet (N) marketplace (i.e. $r \in H$ or $r \in N$). Then, by averaging the price over all retailers observed in each of these two categories, the price for the title can be compared (P_{Hit} versus P_{Nit}). The minimum prices instead of the average prices can also be compared (P'_{Hit} versus P'_{Nit}). Finally, the standard deviation is calculated by examining the spread of prices for a given title, and then the average is taken across all titles. It is important when calculating the standard deviation to take the average of the standard deviations across titles and not a standard deviation of the average prices. Table 4.1 details these equations used.

Table 4.1: Formulas for Statistical Analysis of Internet Price Competition

	Physical Marketplace	*Internet Marketplace*
Average	$P_{Hit} = \text{Avg}\,(P_{irt} \mid i, t\ \forall\ r \in H)$	$P_{Nit} = \text{Avg}\,(P_{irt} \mid i, t\ \forall\ r \in N)$
Minimum	$P'_{Hit} = \text{Min}\,(P_{irt} \mid i, t\ \forall\ r \in H)$	$P'_{Nit} = \text{Min}\,(P_{irt} \mid i, t\ \forall\ r \in N)$
Standard Deviation	$\text{S.D.}(P_{Hmt}) =$ $\text{Avg}\,(\text{S.D.}\,(P_{irt} \mid i, t\ \forall\ r \in H)\ \forall\ i \in M_n)$	$\text{S.D.}(P_{Nmt}) =$ $\text{Avg}\,(\text{S.D.}\,(P_{irt} \mid i, t\ \forall\ r \in N)\ \forall\ i \in M_n)$

Once these values are calculated for the data, determining the average discount when shopping on the Internet becomes possible. This is the value consumers would receive if they chose to purchase something via the Internet as opposed to purchasing in a physical store. For example, if six compact discs cost \$100 $\left(\sum_t P_{Hit}\right)$ in a physical store on average, and they cost \$90 $\left(\sum_t P_{Nit}\right)$ from an Internet retailer, then the Average Internet Discount can be calculated with the following formula:

$$\text{Average Internet Discount} = \left[\left(\frac{\sum_t P_{Nt}}{\sum_t P_{Ht}}\right) - 1\right] \times 100\% \mid t$$

For this example, the Average Internet Discount is (0.9-1) x 100% = 10%. By summing the average (or minimum) prices in other markets, similar figures can be computed.

This value can be used to test whether it is less expensive to buy a given title over the Internet versus buying it in a physical marketplace–Hypothesis 1. Support of this hypothesis would lead to an Average Internet Discount > 0 because the market basket of titles would cost less on the Internet than in a physical store. Because this test is more conservative than testing the prices for each individual title, a positive Average Internet Discount would indicate the hypothesis is true while a negative number would refute the hypothesis. To make sure this is adequately analyzed, spread of prices is examined to determine the statistical significance of these numbers.

The statistical significance of the differences in prices can ensure that the data supports or refutes Hypothesis 1. The statistical test used with normal distributions is the t-test. A t-test is for comparing two normal distributions to determine how likely one number is greater or less than another number. The test requires the number of observations in the two distributions (m and n), along with the means of the two distributions ($\mu_1 = \frac{\sum x}{m}$, $\mu_2 = \frac{\sum x}{n}$) and standard deviation, σ, (where $\sigma_1^2 = \frac{\sum(x - \mu_1)^2}{m - 1}$, $\sigma_2^2 = \frac{\sum(x - \mu_2)^2}{n - 1}$) of the numbers. The formula is as follows:

$$t = \frac{\mu_1 - \mu_2}{\sqrt{\frac{\sigma_1^2}{m} + \frac{\sigma_2^2}{n}}}$$

The assumptions underlying the basic analysis of this data indicates limitations to this approach. When data are sampled from two populations with different underlying standard deviations, a standard t-test results in an increased likelihood of committing type I error[37] (see Sheskin 1997, p. 163). This situation is known as the Behrens-Fisher problem in the statistical literature. Even though several variants on a standard t-test have been proposed to address this problem, none has gained universal acceptance (Ramanathan 1993, p. 227). Therefore, examining the same data may be easier with an approach that does not make such assumptions about the distribution of the underlying data. The analysis approach that makes the fewest assumptions about the data is the nonparametric method of analysis.

4.2.2. Nonparametric Analysis

The nonparametric approach can examine the data without making any assumptions about the underlying distribution of the data (as done in the previous section). Unlike the statistical analysis above, the normal distribution assumption is relaxed. The foundation for this analysis is that prices from physical and Internet retailers can be compared by asking, "Who has the lowest price?" and not, "How much is the price different from other retailers?" This fundamental difference in the type of question asked can also help answer the question to Hypothesis 1.

The nonparametric analysis begins with a simple test of comparing the number of times the lowest price for a product is found for each type of retailer. Under the null hypothesis, where a consumer is equally likely to find the minimum price in either market, this statistic is expected to follow a binomial distribution. In other words,

[37] A type I error is rejecting the null hypothesis when it is actually true.

approximately half the time the lowest price is found on the Internet and the other half it is found for retailers with physical stores.[38]

A benefit of the nonparametric approach is that it provides an alternative to a standard t-test in this situation—they avoid the Behrens-Fisher problem and allows the normality assumption on price disturbances to be dropped. Two nonparametric tests are considered. The first compares the minimum prices found among the Internet retailers vs. the minimum price for retailers with physical stores. The second compares the mean prices found in each market. The first test corresponds roughly to a situation where a consumer searches many retailers before making a purchase. The second test corresponds to a situation where the consumer picks a retailer at random.[39]

The second nonparametric test compares the mean prices in each market for each product. Here the Mann-Whitney U test is used. The Mann-Whitney test takes the n_1 observed prices on the Internet and the n_2 observed prices for retailers with physical stores and places them together in ascending order with ordinal ranks (1 to $n_1 + n_2$) assigned to each observation.[40] The test statistic T is formed by taking the sum of the ranks for one of the samples (in this case, for the Internet prices). The test statistic is then converted into a standard z statistic:

$$z = \frac{T - E(T)}{\text{S.D.}(T)}$$

Where E(T) and S.D.(T) are the expected value and standard deviation of the underlying T distribution (see Sheskin 1997, p. 181-192 for details). The resulting value for the z statistic is then used to evaluate the null and alternative hypotheses.

The Mann-Whitney U test retains the homogeneity of variances assumption for the two populations sampled. However, empirical evidence suggests that the Mann-Whitney test is less sensitive than the standard t-test to violations of the homogeneity of variances assumption in the presence of outliers (see Sheskin 1997, pp. 181-182). A graphical analysis of the data indicates the presence of outliers in the Internet price data. Thus, the Mann-Whitney is an improvement over the t-test because it (1) reduces the impact of data outliers and (2) drops the t-test's assumption that prices are normally distributed.

---

[38] Interpretation of this statistic is complicated by the fact that in most cases sampled, there are more prices from Internet firms than from physical firms. Because of this, the tests are biased toward showing that Internet prices are lower than prices for retailers with physical stores. This gives greater credence to instances where the data shows higher prices on the Internet.

[39] One could imagine other tests to consider intermediate positions. For example, one could test an environment where the consumer searches n_1 Internet retailers and n_2 physical retailers before making a purchase. The resulting test statistic could be the average of the minimum price found in each combination of the n_1 retailers.

[40] In the case of ties, the ordinal rank is the average of the ranks for the tied values.

Data collected using the methodology described above can give insight into the variance of prices and not just the expected price for a given consumer. For example, by taking each data point and comparing it to other data points at the same time for the same title (i.e. just the retailer changes), the analysis can determine if the spread of prices for Internet retailers is different than the spread of prices for physical retailers.

4.2.3. Analysis With Endogenous Consumer Heterogeneity

The last assumption relaxed in this methodology is homogenous consumer characteristics. While the previous two subsections focused on the average consumer, consumers are not homogenous, and they will most likely pay different prices depending upon who they are and where they live. Consumers might not always be expected to pay the same price on the Internet or in the physical marketplace. As Salop and Stiglitz (1977) point out, because different consumers have different costs of gathering information, there can be price dispersion even if the product being sold is homogenous. Therefore, further analysis on the data set can determine how different consumers are affected by different prices. The main benefit of this approach is that consumer demand no longer looks homogenous and the analysis can show the relative savings of Internet commerce for different types of consumers.

This subsection separates consumers into four types each with their own heuristic depending upon they type of Internet and physical marketplace consumer they depict. The goal of this separation is to determine how consumers will face different prices in the physical and Internet retail marketplaces. Dependent upon the consumer's search costs in these different environments, they can expect to gain more or less benefit by using the Internet for commerce. For example, a consumer who lives in Harvard Square probably has many alternatives in the physical marketplace nearby in a competitive book market. Meanwhile, a consumer who lives in rural Wyoming has fewer choices in the physical marketplace so would benefit more from purchasing over the Internet.

Given price data, a consumer will be faced with the decision of purchasing a title (the product) from a number of different retailers at different prices at different periods in time. The search process will reveal new information to them by finding new retailers or navigating a new retailer's Web site to find the price. With this new information, they can then make a decision to maximize their welfare. Because all consumers are not the same, they may search exhaustively or just purchase the first item they come across. If they purchase the first item they see in a given medium (physical or Internet market), they can expect to pay the mean of the observations.

Whether or not the consumer can be expected to pay the average or minimum price for a product depends upon the type of consumer and market environment. Table 4.2 describes four possible heuristics that can be used to compare prices from Internet and physical retailers depending on the physical marketplace environment (competitive or monopolistic) and the Internet experience the user has (experienced or novice). After the table is presented, each heuristic in described in detail:

Table 4.2: Heterogeneous Consumer Demand

		Physical Marketplace	
		Competitive	*Monopolistic*[41]
Internet User	*Experienced*	Heuristic 1 (min vs. min)	Heuristic 2 (min vs. avg)
	Novice	Heuristic 3 (avg vs. min)	Heuristic 4 (avg vs. avg)

Consumers that are experienced with Internet technology use Heuristic 1 or 2. A consumer who has the greatest number of choices for purchasing a title follows Heuristic 1. This consumer has many physical retailers within walking distance and any one of these physical retailers may loose the sale to their competition without the consumer incurring a high search/transaction cost. This particular consumer is also experienced with Web searching tools and agent technology so it is possible for them to search the entire Web to find the lowest price. Therefore, this consumer can be expected to pay the best price (minimum price) for the product whether they purchase it via the Internet or in a retail showroom. Similar to the previous consumer, the consumer with Heuristic 2 knows Internet and Web tools so that they can find the best price on the Internet. However, instead of living in Harvard Square, they live in a rural area where only one retailer exists who may have the best price, but may have a higher price due to the lack of competition. This consumer can expect to pay the minimum price on the Internet, but only the average price in the physical market.

Consumers less experienced with Internet technology use Heuristic 3 or 4. Consumers with Heuristic 3 are a departure from the previous two types of consumers. Unlike the previous two consumers, this consumer does not know the Internet and Web technology well. They know how to access the Internet and find someone selling a product they wish to purchase, but they incur too many expenses trying to find the lowest price. Instead, they will purchase the item from the first Internet retailer they find (they might have had a transaction there already) so they can expect to pay the average Internet price. Their physical environment is very competitive and, similar to the consumer using Heuristic 1, they can always find the lowest-priced physical retailer. The consumer with the fewest number of alternatives is the consumer with Heuristic 4. This consumer lives in a rural area and has novice Internet skills. They can expect to pay the average price for both Internet and physical retailers.

Another reason to separate consumers is their heterogeneous value of convenience they find with shopping on the Internet. A busy person would have large opportunity costs if they had to search many retailers for the best price so they would pay, on average, the mean price for that product after finding it at the first retailer. On the other end of

[41] It may make sense to analyze the monopolistic case by taking the maximum price because the monopoly does not face any price competition. However, this analysis will assume that the consumer with only one alternative can expected to pay the average price.

the spectrum, a graduate student may choose to search the entire marketspace for the lowest price because their time value of money is less.

This methodology is tested with an exploratory data set in the next chapter, Chapter Five. By testing the methodology with data collected for three markets selling homogenous goods—books, compact discs, and software–the limitations of this methodology along with the development of new hypotheses are explored. In particular, Chapter Five will try to find the data to support the four hypotheses in this chapter with the data collected.

4.3. Data Gathering

With the formulation in section 4.1, empirical analysis requires the collection of data. Specifications developed for the data gathering process because selecting certain markets, titles, or retailers may introduce bias. This section focuses on how to get the data points defined as P_{irt} so analysis of the data can be performed to test the four hypotheses.

The first important selection comes in which markets will be tested. Selecting markets for homogenous goods is important.[42] The results in Chapter Five are based on an empirical analysis of Internet retailers in three markets: books, compact discs (CDs), and software. These three industries were chosen because they each have well defined products that appeal to a variety of consumers (i.e. they have low asset specificity) and they are sold in "competitive" markets (i.e. there are more than a handful of retailers) both via the Internet and in physical stores. Selection of homogenous goods helps the data collection because prices are tractable.

The selection of retailers used in the study is an important step in a successful data collection process. Because the same title should be compared across retailers, the retailers selected are defined to be aggregators and price setters. Therefore, from the consumer's perspective, they have a selection of products from a variety of suppliers. Next, a set of retailers is chosen. Just as selecting a title introduces a bias to the data, a bias may enter the selection of retailers whether they are "physical" or "Internet."

Then, sets of titles from the different markets are selected. These titles are to be standard across the retailers observed so they should exhibit homogenous product characteristics–low asset specificity and standardized across retailers. Any bias in title selection will influence the results. If the selection is randomized, the title may not be found at many of the retailers. Because of small inventory, the results of the analysis may not be statistically significant. If the selection only examines popular titles, then the results may be skewed towards products that are thought of as loss leaders by some retailers.

---

[42] Chapter Five explores the book, compact disc, and software markets.

Assumption 6 (A6): The prices physical retailers post on the Web are the same prices they have in their physical stores.

Finally, the granularity of temporal data collection is chosen. How often should changes in prices be examined requires a balance of collection and processing time with a measurement of signaling and response in the marketplace. While choosing this level of granularity mostly affects Hypothesis 3, the time periods chosen should not be too long when many price changes could occur and the observations do not collect price points for all in-between changes. If the time periods are too short, the overhead necessary to collect and analyze large amounts of data may be too difficult. Chapter Five will use two different granularities of weekly and monthly changes.

Once this information is determined, there is now a set of titles, retailers, and times that are used to uniquely describe the dependent variable of price. The title/retailer/time pairing is the independent variables chosen for the analysis and the dependent variable of price is collected. While data may be analyzed across titles, retailers, or titles, the fundamental element at the lowest level of granularity is the price for a unique title/retailer/time combination. How does one find the dependent variable of price?

One of the benefits of the Internet marketplace is that Internet tools can be used to collect the price data. A mechanism to ensure easier data collection is to select retailers in both categories that posted prices on the Internet. Most physical retailer price data in the next chapter was collected through the Internet in the same way it was collected for Internet retailers. This methodology allowed lower cost data collection when compared to the many hours necessary to visit physical locations and track prices. The result is that a greater amount of data was collected. However, this method of data collection means that the results must be carefully interpreted. Even if the physical retailers posted the same prices as they had in their stores, it may be that they differ systematically from stores that avoid posting prices on the Internet. Furthermore, in the data from Chapter Five, posted prices were not verified with the in-store prices for these retailers. Accordingly, any price difference found should be interpreted as differences in posted prices and not necessarily differences in actual in store prices.[43] The vast majority of sales for the "physical retailers" were via their physical retail locations, not Internet sales, during the sample period as indicated by the retailer information in Appendix C. For each pairing, a URL (Uniform Resource Locator)–the unique Web identifier– is used which lists the price for this title/retailer pairing.

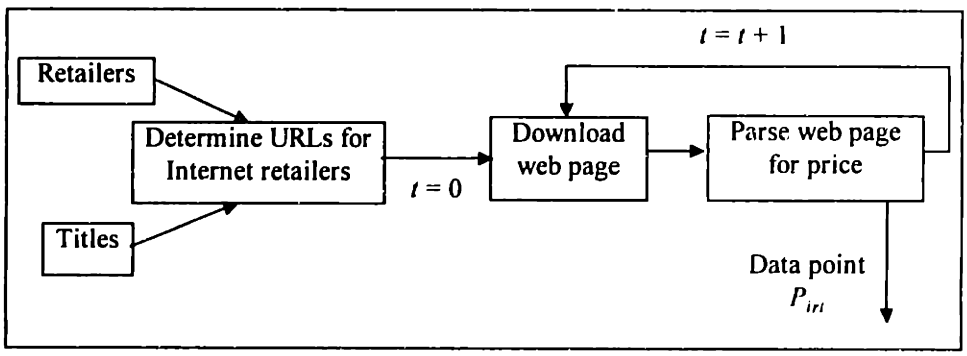
While using a URL provides easier data collection, there are limitations to its use. Because many retailers who have Internet Web sites aggregate a large number of products, they do not code individual Web pages and assign a URL. Rather, these retailers have databases of their products and product information and the HTML document is

[43] An extension of this work and an opportunity for future research could explore the robustness of the results to a finer partitioning of retailing types, including a check of prices charged in different channels by the same retailer. This exploratory analysis will only focus on one type of distinction: prices posted by retailers with a physical presence vs. those that are pure Internet retailers.

generated on demand. As long as the URL used for the data collection asks for the same information to be processed this is not a problem. However, if the syntax for generating a Web page changes or if the URL includes temporal information that expires, revisiting the same URL over time may give false information. While the data collection in Chapter Five did not find these problems to be ubiquitous, it may be in the best interest of Internet retailers to do this as sophisticated search intermediaries and increased price competition erode profit margins. In effect, the retailer could increase consumer search costs by having URLs that expire.

The resulting data collection methodology for analyzing prices set by Internet and physical retailers is shown in figure 4.1. The main idea is to collect prices for different products sold by different retailers over time. The data can then be used to describe what a particular user would expected to pay given particular environment variables such as their experience with Internet shopping and the alternatives they have in the physical market. In graphical terms, the methodology is described in Figure 4.1. Figure 4.1 is a diagram that identifies the elements of this data collection. Then, at $t = 0$, the Web page is downloaded, the page parsed for price information, and the data point is extracted. This process is repeated in subsequent time periods.

Figure 4.1: Data Gathering Flow Chart



Automation of the process of downloading the Web page is possible but automating the parsing of that Web page is more difficult. Given a set of URLs, a script can fetch the data (the HTML document) and save it locally for future analysis or the script can immediately hand this data to the parser. This process eases the burdens on labor of collecting a large number of data points. The more difficult task is to parse through that information to find the price. Because there is no standard way to report price, sometimes the price is ambiguous of not available in the source code. For example, the retailer can put the price in an image format so the source code would look something similar to "price: <img src="price.jpg">" and analysis of this would not be possible. The ability for new protocols such as XML to standardize Internet commerce fields may make this parsing process easier, but as Zettelmeyer (1995) discusses, making the search process easier for consumers may not be in the best interest of Internet retailers. Putting price information into a picture format is just one way the can increase the consumer search costs.

The final element of the methodology shown in Figure 4.1 involves the temporal process of collecting data from Internet retailers over time. By finding the URL of a Web page that describes a unique retailer selling a unique titles can greatly aid in data collection. Because the URL may not change even though price changes, linking to a URL at different times can get access to different data points but a common retailer/title pairing. Downloading the source code from the URL is not difficult, but parsing the information within the HTML coding may be. Therefore, while it is relatively easy to automate the Web page download, a human filter may be necessary to parse the Web page and extract the data point.

When gathering the price information there is an open question of whether to include tax and shipping costs. This is a difficult issue because tax rates vary from state-to-state and shipping options often vary. For example, purchasing a book in a local Barnes & Noble in the Boston area would mean a six percent sales tax while buying the same book via the Internet with Amazon.com, this sales tax could be avoided. However, Amazon.com would charge for shipping and the Barnes & Noble "shipping costs" would materialize in the form of personal transportation costs.

This methodology eliminates this confusion by only examining the price of the title and separating out the sales tax and shipping cost. This is reasonable because consumer behavior often does not always factor in the sales tax and/or shipping costs that accompany such an order. This is also consistent with the theory developed in Chapter 3 on the price setting and aggregation role of the intermediary separate from the transport of the good to the consumer. In essence, the transaction agreement is separated from the transaction fulfillment.

5. AN EXPLORATORY ANALYSIS OF INTERNET COMMERCE

This chapter uses the four hypotheses and methodology developed in Chapter Four to analyze an exploratory data set. The analysis in this chapter indicates why there is still friction in Internet commerce markets. This analysis describes possible reasons why no evidence was found to support three of the four hypotheses in Chapter Four. Finally, this chapter concludes with a discussion of the strengths and weaknesses of Chapter Four's methodology, and the need for more data collection to determine whether or not the exploratory data is representative of the future of Internet commerce.

This chapter introduces both a quantitative and qualitative discussion of early pricing strategies for Internet commerce by examining prices for several homogenous products to test the four hypotheses. Two types of retailers are chosen: those which rely exclusively on the Internet for sales and a matched set of firms selling identical products who primarily use conventional channels. In total, 30,254 (23,789 from February/March 1997 and 6,465 from May 1997 through January 1998) observations from 52 different retailers for 337 distinct titles of books, music compact disks and software were collected and analyzed.[44] Because of a major new entrant in the Internet commerce book market, Barnes & Noble, the analysis for the book market was extended past March 1997 for monthly observations from May 1997 through January 1998.

While exploratory, the data presents some striking results. Specifically, there is no support of three of the four hypotheses from Chapter Four indicating that the Internet market may not be as frictionless as the theory suggests. Each hypothesis is explored in greater detail in Section 5.1. In this sample of products and firms, the data does not show that Internet retailers who rely exclusively on the Internet for sales do not have lower prices than retailers who primarily use conventional channels do (Hypothesis 1). Furthermore, in two of the three markets studied, there was more price dispersion among Internet retailers to contradict Hypothesis 2. However, there is data to support Hypothesis 3 because the Internet retailers in the sample changed prices more frequently than their counterparts with physical stores. Finally, there did seem to be differences in the results from the three markets which indicates that product and market characteristics do matter which contradicts Hypothesis 4.

---

[44] This data collection follows an even more exploratory conducted in June-August 1996 with the top ten titles in the same three markets: books, compact discs, and software. The findings indicated that prices are not lower on the Internet and led to the development of the February/March 1997 data collection and analysis. Bailey, Brynjolfsson, and Smith (1998) detail the early findings and compare them to the February/March 1997 findings.

The conclusions of these results should not be taken out of the context of the exploratory nature of the data. By applying this methodology to a relatively small and static data set, no evidence was found to show that a Bertrand price competition model holds for Internet commerce. While this analysis is still quite preliminary and subject to change as the Internet evolves, it does suggest that some of the existing assumptions and theories about the effect of the Internet on pricing need to be extended or revised to account for actual practice.

Other data sets and analysis in other markets do support this Chapter's conclusions. The report by the OECD (1998) used analysis from Goldman Sachs that showed that a market basket of thirty-one items purchased on the Internet costs $457.89 while the same market basket costs $453.07 in Wall-Mart. The report by Lee (1998) examines prices for used automobiles sold at auction and finds that the price for the automobiles sold via the Internet was higher than the price of a similar automobile when sold in a physical market.[45] However, the immaturity of Internet commerce makes all such analyses exploratory.

Nakagawa (1997) examines pricing strategies on the Internet for music CDs, computer-related goods, books and wines. While his work does not explore price competition among retailers as this thesis does, he does develop a framework for pricing strategies by Internet retailers from a marketing perspective. Nakagawa finds that retailers targeting Internet consumers who are looking for the best product features and not the lowest price (such as consumers in the wine market) should not use price promotions (coupons, for example) to attract consumers. Conversely, Internet retailers in the software market should offer price promotions to attract the price-conscious Internet consumers.

Even though the results are preliminary, these findings are not consistent with much of the conventional wisdom regarding Internet commerce or with the simplest interpretations of existing theory regarding the effects of lower search costs on price competition. Indeed, the systematic difference in prices for apparently identical products is in itself evidence that Internet markets are not "friction-free". Accordingly, this chapter presents several alternative explanations for the results.

The empirical analysis suggests different reasons why the Internet market may not reduce friction. Section 5.3 explores five possible explanations why the data contradicts three of the four hypotheses. Several reasons are possible for these observations including: 1) *high search costs*: the Internet may not reduce the friction in the market sufficiently for consumers to search product features and prices at a low cost; 2) *lack of trust:* consumers do not trust all retailers the same, therefore retailers can maintain higher prices because they are more trustworthy; 3) *market immaturity*: Internet retailers are still experimenting with strategies for setting prices and developing consumer

[45] Because the automobiles in Lee's study were only similar and not identical, it is questionable whether or not his results are very significant. Greater participation by consumers in an auction market may lead to higher prices*regardless* of the medium used to support the transaction. Furthermore, a third party certified the automobiles sold on the Internet but the automobiles sold in a physical market auction were not.

relationships; and 4) *price discrimination*: retailers are able to separate groups of consumers to charge them higher prices based upon consumer demographics.

5.1. Description of the Exploratory Data Set

Selecting the parameters for data collection is an important part of the design of the experiment. During February and March 1997, the analysis examined different markets, retailers, titles, at weekly time intervals.[46] Each of these decisions affects the results so they will be examined in greater detail before a presentation of the results. For specifics on this data, Appendix A of this thesis lists the titles and some price data and Appendix C lists descriptions of the retailers. When the retailers and titles are selected for analysis, careful attention is paid to the characteristics of each to ensure proper sampling. With adequate depth in the number of retailers and titles that reflect the complex marketplace in the design stage of the research, this can ensure that the results generated have a greater chance of being statistically significant. By exploring only a subset of the wide-ranging titles sold and retailers that sell over the Internet, the analysis may lose a larger strategy developed by the retailer. For example, selecting only popular titles may only indicate prices set for loss-leader products. While more data is always preferred to less data, more data from the same class of retailers and titles may only be redundant and could give unequal weight to a category of titles, which would affect the results.

The three markets selected for this analysis—books, compact discs, and software—are all homogenous goods, which is necessary to support an assumption of the Bertrand competition model. Products were selected for their fairly high level of competition among retailers–the aggregation and pricing intermediaries–so price would be an important element of competition. Finally, markets were selected where suppliers (such as the publisher of titles in these three markets) did not try to impose a disintermediated market structure by selling directly to consumers. Direct selling may skew price competition among the aggregation and pricing intermediaries because suppliers would be influencing the consumer prices. While there are publishers in each of these three markets that do sell directly, they usually sell at the list price of the title while the intermediaries or retailers sell at a discounted price (thereby trying not to undercut the retailers).

A total of 52 retailers were chosen for the study. The essential requirement for Internet retailers is that they have Web sites where they post their prices. Most of the physical retailers also were found to have Web sites. Because an exhaustive list of retailers in these three markets would be much larger than 52, a subset was selected to reduce the overhead of data collection. Retailer's that allowed titles to be tracked by a unique URL (i.e.,

[46] Chapter Two described why a reduced friction might lead to reduced transaction and menu costs. The preliminary exploratory analysis, which was conducted in June-August 1996, had two observations per week that rarely indicated price changes during the week. Therefore, weekly observations were appropriate.

www.retailer.com/title?12345) were given preference.[47] This choice does not introduce any significant selection bias because most Internet retailers use a unique URL for tracking, and those that did not use a unique URL did not appear to have prices significantly different from the retailers selected. Within the three markets, there were eight book, nine CD, and 35 software retailers.[48]

A total of 337 titles were examined: 125 in the book market, 108 in the CD market, and 104 in the software market. Approximately half of these titles came from the "most popular" lists in the different industries. [49] To ensure a greater depth, the remaining half are more "obscure" or "niche market" titles which came from specialized lists, recommendations from friends, or identification by niche retailers as a featured selection. While the gauge of popularity was thought to have some effect on the findings below, the analysis did not seem very different for the 50th title on the Billboard list and a more obscure title. This mix of bestsellers and less-popular titles was chosen to reflect the mix of titles purchased by consumers in the market. If only bestsellers were chosen, then the prices observed may only reflect the loss-leader products. If a random sample of all titles sold were selected it might not give enough weight to the sales volume of popular titles.

The time period selected for the analysis in February and March 1997 was weekly. Humans made weekly observations by accessing the unique URL and recording the prices. While there are a total of 44,896 possible observations (8 weeks [observations] * [125*8 + 108*9 + 104*35]) not all permutations resulted in an observation. Some retailers were out of stock of a title on a particular week and other retailers never carried some titles being tracked. In total, 23,789 observations were logged, which is approximately 56% of the total possible. The extension of the analysis for the book market changed the time granularity to monthly observations, which is discussed in Section 5.2. Additional details on the data gathering methodology can be found in Chapter Four.

With the markets, retailers, titles, and time period selected, all that was necessary was the collection of the dependent variable–price. While this may seem trivial, which price point to select is an important part of the data collection because there may be more than one price. For example, should the price data include shipping cost? Should the price point come from the general price or membership price? For this analysis, member prices were not used except when there was no membership fee (disclosing an email address to an Internet retailer may create a free

---

[47] This URL represents a dynamically-rendered html document based on a query from the user for title "12345." Many of the retailers in the study had dynamically-rendered documents from a database as opposed to static html documents.

[48] The reason for such a large number of software retailers is that the method for data collection in the software market was made easier by the UVision search intermediary. Instead of a unique title/retailer URL, there was one URL which could get the sales price for many (often 20 or more) retailers.

[49] Books used the New York Times Bestseller list. CDs were taken from the Billboard top 50. Software titles were found in *PC Week's* column on popular CD-ROM titles.

membership, for example). This analysis also uses prices that do not include shipping costs.[50] While the full transaction requires shipment of the product (if the product is physical and not electronic), shipment costs for purchasing a product is the rough equivalent for state tax when the product is purchased in a physical retail location.

5.2. Empirical Analysis of Exploratory Data

Given the design of the experiment, testing the four hypotheses from Chapter 4 is analyzed. These hypotheses will determine the differences between Internet and physical markets. To goal is to examine Internet prices in depth: both across and within markets, and statically and dynamically. Four basic findings are presented: 1) prices for products sold by the Internet retailers are not lower than prices for the same products sold by retailers with physical stores, 2) there may be greater price dispersion among Internet retailers, 3) market and product characteristics do impact the findings, and 4) Internet retailers appear to change their prices more frequently. These findings support Hypothesis 4 from Chapter Four and do not support Hypotheses 1, 2, and 3. Each finding is explored in detail in the subsections that follow.

5.2.1. Higher Prices on the Internet

Table 5.1 shows the price premium for purchasing products from Internet retailers, which does not support the Hypothesis 1. This result assumes a normal distribution of prices around a mean. The mean (or average) of the price is used to compute the price premium–how much more the mean price for a product is when purchased from an Internet retailer relative to a physical retailer. The statistical significance of these findings is also reported. Both calculations use the methodology in Chapter Four with the data from Appendix A. As Table 5.1 indicates, all markets have higher prices, but the results vary by market. Subsection 5.1.4 discusses the relevance of this in greater detail.

[50] In the comparison of prices, no taxes or shipping costs factored into the analysis. While this cost is significant to the consumer who may choose to buy the item on the Internet or in a physical store, the cost differences between Internet retailers are not very different. Shipping costs add an average of 15%, 10%, and 8.5% to the cost of a single item and 11%, 7.5%, and 6% the to cost of a two item order for books, CDs, and software, respectively. Taxes add approximately 0-8% (depending on the particular state sales tax) to the total price of an order at physical stores.

Table 5.1: Internet Retailers' Relative Price Premium, February/March 1997

Market	*Internet Retailers*	*Statistical Significance*
Books	6.27%	$p < 0.01$
Compact Discs	13.02%	$p < 0.01$
Software	2.96%	$p < 0.01$

Because the normal distribution of prices may not be an appropriate assumption as discussed in Chapter 4, a nonparametric approach to this hypothesis is also explored. Table 5.2 shows the number of times that the lowest price is found for Internet retailers or for retailers with physical stores for the February/March 1997 data. The null hypothesis–that this statistic follows a binomial distribution against the alternative hypothesis that it does not–is tested. The test's critical region is determined by finding the smallest number c such that the cumulative distribution function for the binomial distribution is less than a set significance level, in this case 0.001. In the case of ties, the number of ties is evenly divided between the two markets.[51]

Table 5.2: Instances Where Minimum Price is Found, February/March 1997

Market	*Internet Lowest*	*Physical Lowest*	*Tie*	*Statistical Significance*
Books	640	477	601	$p < 0.001$
Compact Discs	181	523	0	$p < 0.001$
Software	584	222	1	$p < 0.001$

This test rejects the null hypothesis for each of the three markets. In the CD market, the finding that retailers with physical stores carried the lowest price more often than Internet stores is consistent with the prior results that Internet retailers average prices are higher than those of retailers with physical stores (see Table 5.1). However, the data in the book market indicates the exact opposite—the lowest price for books is found on the Internet more often than in physical stores.

Table 5.3 continues the nonparametric analysis by showing the test results for the three product markets and two time periods. In each case the null hypothesis–that the mean price in each market is the same ($P_N = P_H$) against the alternative hypothesis shown—is tested. In the book and CD markets the findings using the Mann-Whitney test correspond to the earlier results using a t-test—in each market mean prices are significantly higher on the Internet than for retailers with physical stores. The software market uses a different alternative hypothesis ($P_N < P_H$) because the nonparametric analysis found that software prices were lower on the Internet, not higher.

[51] An alternative approach based on Fisher's Principle of Randomization would consider the Bernoulli distribution without the tied observations. This approach does not change the thesis conclusions.

Table 5.3: Mann-Whitney Test of Mean Prices, February/March 1997

Market	*z-statistic*	*Statistical Significance*	*Alternative Hypothesis*
Books	-3.57	0.001	$P_N > P_H$
Compact Discs	-34.4	0.001	$P_N > P_H$
Software	-3.36	0.001	$P_N < P_H$

In the software market, the conclusions using the Mann-Whitney test differ from the prior results using a t-test. Here the data from February/March 1997 shows that Internet prices for software are statistically *less* than software prices in physical stores. This is the same as the result from the nonparametric test of minimum prices above. This result yields two tentative conclusions, one methodological and one empirical.

From a methodological standpoint, this result suggests that the price data is sensitive to the underlying test assumptions. Because the t-test is more restrictive than the nonparametric test[52], the nonparametric result has higher validity. From an empirical standpoint the results suggest that the unique characteristics of the software market (i.e., greater buyer sophistication and successful price intermediaries) may have intensified price competition in the Internet software market—over and above what is seen in the book and CD markets. Each of these results deserves further consideration with more recent price data.

Following up with the nonparametric analysis, a relaxation of the consumer heterogeneity assumption by exploring different consumers with different heuristics is done in a static and temporal setting. The important aspect of relaxing this assumption is to determine if the Internet affects all consumers in the same way. If the Bertrand competition hypothesis holds, what type of Internet user is not important–the average Internet price would be the same as the minimum price. Friction in physical markets mean that consumers who live in physical, monopolistic marketplaces gain more than consumers who live in physical, competitive marketplaces.

Table 5.4 presents the results of a static analysis of consumers with the four different heuristics explained in Chapter Four. The analysis examines different consumers and their heuristics for purchasing the market basket of products over the Internet versus the physical marketplace. Table 5.4 lists how much it would be for a consumer who bought the entire market basket of books in this study and how much their savings is when they purchased the products from an Internet retailer. The list price for the different market baskets of goods is noted below the following tables.

[52] In other words, the t-test assumes an underlying normal distribution while the nonparametric test, by design, makes no assumptions on the underlying distribution of the observations.

Table 5.4: Heterogeneous Consumers' Internet Book Purchase Surcharge[53]

		Physical Marketplace	
		Competitive	*Monopolistic*
Internet User	*Experienced*	$21.56	-$190.93
	Novice	$270.79	$58.30

Note: List price for all titles is $2,615.04

Table 5.4 shows mixed results for consumers with different heuristics. The consumer who gets the best deal is the one with Heuristic 2 (the experienced Internet user who is in a monopolistic physical market) which is true for all three markets. Also true, for all three markets, is that consumers with Heuristic 3 do not do better when purchasing products on the Internet. Table 5.4 indicates a definite advantage for consumers to learn how to do competitive price shopping on the Internet. Moving from a novice to an experienced Internet user would not matter if the law of one price were true for Internet retailers. The minimum price would be the same as the average price. However, this is clearly not true as the four tables above show. As expected, the consumers who live in physical, monopolistic marketplaces gain more by learning how to use the Internet more effectively than those in physical, competitive marketplaces.

A result of the methodology is that a consumer will always do at least as good and probably better by learning how to use the Internet to shop (moving from novice to experienced user). From the data in Table 5.4, a consumer can save $249.23 when purchasing a market basket of 125 books by shifting from a novice to an experienced Internet user. On average, consumers save more than a dollar per book.

Following the static analysis, the temporal analysis of users with different heuristics will also aid in the analysis. While comprehensive data reporting is done in Appendix A, this subsection will report the temporal results for consumers with Heuristic 1–minimum Internet price versus minimum physical price. A graphical analysis of the data confirms the results for minimum prices in each market. For the February/March 1997 time period, Figures 5.1, 5.2, and 5.3 show differences in the three markets when the minimum prices for the common market basket[54] of titles is compared among the retailers. The book (Figure 5.1) and software (Figure 5.3) markets show that minimum prices found at Internet retailers are lower. In the compact disc market (Figure 5.2), the minimum price is lower for retailers with physical stores. The prices listed are for the market basket of titles explored that are common in the Internet and physical marketplace. If the title cannot be bought in both the physical and Internet markets, the title is

[53] This is the price for all 125 books in the market basket purchased on March 24, 1997 using the price data available in Appendix A.

[54] The "common" market basket is all titles that that could be bought from at least one of the observed set of retailers with physical stores and at least one of the observed set of Internet retailers.

dropped from the market basket. While the title may be bought at the list price so the market basket can remain the entire set of titles, this distinction does not effect the results of the analysis.[55]

Figure 5.1: Minimum Prices in the Book Market

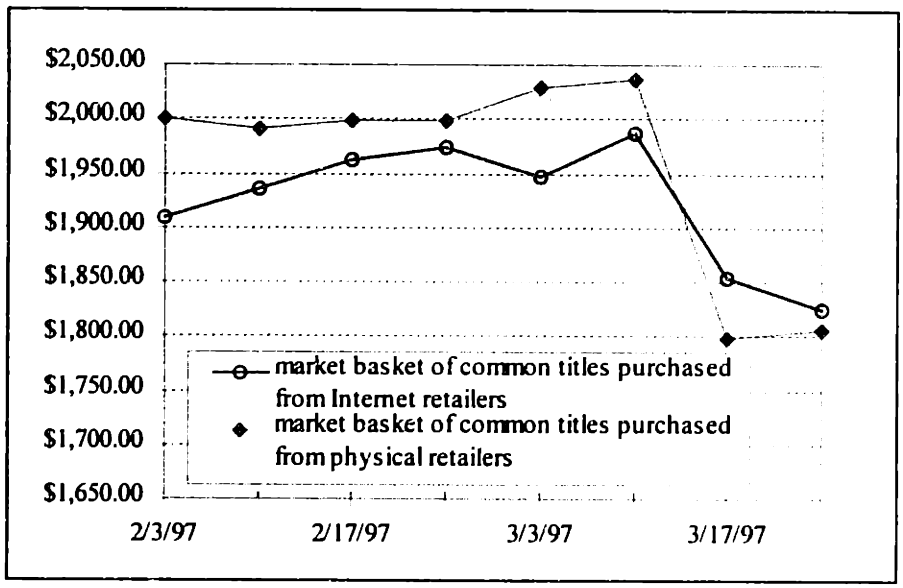
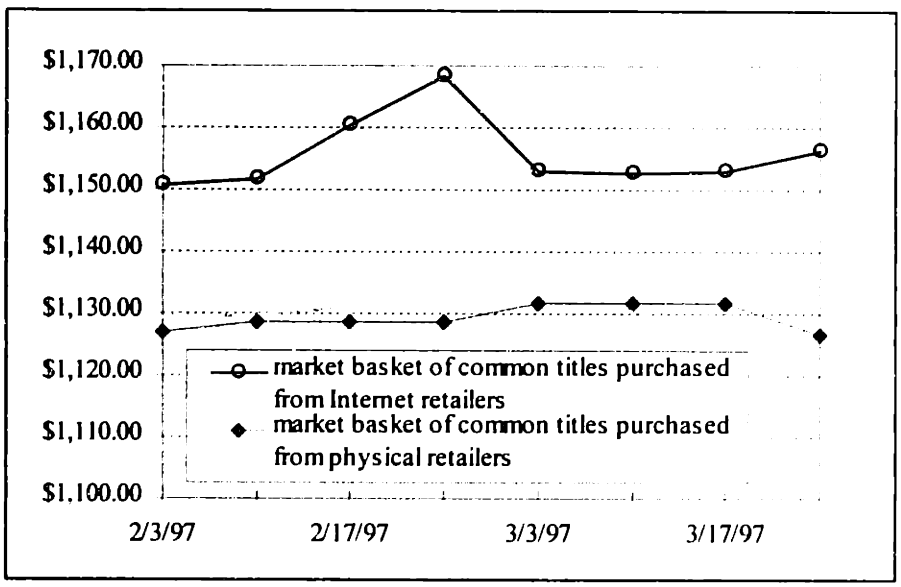
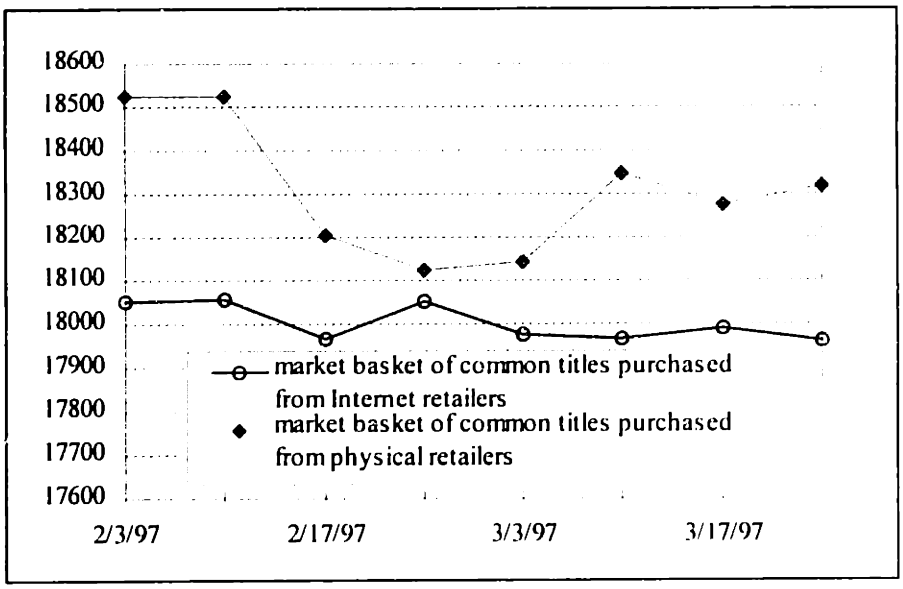


Figure 5.2: Minimum Prices in the Compact Disc Market



[55] See Appendix A for the graphs which list the "total market basket" versus "common market basket" of goods and it is clear that using list price as a substitute for a missing title does not affect the results.

Figure 5.3: Minimum Prices in the Software Market



The results in Figures 5.1 - 5.3 confirm a result from other methodologies. The consumers shopping for the lowest price for the market basket of compact discs would do better if they shopped in physical stores. Consumers shopping for the lowest price in the software market would actually do better by shopping on the Internet. The book market reports mixed results with the physical retailers actually charging lower minimum prices for the market basket of books at the end of March and not at the beginning of the data collection. The change in results is related to the entry of Barnes & Noble on the Internet–an exogenous force that is discussed in detail in Section 5.2.

5.2.2. Less Price Dispersion on the Internet

Analysis of the exploratory data does not support Hypothesis 2 (lower price dispersion on the Internet). The standard deviation of prices (normalized to the average price) for the exploratory data set are reported in Table 5.5. This analysis assumes the normal distribution of prices around the mean reported in the previous subsection. The corresponding statistical significance test is the F-test. Similar to the prior analysis, the data from the book and CD markets indicate that does not support the Hypothesis 2 while the software market does.

Table 5.5: Standard Deviation of Price Discounts, February/March 1997

Market	*Internet Retailers*	*Physical Retailers*	*Statistical Significance (F-test)*
Books	13.19%	10.44%	$p < 0.01$
Compact Discs	17.61%	10.95%	$p < 0.01$
Software	7.07%	8.12%	$p < 0.01$

A possible explanation of why the standard deviation of prices is still large is that Internet retailers are adopting an aggressive loss leader strategy. More obscure titles have a smaller spread of prices because they are not competed for. However, more obscure titles have a larger spread because search costs are higher and there is so much price competition for popular titles. The result of different retailers competing with different loss-leader products is that they do not have consistent prices even though there is price competition.

5.2.3. Product and Market Characteristics

As the previous subsections indicate, product and market characteristics do matter, which contradicts Hypothesis 4. From a theoretical perspective, the product and market characteristics should not matter as long as the product is homogenous. This section will explore the evidence and possible reasons why it does matter. Part of the explanation begins with the products themselves. Books, CDs, and software have different levels of standardization, product differentiation, and asset specificity. Table 5.10 summarizes the differences in the three markets.

Table 5.6: Market Differences

Market	*Standardization*	*Product Differentiation*	*Asset Specificity*
Books	high	medium	low
Compact Discs	medium	low	low
Software	low	high	low

Standardization may seem to be part of the definition of homogenous good, but this is not true in practice. By looking at how a consumer can define a product, to differentiate it from all substitute products, indicates that various degrees of standardization for products in these markets. Books have a unique ISBN number so they are highly standardized. CDs do have a standard artist/title/media combination (i.e. Dave Matthew's Band/Crash/Compact Disc) but this may not be enough information to identify a unique product. Differentiating the CD into further categories can take place, such as an explicit language or a clean version. The book market does not have these

differences because the ISBN number changes for each new version of a book. For example, the hardcover, paperback, and large print editions of a book have different ISBN numbers. Software is the least standardized because it has the most differentiation and require the most specification to be precise in identifying one product versus another.

Product differentiation is a method to distinguish one product with another to appeal to different consumers. The three markets have varying degrees of product differentiation. Retailers or suppliers use product differentiation as a tool to differentiate the market to extract larger amounts of consumer surplus –price discrimination. The previous discussion addressed ways for CDs to be differentiated based on artist/title/media and some more obscure categories and this indicates product differentiation. Hardcover, softcover, audio, paperback, and large print editions are just a few ways books can be differentiated. Software has the greatest degree of product differentiation because of the many different versions of software that can be produced. Versioning is discussed later in this subsection.

Finally asset specificity is the degree to which the product has been manufactured for a particular consumer or group of consumers and where these consumers can use their buying power, in concert, to influence the price of the good. The economic literature (see Coase 1937; Demsetz 1968; Williamson 1979) notes that in the presence of high asset specificity consumers will be able to use their bargaining power to extract rents from producers. The potential for buyer "hold-up" of producers will lead to market contracting problems and potential market failure. Because the analysis only examines commercial, off-the-shelf products and not custom-made products, all markets have minimal asset specificity. The book, CD, and software products in this data set all have low asset specificity.

Other market differences are important to examine because they can help explain differences shown earlier in Section 5.1. These differences include industrial organization structure, market size, and comparative advantages. The next few paragraphs explore these qualitative differences between the book, CD, and software markets.

Search intermediaries may exist in different markets, lowering the cost of consumer search. The software market has a search intermediary that may increase the level of price competition. The CD and book markets have fewer search intermediaries promoting price competition.[56] In a fully disintermediated market, the consumer would interact directly to the publisher as Chapter Three describes and the search intermediary would search on product features–not price. The search intermediary used across retailers who carry the same product can help the consumer do a price comparison. The possible addition of a search intermediary to help consumers find the lowest price would increase price competition among retailers. UVision is one such intermediary for the software market.

[56] This is not to say that search intermediaries have never been implemented, but they have less success. Bargain Finder (Belman 1996), for example, tried to become a search intermediary for the CD market and failed (Bailey and Bakos 1997).

Consumers in the different markets have different demographics. The different results in the three markets suggest that friction in the marketplace is relative to the consumer and not something inherent in the infrastructure itself. The consumers who understand how to use search technologies and intermediaries may achieve lower search costs. Thus, if a whole class of users (e.g. software consumers) have systematically lower search costs than other classes of consumers (e.g. book and CD consumers), the type of competition and price difference may also be different, even when the channels are seemingly identical.

Internet retailers can develop loss leader strategies when pricing the products they carry. Bailey, Brynjolfsson, and Smith (forthcoming) found that when Internet retailers had the lowest price, it was slightly lower than the physical retailers' price. However, when the physical retailers had the lowest price, it was significantly lower than the Internet retailers' price. Physical book retailers appear to use loss leader pricing more aggressively than Internet stores. This could be because shoppers in physical stores are more likely to browse than Internet shoppers because of the "switching costs" associated with finding a substitute produce. Thus, the data provide empirical support for the dual hypotheses that such switching costs have powerful effects on pricing and product strategies (e.g., Klemperer and Padilla 1997), and that the Internet can affect switching costs.

Related to product differentiation is product versioning that is apparent in the software market. Versioning is a method to distinguish one product from another to appeal to different consumers. Retailers and suppliers use versioning as a tool to differentiate the market and extract larger amounts of consumer surplus using price discrimination (Varian 1997). There may be more versioning in books than CDs because the publisher and retailers are able to segment the market based on successive releases in different media while the compact disc market only has one release date. (The CD format is a de facto standard and audiocassettes or vinyl records are released simultaneously with the CD release). Software has even more versioning. New versions replace existing versions according to a fast time cycle and there are multiple media (CD-ROM, floppy diskette, and electronic distribution), differences in software support (manuals and telephone consumer support), and differences in capabilities (e.g. some Windows NT servers support only 20 users while others support 40 users).

List prices have different effects in the three different markets as Table 5.11 shows. The price discounts relative to the list prices are similar for books and CDs, but are significantly greater for software. While the steeper discounts are related to quicker product lifetimes and versioning, the anchoring effect that list prices have on products is lower. In fact, approximately half of the software titles in the data set do not even have list prices. The result is that retailers must compete on price relative to other retailers as opposed to a list price. This may result in greater price competition.

Table 5.7: Summary of Retailer Price Discounts

	February/March 1997		
	Books	CDs	Software
Average Discount Relative to List Price	-16.8%	-16.82%	-25.82%

The price of a title also impacts the scope of consumer search. In general, software has the highest average price relative to books and compact discs. Therefore, the consumers search more because small percentages in price changes are larger price differences when the price for an item is larger. This is consistent with the work of Bakos (1997) presented in Chapter Two. With a constant fixed search cost, consumers will search more if they believe there is more to benefit. Even if there is small percentage fluctuations in price for all products, that corresponds to larger absolute fluctuations when the average price is higher. Therefore, a consumer would search more to find a better price for a $400 software title than a $14 compact disc when the search costs were the same for both products.

The concentrated industrial organization structure of the book market is also an important characterization of the market. The Internet book retail market while the products are very standardized and somewhat differentiable, has a duopoly industrial structure. The competition between the two major players, Amazon.com and Barnes & Noble, may set a pricing precedent that other Internet book retailers would follow. However, the followers are not matching their prices even though these smaller retailers are competing with similar services. The competition between these two players and the effect it has on the market is discussed in greater detail in Section 5.2. The global Internet book market favors the United States retailers because U.S. retailers have lower prices than Internet retailers based abroad.

Amazon.com chose the book market over the compact disc market because of competition in the electronic hierarchy. This is seen with the following quote:

> "When Amazon's Jeff Bezos was first scouting for retail sectors in which to work his online magic, he considered music, but decided against it. Whereas the book industry had thousands of publishers, the music industry was controlled by just a few labels. He was afraid they would have the power to stifle any online venture that offered serious competition. And indeed, several online music stores that have the making of a site as useful as Amazon's have had trouble getting record companies' permission to offer album samples, and their prices are typically little lower than those of physical music stores." (Economist 1997)

Although this quote indicates that the compact disc market offers lower prices, that is not entirely true as the statistics above indicate.

The industrial organization structure of the compact disc market is less concentrated. CDs as a product are less standardized than books because there is no equivalent of an ISBN number for compact discs. CDs are also less differentiated because they do not have as many editions of the same material as books do with their hardcover, softcover, foreign language, and large print editions. The CD market also has a fewer number of publishers than the book market. While this may lead to more supplier influence over the retailers, the retailers have still found this market quite lucrative. In fact, the CD market is growing quickly:

> "Analysts Jupiter Communications projects that CD sales on the Web will reach $47 million this year–more than double the $19 million sold last year. That's tiny next to the $9.9 billion worth of CDs sold worldwide last year, but Web commerce is growing at a fast clip while store-bought music has those going-nowhere blues." (Furchgott 1997)

This is an indication that it is still the early stages of Internet commerce but there has already been some market exit. For example, the "1-800-music-now" service decided to terminate its Web sales and is no longer in existence.[57]

The industrial organization structure of the software market is the least concentrated. This is interrelated with the software product characteristics of high product differentiation and low standardization. Compact discs and software in a CD-ROM format involves similar packaging costs and they have the same copyright law protection. However, unlike the CD music titles, the CD-ROM software titles should have a greater appeal to people on the Internet. By definition, the people who access the Internet have access to a computer and, therefore, are more likely to be interested in CD-ROM titles. The standard deviation of prices is lowest in this category (even though there is a noticeable absence of list prices for many of the titles) and this has as much to do with the sophistication of the user but also the ability for intermediaries to exist in this market. This phenomenon is described in greater detail in subsection 5.3.5.

To understand some of the intra-market dynamics, Section 5.2 explores the retail book market at a time when an exogenous force changed the nature of competition. What is clear from the pricing strategies discussed in this section and the details that follow in the next section, pricing is one variable that a retailer can use to differentiate themselves from their competition (i.e. pricing is strategic). Internet retailers are not price-takers because they are not subjected to the Bertrand competition model. Instead, market positioning and strategy often explains the data.

5.2.4. Frequency of Price Changes

Table 5.8 shows that there are more price changes among Internet retailers than with physical retailers using the February/March 1997 data to support Hypothesis 3. Once again, the data was analyzed using the methodology in Chapter Four. The result reported in Table 5.8 is the probability of a price changing in period t given a price for the

[57] This site was part of the larger networkMCI site for Internet commerce that was disbanded altogether because of the Web site's inability to grow quickly enough to cover mounting costs.

same title/retailer pairing at $t-1$. All the Internet retailers changed their prices more often than the physical retailers did. In fact, they change their price more than twice as often for books (3.38% versus 7.81%), compact discs (2.98% versus 6.80%) and software (3.28% versus 8.83%). Therefore, having an Internet-only presence appears to allow retailers to change price more quickly in response to market changes.

Table 5.8: Price Changes of Physical and Internet Retailers, February/March 1997

Market		*Price Change*	*Price Change Opportunities*	*Percent of Changes*
Books	Physical	71	2,101	3.38%
	Internet	233	2,984	7.81%
Compact Discs	Physical	21	704	2.98%
	Internet	338	4,968	6.80%
Software	Physical	20	610	3.28%
	Internet	1,097	12,422	8.83%

The question that follows the previous one of how quickly prices change is how do prices change? If prices become lower over time, is this evidence that retailers are lowering prices in response to their competitor's lower prices? However, if prices increase over time, than something else may have triggered this price change, requiring further analysis. Table 5.9 shows that the average price change in the book and compact disc market are not significant while the average price change in the software market is significantly a price reduction.

Table 5.9: Changing Prices in Internet Commerce

Market	*percent of price change*	*average price change*
Books	7.81%	$0.04
Compact Discs	6.80%	$0.06
Software	8.83%	-$3.78

Table 5.9 once again shows that the software market is an interesting case where there may be less market friction. The percent of titles that changed prices is greater for software (8.83%) than for books or CDs. Therefore, software retailers are changing their prices more frequently than the book and CD markets. Next, the average price changes are interesting to note because the software market is the only market where prices changes are actually negative–

meaning that when prices do change, the are, on average, reduced by approximately $4.[58] The difference among the three markets is the basis for Hypothesis 4.

5.3. Amazon.com, Barnes & Noble and Competition in the Internet Book Market

This section investigates the impact of the entry of Barnes & Noble, a large physical retailer, on the Internet book market. During the February/March data collection, an exogenous force–the entry of Barnes & Noble to the Internet book retail market–was observed. There was an incredible change in prices when Barnes & Noble entered the book market with the incumbent giant Amazon.com and other smaller Internet retailers such as Books.com. However, few other Internet book retailers seemed to take notice. This section explains the strategy and price competition among Internet retailers at the time of entry and the months that follow.

Barnes & Noble is the more traditional physical retailer that is bringing consumers and a brand name to the Internet marketplace. Barnes & Noble started in 1965 in New York City as student book exchange and grew throughout New York providing better service, selection, and consumer support than other bookstores. Growing through traditional retail stores its growth through acquisitions such as the B. Dalton bookstore chain in 1987 has established Barnes & Noble as an industry leader in the physical commerce world. In 1997, it would begin exploring the Internet marketplace.

Amazon.com also started off small but based on a totally different economic model–Internet sales and book shipping. Although it did not have, nor does it have today, any physical locations, Amazon.com was able to establish a global presence in less than two years because of the Internet's reach. It recognizes that competition is a factor that it "expects to intensify in the future. Barriers to entry are minimal, and current and new competitors can launch new sites at a relatively low cost." (Amazon.com 1997) It hopes that providing better service at a good price along with its first-mover advantage will put it in a better position to compete with Barnes & Noble and other bookstores.[59]

The two companies, Barnes & Noble and Amazon.com, started to compete in 1997. Barnes & Noble used a slow rollout of their service to compete with the Internet incumbent, Amazon.com. Barnes & Noble only offered their electronic storefront to America Online (AOL) consumers who had a dial-up connection to the network in the beginning. The AOL users who had Internet connections were blocked from the Barnes & Noble store. In other words, they blocked all consumers who tried to connect using TCP connections. Perhaps one reason to do this is technical–they reduced the amount of congestion at their server before it was fully functioning by blocking some users. However, this also reduces the possibility of people bombarding their site to get the price information–

[58] This price seems high relative to the book and CD markets, but the prices changes are affected by the higher average price of software.

[59] Barnes & Noble and Borders are the two physical world book retailers Amazon.com mentions in its IPO (Amazon.com 1997).

exactly what search intermediaries sometimes do. Fortunately, they lifted this restriction in late April 1997 and by May they had a Web site running for all users.

Two Internet retailers competing for the same Internet book market books provides some interesting insight into the strategy developed by Internet retailers. Both Barnes & Noble and Amazon.com have extensive Web sites for consumers to purchase books. While Amazon.com has a first-mover advantage because they developed their Web presence in 1995, Barnes & Noble already has a brand name in the physical world. While it is true that both Barnes & Noble and Amazon.com are aggregation and pricing intermediaries, they follow different intermediary models. As aggregation intermediaries, they group books from different publishers (suppliers) to sell to consumers. As pricing intermediaries, they determine the price the book the consumer sees. However, the differences between the two retailers highlight how they can assume different intermediary roles.

One major difference between the two retailers involves the physical distribution of books. Because of their physical market presence, Barnes & Noble has a great number of distribution channels and warehouses full of books. To reduce overhead, Amazon.com keeps little inventory for most of the 2+ million titles listed on their Web site. For the books not in their warehouse, they order the books on-demand from nearby distributors. [60] The result is that Barnes & Noble collects more books and Amazon.com collects more information about books.

Another difference is the way the two retailers use information. Amazon.com is an Internet retailer that is information intensive. They encourage reviews from consumers and the building of consumer communities to promote value. Barnes & Noble also uses information, but they are more likely to use their ability as a vertically integrated retailer and not the information they process to maintain a price advantage to dominate the market. This difference in strategy between the two is illustrated by the following quote.

> "'Ultimately, we're an information broker,' says Mr. Bezos. 'On the left side we have lots of products, on the right side we have lots of customers. We're in the middle making the connections.'" (Economist 1997)

In a fully disintermediated market, consumers can buy from the publisher, but they will pay the list price. Both Amazon.com and Barnes & Noble charge prices at or below the list price.

The competition between the two companies intensified during the first half of 1997. Table 5.10 lists some developments during this time period that indicate actions taken by the two firms. In March of 1997, Barnes & Noble entered the Internet book market, which was previously dominated by Amazon.com. This set off competition between Barnes & Noble and Amazon.com as is evident in price changes and strategy decisions shown in Figure 5.4. While they reached an out-of-court settlement by late 1997, the price battle is still continuing in 1998 and the developments so far have been very interesting.

---

[60] This difference between Barnes & Noble and Amazon.com underlies a lawsuit against Amazon.com in which Barnes & Noble claims that Amazon falsely claims to be the "Earth's largest bookstore" when, in fact, it really does not have any books.

Table 5.10: 1997 Competition between Amazon.com and Barnes & Noble

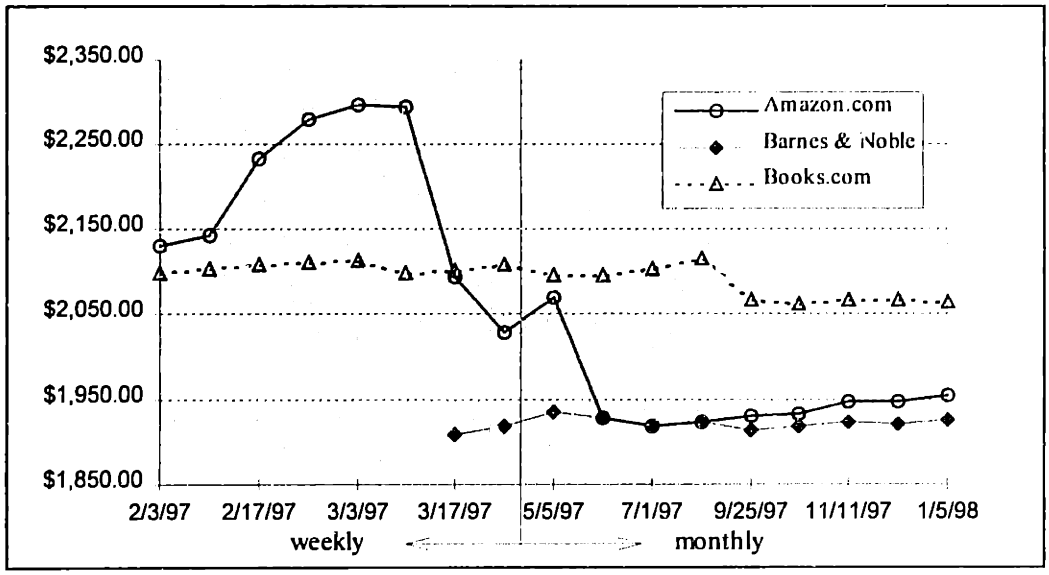
Date	*Amazon.com*	*Barnes & Noble*
July 1995	start of Web service	
March 19, 1997	announces discounts for its most popular titles	start of AOL Service
March 25, 1997	discloses that it will have an IPO	
May 12, 1997		start of Web service
May 12, 1997		sues Amazon.com for claiming to have the "worlds largest bookstore"[61]
June 10, 1997	announces further discounts for its titles	
July 8, 1997	pays AOL $19 million to receive exclusive promotion on its service	
July 11, 1997	announces a loss $6.7 million in the second quarter of 1997–less than expected	
November 1997	out -of-court settlement with Barnes & Noble	out -of-court settlement with Amazon.com

Because Barnes & Noble entered the Internet book retail market towards the end of March 1997, data collection and analysis was extended past March from May 1997 through January 1998 with monthly observations. The same retailers and titles were consistent. The reason for this extension is to determine the longer-term impacts of the entry of Barns & Noble. The data for the extended analysis is reported in Appendix B of this thesis.

Amazon.com did see the newcomer Barnes & Noble as a potential threat to their market power and their strategy to change prices reflects that. Figure 5.4 shows how prices changed at Amazon.com with the entry of Barnes & Noble from the time before Barnes & Noble entered the market until January 1998. This graph measures the price for a market basket of 125 books sold at Amazon.com and Barnes & Noble.

[61] Some details about this lawsuit are detailed in Reilly (1997). In his article, Reilly explains that Barnes & Noble disagrees with Amazon.com's claim to be the biggest because being the largest is the market positioning of Barnes & Noble.

Figure 5.4. Price Differences at Amazon.com and Barnes & Noble



Note: The list price for the same market basket of books is $2,615.04.

The entry of Barnes & Noble (which has a significant physical world presence) into the Internet book retailing market appears to have led Amazon.com (an Internet retailer) to significantly lower its prices as seen in Figure 5.4. While the price change was not immediate, there was almost the exact same price for the full market basket of books by June 1997–four months after the entry of Barnes & Noble. The price convergence is consistent with the theory of price competition. However, there is a divergence of prices noticeable after August 1997. The prices at Amazon.com has increased from August 1997 through January 1998 as titles moved off the bestseller list, and became more expensive at Amazon.com who has a very aggressive loss-leader strategy.

One of the many interesting things about Figure 5.4 is the anticipatory price increase at Amazon.com. The price of the market basket of 125 books increased slowly just before Barnes & Noble entered the market, and then Amazon.com lowered its prices dramatically just before Barnes & Noble entered. After sustaining a slightly higher price for almost four months after Barnes & Noble's entry, Amazon.com then lowered its prices so it matched the prices at Barnes & Noble.

While convergence with the prices is interesting, it is also interesting to note which retailer changed their prices to reach convergence. Did Amazon.com lower its prices to meet Barnes & Noble, or did Barnes & Noble increase its prices to match Amazon.com? What is interesting is the incumbent, Amazon.com, changed their prices. Amazon.com would risk consumers switching to the lower prices at Barnes & Noble if they tried to maintain their higher prices. Another possible explanation is that the price changes at Amazon.com and not Barnes & Noble may reflect Amazon.com's lack of experience in setting prices and developing a loss-leader strategy. Because Barnes & Noble has this experience in the physical marketplace, they can take this skill and apply it to their Internet sales.

The entry of Barnes & Noble has also increased the number of price changes at Amazon.com. Figure 5.5 shows that Amazon.com had three main price changes. The price change in the middle of February indicates the anticipatory price increase. The price changes in March 1997 shows the price decrease just before Barnes & Noble entered. Then, in June 1997, Amazon.com changed its prices to almost exactly match the prices at Barnes & Noble. In fact, for the prices that were still different in June 1997, the price differential was sometimes only $0.01. An interesting observation about Figure 5.5 is that only Amazon.com seems to be changing its prices dramatically with all other incumbents remaining fairly constant.

Figure 5.5: Price changes in the Internet Book Market, February/March 1997

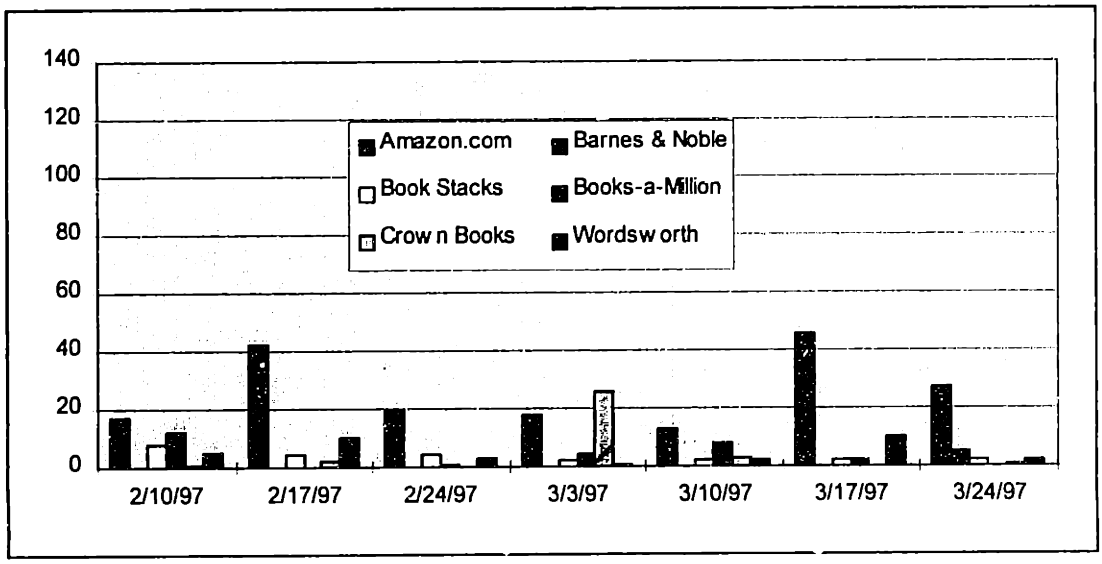
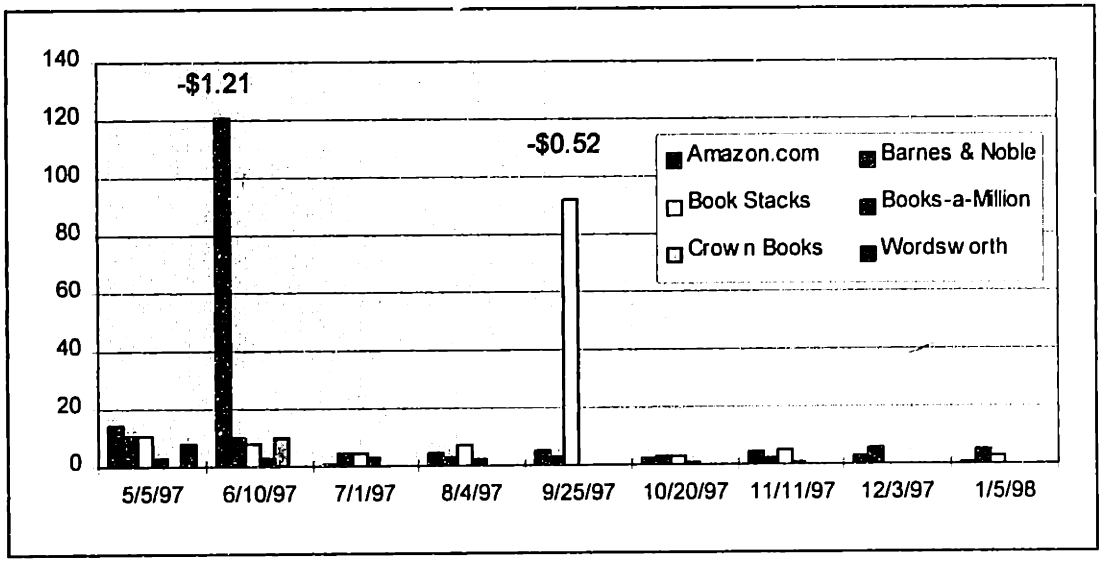


Figure 5.6: Price changes in the Internet Book Market, May 1997 - January 1998



Barnes & Noble may not be able to change its prices as rapidly because of the inertia that there physical presence they have. In some preliminary discussions with Boston-area Barnes & Noble retailers, they said that prices on the Web site are the same as the prices in the physical store. Since then, further research has shown that Barnes & Noble physical retail stores do not even charge the same price because they can price discriminate based on geography. Therefore, by definition the prices on the Web site will not be the same as the prices in the store because the store prices are not uniform across retailers. While the Barnes & Noble physical retailers are quick to point out that the Web site sales may have better prices for some items because of lower costs, they are still part of the same company. The Barnes & Noble Web site is associated with brand name carried over from the physical marketplace. Therefore, the Barnes & Noble Web site may not be as aggressive with price changes as Amazon.com can be because of their desire for their Web site not to compete against their physical stores. While Amazon.com changes its prices significantly, Barnes & Noble's prices did not budge. Does this mean that a retailer who has a combined physical/Internet presence has the ability to affect the sales and market positioning of an Internet-only retailer? While the answer appears to be yes, the data collection and analysis is still an ongoing research issue.

Amazon.com changed its prices with the entry of Barnes & Noble. As the graphs in Figures 5.5 and 5.6 show, according to observations taken during the weeks of 17 March and 24 March, 1997, Amazon.com lowered its prices on over half of its titles. As the table further indicates, the result of these price changes was that a consumer would find 124 of the 125 titles observed at the two different Internet stores to be different. Consumers who bought all 125 titles would save a total of $177.87 by shopping at Barnes & Noble. These prices do not include the shipping or tax costs but there is not a great disparity between the two retailers for these costs: they average approximately $1.50 per book (after a fixed $1.50 shipping fee) for both Amazon.com and Barnes & Noble.[62] The data in Table 5.13 shows that Amazon.com was changing prices quite regularly before Barnes & Noble entered the market. Also, Amazon.com was, on average, raising their prices. The price changes during time period 3 (February 17, 1997) show that 42 titles changed prices with an average increase of $2.23. Then, when Barnes & Noble entered the market on March 17, 1997, Amazon.com lowered 46 titles by an average of $4.40. So, while Amazon.com did lower prices when Barnes & Noble entered the market, part of the reduction was off of a marked-up price. Such strategic pricing flexibility is not consistent with the existence of Bertrand competition. What is clear from this analysis is that Amazon.com appeared to have fewer price changes after Barnes & Noble entered the market. With the first entry of Barnes & Noble, Amazon.com lowered its prices, on average, and differentiated itself from Barnes & Noble with frequent price changes and price differentials between the two Internet book retailers. However, after the price changes on June 10, 1997, there has been much less of an aggressive strategy by Amazon.com to change prices as frequently. Because there may be a convergence in prices, the consumer may choose between the retailers for reasons other than price.

---

[62] While Amazon.com does not currently charge sales tax and Barnes & Noble only charges sales tax in four states (IL, NJ, NY, and VA), Amazon.com is suing Barnes & Noble to force them to charge a sales tax in other states where they have a physical presence.

Competition between Amazon.com and Barnes & Noble did not seem to influence other Internet retailers. It appears that no other retailer listed in Table 5.14 is trying to follow. If the market were generally characterized by Bertrand competition, the other retailers would have no choice but to match the lower prices or exit the market. Under Bertrand competition, retailers with higher prices would have no sales because consumers would only buy from the lowest-price Internet retailer. In the analysis, no Internet book retailers exited the market even though they had higher prices. So, one interesting conclusion from this case study is that price competition from two players with large market share may not immediately affect the pricing of firms with smaller market shares.

Strategic pricing for Internet retailers is evident. Amazon.com and Barnes & Noble both have strategies to capture the same consumers but have different competitive advantages (Porter 1985) to leverage. The mere fact that strategic pricing of Internet retailers exists is prima facia evidence that Bertrand competition does not explain what is happening with Internet commerce. What is not clear from Figures 5.4 and 5.6 is that Books.com was positioned for a radical change by implementing a price discrimination strategy. This strategy will be examined in Chapter Six. Therefore, the next section proposes possible reasons for the results found in the first two sections of the chapter.

5.4. Analysis

While there is much speculation about the effect that the Internet will have on prices, thus far there has been virtually no systematic evidence or analysis. With this data set, no evidence was found for some of the widely assumed "facts" about the Internet. In particular, the data did not show that prices were lower on the Internet when compared to a matched sample of identical products sold by physical retailers; nor was price dispersion lower on the Internet. The price difference among Internet retailers is prima facie evidence that markets on the Internet are not "friction-free".

Five possible explanations for these findings are explored. First, Internet consumers may have a higher reservation price because of their demographics or the convenience of ordering over the Internet; and Internet retailers may be responding to this characteristic with higher prices. Second, Internet markets may not be in equilibrium and over the long run prices will decrease and become more uniform as retailers settle on their strategies and inefficient retailers exit the market. Third, the Internet may not have lowered search costs as much as expected. Fourth, the price differences may reflect price discrimination by retailers who sell through multiple channels. Finally, search intermediaries may be present in the marketplace where they may be necessary to increase the amount of price competition. While, in isolation, none of these possibilities explain the results fully, together they give some insight into the current nature of competition on the Internet and suggest avenues for future work.

The goal of this exploratory analysis was not to distinguish among all the possible explanations for the results. Instead, the analysis sought to provide a base line of evidence in this area to help put future theory and empirical work on a firmer footing. While the results are subject to change as the Internet evolves, they suggest that some of

the existing assumptions and theories about Internet competition need to be extended or revised to account for actual practice.

5.4.1. High Search Costs

One implication of the large observed standard deviation of prices among Internet retailers is that the Internet has not lowered consumer search costs. As noted above, Bakos (1997) finds that the spread of prices reduces in the presence of lower search costs. This finding is in opposition to the finding that in two markets (books and CDs) the standard deviation of prices is higher on the Internet than in physical stores.

However, the evidence also indicated that, in the software market, prices and the standard deviation of prices were lower on the Internet than in physical stores. One explanation for this is that software consumers are more sophisticated in their knowledge and use of technology than consumers in the book and CD markets. Additionally, the software market has relatively successful price intermediaries while the book and CD markets do not.

Thus, overall search costs may decline as search technology improves and Internet users become more sophisticated in their use of this search technology. Search engines and agent technology are evolving to the point where it is much easier for a consumer to search a large number of Web sites or databases with little effort. As consumers learn how to use these technologies and the services become more sophisticated, the overall lowering of search costs would lead to greater price competition among Internet retailers. This may result in lower prices for products bought on the Internet and a smaller standard deviation of prices among Internet retailers.

The countervailing opinion is that search costs could increase as the amount of information increases. The "information overload" problem would make it harder, not easier, to find prices thereby increasing the search costs. Too much information is already a problem on the Internet as users abandon the Usenet because of too much "noise" and some search services such as AltaVista return so many results for a text-string search that it is impossible to examine them all. Also, retailers being searched may choose to block the search agent as described by Crowston (1996) to increase search costs and eliminate Web server congestion. By blocking the search engine's agent, consumers cannot use Internet search engines to find the lowest price. Furthermore, sellers can intentionally complicate their pricing structure to prevent prices from becoming transparent in the face of powerful search technologies. For instance, airlines change their prices an average of five times per day and there are now about 55 million airfares in airline computers.

Some Web sites intentionally intermediate the market without performing a retail function. UVision and Price Watch are case studies outlined by (Crowston 1996) where price and product information can be found at a central site without the consumer having to identify places to shop and searching through their Web sites. UVision operates a Web site called Computer ESP that posts price information for software and hardware for different retailers. The

retailer's responsibility is to give information to UVision and not UVision's responsibility to search out the information. This helps the search intermediary/retailer relationship because information that wants to be posted can be shared. Also, there is a technical benefit because the search load is experience by UVision's server and not that of the retailer. Price Watch (www.pricewatch.com/) operates using a very similar model to UVision's Computer ESP.

While search intermediaries such as Computer ESP and Price Watch may promote pure price competition, there is some anecdotal evidence that consumers do not only focus on prices when making a purchase. The reputation or brand name recognition of an Internet retailer often leads a consumer to choose one retailer over another. Tonny Yu, UVision's president, points out that when Computer ESP lists many retailers selling the same product with very similar prices, consumers perceive that there really is not that much savings to choose the lowest price versus the second lowest price. However, there are some cases where the lowest price does win and there are almost no cases where the highest price gets the attention of the consumer.

One pitfall of the "search intermediary" is the "bait-and-switch" tactic used by some retailers. In a bait-and-switch scam, a retailer will advertise the lowest price on a given good, which brings the consumer into the store. However, when the consumer visits the store expecting to buy the advertised good, they are shown a substitute product at a lower price. For example, an Internet retailer can list their very low price on Computer ESP's Web site and then when the consumer visits the Web site for the product they are interested in, the Internet retailer shows them a different product. The "bait" is the low price but the retailer does not intend to sell at that price. Rather, the price becomes the reason for consumers to enter the store and the switch becomes the mechanism to make money once they are in the store. While the "bait-and-switch" tactic is used quite effectively in Manhattan electronics stores, the sales tactics and persuasiveness of salespeople is less effective on a Web site for reasons such as:

- The consumer's interaction with the Web site is browsing and not a conversation with a persuasive salesperson.
- The salesperson cannot "size-up" the consumer and find their "weak points."
- The consumer only has to press the "back" button on their browser to return to Computer ESP and find another retailer.

The result is that a consumer can get the product they want and not succumb to sales pressure for a substitute product.

More data could be used with the same methodology discussed in Chapter Four to further support the preliminary findings with this exploratory data set. Specifically, a larger data set with more retailers could be used to determine if the retailers selected for analysis in this chapter represent a minority of Internet and/or physical retailers. Sales data could be used along with price data to take weighted averages of prices instead of a uniform weighting approach. Finally, more data over a longer time period could be used to determine if the finds from February and March 1997 were market anomalies and not characteristics of Internet commerce at competitive equilibrium.

Given the strategic pricing Internet retailers have, the next chapter will explore the possibility of Internet retailers of perfect price discrimination. While Internet retailers may be able to do this, there are many policy concerns about price discrimination in practice with regard to its legality and whether or not it reduces social welfare. Chapter Six, the final chapter of this thesis, will address these questions in depth.

5.4.2. Lack of Trust

The differences in prices among Internet retailers can be explained by differences in trust. Some retailers are trusted more by consumers and can, therefore, charge higher prices. The Internet retailers that do not invest in promoting consumer confidence of sometimes sell "lemons" (i.e. poor quality products) are less trustworthy and must charge lower prices. Even though the exploratory data examined homogenous goods, there are trusted elements to the delivery of such good for order fulfillment. A consumer may be willing to pay a higher price if they have confidence that their transaction will be processed.

Consumer uncertainty of trust in the Internet marketplace is a concern to Internet commerce participants. Since the Internet is a network of networks, Internet traffic often traverses networks that neither the sender nor the receiver knows or trusts. This unknown network operator may collect traffic and process it as it passes through their network. In this way, passwords and credit card number can be collected by this external party and compromise the security that consumers need to have commerce. Technology solves some security flaws, but consumer education and proper use of the technology is necessary for fully trusted transactions.

Intermediaries who play trusted roles may help reduce transaction costs associated with trust. CommerceNet, a consortium of larger Internet companies, examines problems with the Internet that may prevent the growth of Internet commerce. Since trust is one of the elements that has been slowing consumer confidence, it is a priority for them. They help create a trusted third party called TRUSTe (www.truste.org) which is also non-profit. Their role is to help promote trust in Internet commerce by certifying the privacy practices of different Web sites including the Web sites of Internet retailers. While they have only played a limited role thus far, perhaps they can help add credibility to the lesser-known Internet retailer Web sites so that consumers may choose the lowest price from a trusted retailer.

5.4.3. Immaturity of Internet Commerce

Prices may also be high because Internet commerce is still very new. Because markets do not reach their long-term equilibrium immediately, there may be a diffusion process where learning and infrastructure development will ultimately lead to lower Internet prices. Beyond the discussion about demographics changing over time as the

Internet grows and diffuses (as discussed in the previous subsection) there is also the possibility that retailers have not yet reached a sufficient sales level to be concerned about their competitors. Rather, these Internet retailers are still trying to satisfy the needs of their existing consumers that they do not have the inclination to respond to competitor actions.

As Internet sales increase, the Internet retailers are able to amortize their fixed costs over a larger volume of sales to achieve economies of scale. The result of economies of scale is a lower average cost for each item sold. The Internet retailer may pass on these lower costs to consumers in the form of lower prices. As the introduction indicates, Internet commerce is very new and growing quite rapidly and is not even close to its projected sales volume. As companies such as Amazon.com invest in software and hardware to reach this growing population, they must pay for the fixed costs of operation and amortize it over a sales volume, which is very small. Once these fixed costs are sunk and sales volume increases, it may be possible to profit from even lower costs. If consumers become more price sensitive, lowering prices may be the only sustainable strategy for Internet retailers.

Alternatively, inefficient producers and those who lack a good understanding of the business may still be participating in Internet commerce even though the economics indicates that they should exit the market.. Indeed, virtually all Internet retailers are currently willing to subsidize losses as they explore this new sales channel. Many Internet companies are developing business plans that they know will be obsolete in only a few weeks or months. While there is great potential for growth, there are also conflicting views on which technologies and Internet services will survive in the long run. Therefore, Internet retailers must be prepared to experiment in competing technologies and strategies. The retailers also do not have firm market research due to a lack of historical data.

5.4.4. Price Discrimination

The Internet consumer may be signaling that they have a higher willingness-to-pay and, in response, the Internet retailers are charging higher prices. Because the current users of the Internet, as described by Hoffman, Novak, and Chatterjee. (1996), are mostly educated, higher income users they may be less price sensitive than the consumers in the general population who shop at physical retailers. Internet retailers, knowing that their consumers are more affluent, are able to charge a higher price because their consumers have self-selected from the average user (Varian 1997). Furthermore, consumers who shop on the Internet may place a premium on the convenience of having goods delivered directly to them, instead of having to visit a physical store.

If demographics, convenience and price discrimination are driving the pricing differentials between Internet and physical retail prices, then the price differentials for the book, CD and software markets will not necessarily be the same. In particular, because virtually all consumers in the software market have computers, and are likely to therefore have demographics similar to those of Internet users in general, it may be more difficult to make inferences

about their willingness-to-pay based on their choice of channel.[63] In other words, software consumers who shop on the Internet do not particularly distinguish themselves from the software consumers who shop at physical retailers. This is less likely to be true for books and CDs. Consistent with this hypothesis, the data in Table 5.1 indicates that the software market has the lowest differential between average Internet retailer and physical store retailer.

Under this hypothesis, the higher Internet prices in the book and CD markets may not be sustainable as more people gain Internet access and the demographics of Internet consumers thus match those of the general population more closely. As technologies such as WebTV and general Internet use grows, the signaling to retailers decreases and the fact that a particular consumer shops on the Internet does not necessarily mean they have a higher willingness-to-pay. The software market may have consumers who are the earliest adopters of Internet commerce and thus reflect the leading edge of pricing.

A fourth hypothesis is a twist on the signaling explanation described above. There is a possibility that the prices posted on the Internet by the retailers with physical stores are not constrained to be the same as the prices they charge to consumers who walk into their stores. As noted above, Shepard's (1991) model of service differentiated competition predicts that firms who sell through multiple channels will, if possible, set lower prices in their low service channel than firms who sell through only one channel. This prediction could explain the finding that prices charged by retailers with physical stores seem to be lower in some markets than prices charged by Internet retailers. Specifically, it may be that the prices that the "physical" stores post on the Internet are lower than the prices they charge to consumers who walk into their stores. However, to apply Shepard's model to the data requires two critical assumptions.

The first assumption is that Internet retailers have market power. In this setting market power could arise through a variety of sources. Brand recognition may give one retailer an advantage over another just as Barnes & Noble's brand name is well know as a physical bookseller. The reputation of an Internet retailer can help increase market power . For example, numerous positive stories about Amazon.com's in the popular press may give them market power. Prior experience may also lead to market power. For example, if a consumer bought from Books-A-Million in the past they may not want to risk dealing with someone else. Market power arising from these sources is more likely in the early stages of Internet commerce where few Internet stores have established brand names, consumers are less aware of the different retailers on the Internet, and consumers may be skeptical of the reliability and reputability of Internet retailers. Thus, the ability of firms who sell through multiple channels to price discriminate may decline over time. Of course, the assumption that Internet retailers have market power is directly contrary to the hypothesis of Bertrand competition on the Internet.

---

[63] Zettelmeyer (1995) describes a variant of this explanation in greater detail, although his model assumes that it is the Internet shoppers who will initially face lower prices.

The second assumption is that, *ceteris paribus*, consumers prefer the "high service" shopping experience of physical stores to the "low service" experience of shopping on the Internet and will therefore pay a premium for it. This is similar to the findings of Shapiro (1983). In this work, Shapiro describes price differences as a result of investment in increasing the quality of the goods to promote a positive reputation with consumers. These preferences could arise because consumers prefer to have access to salespeople who can make recommendations, or because it is easier to compare different products in a physical setting. As Preston (1962; 1963) shows, there can be price competition among retailers but the price does not converge to one price because the retailers have different products targeted as loss leaders.

However, regardless of how the preference for high service arises, it must dominate the increased convenience of shopping for products over the Internet. One could imagine that service would dominate convenience when consumers come to a store to browse for goods rather than when consumers already know what good they want to buy. Thus, markets where consumers frequently browse for goods may experience a larger physical to Internet price differential than markets where consumers do not browse as frequently.

In light of this service differential, it is interesting that some retailers are actively attempting to counter the potential service advantages of physical stores. For example, Amazon.com allows consumers to post reviews of books they have read. Likewise, the Internet retailer Music Boulevard (among others) allows consumers to sample songs from CDs before purchasing. Given that physical retailers profit by maintaining a distinction between "high" and "low" service channels, physical retailers may use the Internet as a service channel to distinguish it from physical channels. Furthermore, retailers that use the Internet exclusively as a service channel may more aggressively attempt to reduce the service distinction between Internet and physical channels to reduce their competitor's higher profits from such a price discrimination strategy. This prediction will be explored more fully through future research and data collection.

It is also possible that prices are different on the Internet because retailers who sell products in both Internet and physical markets have different pricing strategies than retailers who sell products in only one market or the other. Shepard (1991) considers such an environment in her study of the consumer market for self- and full-service gasoline. Her model shows that if consumers differ in their willingness-to-pay for service, retailers who offer both levels of service will engage in discriminatory pricing—setting lower prices in low service markets and higher prices in high service markets than retailers who only offer one service level.

Specifically, Shepard considers a model where consumers have unitary demand and utility functions that are separable in income and consumption. The resulting consumer preferences are given by

$$U = \begin{cases} V(g)(t - p_g) & \text{if the consumer purchases one unit of service level } g \text{ (high or low)} \\ V(0)t & \text{if the consumer does not purchase} \end{cases}$$

where $V(g)$ is consumer utility from purchasing one unit of service level g, $V(0)$ is consumer utility from not purchasing, t is the consumer's normalized income level assumed to vary uniformly on the interval [0,1], and p_g is the normalized price of one unit of service level g. If a retailer sells through only one channel, consumers will purchase if their utility to purchasing at p_g exceeds their utility from not purchasing. The resulting demand is given by

$$D(p_g) = 1 - \frac{V(g)p_g}{V(g) - V(0)}$$

If a retailer sells through both high and low service channels, consumers will purchase service level g if their resulting utility exceeds both what they could get by not purchasing and what they could get by purchasing the other service level. Given that consumers prefer high to low service, the resulting demand for the low service good is given by

$$D_l(p_l, p_h) = \frac{V(h)p_h}{V(h) - V(l)} + \frac{V(l)[V(h) - V(0)]p_l}{[V(h) - V(l)][V(l) - V(0)]}$$

where the subscripts h and l index the high and low service levels respectively.

Retailers who sell through only one channel will set prices to maximize profits from the one channel. For low service retailers the resulting price is given by

$$p_l^{SC} = \underset{SC}{argmax}\ (p_l - c_l)\, D(p_l)$$

where the superscript SC indicates a single channel retailer and c_l is the retailer's marginal cost for low service. Likewise, retailers who sell through both channels will set prices to maximize the sum of profit through both channels. The resulting price for the low service good is given by

$$p_l^{MC} = \underset{MC}{argmax}\ [(p_h - c_h - c_l)\, D_h(p_h, p_l) + (p_l - c_l)\, D_l(p_l, p_h)]$$

where the superscript MC indicates a multiple channel retailer and c_h is the retailer's marginal cost for high service.

Shepard goes on to show that $p_l^{MC} \leq p_l^{SC}$ and $p_h^{MC} \geq p_h^{SC}$ [64]. Shepard confirms these predictions through empirical data on gas station prices which show that retailers who offer both self- and full-service have a $0.04 higher price differential than the differential among retailers who sell only one level of service. In the Internet marketplace, this model corresponds to a situation where retailers have market power (which could be based on brand name or reputation). In this environment, a consumer purchasing books from Barnes & Noble would choose to purchase over the Internet or through a physical store based on their reservation price for service or convenience. Knowing this, Barnes & Noble would price its goods to separate consumers based on these characteristics. The resulting equilibrium would have retailers who sell using both Internet and physical channels setting lower prices on the Internet than stores who sell only through the Internet. The implications of this model for the data are discussed in more detail in the Analysis section.

5.5. Limitations of Exploratory Analysis

The empirical data explored in this chapter is labeled as exploratory because it is too early to tell whether or not the data indicates anomalies of the growing Internet marketplace or conclusions which will exist for the foreseeable future. Therefore, this section will investigate the limitations of the methodology and the data to explain its limitations and suggest how future studies may be improved.

The assumptions presented in Chapter Four may indicate why Bertrand competition is not a suitable model to analyze price competition in Internet commerce. *A1*: Internet retailers choose prices as demonstrated by the results reported in Sections 5.2 and 5.3. However, firms may simultaneously decide how many products they wish to sell because of the number items in their warehouse, for example. *A2*: Books, CDs, and software may not be homogenous products. While the product is the same physical item, there are other elements in the transaction related to customer service and complementary products which may make a product that appears to be homogeneous and make it differentiable. *A3*: Consumers do care about the Internet retailer they purchase from. Internet retailers are able to go beyond the aggregation and pricing roles to take on search and trust roles to differentiate themselves from their competitors and give consumers greater value. *A4*: Internet retailers may not be big enough to supplier the entire demand for a given good. Because they may have limited quantities of the item in their warehouse, for example, they cannot meet the quantity for the entire demand.

The two assumptions related to Internet commerce and its relationship to physical commerce must also be reexamined. *A5*: Internet retailers may have higher marginal costs for the items they sell. Even though the Internet retailers do not have to pay for multiple physical locations, they may not yet be large enough to negotiate a price discount with the suppliers to reduce their marginal cost below the physical retailers' marginal cost. *A6*: The data

[64] These inequalities will be strict if c_l and c_h result in nonnegative equilibrium quantities demanded.

collected off the Internet may not adequately reflect the price in the physical store of the retailers. Since the methodology described in Chapter Four only uses the Internet for price data collection, the physical retailers may use the Internet to sell products at a different price. Further research may incorporate data collection from physical stores from a wider geographic area.

The exploratory data set is limited in scope and size so it is difficult to draw conclusions. Even though there are over 30,000+ data points used in the exploratory data, there is a bias introduced in selecting titles, retailers, and time periods that may be eliminated by future research. The relative immaturity of the Internet marketplace is one reason why there were only limited choices of retailers to select from. However, future research should expand the set of retailers because augmenting the size of the retailers will likely increase the robustness and highlight Internet retailers who may be outliers. The large set of titles in the exploratory data may be too many for future research. The same conclusions in this thesis may have been found with a smaller set of carefully selected titles instead of a relatively large number (approximately 100) of titles. The mix of popular and obscure titles is important to determine the effect of loss-leader products, but obscure titles should be selected in a more random manner than was done for this thesis. Finally, the iteration of weekly observations in early 1997 were important because of the exogenous forces shaping the Internet marketplace (i.e. the entry of Barnes & Noble) but are not necessary when there is no exogenous force. Monthly observations suited most of the analysis.

Overall, the benefit of the methodology and empirical analysis is to determine how to measure friction in Internet commerce. While the data is only exploratory, and the methodology can be improved, by testing the propositions future researchers may learn from this work. Hindsight can help improve the methodology and data collection. Furthermore, new areas of research are opened up. For example, the ability to strategically price and change prices dynamically begs the question of whether or not Internet price discrimination is likely. This question is addressed in the next chapter.

6. INTERNET PRICE DISCRIMINATION

This chapter will explore technical, economic, and public policy issues regarding Internet price discrimination by expanding upon Chapter Five, which showed that Internet retailers can use pricing strategies and are not subject to pure price competition in the Internet marketplace. Specifically, this chapter will address the issue of what public policy concerns there are if an Internet retailer can set a price specific to an individual consumer.

The Internet may reduce market friction but strategic pricing is sill evident. As the data in Chapter Five shows, Internet retailers do not have price competition to the point where price is the only attribute that differentiates one Internet retailer from another. Higher prices and a wider spread of prices show that a reduction of market friction with the introduction of the Internet does not ensure consumers will reap all the benefits. The Internet retailers have set themselves up as differentiating their service in order to extract more consumer surplus and give consumers an incentive to develop a relationship with them. The relationship can be used to a retailer's advantage because consumers prefer transacting with someone they know and trust rather than someone they do not know. The extra cost in developing a relationship with a new retailer or searching for the lowest price is not worth the price advantage.

This chapter shows that in many cases, consumers can develop a strategy to counteract price discrimination, but there are some cases, which may require government intervention. This conclusion is the result of the three sections that follow. Section 6.1 describes why Internet price discrimination is attractive to Internet retailers and how it can be implemented. Section 6.2 describes both the strategy used by Internet retailers and the consumer who may transact in an unregulated environment. Finally, Section 6.3 describes what policies the government should adopt, if any, to ensure that price competition does not erode the competitive nature of the Internet marketplace. The analysis uses the foundations of economic analysis of regulation described by Kahn (1988) and Viscusi, Vernon, and Harrington (1997) to analyze public policy with respect to Internet price discrimination. The chapter concludes with three policy recommendations:

- No regulation or self-regulation of pricing policies is most consistent with the culture of the Internet and is therefore the most likely to be accepted by Internet consumers and retailers.
- The Federal Trade Commission is the most appropriate U.S. agency to monitor Internet pricing practices and intervene when necessary.

- The global scope of Internet commerce requires coordination and cooperation internationally with organizations such as the World Trade Organization.

Each of these policy recommendations will be discussed in detail in Section 6.3.

6.1. The Threat of Internet Price Discrimination

The empirical data in Chapter Five shows that Internet retailers can set prices to differentiate themselves from their competitors. Amazon.com lowered its prices to match the lower prices of Barnes & Noble—the market entrant. However, Books.com did not follow Amazon.com's lead. In early 1998, Books.com adopted a price discrimination pricing strategy whereby different Internet shoppers paid different prices for the same good depending upon their shopping behavior. While this is price discrimination in a relatively simple form, the threat of more complicated price discrimination strategies may shift some of the benefits of Internet commerce from consumers to retailers.

Books.com is able to use its Web site design to separate their price-sensitive consumers from other consumers and charge different prices for the same good. After a consumer shopping at the Books.com Web site searches for a book and determines the price, there is a button on the Web page labeled "compare prices." By clicking on this button, a query is made by the Books.com server to determine the price for the same book sold at Amazon.com's and Barnes & Noble's Web sites. If Books.com does not have the lowest price, it will automatically lower the price *for the consumer who compares prices only.* For example, a consumer who shopped the Books.com Web site on April 8, 1998 may have selected the book Singing in the Comeback Choir for $17.41 (which is a 30% saving off the list price). If the consumer compared prices by clicking on the appropriate button, they would see a new Web client window indicating the prices for the same book sold at Amazon.com ($17.47) and Barnes & Noble ($14.97). Since the Barnes & Noble price is below the Books.com price, there is a note on this Web page which states, "We're lowering our price to beat Barnes & Noble!" By clicking on the button labeled "Click here to see our new lower price!", the consumer sees a Web page identical to the one with the $17.41 price tag, however the price is now $14.67. If this same consumer returns some time later to the Books.com Web site, the price would return to $17.41 unless the consumer compared prices again.

The dynamically rendered pricing example at Books.com may seem benign or even beneficial to consumers at first. However, Internet retailers may use complex consumer information along with shopping behavior to go beyond a binary separation of consumers into those who compare prices and those who do not. The ability of computers to store and process large amounts of information may make other forms of price discrimination possible and very profitable for Internet retailers.

This section describes why Internet retailers may choose to price discriminate and how they can develop the technology to approach first degree price discrimination. Underpinning this discussion is a description of the

economic effect price discrimination has on consumer and producer surplus. How price discrimination may work and what tools retailers and consumers have to aid or hinder price discrimination is described. The final section then assesses how price discrimination may help or hurt retailers and consumers.

6.1.1. Price Discrimination as a Profit-Maximizing Strategy

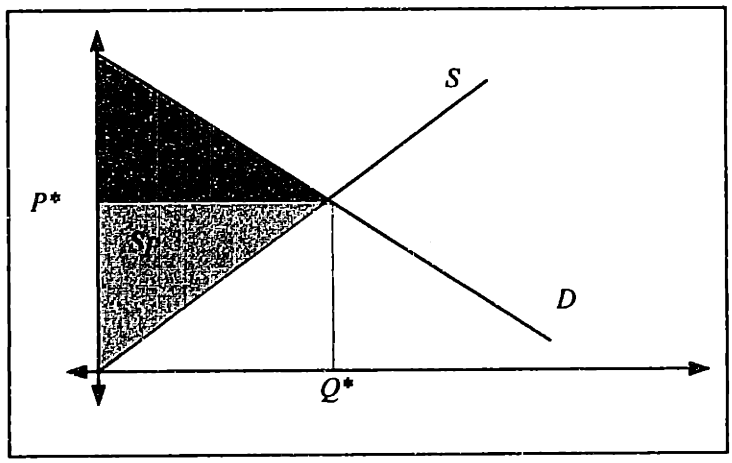
Price discrimination is the charging of different prices for the same product or service to different consumers (Varian 1989). There are three degrees of price discrimination. The first degree is perfect price discrimination, where the price is exactly equal to the consumer's reservation price (the maximum price a consumer is willing to pay) of the consumer. Second degree price discrimination is based on consumer behavior—this includes non-linear pricing.[65] Third degree price discrimination is based on setting different prices for different groups of consumers. The distinction between second and third degree price discrimination may be difficult to discern because the implementation of price discrimination may appear to be both second and third degree price discrimination. For example, some types of airline travelers pay less than others, but it is unclear if the airlines are separating different groups of consumers (third degree price discrimination) or are the airlines are charging different prices based on behavior (second degree).

The reason why a retailer finds price discrimination an attractive pricing strategy is because they can garner higher profits without increasing their costs. From the consumer's perspective, they would prefer paying a lower price even though they may be willing to pay a higher price (their maximum price they are willing to pay is their reservation price). The difference in what they are willing to pay and what they actually pay is called their consumer surplus. The difference in what the retailer is willing to sell at and what the actual price they charge is called the producer surplus. Price discrimination moves some of the consumer surplus to producer surplus.

The shift from consumer surplus to producer surplus is shown graphically in Figure 6.1. The market is in competitive equilibrium where the demand and supply curve meet. This is where the price for the good is P^* and the quantity sold is Q^*. Consumer surplus is shown by the triangle labeled S_C which represents the total benefit to consumers who were willing to pay more for the good but only paid P^*. Similarly, the producer surplus is shown as the triangle S_P which represents the total benefit to producers who sold at a price above what they were willing to sell at. When price discrimination occurs, the price producers charge is no longer P^* for all consumers, but varies from consumer to consumer. First degree price discrimination would have the price equal to the consumer's reservation price. The effect would be to enlarge the producer surplus from S_P to $S_P + S_C$.

[65] For a detailed description of non-linear pricing, see Wilson (1992).

Figure 6.1: Producer and Consumer Surplus



Second and third degree price discrimination do not shift as much consumer surplus to producer surplus as does first-degree price discrimination. By separating consumers into groups or distinguishing them based upon their behavior, the producer hopes to make more profits than at the competitive equilibrium. The price they charge an individual consumer is then greater than P^* but may be less than the consumer's reservation price. By adopting such a strategy the producer surplus shifts to S_P to $S_P + \delta$ (s.t. $\delta > 0$) which is less than $S_P + S_C$.

The success of price discrimination as a strategy is dependent on the nature of the product. When products are unique to the exchange between supplier and consumer (i.e. they have a higher degree of asset specificity), it is more likely that price discrimination can be used because the product features and price are negotiated. The products investigated in Chapter Five were homogenous with low asset specificity and broad appeal. Therefore, it is unlikely that first degree price discrimination would be evident. Because the Internet may become a tool for mass-customized products and custom-tailored information, the products and services become highly asset specific. The movement from "mass marketing" where consumers demand general-purpose products to the specifically tailored to an individual ("mass customized" products) is described by Pine, Peppers, and Rogers (1995). The Internet may increase the importance of suppliers positioning their products and services in "marketspace" because of the large number of competitors in a global scope as described by Rayport and Sviokla (1994). Therefore, it is unlikely that the price discrimination tools that are described above will apply to the book, compact disc, and software markets analyzed in Chapter Five, price discrimination may be more likely in news clipping services, collaborative filtering, and other customized Internet markets. These are cases when the product (and not just the process and players) increase how electronic the Internet commerce is (Choi, Stahl, and Whinston 1997).

The example of Books.com's price discrimination strategy does not shift all consumer surplus to producer surplus as first degree price discrimination would. However, retailers using the Internet as a medium for commerce may gather larger amounts of information about their consumers so that they may better estimate the consumer's reservation price. Furthermore, the computing power of the Internet retailer's Web server can be used for complex algorithms

to determine prices and approach first degree price discrimination. The next subsection discusses the details of a price discrimination strategy that Internet retailers could use to shift more consumer surplus to producer surplus.

6.1.2. Implementing Internet Price Discrimination

This subsection will describe how Internet retailers can use Internet tools to set prices with such sophistication that they approach first degree price discrimination. While no Internet retailer is currently doing so, Internet retailers could implement such a system in the future as they focus less on market share and more on profitability. Furthermore, as the size of Internet commerce grows, Internet retailers will have more information about consumers that they can leverage to dynamically set prices.

The Internet may reduce menu costs which makes Internet price discrimination feasible. As was discussed in Chapter Two, menu costs are the economic costs of changing prices or "printing menus" which contain the prices for the items you carry.[66] As the creation of "menus" becomes electronic, the only cost associated with changing this price is the marginal cost of someone entering in a new number. To the extent that the price is determined by an algorithm which can change costs in an automated environment, the short-run marginal menu cost may be zero. This is different from the physical marketplace where there is evidence that menu costs are not insignificant. It is unlikely that the menu costs associated with Internet commerce are as high as the $0.52 per price change menu cost in supermarkets (Levy, et al. 1997). As the data in Chapter Five indicated, prices may change more frequently for Internet retailers because menu costs decrease.

To identify a consumer and determine a price, retailers must have information about a consumer. This information can be purchased from marketing firms, passed among Internet servers, or collected within the confines of a consumer/retailer relationship. This chapter only looks at information specific to a consumer/retailer relationship because it is the most likely scenario. Marketing information can help if the information can be correlated with the consumer. This is not easy because consumer identifiers such as Internet Protocol addresses often change because they may be dynamically allocated. Information exchanged among Internet servers is more likely if some protocols—such as network protocols to reserve bandwidth—are widely adopted, but sharing information among Internet service providers (ISPs) may reduce an ISP's competitive advantage. If two retailers share information about their consumers, they may both compromise their competitive position. The most widely used tool for consumer information in use with Internet commerce today is tracking the information exchange between consumer and retailer.

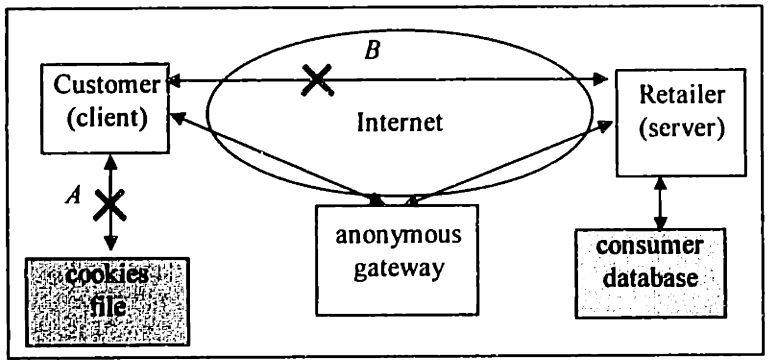
---

[66] Sheshinski and Weiss (1993) describe how menu costs affect the setting of prices and often explain the non-optimal prices in an economy.

There is an emerging market for consumer information on the Internet. Sites such as CyberGold (www.cybergold.com) pay consumers to reveal personal information by answering survey questions. Other sites such as Firefly (www.firefly.com) use collaborative filtering technology to help consumers search for product features. While Firefly does not sell consumer information at the granularity of an individual user, they are able to command higher prices for advertising to groups of users with predefined demographics. Firefly can charge two or three times the going rate for banner advertisements because they can help advertisers target specific groups of consumers. While neither example is price discrimination per se, both examples indicate that the Internet marketplace values information about consumers.

The consumer-retailer information can be collected and stored in a number of ways. Figure 6.2 shows the two most likely places that this consumer tracking information may be stored: in a cookies file at the consumer site (i.e., in the consumer's computer) or in a consumer database at the retailer site. The cookies file is a "writable" file for the retailer on the consumer's client machine. Any information can be stored there and the same retailer can retrieve that information at some time in the future. Information stored at the retailer site involves tracking user's Internet Protocol (IP) addresses or requiring consumers to identify themselves when they access the server. The IP approach has the problem of dynamically allocated IP addresses described above. Having a consumer identify themselves with a username and possibly a password is cumbersome and may make an Internet user suspicious of the retailer's intention for collecting such information. However, retailers may be able to convince some consumers to oblige if the retailer offers consumers membership "discounts" or a user-interface designed to fit the consumer's preferences. Web server software has been developed to customize Web pages after a consumer has been identified.[67]

Figure 6.2: Mechanisms for Consumer Profiling



The price with consumer information may be higher or lower than the price with no consumer information. If the information indicates a higher reservation price, then the price discrimination algorithm can increase the price. For example, a consumer that often selects hardcover over paperback books when both are available is a good candidate

[67] An example of such a software package is the Web software developed by Broadvision

for higher prices. Conversely, a consumer who returns to the Internet shop examining the same title week after week looking for a reduction in price is a likely candidate for a price discount.

A consumer can try to prevent information collection about their behavior by one of two methods. The consumer can prevent the server from writing to their cookies file. This block is seen as point "*A*" in Figure 6.2. The default setting for Web browser client software is for the cookies privileges to be enabled. The user must disable cookies if they so desire. However, even if a consumer blocks the cookies write command by the server, it is not the only place to keep records of behavior and transactions.

The consumer database on the retailer's site can also collect consumer information. The consumer's strategy to prevent collection of information on their behavior can be done by using an anonymous gateway shown in Figure 6.2. In effect, the consumer is preventing direct communication from the client to the server through the Internet. This is shown as blocking communication channel "*B*" in Figure 6.2. With the current Internet, some Internet users use anonymous gateways to send email without disclosing their identity but use of anonymous gateways to prevent price discrimination is not used. This is mostly due to the fact that price discrimination is not used. However, if Internet retailers start using price discrimination more widely, the anonymous gateways may become more popular.

Full identity hiding to prevent consumer information is not always possible. If a consumer orders a physical product, which requires shipping, then the consumer reveals their identity when they give their shipping information. Payment can also reveal information about the user. Once the user reveals their credit or debit card information, they reveal their name, which can be correlated with past history.[68] From the consumer's perspective, it is important to reveal this information after the price has been negotiated and not before. Also, keeping one's identity private but paying for a product is one of the advantages of electronic cash transactions. With such micropayment systems, the identity of the user can remain anonymous because the cash is fungible.

Just because price discrimination practices and price discrimination in the Internet marketplace can be done, there is no certainty that it will be done. From the retailer's perspective, the marginal cost of price discrimination is likely to be small and the benefits may be large. Therefore, it would seem logical to price discriminate. However, there may be competitive pressures and consumer satisfaction reasons why price discrimination is unlikely even without regulation. The next section will explore when price discrimination is and is not a likely outcome for Internet retailers in a competitive market.

[68] Use of digital forms of money or electronic cash may enable consumer to preserve a level of anonymity, but also exposes consumers, retailers, and governments to new risks. Further discussion of these issues is however beyond the scope of this thesis. See Reagle (1996) and Sun (1997) for further exploration of some of these issues raised by Internet commerce.

6.2. Consumer Actions in an Unregulated Environment

This section explores how consumers can avoid first degree price discrimination by Internet retailers without any regulation. Four possible mechanisms are explored: price competition, consumer strategies, reputation, and intermediation. Each mechanism prevents a total shift of consumer surplus to producer surplus. While each mechanism can be used independently, combination of these mechanisms may give consumers even greater assurance that they are not being taken advantage of.

Price discrimination when there is price competition is not sustainable. Because price discrimination requires market power to set a price, it may not be possible to charge higher prices when consumers can choose another retailer. In the Bertrand competition model (a game theory model of perfect price competition) the competitors must sell at the market equilibrium price or else they will have zero sales for that product. In many markets that Internet commerce currently supports—such as books, compact discs, and software—different retailers carry the same product and compete on price. While this is not perfect price competition as Chapter Five shows, prices noticeably higher than competitor's prices may encourage the consumer to switch retailers. If competition were driving pricing strategies of Internet retailers, dynamic pricing on the Internet could be an advantage for consumers. For example, Books.com may automatically lower the price to beat their competitors regardless of how a consumer behaves while shopping at their Web site.

Consumers may develop a strategy that, while not perfect, would result in them being treated as an "average consumer" would be treated. This strategy counteracts a retailer's price discrimination strategy. Examples of this are described in the previous section where the consumer uses an anonymous gateway to create a virtual identity to remain anonymous. With no information about the consumer,[69] the retailer can only set a price for an average consumer (most likely P^* from Figure 6.1). Similarly, the retailer also has their choice of strategies once it knows what the strategy of the consumer is.

If the retailer uses the consumer information to help the consumer find the product they are looking, the consumer may be willing to pay for this benefit. For example, the retailer could help the consumer search large volumes of information about product features and then help them choose the product most appropriate. After revealing information, the retailer's best strategy would be to price discriminate this consumer. It is possible (although not in the interest of the consumer if they are trying to maximize their welfare) that the consumer may allow themselves to be price discriminated if they find this search and matching service worthwhile. A more price conscious consumer

[69] The consumer may also convey misinformation about himself or herself to the retailer hoping that such information will lead to a price discount. For example, the consumer may reveal himself or herself as a student to a price discriminating retailer because they know students get discounts.

may search for features at one retailer and then visit another retailer anonymously to purchase the product because their identity and behavior has not been revealed.

Retailers may not want to price discriminate because they can harm their reputation in the marketplace. When a retailer and consumers have repeated transactions, the retailer would not only be interested in immediate payoffs, but payoffs in the future as well. If consumers discerned the retailer's price discrimination strategy, the retailer may lose its ability to attract sales because of damage to their reputation. Because Internet commerce is expected to grow and Internet retailers place a large emphasis on growing market share and brand recognition, the negative impact of being labeled a "greedy" price discriminator may be enough to deter some retailers from practicing such a tactic.

The impact of a reduction in reputation is lost sales. Consumers with repeated transactions have options available to them to ensure they are less likely to be subjected to price discrimination. If the consumer perceives that retailers are taking advantage of them, the consumer can exit that relationship to shop and transact with a different retailer. If the initial retailer promoted some loyalty with the consumer, the consumer may choose to voice their concern over the retailer's practice of price discrimination. Hirschman (1970) introduced analysis of exit, voice, and loyalty in markets. In fact, the Internet may help promote the importance of consumer loyalty and voice in markets. As the speed of communication accelerates and the response to changes in the market become almost instantaneous with the Internet, consumers can shape a retailer's pricing policy and see the impact quickly. Consumer feedback, if internalized by the supplier or intermediary and acted upon, can help suppliers be more competitive with their product offerings and consumers benefit when a product better suits their needs.

Finally, market intermediaries can help ensure that price discrimination does not shift consumer surplus to producer surplus. Intermediaries that allow for low cost search on product features and price can increase the amount of price competition and therefore keep prices in check. The introduction of a search intermediary in the software market described in Chapter Five (UVision) partially explains why the software market has more price competition than the book or compact disc markets. If software retailers started to price discriminate and the price of a product increased, UVision could help a consumer search for lower prices at different retailers. Intermediaries who take on the role of trust and risk management can help consumers feel confident that the retailer is not going to take advantage of them. For example, TRUSTe (www.truste.org) promotes consumer confidence by certifying that some Web sites do not share consumer information for marketing purposes.

While there are many ways to ensure price discrimination does not erode consumer welfare for Internet commerce, none of them may work in practice. Therefore, Internet price discrimination becomes a public policy question of whether or not the government should get involved in monitoring, and possibly regulating, corporate pricing practices on the Internet. While this is a complex policy and political problem, the next section of this chapter explores the viability of self-regulation, U.S., and International policies to ensure fair Internet commerce transactions.

6.3. Public Policy, the Internet, and Price Discrimination

This section explores public policy with respect to Internet commerce developments. The policy papers developed by the U.S. (Clinton and Gore 1997), European (CEC 1997), and Japanese (MITI 1997) governments currently support no or few restrictions on Internet commerce to promote growth. However, none of the three documents addresses the questions of price discrimination introduced in this chapter. Therefore, this section explores the feasibility of regulating price discrimination practices of Internet retailers, and addresses the difficult question of who should regulate. Furthermore, the question of regulating price discrimination practices on the Internet is part of a larger question of communications policy that Garcia (1995) argues should not be examined compartmentally. [70]

Promoting electronic commerce is a high priority for many developed nations. The United States (Clinton and Gore 1997), European (CEC 1997), and Japanese (MITI 1997) governments all issued policy papers in 1997 that encourage electronic commerce development in their jurisdictions. While the reports differ on some issues such as taxation, the reports are mostly similar–they all indicate their government's intentions to promote global electronic commerce with minimal regulation.

The United States, as a leader in Internet commerce development, recommends that the government should have a limited regulatory role as detailed by the "Magaziner Report" (Clinton and Gore 1997). Much of the report describes why the government should not get involved. For example, the report discusses how electronic commerce should have no new taxes and promote the Internet as a "duty-free" zone. There are some statements in the report indicating how trusted transactions are important for electronic commerce. For example, the report describes why it is important for Internet commerce to "maintain privacy and the integrity of personal information" but does not indicate how this should be done. The normative sections of the document for government intervention suggest a limited government role. Self-regulation is noted as preferred to government regulation. When government does get involved, the report suggests partnering with industry. Two positive actions the government should take related to electronic commerce protection in a global environment. One is the protection of intellectual property in a global economy. The other is to create a "Uniform Commercial Code" for electronic commerce.

The report by the European Union (CEC 1997) is very similar to the Magaziner Report. The EU report also describes the need for international cooperation and how governments should avoid new regulations that may hinder the development of electronic commerce. The EU report is slightly more normative by promoting some new

---

[70] The Internet is proving to be a tremendous funding opportunity for the U.S. government research and education agencies but a headache for telecommunications regulation. As Werbach (1997) explains, the existing policies of the Federal Communication Commission are difficult to apply to the Internet because the Internet is fundamentally different than traditional communication medium with regard to technology and market structure.

policies. Specifically, the EU report describes the need for telecommunications liberalization to ensure greater access to the tools necessary to conduct electronic commerce. Furthermore, the report promotes a "Single Market" framework for global electronic commerce whereby electronic commerce can have globally uniform policies. While the specifics of the framework are not detailed, the document suggests a more proactive role for governments to coordinate globally to promote trust in electronic markets.

The Japanese report (MITI 1997) on electronic commerce is the most descriptive (least normative) of the three documents. The document does not promote a particular policy specifically, but it does indicate the current thinking of the Japanese government with respect to electronic commerce. The report describes the close collaboration of government and industry to develop testbeds and conduct studies for electronic commerce. This is not surprising because the document comes from the Ministry of International Trade and Industry that has a history of close and proactive collaboration with the private sector. While the report indicates the Japanese government is still in the early stages of developing policies with respect to electronic commerce, they do describe U.S. and European initiatives indicating their recognition that electronic commerce is a global initiative that may require international cooperation.

6.3.1. Self-Regulation of Internet Price Discrimination

While the Internet has some degree of government intervention, this intervention is kept to a minimum. This government intervention comes in many forms. For example, users access the Internet through regulated telephone lines or pass traffic through government-funded Internet resources. However, most of the Internet is decentralized and coordinated through the use of competitive markets as described by Gillett and Kapor (1997). Those resources that are unique and require centralized control, such as the domain name system, have recently come under the scrutiny of Internet users as being monopolistic. The heterogeneous and decentralized nature of the Internet and criticism of centralized authority defines much of the Internet culture.

To protect the minimal government intervention culture of the Internet, businesses conducting commerce on the Internet are selecting to govern themselves rather than be subject to government regulation. For example, the CommerceNet consortium of companies is working to grow the Internet as a medium for market transactions even though its members compete with one another. By working together, the Internet commerce participants hope to avoid standardization difficulties and conflicts that may require costly lawsuits or government regulation.

Mechanisms to protect consumers and promote trust in Internet commerce are already being developed in a self-regulatory manner. TRUSTe, a non-profit organization developed by the CommerceNet consortium, reviews the privacy policies and practices of Internet Web sites to add their seal of approval. In many ways, they are similar to the Good Housekeeping seal found on some products or the Underwriters Laboratories seal found on electrical appliances. When a consumer sees the TRUSTe seal on a Web site, they are more likely to trust that Web site.

TRUSTe has come under the scrutiny of the Federal Trade Commission (FTC) because it only certifies that the policies and practices are consistent and does not hold the Web sites they certify up to a particular standard.[71] However, even the FTC has commended TRUSTe in their initiatives to be a self-regulating body to protect consumers.

While TRUSTe has not identified price discrimination as an important element of their mission, they are in an excellent position to extend their current role to start certifying the pricing policies and practices of Internet retailers. Similar to the way TRUSTe already certifies Web sites, they could ask Internet retailers to articulate their pricing policy which could be as simple as a statement of whether or not they price discriminate. Then, TRUSTe could examine the practices of that Internet retailer to make sure they are telling the truth. TRUSTe could then give their "no price discrimination" seal of approval to Internet retailers such as Amazon.com or Barnes & Noble. Books.com would have a different seal reading "price discrimination" so consumers know the pricing practice of their Internet retailer.

The ability for mechanisms other than government intervention to thwart the threat of Internet price discrimination has potential. They are consistent with Internet culture and do not have the cumbersome bureaucratic delays that often slow down the public policy making process. Furthermore, the technology of Internet commerce and Internet price discrimination is changing rapidly and the practitioners are in a better position than government regulators to monitor the technology changes. *No regulation or self-regulation of pricing policies is most consistent with the culture of the Internet and therefore the most likely to be accepted by Internet consumers and retailers.* Further exploration of these issues, and the Microsoft case in particular is beyond the scope of this thesis.

6.3.2. U.S. Federal Policy

The U.S. federal government's three branches are at the root of all public policy. The government protects consumer transactions ex ante through lawsuits and a priori through market regulation. Currently, much of the current U.S. public policy debate concerning Internet commerce relates to taxation. This subsection will explore the taxation question briefly, and then focus on Internet price discrimination specifically.

Even though the Magaziner report suggests a "duty-free" Internet, the foundation on which this policy stands is not solid. Many states have bonded together to assert their jurisdiction over Internet commerce and, therefore, claim that existing tax laws apply (Fox 1997). For example, Texas claims that any Web server conducting commerce that is physically located within Texas is subject to state taxes. Furthermore, The American Governor's Association is

[71] The Land's End Web site lists the TRUSTe logo to let their consumers know that their use of consumer information is consistent with their stated policy. However, Land's End does not promise that they will not sell consumer information. The shortcomings of TRUSTe's practices do not mean that it will fail altogether. The approach of self-regulation shows promise and something analogous may be needed.

backing a plan that will allow states to determine whether or not they will allow Internet commerce taxation.[72] However, much of commerce is termed as interstate commerce and, therefore, under federal jurisdiction and requires coordination among states (McLure 1997). Meanwhile, at the time of this thesis' writing, there are bills in both the House of Representatives and the Senate to give the U.S. federal government jurisdiction over Internet commerce. While the resulting Internet tax policy has yet to be determined, there is much at stake for the coffers of both state and federal governments as well as the future growth of Internet commerce.

With the focus of state, national, and international public policy with regard to the Internet on taxation, the question of price discrimination has yet to be considered by policy makers.[73] There is a policy question of whether or not such a price discrimination strategy by a retailer is legal under existing laws. If price discrimination tools are used to exercise or to create a monopoly or to be anti-competitive, then price discrimination is not legal (Armstrong and Vickers 1993). There are also other instances where price discrimination may be seen as a threat to consumers.

The beginning of consumer protection came under the presidential leadership of U.S. President Woodrow Wilson. The Federal Trade Commission Act (which created the Federal Trade Commission) was established around the same time as the Clayton Anti-Trust Act. According to Dahl (1976) the passing of such a bill was possible because President Wilson was very effective in gaining congressional support for his domestic policies. The Federal Trade Commission (FTC) is an executive branch agency whose budget is approved by the Congress. The President appoints senior level posts within the Commission. The Commission can be sued by private interests and have to defend themselves in front of the Supreme Court.

Since the creation of the FTC, the commission has changed to adapt to a changing marketplace. The FTC and the Department of Justice often work together on issues related to antitrust. While their jurisdictions often overlap, the FTC is more concerned with protection of consumers through regulation of business practices while the Department of Justice is more concerned with the industrial structure of markets leading to monopolization. The current Department of Justice's investigation of Microsoft, for example, is an instance where the FTC is involved because of the trading practices of Microsoft, but the Department of Justice has the lead role because of the monopoly nature of Microsoft in the operating systems market. The FTC is currently involved with many fraud and privacy issues regarding Internet commerce and direct marketing using the Internet.[74] While they have not directly addressed the

---

[72] Not all states support state taxation of Internet commerce. For example, Governor Celluci of Massachusetts is in favor of the Cox-Wyden Bill in U.S. Congress that would make Internet taxation of federal, not a state, issue. Furthermore, some states have allowed Internet service providers to operate without collecting state taxes from their subscribers to help promote Internet growth. Massachusetts is one such state.

[73] The recently filed Microsoft antitrust case brought by the U.S. Department of Justice and twenty state attorney generals (see New York Times, May 18, 1998) could be considered to be based partly on Microsoft's, and Internet companies' generally, practice of producer price discrimination. For example, it is common that Internet software goods are given away to consumers to induce the purchase of related products and services.

[74] The FTC's main web site (www.ftc.gov) contains many of the FTC's policy papers on Internet commerce and direct marketing practices.

question of Internet commerce price discrimination, they have taken steps to educate Internet consumers about potential privacy problems and fraudulent businesses on the Internet. The FTC has even set up their own Web site (www.consumer.gov) to convey this information to Internet consumers. In this way, the FTC is acting as a market intermediary that takes on the role of promoting trust in Internet commerce. While the FTC's education initiative is laudable, as sharing information among consumers and retailers can help slow down price discrimination, but it will not prevent price discrimination. While the FTC has done little more than investigate Internet consumer information sharing, TRUSTe has been very involved ensuring consumer information will be protected. The FTC's Bureau of Economics and Bureau of Competition are leery at best about the effectiveness of TRUSTe to self-regulate the marketplace and protect consumers. Therefore, these two bureaus are positioned to intervene if consumer privacy protection fails.

The Clayton Act gives the FTC authority to prevent price discrimination in cases where the intent of price discrimination is to be anti-competitive. According to Pindyck & Rubinfeld (1992, p. 375), the Clayton Act of 1914 "prohibits price discrimination unless it is 'affirmatively justified' (e.g. leads to lower cost)." . In 1936, Section 2 of the Clayton Act was amended by the Robinson-Patman Act (U.S. Congress 1936) that details how price discrimination to act anti-competitively is not legal. While proof of price discrimination practices is necessary, it is not a sufficient condition to show that a company such as Books.com is in violation of being anti-competitive. [75] Therefore, it is unlikely that Internet retailers who implement price discrimination could be subject to a suit by the FTC because consumers have a choice of many Internet retailers. It is difficult for any one retailer to stifle competition by adopting a price discrimination strategy. Furthermore, an ex post lawsuit may not be enough to promote trust in Internet commerce and it is often difficult to prove intent to monopolize such as is alleged in the Department of Justice's case against Microsoft.

The relevant question is whether or not Internet commerce is similar to commerce via the mail and, therefore, bound by the Racketeering Influenced and Corrupt Organizations (RICO) Act. RICO makes fraudulent or misrepresented businesses illegal including those conducted by the mail system. Within RICO, it is important for the price discrimination cases not to be isolated, but for the firm to have a history of price discrimination with a possible intent to harm. This was the basis for argument in the Katzman v. Victoria's Secret Catalogue (1996) case. In this case, Katzman received a catalog from Victoria's Secret with a discount that was different than the discount her male colleague at work received. Katzman tried to prove that Victoria's Secret was price discriminating based on gender. Even though the plaintiff lost this case (and also lost the appeal), the interest in the pricing practices caught

---

[75] An example of a Robinson-Patman case of where price discrimination was an indication of anti-competitive behavior is the National Association of College Bookstores, Inc. v. Cambridge University Press, et al. (1997). In this case, major book publishers gave "unjustified quantity discounts" and "secret discounts" to retailers affiliated with the National Association of College Bookstores. The FTC argued that their actions would provide incentives for bookstores to exit from the association and thereby reduce the bargaining power of the association. This is anti-competitive and a violation of the Robinson-Patman Act (www.ftc.gov/os/9609/d9217let.htm).

the attention of the Federal Trade Commission. In an out-of-court settlement, the Federal Trade Commission was able to act on behalf of consumers by stopping the price discrimination practices of Victoria's Secret.

The FTC combines the ability to understand the necessities of commerce such as consumer rights and marketing practices. By launching their Internet consumer education Web site, the FTC is already positioned as the leading U.S. agency to address Internet commerce issues. This experience along with their expertise of price discrimination issues to protect consumers makes them the natural choice to address Internet price discrimination in the marketplace and intervene when the self-regulating entities such as TRUSTe fail. The thesis therefore concludes that *the Federal Trade Commission is the most appropriate U.S. agency to monitor Internet pricing practices and intervene when necessary.*

6.3.3. International Efforts to Monitor Internet Price Discrimination

Public policy makers such as the FTC should examine and monitor the competitive forces and self-regulation of the Internet marketplace and coordinate their actions internationally. Because of jurisdictional questions, the FTC may not be the policy maker with the authority to protect some groups of consumers. The Internet retailer and/or the Internet consumer may not be conducting commerce in the United States so it becomes unclear whether or not the FTC has any jurisdiction. Already, Internet gambling sites have emerged outside the U.S., beyond the jurisdiction of the U.S. government, even though these Web sites target U.S. consumers. Because the Internet has a global scope, the FTC is just one of many international government bodies that has jurisdiction over commerce regulation. In international cases, it is important for the FTC to cooperate with foreign governments to protect consumers both at home and abroad. Domestically, the Department of State, and the National Telecommunications and Information Administration (NTIA) of the Department of Commerce, may have the legal authority to represent U.S. citizens internationally. For example, the work of the OECD (1997a; 1997b; and 1998) acknowledges the authority of such U.S. agencies to represent U.S. interests in international fora.

An international approach to Internet price discrimination is consistent with the policy papers from the U.S. (Clinton and Gore 1997), European Union (CEC 1997), and Japan (MITI 1997). As exemplified by the discussion in Chapter Three, the Internet's global scope hopes to make new market opportunities possible by leveraging this global scope. Therefore the U.S. must work with international bodies such as the World Trade Organization to ensure that there are consistent regulations about Internet price discrimination such that consumers globally are protected.

Policy documents authored by the U.S. government regarding electronic commerce should have input from the FTC. If the U.S. supports a "tax-free" environment for commerce transactions, Internet retailers may get the impression that this means "lawless." This may result in price discrimination policies by Internet retailers that then need to be undone through FTC lawsuits. By incorporating concerns about Internet price discrimination in current policy papers, the U.S. can send the right signal to consumers and retailers in the U.S. and abroad: unfair price

discrimination in Internet commerce will not be tolerated. The Magaziner Report was created with the input of the FTC.

When the U.S. forms Internet policy in an international environment, the benefit may be U.S. industry players. Since the U.S. has the lead in many Internet-related products such as computer software and hardware, it is in the best interest of the U.S. to export products to areas where the Internet market is less mature. By collaborating and cooperating with foreign governments and international organizations to lower trade barriers, U.S. industry may benefit. A more detailed exploration of the global dimensions of electronic commerce regulation is beyond the scope of this thesis.

To conclude, the Internet is still a small influence in the global marketplace but it is growing quickly. The policy papers of developed nations emphasize the need to coordinate actions globally. Even though these papers do not specify Internet price discrimination, it is a natural outgrowth of the issues the papers raise. U.S. monitoring and self-regulation should have input and coordinate globally on Internet price discrimination policies. Therefore, a *global scope of Internet commerce requires coordination and cooperation internationally with organizations such as the World Trade Organization.*

7. CONCLUSION

This chapter concludes this thesis by summarizing the thesis findings and discussing areas for further research. The motivation, hypothesis development, and thesis insights are summarized in Section 7.1. Section 7.2 describes the relevance of these findings in developing business strategies in Internet commerce and how the strategies may change in the dynamic Internet market. Finally, Section 7.3 describes further research that could build on this thesis.

7.1. Thesis Findings

This thesis began by exploring the hypothesis that the Internet will reduce the market friction of physical market transactions. The introduction of information technology has changed the cost of transacting. The Internet, because it promotes interoperability, may reduce transaction costs inherent in exchanges between suppliers and consumers. In physical markets with friction, intermediaries help reduce the transaction costs otherwise borne by the supplier and/or consumer. However, if the Internet can sufficiently reduce transaction costs, suppliers may choose to transact directly and not through an intermediary. This thesis specifically examines the aggregation and pricing roles of intermediaries to determine if their value in reducing transaction costs is diminished with the introduction of the Internet.

The thesis describes four roles of intermediaries and how the roles of intermediaries may change with the introduction of the Internet. The thesis explores the existing literature on intermediaries in markets to describe how intermediaries are in a position to lower the costs of transacting. A comprehensive search of the literature indicated four intermediary roles: aggregation, pricing, search, and trust. The intermediary roles of aggregation and pricing are important on the Internet and hypothesized why they may be the only roles for Internet retailers selling homogenous goods. Internet search tools may enable consumers and suppliers to find information more easily so the search role of intermediaries in the Internet is diminished or eliminated. The trust role is important, but may not be an issue in markets where the product is homogenous. Homogenous product markets are the markets currently being explored by Internet retailers.

The thesis then developed testable hypotheses and a methodology to determine if Internet commerce has less friction than physical markets. If the Internet reduces market friction in a static environment, than intermediaries selling

homogenous goods may enter a Bertrand competition model. In the Bertrand model, Internet retailers are unable to command higher prices than their physical counterparts because consumers can more easily find the lowest price. The dispersion of prices among Internet retailers should be less than the price dispersion among physical retailers because of Bertrand competition. Finally, as long as the product is homogenous, the product and market characteristics should not influence lower prices and less price dispersion on the Internet. If the Internet has less friction in the dynamic attributes of the market, then prices should move quickly to a competitive equilibrium when the market is perturbed. This thesis develops testable hypothesis and a methodology to test these hypotheses using price data for products sold by Internet and physical retailers. These testable hypotheses are mathematically presented using parametric and nonparametric analysis, and a formulation of heterogeneous consumer preferences. Finally, a mechanism to gather data price data using Internet technology is presented.

The thesis examines an exploratory data set using the methodology presented in this thesis. The exploratory data set consists of more than 30,000 observations for the book, compact disc, and software markets collected from February 1997 to January 1998. The data supports one of the four testable hypotheses. The exploratory data does not support the three hypotheses that result from Bertrand competition. The data does not show that prices are lower or that there is less price dispersion for Internet retailers relative to physical retailers. Furthermore, the results are not consistent among the book, compact disc, and software markets analyzed. The software market comes closest to a market with more price competition perhaps because it is a more mature market than books and compact discs. However, the exploratory data does show that prices change more often on the Internet. This result may stem from lower costs of changing prices—menu costs.

This thesis uses a case study of competition between Amazon.com and Barnes & Noble in the Internet book market. The analysis shows that competition among major players in the Internet marketplace may not affect the whole market. The entry of Barnes & Noble in the Internet book retail market changed the pricing strategy of the major incumbent, Amazon.com. However, no other retailer in the exploratory data set responded to this entry. Many of them maintained their pricing strategy that existed before Barnes & Noble entered the market. However, one of them, Books.com, did decide to use a price discrimination strategy.

The thesis proposes four possible explanations for the empirical findings: high search costs, lack of trust, immaturity of Internet commerce, and price discrimination. The ability of Internet retailers to maintain prices different than their competitors indicates that pricing strategy is an important element of Internet commerce. These findings substantiate the conclusion that conclusion that the role of intermediaries participating in Internet commerce will not vanish, since they provide value to consumers and suppliers. Intermediaries can extend their aggregation and pricing to search and trust roles even when they sell homogenous products. Internet commerce is not yet mature enough for it to be evident whether or not it will have less friction than physical commerce in the long run. At this time, Bertrand competition does not characterize competition on the Internet. The exploratory

empirical findings reported in this thesis indicate that there are higher prices and a larger dispersion of prices on the Internet.

Charging different prices for the same product sold to different consumers (i.e. price discrimination) is a strategy that may simultaneously be adopted by Internet retailers and gain the attention of policy makers. Using consumer information, Internet retailers can single out the buying behavior or preference of consumers to set a unique price. For example, Books.com uses a price discrimination strategy to offer their price sensitive consumers a more competitive price than consumers who do not compare prices. The availability of increased consumer information coupled with the reduced menu costs to change prices enables dynamically rendered prices. If price discrimination decreases consumers' net benefit and increases the profitability of Internet retailers dramatically, market forces and regulation may be appropriate mechanisms to combat price discrimination. Market forces such as reputation effects and consumer strategies may hold price discrimination policies at bay. However, failure of market forces may lead to regulation. While many forms of regulation are possible, self-regulation of the industry through non-profit organizations may be most palatable for Internet commerce participants and most consistent with Internet culture. Failure of self-regulation may be the impetus for the Federal Trade Commission in conjunction with international players to intervene.

7.2. Internet Strategy in a Dynamic Marketplace

Businesses must decide whether the Internet is a threat to their current business model or an opportunity to expand their vision. The reasons for intermediaries to participate in Internet commerce are many. Since Internet commerce is growing quickly, even a small market share today may translate into a multimillion-dollar business in a few years if Internet commerce projections are accurate. This explains why some companies, such as Amazon.com, continue to lose money but are happy with their growth in revenue and stock price (Amazon.com 1997). It is unclear how long companies can continue to sacrifice profitability to gain market share, but of course increasing corporate losses are not indefinitely sustainable.

Evidence of a differentiation of prices indicates different strategies by Internet retailers even for homogenous products. Companies such as Amazon.com and Barnes & Noble may compete for the same consumers, but they have different marketing practices and offer consumers different services. As this thesis indicates, differentiation can explain price differences among Internet retailers and the price surcharge of Internet retailers relative to physical retailers. The differentiating characteristics relate directly to the strategy of individual Internet retailers. While Internet strategy is in its nascent stage, there are some strategies already being used. Internet retailers in the book, compact disc, and software markets are using strategic pricing as part of their competitive strategy. If they only were aggregation and pricing intermediaries, and if transaction costs were minimal, these retailers would compete only on price. The fact that price differentials among Internet retailers exist is evidence to refute initial hypothesis

of this thesis. In practice, it has been shown that Internet retailers are able to set a price other than the price of their competitor.

Internet retailers are taking advantage of the reduced dynamic friction of Internet commerce to change their prices more often. Because of a possible reduction in menu costs, Internet retailers can respond to changes in the marketplace more often and more quickly. Since no data was found to support the hypothesis of pure price competition described above, the Internet retailers may not be changing their prices to the same price as their competitor. Rather, Internet retailers can chose prices to develop such pricing strategies as loss leaders and price discrimination. The loss leader strategy discounts some products greatly so that a consumer is drawn into a store, but their other purchases help make up the minimal profit made on the loss leader product. Third-degree price discrimination may help some Internet retailers such as Books.com compete with their larger rivals, however Internet retailers may find that they are the target of public scrutiny if they attempt first-degree price discrimination. For example, Microsoft might argue in their antitrust case that they are simply following a time-honored practice of offering consumers products that serve as loss leaders.

An intermediary on the Internet can use their roles of search and trust for differentiation. Even when intermediaries are coordinating markets for homogenous goods, Internet retailers often have different prices for the same good. This indicates that retailers do more than the two intermediary roles of aggregation and pricing. Trust is another intermediary role that an Internet retailer can use to differentiate themselves from their competitors. Since Internet commerce involves a person-to-computer interaction, it is important for the consumer to reduce the uncertainty of this transaction by trusting the intermediary. Search is the fourth and final intermediary role identified by this thesis that Internet retailers can use to differentiate themselves. Consumers may be overwhelmed with product features and price information because the Internet and the Web helps make large amounts of information available. Therefore, intermediaries can help search by customizing information to individual consumers.

Developing long-term Internet strategy is difficult because Internet technology is changing and the number of Web users is growing. Therefore, this thesis has only begun to explore the beginnings of a growing economy. It is important to remember that the data is exploratory and the findings are preliminary. As Internet commerce reaches maturity, it is likely that both retailers and consumers will become more educated and experienced with Internet commerce transactions. Some of the findings may be indicative of the nascent stage of Internet commerce or the experimentation strategies of Internet retailers. Only future research can definitively answer the question of whether or not Internet commerce reduces the friction of physical market transactions.

7.3. Further Research

This thesis has explored the theory and developed a methodology for analysis that can be applied to future research. Chapter Four can be used as a methodology to analyze price data in other Internet markets, for different retailers,

different titles, and for a different time period. In fact, the exploratory data should be compared with such analyses to increase the robustness of the insights.

The data in this thesis opens up new opportunities for further data analysis. While the data does not support some of the hypotheses developed in Chapter Four, this may have been only a limitation of the snapshot in time that the data was collected. More data collection using more retailers and titles can give greater insight into the questions of how this data is indicative of Internet commerce in the future or an aberration of the present. Most importantly, data collection that increases the time window examined can give insight into the progression of changes that characterize Internet commerce development.

A more complex methodology can examine game theory models other than Bertrand competition to determine which model best describes competition on the Internet which may vary by market. The data collection can be expanded beyond the U.S. to examine international competition among Internet retailers. Correlation of data gathered on the Internet can be merged with data from physical markets to determine how geographic price discrimination changes as Internet retailers compete with local physical stores.

Since Internet commerce is not as frictionless as expected, new hypotheses can be developed to augment the four hypotheses presented in Chapter Four. For example, retailers may be split into three categories (not two): physical-only presence, Internet-only presence, and dual physical and Internet presence. The retailers who have a dual strategy can price discriminate just as the gasoline stations in Shepard's (1993) analysis who had a dual strategy (i.e. they sold both full- and self-service gasoline) were able to charge more for the convenience of full-service. Other data may be merged with price data to do a regression analysis of the quality factors which influence price. For example, a regression analysis could try to answer the questions of how an Internet retailer can charge more for a homogeneous product if the retailer takes on the roles of search and/or trust. An econometric analysis could correlate the independent variables of differentiation with the dependent variable of price. Finally, survey and interview data could help compliment the price data to do a more qualitative assessment of Internet strategy.

This thesis brings an empirical methodology and analysis to an area of academic theory and market speculation. The introduction of the Internet, an interoperable infrastructure that is a foundation for heterogeneous applications and markets, provides some of the first evidence of friction in electronic markets. The growing number of transactions the Internet supports is indicative of the dynamic nature of Internet commerce. While this thesis develops tools necessary to understand the nature of friction in electronic markets, the exploratory data indicates that the theory must be reexamined to take into consideration the complex and heterogeneous nature of Internet commerce. Even though the data analyzed in this thesis is exploratory, the results indicate that Internet commerce may not be as frictionless as previously thought and may require new theory development. Therefore, the development of an Internet strategy by Internet retailers is an important part of deciding how they can coordinate markets to reduce transaction costs.

APPENDIX A. FEBRUARY/MARCH 1997 DATA ANALYSIS

This Appendix will list the details of the data gathered in February and March of 1997 for Chapter Five of this thesis. The raw data is not published here because of its enormity. However, the aggregated statistical data and the core variables are outlined here. As described in Chapter Five, the price for a given a title, time, and retailer consists of an observation. The following table lists the values of these variables for the February/March 1997 data.

February/March 1997 Variable Values

Variable	*Definition*	*February/March 1997*
i	the title	1, 2, 3, ... 338
r	the retailer	1, 2, 3, ... 48
t	the time period	1, 2, 3, ... 8
P_{irt}	the observed price[76]	

Not all possible title, retailer, and time period combinations result in an observation. The total number of combinations given the variable values listed in the table above would result in 129,792 observations (338 titles x 48 retailers x 8 time periods). Many combinations are not possible because the retailers specialize in one of the three markets this data set covers: books, compact discs, and software. Given this split, the maximum total number of observations would be 6,048 in the book market (126 titles x 6 retailers x 8 time periods), 6,048 in the compact disc market (108 titles x 7 retailers x 8 time periods), and 29,120 in the software market (104 titles x 35 retailers x 8 time periods). The actual number of observations are listed in the following table.

Number of February/March 1997 Observations

Market	*Observations*
books	5,085
compact discs	5,672
software	13,032
TOTAL	23,789

[76] This is the price without tax, shipping costs, or membership discounts.

The titles examined in each market are described in the following three tables. Approximately half of the titles in each table are considered "more popular" while the other half are "less popular." The general measure of popularity is different for each market. New York Times bestsellers are the measure of popularity for the book market. The Billboard top 50 are used to distinguish popular music titles. The software market is the most difficult market to find popular titles, but a combination of PC Week Magazine rankings and popular titles listed on Internet retailers' Web sites were used to select approximately half of the titles listed. The reasoning behind the mix of popular and less popular titles is to choose a scope representative of sales.

Books' Number and Name

i	*Name*	*i*	*Name*	*i*	*Name*
1	24 Hours in Cyberspace	43	Mindhunter	85	What Works on Wall Street
2	A Civil Action	44	Moonlight Becomes You	86	Where Wizards Stay Up Late
3	Absolute Power	45	My Gal Sunday	87	Woe Is I
4	Against the Gods	46	Netspy	88	A Reporter's Life
5	American Tragedy	47	Neuromancer	89	A Secret Affair
6	At Home in the Universe	48	Only the Paranoid Survive	90	Airframe
7	Born to Rebel	49	PC Roadkill	91	Angela's Ashes: A Memoir
8	Chance	50	Primary Colors	92	Behind the Oval Office
9	Chicken Soup for the Woman's Soul	51	Programming Perl 5	93	Blood and Honor
10	Climbing Mount Improbable	52	Rapid Development	94	Christmas Box
11	Contagion	53	Reviving Ophelia	95	Cindy Crawford's Basic Face
12	Creating Great Web Graphics	54	Rush Limbaugh Is a Big Fat Idiot	96	Conversations with God
13	Creating Killer Web Sites	55	Searching for Memory	97	Deep Waters
14	Crossing the Chasm	56	Silent Night	98	Down in the Garden: Book of Days
15	Dave Barry in Cyberspace	57	Sleepers	99	Drums of Autumn
16	Designing Web Graphics	58	Slouching Towards Gomorrah	100	Everyone is Entitled to My Opinion
17	Desperation	59	Song of Solomon	101	Falling Up
18	Dogbert's Top Secret Management Handbook	60	Sudden Prey	102	Forever Erma
19	Don't Block the Blessings : Revelations of a Lifetime	61	The 3rd Twin	103	Hornet's Nest
20	Ender's Game	62	The Celestine Prophecy	104	I'm Not Really Here
21	Enter the Zone	63	The Deep End of the Ocean	105	Living Faith
22	Executive Orders	64	The Dilbert Principle	106	Mastering the Zone
23	Extraordinary Popular Delusions & the Madness of Crowds	65	The English Patient : A Screenplay	107	My Sergei: A Love Story
24	Fugitive from the Cubicle Police	66	The Fourth Estate	108	My Story
25	Full House	67	The Horse Whisperer : A Novel	109	Remember When
26	Get a Life	68	The Laws of Our Fathers	110	Silent Honor
27	Hidden Order	69	The Liars' Club : A Memoir	111	Silent Witness
28	High Tide in Tucson	70	The Lost World : A Novel	112	Simple Abundance: A Daybook
29	History Laid Bare	71	The Notebook	113	Star Trek First Contact
30	Holy Fire : A Novel	72	The Pinball Effect	114	Strong Women Stay Young
31	How Good Do We Have to Be?	73	The Regulators	115	The Arthritis Cure
32	How Stella Got Her Groove Back	74	The Rules	116	The Clinic
33	I was Amelia Earhart	75	The Runaway Jury	117	The Fallen Man
34	Idoru	76	The Soul's Code	118	The Gift of Peace
35	Intensity	77	The Stars My Destination	119	The Path to Love
36	It's a Magical World	78	The Tailor of Panama	120	The Simple Abundance Journal
37	Longitude	79	The Tenth Insight	122	The Unlikely Spy
38	M Is for Malice	80	The Visual Display of Quantitative Information	123	This Year it Will be Different
39	Make the Connection	81	The Web	124	Total Control
40	Malice	82	The Yellow Admiral	125	Trunk Music
41	Martha Stuart's Better Than You at Entertaining	83	Undaunted Courage	126	Vendetta: Lucky's Revenge
42	Men Are from Mars, Women Are from Venus	84	Virus of the Mind		

Compact Discs' Number and Name

i	*Name*	*i*	*Name*	*i*	*Name*
127	"112"	163	Family Scriptures	199	Recovering the Satellites
128	"311"	164	Fashion Nugget	200	Remember
129	(What's the Story) Morning Glory?	165	From the Muddy Banks of the Wishkah	201	Romeo & Juliet
130	A Place in the World	166	Garbage	202	Seasoned Veteran
131	Aenima	167	Get on up and Dance	203	Secrets
132	All Eyez on Me	168	Gettin It	204	Set it Off
133	All World	169	Ginuwine...The Bachelor	205	Sheryl Crow
134	Among My Swan	170	High School High	206	Siempre Selena
135	Another Level	171	Home Again	207	Sixteen Stone
136	Anthology 3	172	II	208	So So Def Bass All-Stars
137	Antichrist Superstar	173	Ironman	209	Stardust
138	Anuthatantrum	174	It Was Written	210	Sublime
139	Atliens (clean version)	175	Jagged Little Pill	211	Ten Thousand Angels
140	Az Yet	176	Jock Jams Vol. 1	212	Tha Hall of Game
141	Baja Sessions	177	Jock Jams Vol. 2	213	That Thing you Do!
142	Banana Wind	178	Just the Same	214	The Day
143	Beavis and But-Head Do America	179	Keith Sweat	215	The Don Killuminati: The 7 Day Theory
144	Best of Volume I	180	Legal Drug Money	216	The Greatest Hits
145	Billy Breathes	181	Let's Get the Mood Right	217	The Greatest Hits Collection
146	Blue	182	Life is Peachy	218	The Moment
147	Blue Clear Sky	183	Load	219	The Score
148	Borderline	184	Love Songs	220	The Woman in Me
149	Bow Down	185	Maxwell's Urban Hang Suite	221	This is the Time -- The Christmas Album
150	Bringing Down the Horse	186	Me Against the World	222	Tidal
151	Crank it Up	187	Mellon Collie and the Infinite Sadness	223	To the Faithful Departed
152	Crash	188	Mr. Happy Go Lucky	224	Tragic Kingdom
153	Da Storm	189	MTV Party to Go volume 10	225	Trial by Fire
154	Dance into the Light	190	New Adventures in Hi-Fi	226	Unplugged
155	Daydream	191	New Beginning	227	What I do the Best
156	Did I Shave my Legs for This?	192	No Code	228	What if it's You
157	Down on the Upside	193	Now in a Minute	229	Whatcha Lookin'
158	E. 1999 Eternal	194	One in a Million	230	Your Secret Love
159	Everything I Love	195	Picture This	231	The Preacher's Wife
160	Evil Empire	196	Piece of Mind	232	Evita
161	Fairweather Johnson	197	Pieces of You	233	Space Jam
162	Falling Into You	198	Pinkerton	234	Razorblade Suitcase

Software Titles' Number, Name, and Operating System

i	*Name*	*O/S*	*i*	*Name*	*O/S*	*i*	*Name*	*O/S*
235	"1-2-3"	W	294	Office Professional 7	W	277	Kai's Power Tools 3.0	W
236	Acrobat v3.0	M	295	OS/2 Warp Server	W	278	Kai's Power Tools 3.0	M
237	Acrobat v3.0	W	296	PageMaker 6.5	M	279	Keyview v5.1	W
238	ACT!	W	297	PageMaker 6.5	W	280	Kiplinger TaxCut 1996 Filing	W
239	AltaVista Search My Computer	W	298	PageMill v2.0	M	281	Kiplinger TaxCut 1996 Filing	M
240	Approach 96	W	299	Painter 4.0	W	282	Macintax Deluxe 96	M
241	ASAP WordPower v1.95	W	300	Painter 4.0	M	283	MechWarrior 2	95
242	cc:Mail	W	301	PC-cillin v2.0	W	284	MechWarrior 2	M
243	Civilization 2	W	302	pcAnywhere 7.5	W	285	Money	W
244	Clean Sweep 95 v2.0.3	95	303	Photoshop 4.0	W	286	Myst	W
245	CorelDraw 7	W	304	Photoshop 4.0	M	315	Rebel Assault II	W
246	Director 5.0	W	305	Plus!	W	316	Rebel Assault II	M
247	Director 5.0	M	306	Print House	M	317	ScreenCam 97	W
248	Easy-CD Pro v1.2	95	307	Print House and Photo House	W	318	SmartSuite v4.0 upgrade	W
249	ECCO Pro v3.0	W	308	QuarkXPress 3.32	M	319	Soft W	M
250	Emissary Desktop 2.0	W	309	QuarkXPress 3.32	W	320	Strata Studio Pro v2.0	M
251	Encarta 96	W	310	Quick View Plus v4.0	W	321	TurboTax Deluxe 96 Federal	W
252	Eudora Pro Upgrade to v.3.0	W	311	Quicken 7.0	M	322	Uninstaller v4.0	W
253	Eudora Pro Upgrade to v.3.0	M	312	Quicken 8.0	W	323	Virus Scan Deluxe v2.0	W
254	Eudora Pro v3.0	W	313	Quicken ExpensAble 2.0		324	Visio 4.0	W
255	Eudora Pro v3.0	M	314	RAM Doubler v2.0	M	325	Visual Basic v4.0	W
256	Excel 97	W	263	Freehand 7	M	326	Warcraft II - Tides of Darkness	W
257	Extra Personal Client 6.1	W	264	Freelance Graphics 96	W	327	Warcraft II - Tides of Darkness	M
258	FileMaker Pro v3.0	M	265	FrontPage 97	95	328	95	W
259	FileMaker Pro v3.0	W	266	Goldmine	W	329	95 Full Service Pack	W
260	First Aid 97	W	267	GroupWise v5.0	W	330	95 Upgrade	W
261	First Aid 97 Deluxe	W	268	Home Publisher Deluxe	M	331	W NT Server (20 client)	W
262	Freehand 7	W	269	HotPage v1.0	W	332	W NT Workstation	W
287	Myst	M	270	Imagestream	W	333	WinFax Pro	W
288	Navigator 3.0	W	271	Infini-D 3.1	M	334	Word 6.01	M
289	Navigator 3.0	M	272	Infini-D 3.5	95	335	Word 97	W
290	Norton Anti-Virus v2.0	W	273	Internet FastFind	W	336	WordPerfect Suite 7 Upgrade	W
291	Notes v4.5	W	274	Internet Phone Release 4		337	Works 4.0 w/Apple Internet	M
292	Office 97	W	275	Internet Sidekick	W	338	Works 4.0 w/Spry Navigator	W
293	Office Professional 7	W	276	IntranetWare	W			

Operating System (O/S) Key: Windows (W), Windows 95 (95), and Macintosh (M)

The retailers in this data collection are listed in the following two tables. A more comprehensive analysis of the retailers is found in Appendix C. The selection of the retailers in the following two tables is important to the price data collected. The physical retailers chosen often had Web sites that posted price information, which roughly corresponds, to the prices found in their physical stores. While these physical retailers have an Internet presence through their Web site, the sales volume on their site is small relative to the sales generated in their physical retail locations. Both the Internet and physical retailers in the following two tables were chosen because they sold a majority of the titles listed in the previous three tables. Smaller, niche-market physical and Internet retailers were excluded from this study because of this criterion.

Book and CD Retailers

r	*Book Retailer*	*r*	*CD Retailer*
1	Amazon.com	7	AB CD's
2	Barnes & Noble	8	CD Banzai
3	Books.com	9	CD Universe
4	Books-A-Million	10	CD World
5	Crown Books	11	E-Music
6	Wordsworth	12	Music Boulevard
		13	Newbury Comics

Software Retailers

r	*Software Retailer*	*r*	*Software Retailer*
14	ABACUS America	32	Midwest Computer (MC) WORKS
15	Bottom Line Distribution	33	NECX
16	Calico Software	34	OMNA Digital
17	CompSource	35	PC Universe
18	Compulink Electronics	36	PCs Compleat
19	Computer Bay	37	Prism Business Products
20	Computer Discount Warehouse	38	Provantage Corp.
21	Computer Express	39	RCSNet
22	Computer Market Place Express	40	Software.Net
23	Computer Quick	41	Sparco Communications
24	Egghead	42	State Street Discount
25	Elek-Tek	43	Systems Unlimited
26	Essential Data	44	Tenet Computer Group
27	First Source International	45	TruCost
28	Global Computing	46	Unicom-Sales
29	Iler Networking and Computing	47	Vektron International
30	Internet Software Outlet	48	Virtual Computer Super Store
31	Internet Shopping Network		

During the February and March 1997 period, weekly observations were made. It was not evident how often the observation process should cycle, so one week was chosen because it would probably collect to many (and not too few) observations. Therefore, a week was chosen to be conservative. The actual date the observations were taken are described in the following table.

Date Numbers and Corresponding Values for February/March 1997 Data

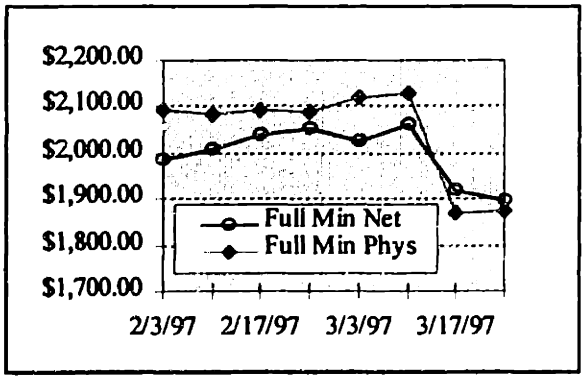
t	*Date*
1	February 3, 1997
2	February 10, 1997
3	February 17, 1997
4	February 24, 1997
5	March 3, 1997
6	March 10, 1997
7	March 17, 1997
8	March 24, 1997

Now that the appendix has outlined the variables that describe the scope of the data collection, the remainder of the appendix will report on the analysis of these variables at a lower level of granularity than is found in Chapter Five.

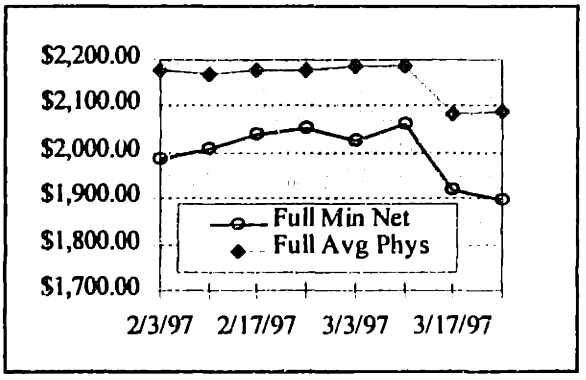
The analysis of these observations follows in the remainder of this appendix.The analysis using the Heuristics from Chapter 4 are used to show minimum and average prices for the full and common market baskets of goods in the three markets (Books, CDs, and Software). The data analysis that follows examines how the different consumers would benefit given their different heuristics. In the data presented, it is assumed that when a title is not available, the consumer can order the title at the list price. In other words, when the value of P or P' is null for a given i, t, then the list price is used. This assumption is relaxed when examining the common market basket of titles and not the full market basket. When determining the price for a common market basket, only titles that have a price point for both Internet and physical retailers over all time periods are used. Because this is the intersection of the data, there is some data thrown out to generate the common market basket data. However, as the following data shows, examining the common or full market basket does not significantly affect the results to any great extent.

Books (Full Market Basket)

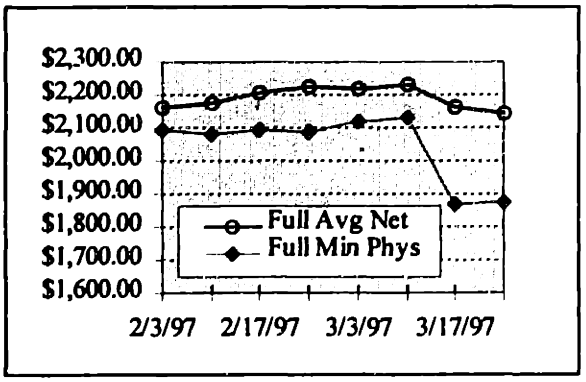
Heuristic 1



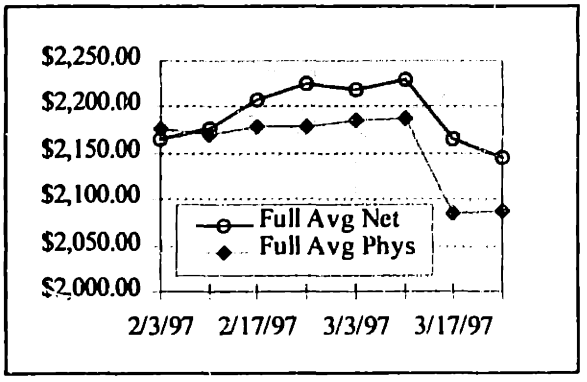
Heuristic 2



Heuristic 3



Heuristic 4

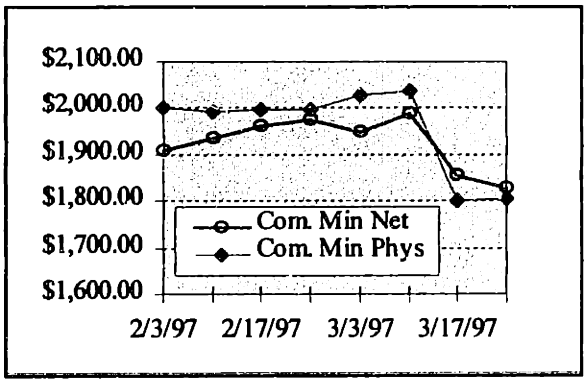


Consumers with Heuristic 1 who can find the lowest price from retailers in both the physical and Internet book markets, benefit more from buying from the Internet. When Barnes & Noble entered the Internet marketplace, the physical stores begin to do better (but not by much). Perhaps the most interesting result is that the entry of Barnes & Noble has lowered prices of both Internet and physical retailers.

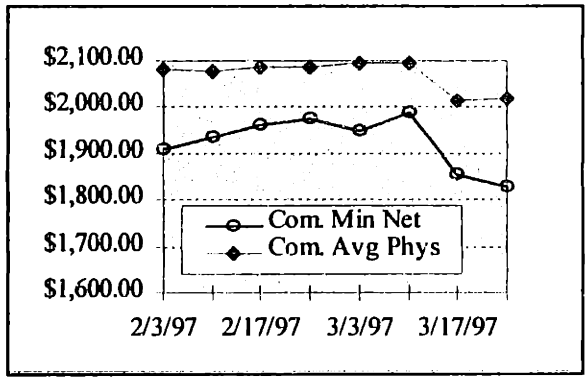
Consumers with Heuristic 2 who is an expert with the Internet technology but does not have many choices in the physical market saves even more money by shopping on the Internet. Once again, the entry of Barnes & Noble has made an impact on the savings as is clear from the graph above. The savings this consumer has increases over time.

Books (Common Market Basket)

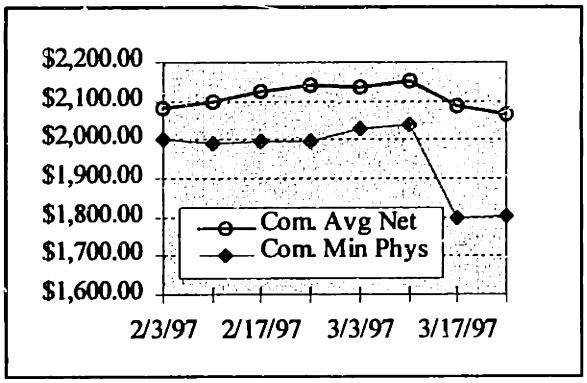
Heuristic 1



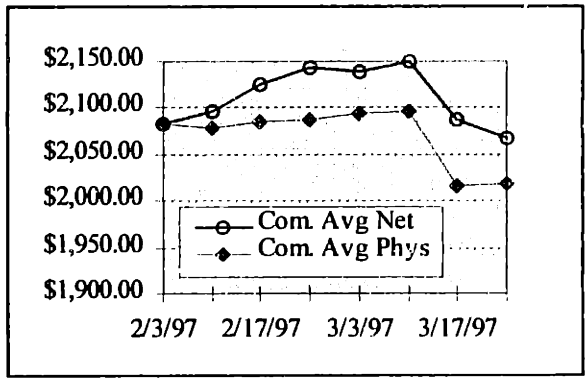
Heuristic 2



Heuristic 3



Heuristic 4

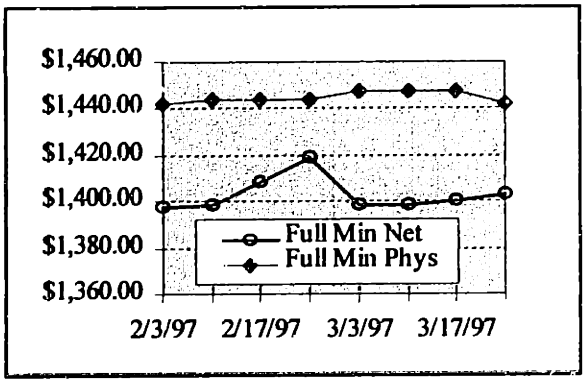


A consumer with Heuristic 3 lives in a physical marketplace that is competitive so it is easy for them to find the lowest prices. For example, the consumer may live in Harvard Square where many bookstores are within a short walking distance of one another. However, this consumer has poor Internet skills. Therefore, they can expect to find a lower price for the bundle of books in the physical marketplace as these graphs show.. Barnes & Noble's entry into the Internet marketplace has had little impact on the average price because only one Internet retailer, Amazon.com, responded to the entry.

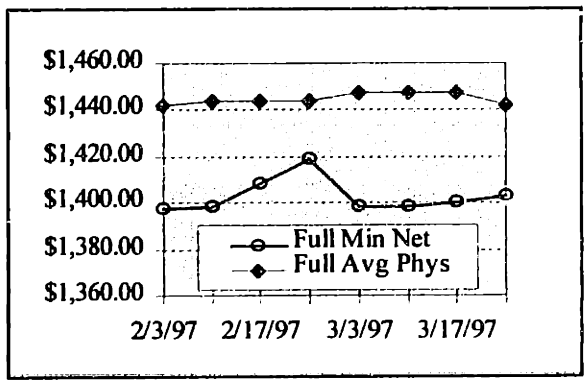
Finally, consumers with Heuristic 4 who can expect to pay the average price in both the physical and Internet markets will do better in the physical market. This Internet novice has the largest incentive to learn how to use the Internet better for price comparison shopping or using a search intermediary to find the lowest price. If they do, they can start using Heuristic 2, which would save them money by shopping on the Internet. If they continue to stay a novice, they are better off shopping in their local physical store than they are buying through the Internet.

Compact Discs (Full Market Basket)

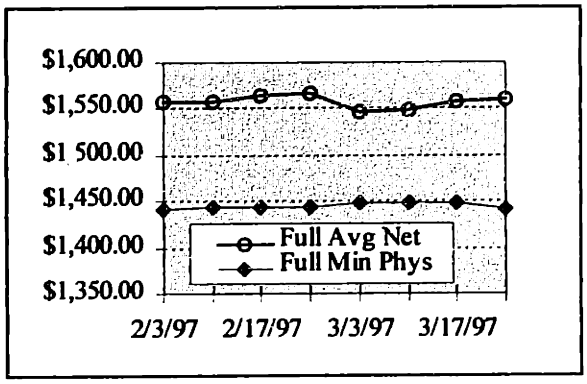
Heuristic 1



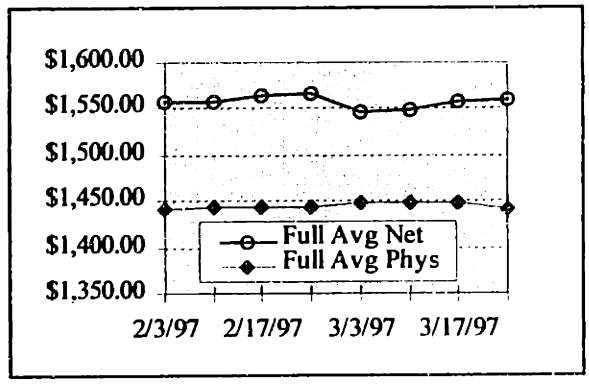
Heuristic 2



Heuristic 3



Heuristic 4

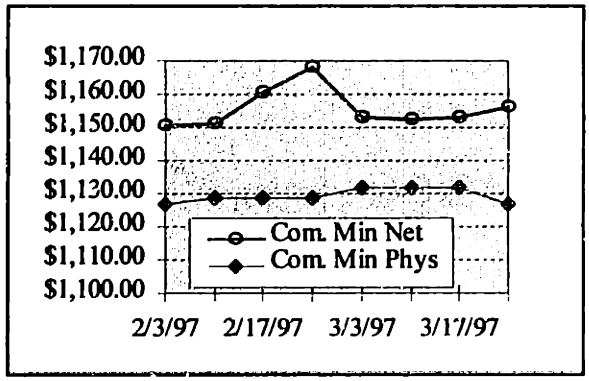


The compact disc (CD) market is also one of the early markets on the Internet but a duopoly similar to the Amazon.com and Barnes & Noble duopoly of the book market do not dominate the CD market. However, the CD market is similar to the book market since different consumers can expect to pay different prices depending on their choices in the Internet and physical markets.

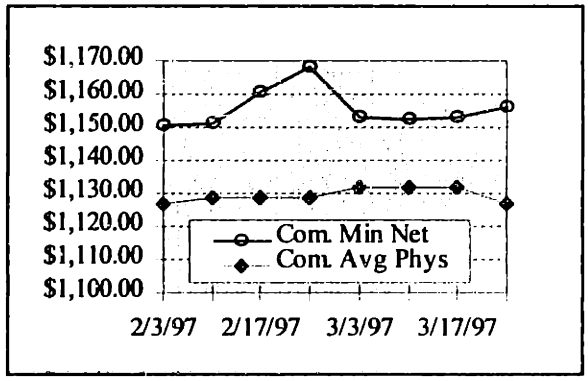
The results for consumers with Heuristics 1 and 2 are the same because there is only one physical retailer in the exploratory data for CDs. Therefore, the minimum physical price is equal to the average physical price. This group of consumers save almost $40 for the 108 titles. Unlike the more dynamic book market, the savings is fairly constant over time.

Compact Discs (Common Market Basket)

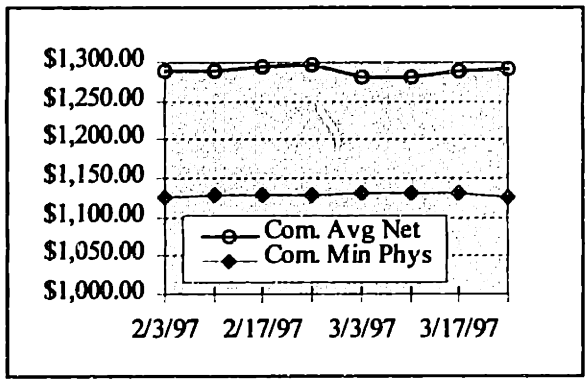
Heuristic 1



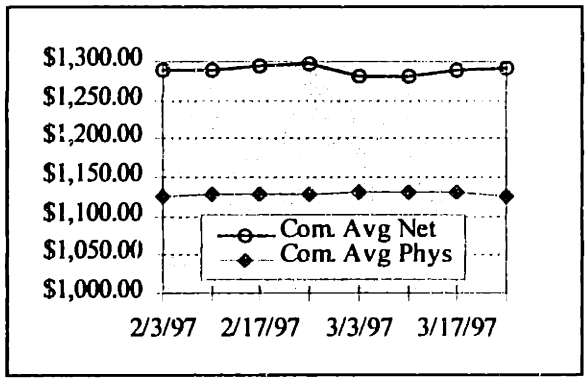
Heuristic 2



Heuristic 3



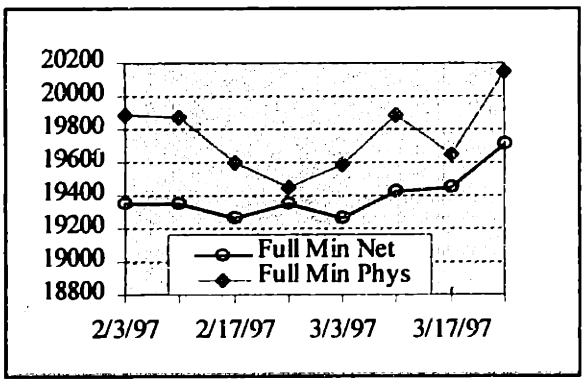
Heuristic 4



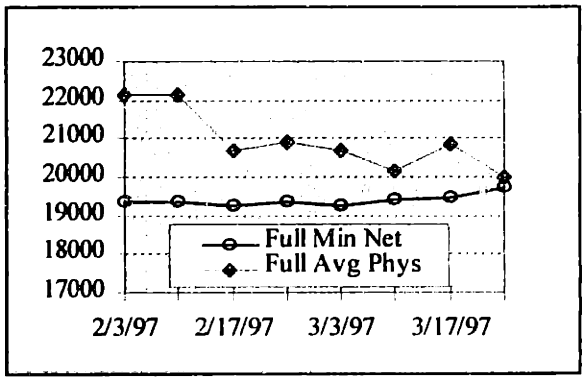
Consumers with Heuristics 3 and 4 are the same for the same reason 1 and 2 are the same—there is only one physical retailer in the exploratory data set that sells CDs. The graphs showing Heuristics 3 and 4 emphasize the importance of knowing how to shop on the Internet. While it saved the consumer almost $40 to buy the lowest Internet price, they spend almost $120 *more* when they can expect to pay the average Internet price. Therefore, the benefit consumers have by learning how to use Internet search tools and intermediaries to do price comparisons is even larger in the CD market than it is in the book market.

Software (Full Market Basket)

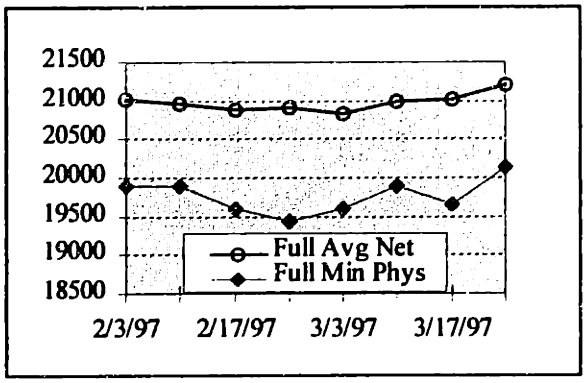
Heuristic 1



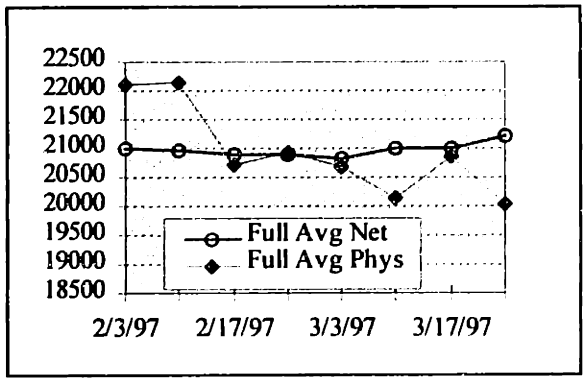
Heuristic 2



Heuristic 3



Heuristic 4

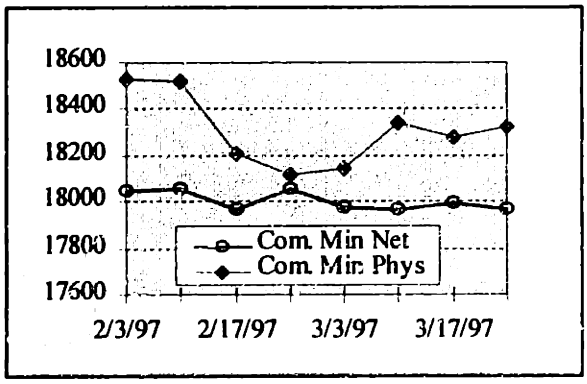


The software market may give indications of the future savings for consumers in all markets. These graphs clearly show that shopping on the Internet can be very beneficial for most groups of consumers. Even though one would expect prices to converge because of the high level of competition, they clearly do not because there are still benefits to becoming a more experienced Internet shopper and/or use of a search intermediary.

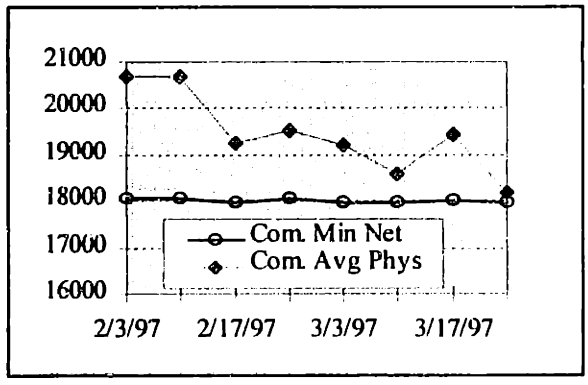
The software consumer using Heuristic 1 does better over time by shopping on the Internet. However, the data in this first graph shows that the market basket of 104 titles gets more expensive over time. This is different than the conclusion drawn when looking at the "common" market basket of goods (graph below) and not the "full" market basket (graph above). When a common market basket of goods is analyzed, the savings increases over time. Therefore, the graph above showing the full market basket of goods may show a price increase over time because there is a greater number of products not offered on March 24th that was offered on February 3rd. The versioning and differentiation of software can explain this because products exiting the market at one price are replaced by the new version of the product at a lower price.

Software (Common Market Basket)

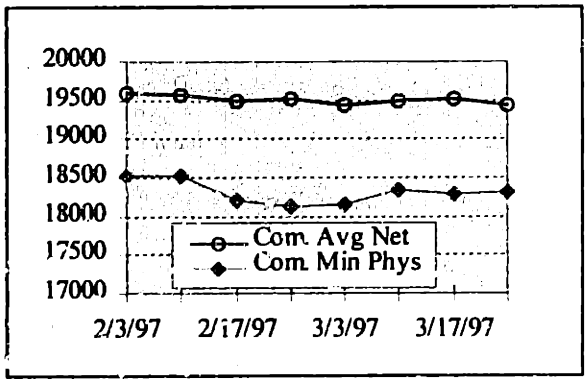
Heuristic 1



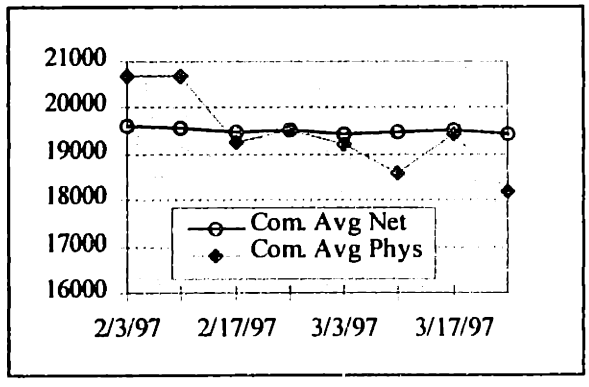
Heuristic 2



Heuristic 3



Heuristic 4



The heuristic consumers use to determine their price for the market basket of software titles matters a great deal. The consumer who is an Internet expert but lives in a monopolistic geographic area (a consumer with Heuristic 2) finds that the benefit of shopping on the internet falls over time. The data supports the hypothesis that physical stores have responded to competition from Internet retailers by lowering their prices. This same conclusion can be drawn from the common and full market baskets of software titles.

Consumers who are Internet novices are more influenced by their geographic region than consumers who are Internet experts. Consumers with Heuristic 3 are the only consumers that benefit by shopping in the physical markets for all time periods. Consumers with Heuristic 4 begin to do better by shopping on the Internet, but are better off buying from physical retailers as prices drop. The conclusions about consumers with Heuristics 3 and 4 are the same for the full and common market basket of software titles.

For the software market, it should be noted that the magnitude of the price should have some affect on the consumer's behavior. Because the savings are potentially greater with more searching, the consumer will search more holding search costs constant.

Dynamic Analysis

The following data reports the analysis of price changes in the three markets explored in the February/March 1997 data set. The first table is a summary table and then the three tables that follow the first table detail the data for each market. The table heading "Δ" represents the number of titles that changed prices and "$" is the average price change.

Market	*average price*	*average standard deviation of prices*	*percent of titles that changed price*	*average price change*
Books	$17.37	$7.10	5.96%	$0.04
CDs	$14.33	$1.94	6.33%	$0.06
Software	$202.16	$250.14	8.57%	-$3.78

Book Retailers' Number of Titles and Average Dollar Change

Retailer	*2/3/97*		*2/10/97*		*2/17/97*		*2/24/97*		*3/3/97*		*3/10/97*		*3/17/97*		*3/24/97*	
	Δ	$	Δ	$	Δ	$	Δ	$	Δ	$	Δ	$	Δ	$	Δ	$
Amazon.com	-	-	17	0.66	42	2.23	19	2.55	18	1.01	13	-0.3	46	-4.4	27	-2.9
Barnes and Noble	-	-	-	-	-	-	-	-	-	-	-	-	0	0	5	1.8
Books.com	-	-	8	0.52	4	1.36	4	0.77	2	-1.8	2	-3	2	0.53	2	4.17
Books-A-Million	-	-	12	1.73	0	0	1	6.9	4	-3.1	8	3.18	2	2.7	0	0
Crown Books	-	-	1	-6.2	2	1.05	0	0	26	0.54	3	1.45	0	0	1	3.44
Wordsworth	-	-	5	-0.8	10	1.39	3	0.23	1	-0.1	2	1.88	10	3.44	2	-2.3

Compact Disc Retailers' Number of Titles and Average Dollar Change

Retailer	*2/3/97*		*2/10/97*		*2/17/97*		*2/24/97*		*3/3/97*		*3/10/97*		*3/17/97*		*3/24/97*	
	Δ	$	Δ	$	Δ	$	Δ	$	Δ	$	Δ	$	Δ	$	Δ	$
AB CD's	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CD Banzai	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CD Universe	-	-	13	0.02	10	0.27	43	0.88	14	-0.2	14	0.76	2	0	6	0.49
CD World	-	-	1	1	0	0	16	-1.1	6	1.27	5	-1.1	1	0.7	15	1.13
E-Music	-	-	0	0	0	0	0	0	0	0	0	0	94	0.5	0	0
Music Boulevard	-	-	0	0	14	1.93	6	0.58	68	-1.6	2	1.5	4	-0.1	4	-0.4
Newbury Comics	-	-	9	0.21	0	0	0	0	8	0.38	0	0	0	0	4	-1.3

Software Retailers' Number of Titles and Average Dollar Change

Retailer	*2/3/97*		*2/10/97*		*2/17/97*		*2/24/97*		*3/3/97*		*3/10/97*		*3/17/97*		*3/24/97*	
	Δ	$	Δ	$	Δ	$	Δ	$	Δ	$	Δ	$	Δ	$	Δ	$
ABACUS America	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bottom Line Distribution	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Calico Software	-	-	0	0	0	0	1	-2.00	0	0	1	0.50	0	0	0	0
CompSource	-	-	-	-	-	-	-	-	0	0	0	0	0	0	12	1.16
Compulink Electronics	-	-	0	0	0	0	32	-2.20	0	0	0	0	0	0	1	3.67
Computer Bay	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Computer Discount Warehouse	-	-	0	0	2	-0.17	18	-0.80	0	0	0	0	0	0	0	0
Computer Express	-	-	0	0	0	0	0	0	-	-	-	-	-	-	-	-
Computer Market Place Express	-	-	0	0	0	0	0	0	65	-2.52	0	0	3	-1.17	0	0
Computer Quick	-	-	0	0	34	-4.59	36	7.17	12	1.00	46	1.89	0	0	0	0
Egghead	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Elek-Tek	-	-	0	0	4	-34.25	0	0	0	0	0	0	0	0	4	-39.00
Essential Data	-	-	25	-5.68	0	0	0	0	0	0	0	0	0	0	0	0
First Source International	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Global Computing	-	-	0	0	9	-3.61	28	-0.01	32	-0.92	0	0	1	-0.40	0	0
Iler Networking and Computing	-	-	1	-0.72	1	0.72	6	2.50	3	-0.23	64	-1.32	2	-0.40	60	-1.51
Internet Software Outlet	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Internet Shopping Network	-	-	2	-219.6	37	-24.34	2	-6.15	4	-0.63	4	0.33	3	0.37	4	-0.38
MC WORKS	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NECX	-	-	2	-15.00	3	-12.33	2	6.00	3	-21.67	5	5.80	1	20.00	0	0
OMNA Digital	-	-	0	0	0	0	0	0	0	0	0	0	4	3.02	1	1.41
PC Universe	-	-	2	-79.36	0	0	0	0	0	0	0	0	0	0	-	-
PCs Compleat	-	-	-	-	-	-	1	-3.00	0	0	0	0	0	0	0	0
Prism Business Products	-	-	0	0	0	0	0	0	-	-	-	-	-	-	-	-
Provantage Corp.	-	-	0	0	3	-0.33	0	0	1	-9.00	0	0	0	0	0	0
RCSNet	-	-	0	0	43	-7.69	0	0	0	0	3	67.11	0	0	0	0
Software.Net	-	-	1	-0.01	3	-0.03	8	0.07	68	-5.25	59	1.95	1	-1.37	0	0
Sparco Communications	-	-	0	0	0	0	0	0	49	-1.35	7	20.86	1	3.00	0	0
State Street Discount	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	0
Systems Unlimited	-	-	0	0	91	-13.35	79	-4.04	0	0	0	0	0	0	1	3.67
Tenet Computer Group	-	-	0	0	0	0	0	0	0	0	9	-1.92	0	0	11	-3.17
TruCost	-	-	0	0	5	-0.40	38	0.13	9	-8.22	0	0	15	1.60	1	3.00
Unicom-Sales	-	-	0	0	0	0	0	0	4	-0.46	5	-3.58	0	0	0	0
Vektron International	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Virtual Computer Super Store	-	-	10	-0.97	0	0	0	0	1	2.50	0	0	0	0	8	0.25

APPENDIX B. MAY 1997 - JANUARY 1998 DATA ANALYSIS

This appendix reports the data collection and analysis for the book market continued past March 1997 in the book market. During March 1997, Barnes & Noble entered the Internet book retail market so this analysis is used to try and determine what long-term impact this entry had on the prices for the incumbent Internet book retailers. As will be clear from the data, the only Internet retailer that changed its prices noticeably was Amazon.com. There was a total of 6,465 data points. Therefore, along with the 23,789 data points from the previous analysis, there were a total of 30,254 data points used in this thesis.

This appendix provides data used in analyzing Internet book retailers extending the data collected in Appendix A. The variables for data collection are the same as in Appendix A. The dependent variable price is a variable P_{irt} where i is the title, r is the retailer, and t is the time. The titles and retailers are the same as those reported in Appendix A. The time periods are different. The data collection progressed with monthly (not weekly) observations. The dates are as follows:

Date Numbers and Corresponding Values for May 1997 - January 1998 Data

t	*Date*
9	May 5, 1997
10	June 10, 1997
11	July 1, 1997
12	August 4, 1997
13	September 25, 1997
14	October 20, 1997
15	November 11, 1997
16	December 3, 1997
17	January 5, 1998

The price for the market basket of 125 books at Amazon.com and Barnes & Noble for this time period are listed in the following table.

May 1997 - January 1998 Book Market Basket Prices

t	*Amazon.com*	*Barnes & Noble*	*Books.com*	*Books-A-Million*	*Crown Books*	*Wordsworth*
5/5/97	$2,068.76	$1,934.90	$2,095.63	$2,371.38	$2,196.45	$2,297.72
6/10/97	$1,927.00	$1,927.32	$2,095.18	$2,364.41	$2,252.66	$2,297.72
7/1/97	$1,918.20	$1,918.93	$2,104.02	$2,380.24	$2,252.66	$2,297.72
8/4/97	$1,922.48	$1,923.87	$2,115.87	$2,444.31	$2,252.66	$2,297.72
9/25/97	$1,931.49	$1,912.82	$2,067.61	$2,323.72	$2,252.66	$2,297.72
10/20/97	$1,933.49	$1,918.58	$2,063.03	$2,418.22	$2,252.66	$2,297.72
11/11/97	$1,948.18	$1,922.19	$2,066.08	$2,378.18	$2,252.66	$2,297.72
12/3/97	$1,946.49	$1,920.01	$2,066.08	$2,384.18	$2,252.66	$2,297.72
1/5/98	$1,956.09	$1,925.81	$2,064.28	$2,219.29	$2,252.66	$2,297.72

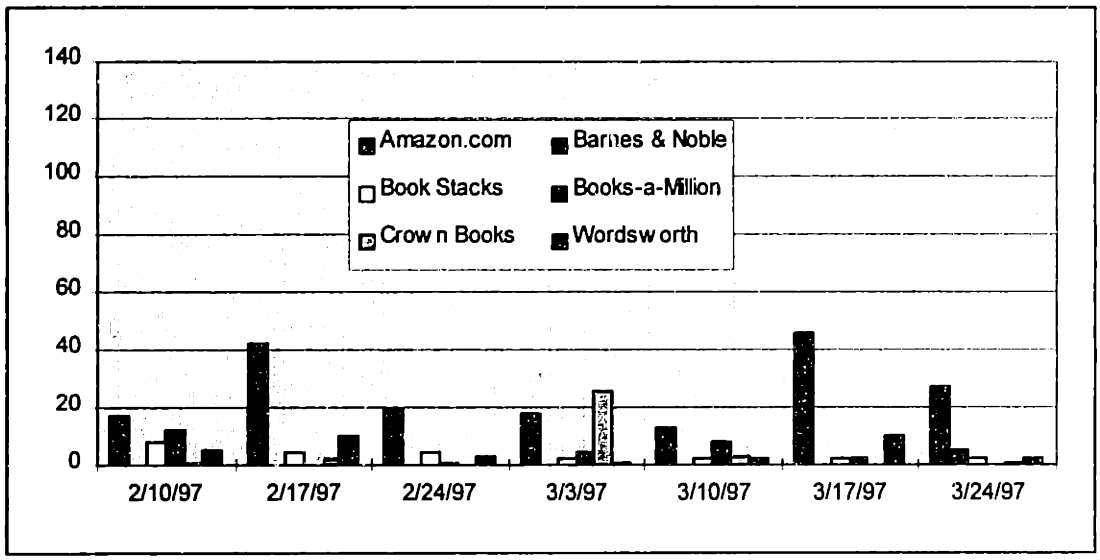
The following table lists price changes for the time periods following March 1997.

May 1997 - January 1998 Price Changes Among Book Retailers

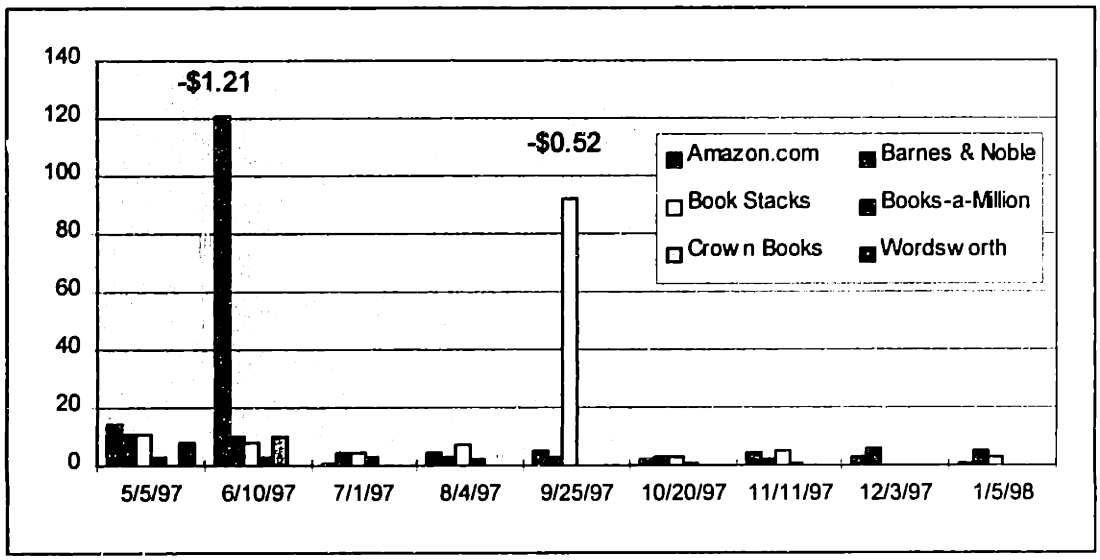
	May		*June*		*July*		*Aug.*		*Sept.*		*Oct*		*Nov.*		*Dec.*		*Jan.*	
retailer	Δ	$	Δ	$	Δ	$	Δ	$	Δ	$	Δ	$	Δ	$	Δ	$	Δ	$
Amazon.com	14	$3.34	121	-$1.21	1	-$8.80	4	$1.07	5	$0.30	2	$4.75	4	$3.67	3	-$0.56	1	$2.40
Barnes and Noble	11	$1.57	10	-$0.76	4	-$2.10	3	$1.65	3	-$3.68	3	$1.92	2	$1.56	6	-$0.28	5	$1.16
Books.com	11	-$1.91	8	-$0.06	4	$2.21	7	$1.69	92	-$0.52	3	-$1.53	5	$0.61	0	$0.00	3	-$0.50
Books-A-Million	3	$7.59	3	$0.89	3	$4.44	2	$6.29	0	$0.00	1	$0.90	1	$0.46	0	$0.00	0	$0.00
Crown Books	0	$0.00	10	$5.62	0	$0.00	0	$0.00	0	$0.00	0	$0.00	0	$0.00	0	$0.00	0	$0.00
Wordsworth	8	$3.72	0	$0.00	0	$0.00	0	$0.00	0	$0.00	0	$0.00	0	$0.00	0	$0.00	0	$0.00

Note: Δ is the number of titles (out of 125) that changed prices in this time period from the previous time period and avg. is the average price change amount.

February/March 1998 Number of Price Changes by Book Retailers



May 1997 - January 1998 Number of Price Changes by Book Retailers



APPENDIX C. RETAILER ANALYSIS

This appendix details the forty-eight retailers included in the exploratory study for February/March 1997 and May 1997 - January 1998. There are six retailers in the book market, seven in the compact disc market, and thirty-five in the software market. This appendix also contains data on seven additional intermediaries that are not used in the exploratory analysis in this thesis. These additional retailers are either search intermediaries who helped the data collection in the software market, or were retailers in the books, CDs, and software markets examined in June 1996 as part of the preliminary exploratory analysis. The forty-eight retailers were selected because of several criteria. All of the retailers in this data set posted prices on the Web. The retailers, their Web page URLs and information about their prices is listed below.

Summary of Retailers' Web Site Features

r	*earch ngine*	*Order Security*	*Best Sellers List*	*Physical (H) or Internet (N)*	*r*	*earch ngine*	*Order Security*	*Best Sellers List*	*Physical (H) or Internet (N)*
1	+	+	+	N	29	–	–	–	N
2	+	+	+	H	30	+	+	–	N
3	+	+	–	N	31	+	+	–	N
4	+	+	+	N	32	–	–	–	N
5	+	+	–	H	33	+	+	+	N
6	+	+	+	H	34	n/a	n/a	n/a	N
7	+	–	–	N	35	–	–	--	N
8	+	–	–	N	36	+	+	–	H
9	+	+	+	N	37	+	–	–	H
10	+	+	+	N	38	+	+	–	H
11	+	+	+	N	39	–	–	–	H
12	+	+	+	N	40	+	+	+	N
13	+	+	–	H	41	+	+	–	N
14	+	n/a	–	H	42	+	+	–	H
15	+	+	–	N	43	+	+	–	H
16	–	–	–	N	44	–	–	–	H
17	+	–	–	H	45	n/a	n/a	n/a	N
18	+	–	–	N	46	+	–	–	N
19	n/a	n/a	n/a	H	47	–	–	–	N
20	+	+	–	H	48	+	–	–	N
21	n/a	n/a	n/a	H	49	n/a	n/a	n/a	N
22	+	–	–	N	50	n/a	n/a	n/a	N
23	+	–	–	N	51	n/a	n/a	n/a	N
24	+	+	–	H	52	n/a	n/a	n/a	H
25	+	+	–	H	53	+	–	n/a	N
26	+	+	–	N	54	+	–	n/a	N
27	+	–	–	N	55	+	–	n/a	N
28	+	–	–	H					

"+" = yes and "—" no

Each of the retailers are examined in greater depth in the analysis that follows. The URL is listed for the different retailers (when available) where more information is available.

1. Amazon.com

Market	Internet or Physical Retailer	URL
Books	Internet Retailer	www.amazon.com

Comments

- Their motto is "Earth's Biggest Bookstore."
- Web site's search engine has many different search capabilities including: author, title, subject, keyword, ISBN numbers, and full-featured search.
- Their interface includes long scrolling front page with different areas and a few sentences describing each area.
- Other features of their Web site include a listing of the New York Times bestsellers and store bestsellers, books featured on other reviews and award winners, "eyes" which is an automated search agent which sends you email every time your favorite author publishes a new book, or a book matching your interests is released.
- Ordering on their Web site is secure (secure sockets).
- In February of 1998, they announced their intention to enter the compact disc market.
- In a critique by Davis and Rosenfeld (1998), two experts on Web design, they found that Amazon.com did a very good job of giving information to the customer without having too many features that would slow down the Web server's response time.
- They use collaborative filtering software called "BookMatcher" to help consumers find title selections.

2. Barnes and Noble

Market	Internet or Physical Retailer	URL
Books	Physical Retailer	www.barnesandnoble.com

Comments

- They use the collaborative filtering software developed by Firefly for book recommendations.
- Web site search on criteria including author, title, and keyword.
- According to Nielsen and Squier (1998), two experts who critiqued the Barnes & Noble Web site, they found the Web page to be too cumbersome with too little information. It is their opinion that the look of the site is too complicated and they prefer Amazon.com.

3. Books.com

Market	Internet or Physical Retailer	URL
Books	Internet Retailer	www.books.com

Comments

- Books.com was previously known as Book Stacks Unlimited prior to 1998.
- Their motto is "our local bookstore...no matter where you live."
- Web site search engine can search on the following: author, title, keyword, and ISBN number.
- Their interface is a long scrolling font page very few graphics.
- Other features of their Web site include: new arrivals, a separate poetry section, a recommended section, they do not have a bestseller list, a birthday section which tells you which famous writer's birthday is today, the Web site has a counter telling you how many other people are currently at the site, and has a scrolling "news" Java applet.
- Ordering on their Web site is secure.
- They started a dynamic pricing system whereby the price is determined after an agent check with the price for the same book at Amazon.com and Barnes & Noble.
- They were the first bookstore on the Internet in 1993 with telnet and dial-in service. Then they developed a Web presence and renamed themselves books.com.

4. Books-A-Million

Market	Internet or Physical Retailer	URL
Books	Internet Retailer	www.booksamillion.com

Comments

- They have some physical locations in Virginia, for example, but they do not have any stores in Massachusetts. They also have a physical retail location in Gainesville, Florida and other physical locations. The real reason why this is listed this as an "Internet retailer" is that during this stage of the analysis, the fact that they had a physical location was unknown and a consumer in Boston would not have the ability to buy from their physical location.

5. Crown Books

Market	Internet or Physical Retailer	URL
Books	Physical Retailer	www.crownbooks.com

Comments

- By storing a URL, the data analysis continued into the Fall and Winter of 1997/1998. However, they did dismantle their Web site during that period for overhauling and even though the price data point was collected, it is unclear if the transaction to purchase the books could have been completed.

6. Wordsworth

Market	Internet or Physical Retailer	URL
Books	Physical Retailer	www.wordsworth.com

Comments

- They only have one physical location in Harvard Square, Cambridge, MA.

7. AB CD's

Market	Internet or Physical Retailer	URL
Compact Discs	Internet Retailer	www.abcds.com

Comments

- Their search engine allows for a search on artist and title.
- Their interface has minimal graphics. The search page, search results, and order form are all on one long scrolling page.
- Web site features include new, used, rare, and import CDs.
- Ordering on their Web site is not secure.
- They use a primary distributor for most items and then use a secondary distributor to fill back orders.

8. CD Banzai

Market	Internet or Physical Retailer	URL
Compact Discs	Internet Retailer	www.cdbanzai.com

Comments

- They are located in Beverly Hills, CA (phone: 818-980-0054).
- Prices are very high on almost all titles.
- They do carry quite an extensive list of imported CDs that are not available from other Internet retailers.

9. CD Universe

Market	Internet or Physical Retailer	URL
Compact Discs	Internet Retailer	www.cduniverse.com

Comments

- They have no phone number listed, just a fax number on their Web site. Their warehouse is in Wallingford, CT.

10. CD World

Market	Internet or Physical Retailer	URL
Compact Discs	Internet Retailer	www.cdworld.com

Comments

- The search engine on their Web site allows for search on artist, title, and catalog number.
- Their Web interface has lists of options and does not have many graphics.
- Some of their Web site features include a sales section and a "Hot Stuff" section.
- They do have a print catalog.
- Ordering on their Web site is secure.
- They do not list a phone number, just fax number, on their Web site. They are located in Campbell, CA.

11. Emusic

Market	Internet or Physical Retailer	URL
Compact Discs	Internet Retailer	www.emusic.com

Comments

- Their Web site includes a search engine that searches on the following criteria: song, year, title, and artist.
- The Web interface is unique since the consumer first sees the search engine after they enter the site. The site has minimal graphics.
- Some of the features of the Web site include the following three areas: "What's New," "What's Hot," and "Essential Picks."
- Ordering on their Web site is secure.
- They are located in Santa Monica, CA (phone number is 310-395-9045).

12. Music Boulevard

Market	Internet or Physical Retailer	URL
Compact Discs	Internet Retailer	www.musicblvd.com

Comments

- Search engine has two modes: a classical music search mode and a non-classical search mode.
- Non-classical mode allows for search on: album name, song title, and artist.
- Classical search mode allows for search on: orchestra, composer, conductor, performer, and album name.
- The interface is heavy graphics and has a distracting black pinstripe background.
- They have a frequent buyers club where a consumer receives a free CD when they buy 10.
- They have no print catalog, but can be reached by phone at: 800-996-8742.

13. Newbury Comics

Market	Internet or Physical Retailer	URL
Compact Discs	Physical Retailer	www.newbury.com

Comments

- They have 18 stores in the greater Boston, MA area.
- Their Web site states: "online prices do not reflect prices in our retail stores." This quote was not on their Web site in February/March 1997 when the compact disc price data was collected. While the quote indicates that prices are not the same, they do not describe how they are different.

14. ABACUS America

Market	Internet or Physical Retailer	URL
Software	Physical Retailer	www.computers-online.com

Comments

- They are located in San Diego, CA. Their phone number is 619-455-7709.

15. Bottom Line Distribution

Market	Internet or Physical Retailer	URL
Software	Internet Retailer	www.blol.com

Comments

- They are located in Austin, TX. Their phone number is 800-347-0052.
- They have no catalog and no retail store—all sales are through their Web site.

16. Calico Software

Market	Internet or Physical Retailer	URL
Software	Internet Retailer	www.calicosw.com

Comments

- They are located in Fort Wayne, IN. Their phone number is 219-492-9617.

17. CompSource

Market	Internet or Physical Retailer	URL
Software	Physical Retailer	Www.c-source.com

Comments

- They are located in Cleveland, OH. They advertise on Price Watch (description of price watch appears below).
- They have a small showroom and a print catalog but most of their sales are through remote locations.

18. Compulink Electronics

Market	Internet or Physical Retailer	URL
Software	Internet Retailer	www.compu-link.com

Comments

- They are located in New York, NY. Their phone is 212-695-5465.
- They just have office space in New York and have no warehouse and no catalog.

19. Computer Bay of Kansas City

Market	Internet or Physical Retailer	URL
Software	Physical Retailer	www.cbaykc.com

Comments

- In December 1997, their Web site was not available.
- They are located in Overland Park, KS.
- They have mainly corporate sales and they do have a physical "showroom".

20. Computer Discount Warehouse

Market	Internet or Physical Retailer	URL
Software	Physical Retailer	www.cdw.com

Comments

- They have print catalog sales and two physical locations (one in downtown Chicago and one in Bernum Hills, IL).
- Their headquarters is in Buffalo Grove, IL. Their phone number is 800-726-4239.

21. Computer Express

Market	Internet or Physical Retailer	URL
Software	Physical Retailer	www.cexpress.com

Comments

- Their Web site was under construction in December 1997 so it was not available at the moment this data was collected.
- They are located in Sudbury, MA. Their phone number is 508-228-7449.

22. Computer Market Place Express (CMPExpress)

Market	Internet or Physical Retailer	URL
Software	Internet Retailer	www.cmpexpress.com

Comments

- They are located in Broomall, PA.
- They have no print catalog, but you can download their catalog from the Internet and they have no retail store locations.

23. Computer Quick

Market	Internet or Physical Retailer	URL
Software	Internet Retailer	www.cqk.com

Comments

- They are located in San Francisco, CA. Their phone number is 415-861-8330 x216.

24. Egghead

Market	Internet or Physical Retailer	URL
Software	Physical Retailer	www.egghead.com

Comments

- They have many physical locations (as of December 1997)–mostly in California. Their phone number is 509-926-5287
- In January 1998, they announced that they would be closing their physical locations and only operating on the Internet.

25. Elek-Tek

Market	Internet or Physical Retailer	URL
Software	Physical Retailer	www.elektek.com

Comments

- They are located in Skokie, IL. Their phone number is 314-541-9000.
- PC Mall bought ElekTek so the same company operates the Web site www.pc-mall.com even though they have different URLs. Both PC Mall and Elek-Tek have physical locations-PC Mall in the Los Angeles area while Elek-Tek is in Chicago.

26. Essential Data

Market	Internet or Physical Retailer	URL
Software	Internet Retailer	www.essential-data.com

Comments

- They are located in Morgan Hill, CA. Their phone number is 800-795-4756.
- They only have a Web catalog–they said it was too expensive for them to print new catalogs all the time with they dynamics of the software market (prices and products change often)

27. First Source International

Market	Internet or Physical Retailer	URL
Software	Internet Retailer	www.firstsource.com

Comments

- They are located in Aliso Viejo, CA. Their phone number is 800-858-9866.
- They have a print catalog in addition to their Web site.

28. Global Computing

Market	Internet or Physical Retailer	URL
Software	Physical Retailer	www.globalcomputing.com

Comments

- They are located in Pearl City, HI. Their phone number is 800-590-3475.
- They have a retail store in Honolulu but none on the mainland.

29. Iler Networking and Computing

Market	Internet or Physical Retailer	URL
Software	Internet Retailer	www.iler.com/pages

Comments

- They are located in Dillon, CO. Their phone number is 970-485-1424.

30. Internet Software Outlet

Market	Internet or Physical Retailer	URL
Software	Internet Retailer	www.shoplet.com

Comments

- They are located in New York, NY. Their phone number is 800-757-3015.
- They have no print catalog and no retail locations.

31. Internet Shopping Network

Market	Internet or Physical Retailer	URL
Software	Internet Retailer	www.isn.com

Comments

- They are located in Palo Alto, CA. Their phone number is 800-677-7467.
- The Home Shopping Network bought them in 1995.

32. Midwest Computer Works (MC Works)

Market	Internet or Physical Retailer	URL
Software	Internet Retailer	www.mcworks.com

Comments

- They are located in Vernon Hills, IL. Their phone number is 800-659-5400.
- They have their Web catalog and a print catalog, but their Web catalog is more recent and has more specials in it.

33. NECX

Market	Internet or Physical Retailer	URL
Software	Internet Retailer	www.necx.com

Comments

- They are located in Peabody, MA. Their phone number is 800-808-3375.
- They started by selling to corporate consumers & now ships to single consumers.
- They have a contract with MIT to sell computer equipment and software to the MIT community at a discount.

34. OMNA Digital

Market	Internet or Physical Retailer	URL
Software	Internet Retailer	www.omna.com

Comments

- They are located in Columbus, OH. Their phone numbers are: 800-263-0036, and 614-336-9223.
- They are also known as Midwestern Commerce
- They are closed to retail consumers.
- They have pointers to NECX & MicroX on their Web site because their Web site is no closed to Internet retail consumers.

35. PC Universe

Market	Internet or Physical Retailer	URL
Software	Internet Retailer	www.pcuniverse.com

Comments

- They are located in Florida. Their phone number is 800-728-6483.
- They have no retail stores, but they do have a print catalog, which is "not a whole lot of difference between their print catalog and their Web site," according to their salesperson.

36. PCs Compleat (CompUSA Online)

Market	Internet or Physical Retailer	URL
Software	Physical Retailer	www.pcscompleat.com

Comments

- They are located in Marlborough, MA. Their phone number is 800-294-4727.
- Because they have an agreement to work with CompUSA, they can also be reached via www.compusa.com.

37. Prism Business Products

Market	Internet or Physical Retailer	URL
Software	Physical Retailer	www.prismbiz.com

Comments

- They are located in Whippany, NJ. Their phone number is 201-952-1500.
- They are also known as Clearview Technologies.

38. Provantage Corporation

Market	Internet or Physical Retailer	URL
Software	Physical Retailer	www.provantage.com

Comments

- They are located in North Canton, OH. Their phone number is 800-336-1166.
- They have 22 warehouses and one retail location in North Canton, OH.
- They do have a print catalog, but their Web site is more comprehensive.

39. RCSNet

Market	Internet or Physical Retailer	URL
Software	Physical Retailer	www.rcsnet.com

Comments

- They are located in New York, NY. Their phone number is 212-949-6935.

40. Software.Net

Market	Internet or Physical Retailer	URL
Software	Internet Retailer	www.software.net

Comments

- They are located in San Jose, CA. Their phone number is 800-617-7638.

41. Sparco Communications

Market	Internet or Physical Retailer	URL
Software	Internet Retailer	www.sparco.com

Comments

- They are located in Starkville, MS. Their phone number is 800-840-8400.

42. State Street Direct

Market	Internet or Physical Retailer	URL
Software	Physical Retailer	www.ssdonline.com

Comments

- They are located in Portsmouth, NH. Their phone number is 800-222-4070.
- They have no print catalog and 7 or 8 warehouses. They update their Web site daily and do have a physical location.

43. Systems Unlimited

Market	Internet or Physical Retailer	URL
Software	Physical Retailer	www.1unlimited.com

Comments

- They are located in Belle Vernon, PA. Their phone number is 888-409-8443.

44. Tenet Computer Group

Market	Internet or Physical Retailer	URL
Software	Physical Retailer	Www.tenet.com

Comments

- They are located in Downsview, ON. Their phone number is 888-338-3638.
- They have locations in each province of Canada.
- Even though they are Canadian, the prices on their Web site are in U.S. dollars, not Canadian dollars.

45. TruCost

Market	Internet or Physical Retailer	URL
Software	Internet Retailer	www.trucost.com

Comments

- They are located in Fremont, CA. Their phone number is 800-892-9476.
- They have an inventory of 70,000+ titles.
- They are temporarily off-line so send them email to cs@inow.com.

46. Unicom-Sales

Market	Internet or Physical Retailer	URL
Software	Internet Retailer	www.uni-sales.com

Comments

- They are located in San Jose, CA. Their phone number is 800-745-8571.
- They have no print catalog and no retail site.

47. Vektron International

Market	Internet or Physical Retailer	URL
Software	Internet Retailer	www.vektron.com

Comments

- They are located in Grand Prairie, TX. Their phone number is 800-725-0047.
- They just have a Web site and they advertise in "Computer Shopper" magazine.
- They have not retail store and they have no print catalog.

48. Virtual Computer Super Store

Market	Internet or Physical Retailer	URL
Software	Internet Retailer	www.vcss.com

Comments

- They are located in Franklin Park, NJ. Their phone number is 888-827-7266.
- Rensselear Solutions, Inc owns them.
- They sell computer books as well as software. On their Web site, their owner is quoted as saying that when Barnes & Noble came online, Amazon.com has raised its prices on computer books.

49. Books From Cyberspace

Market	Internet or Physical Retailer	URL
Books	Internet Retailer	www.bfcbooks.com

Comments

- They have no search engine and ordering via the Internet is not secure.
- Their Web site has three interfaces: "Kids Corner," "Bestsellers," and "Book Bundles."
- They sell NY Times bestsellers at 25% of list price and they do not discount other titles.
- Their Web site is not updated frequently. For example, their bestsellers list is approximately a month old so the newest titles are not available.

50. The Library, Ltd Bookstore

Market	Internet or Physical Retailer	URL
Books	Internet Retailer	www.libltd.com

Comments

- Their search engine was under construction in June 1996 and ordering from them is not secure.
- They have NY Times Bestseller list: 30% discount.
- Their site is still under construction so the search engine is not fully functional. Therefore the only books that consumers can purchase are those that are highlighted in special sections such as "the New York Times Bestsellers.

51. 1-800-MusicNow

Market	Internet or Physical Retailer	URL
Compact Discs	Internet Retailer	1800musicnow.com

Comments

- Their site has a search engine that allows search on: artist, title, and catalog number.
- Their Web interface is mostly graphical and ordering from them is secure.
- Their Web site offers free complimentary goods (such as hats and mugs) to draw in consumers.
- The Web site's bestseller lists include a store top 10 and a radio DJ top 10.
- A feature of their Web site is a pre-release section that allows a consumer to order the CD before it comes out. The consumer then receives the CD on the day of the release.
- They went out of business so they are not included in the February/March 1997 data collection.

52. HMV Music

Market	Internet or Physical Retailer	URL
Compact Discs	Physical	n/a

Comments

- They are a physical retailer who is not on the Web. They have a location in Harvard Square (Cambridge, MA) where data was collected during the preliminary June-August 1996 data collection.

53. UVision

Market	Internet or Physical Retailer	URL
Software	Internet Search Intermediary	www.uvision.com

Comments

- The service is called "Computer ESP" and it was used in this thesis to collect prices from Internet retailers in the software market.

54. Price Watch

Market	Internet or Physical Retailer	URL
Software	Internet Search Intermediary	www.pricewatch.com

Comments

- Crowston (1996) details a detailed description about the role they play to promote price competition in the software market.

55. Bargain Finder

Market	Internet or Physical Retailer	URL
Compact Discs	Internet Search Internediary	www.bf.cstar.ac.com

Comments

- They are a search intermediary in the Internet compact disc market who had trouble with their searches being blocked because they dynamically sent and "agent" to a CD retailer Web site to find the information they were looking for. This put a load on the server, which resulted in congestion for other consumers.
- As Crowston (1996) points out, there may be economic reasons for Internet retailers not to allow searching on their site because it increases search costs and reduces the possibility for pure price competition among Internet retailers.

REFERENCES

Akerlof, George A. 1970. The Market for "Lemons": Quality, Uncertainty and the Market Mechanism. *Quarterly Journal of Economics* 84:488-500.

Alchian, Armen A., and Harold Demsetz. 1972. Production, Information Costs, and Economic Organization. *The American Economic Review* 62 (5):777-795.

Amazon.com. 1997. Prospectus for Initial Public Stock Offering. Seattle, WA: Amazon.com, Inc.

ANX. 1996. Specification for a TCP/IP Network for the Automotive Industry. Southfield, MI: Telecommunications Project Team, The Automotive Network eXchange.

Armstrong, Mark, and John Vickers. 1993. Price Discrimination, Competition and Regulation. *Journal of Industrial Economics* 41 (4):335-359.

Bailey, Joseph P., and J. Yannis Bakos. 1997. An Exploratory Study of the Emerging Role of Electronic Intermediaries. *International Journal of Electronic Commerce* 1 (3):7-20.

Bailey, Joseph P., Erik Brynjolfsson, and Michael D. Smith. 1998. In Search of "Friction-Free Markets": An Exploratory Analysis of Prices for Books, CDs and Software Sold on the Internet. *submitted to Management Science.*

Bailey, Joseph P., Lee W. McKnight, and Paul Bosco. 1996. The Economics of Advanced Services in an Open Communications Infrastructure: Transaction Costs, Production Costs, and Network Externalities. *Information Infrastructure and Policy* 4 (1):255-278.

Bakos, J. Yannis. 1987. Interorganizational Information Systems: Strategic Implications for Competition and Cooperation. Ph.D., Sloan School of Management, Massachusetts Institute of Technology.

Bakos, J. Yannis. 1991. A Strategic Analysis of Electronic Marketplaces. *MIS Quarterly* (September):295-310.

Bakos, J. Yannis. 1997. Reducing Buyer Search Costs: Implications for Electronic Marketplaces. *Management Science* 43 (12):1676-1692.

Bakos, J. Yannis, and Erik Brynjolfsson. 1993a. From Vendors to Partners: Information Technology and Incomplete Contracts in Buyer-Supplier Relationships. *Journal of Organizational Computing* 3 (3).

Bakos, J. Yannis, and Erik Brynjolfsson. 1993b. Information Technology, Incentives, and the Optimal Number of Suppliers. *Journal of Management Information Systems* 10 (2):37.

Bakos, Yannis, and Erik Brynjolfsson. 1997. Aggregation and Disaggregation of Information Goods: Implications for Bundling, Site Licensing and Micropayment Systems. Paper read at Conference on Internet Publishing and Beyond: The Economics of Digital Information and Intellectual Property, June, at Cambridge, MA.

Baligh, Helmy H., and Leon E. Richartz. 1967. *Vertical Market Structures*. Boston: Allyn and Bacon.

Barua, Anitesh, Sury Ravindran, and Andrew B. Whinston. 1997. Efficient Selection of Suppliers over the Internet. *Journal of Management Information Systems* 13 (4):117-137.

Belman, Melissa H. 1996. BargainFinder. Palo Alto, CA: CommerceNet.

Benjamin, Robert, and Rolf Wigand. 1995. Electronic Markets and Virtual Value Chains on the Information Superhighway. *Sloan Management Review* 1995 (Winter):62-72.

Berndt, Ernst R. 1991. *The Practice of Econometrics: Classic and Contemporary*. Reading, MA: Addison-Wesley.

Bertsekas, Dimitri, and Robert Gallager. 1992. *Data Networks*. Second ed. Englewood Cliffs, N.J: Prentice-Hall.

Besen, Stanley M., and Leo J. Raskind. 1991. An Introduction to the Law and Economics of Intellectual Property. *Journal of Economic Perspectives* 5 (1):3-27.

Biglaiser, Gary. 1993. Middlemen as Experts. *RAND Journal of Economics* 24 (2):212-223.

Biglaiser, Gary, and James W. Friedman. 1994. Middlemen as Guarantors of Quality. *International Journal of Industrial Organization* 12:509-531.

Bollier, David. 1996. *The Future of Electronic Commerce: A Report of the Fourth Annual Aspen Institute Roundtable on Information Technology*. Washington, DC: The Aspen Institute.

Bresnahan, Timothy F., and Peter C. Reiss. 1991. Entry and Competition in Concentrated Markets. *Journal of Political Economy* 99 (5):997-1009.

Brock, Gerald W. 1981. *The Telecommunications Industry: The Dynamics of Market Structure*. Cambridge, MA: Harvard University Press.

Brock, Gerald W. 1994. *Telecommunication Policy for the Information Age: From Monopoly to Competition*. Cambridge, MA: Harvard University Press.

Brynjolfsson, Erik. 1994. Information Assets, Technology, and Organization. *Management Science* 40 (12):1645-1662.

Brynjolfsson, Erik, and Lorin Hitt. 1994. Information Technology as a Factor of Production: The Role of Differences Among Firms: Sloan School of Management, MIT.

Brynjolfsson, Erik, and Lorin Hitt. 1996. Paradox Lost? Firm-Level Evidence on the Returns to Information Systems Spending. *Management Science* 42 (4):541-558.

Brynjolfsson, Erik, and Chris F. Kemerer. 1994. Network Externalities in Microcomputer Software: An Econometric Analysis of the Spreadsheet Market: Sloan School of Management, MIT.

Buxmann, Frank Rose, and Wolfgang König. 1997. Intermediation on Electronic Markets: The Case of Java Software Elements. Main, Germany: Institute of Information Systems, Johann Wolfgang Goethe-Universität.

Camp, L. Jean, and Marvin Sirbu. 1997. Critical Issues in Internet Commerce. *IEEE Communications Magazine* (May):58-62.

CEC. 1997. A European Initiative in Electronic Commerce. Brussels: European Commission.

Chandler, Alfred D. 1977. *The Visible Hand: The Managerial Revolution in American Business.* Cambridge, MA: Belknap Press.

Choi, Soon-Yong, Dale O. Stahl, and Andrew B. Whinston. 1997. *The Economics of Electronic Commerce.* Indianapolis, IN: Sams.

Clark, David. 1994. Interoperation, Open Interfaces, and Protocol Architecture: MIT Laboratory for Computer Science.

Clark, David D. 1988. The Design Philosophy of the DARPA Internet Protocols. *Computer Communication Review* 18 (4):106-114.

Clemons, Eric K., and Bruce W. Weber. 1997. Information Technology and Screen-Based Securities Trading: Pricing the Stock and Pricing the Trade. *Management Science* 43 (12):1693-1708.

Clinton, William J., and Albert Gore. 1997. A Framework for Global Electronic Commerce. Washington, DC: Executive Office of the President.

Coase, R. H. 1937. The Nature of the Firm. *Economica* IV:386-405.

Cortese, Amy. 1997. A Census in Cyberspace. *Business Week* (May 5):84-85.

Cosimano, Thomas F. 1996. Intermediation. *Economica* 63:131-143.

Cox, Brad. 1996. *Superdistribution: Objects as Property on the Electronic Frontier.* Reading, MA: Addison-Wesley.

Croson, David C. 1995. A New Role for Middlemen: Centralizing Reputation in Repeated Exchange. Philadelphia, PA: Wharton School of Business.

Crowston, Kevin. 1996. Market-Enabling Internet Agents. Paper read at International Conference on Information Systems, December, at Cleveland, OH.

CSPP. 1994. Perspectives on the National Information Infrastructure: Ensuring Interoperability: Computer Systems Policy Project.

Dahl, Robert A. 1976. *Democracy in the United States: Promise and Performance.* Third ed. Chicago: Rand McNally.

Daniel, Betty C. 1992. Price Setting, Imperfect Information, and the Law of One Price. *Journal of Macroeconomics* 14 (3):383-415.

Davis, Glenn, and Louis Rosenfeld. 1998. Deconstructing Amazon.com. *Internet World,* March 7, 46.

Demsetz, Harold. 1968. The Cost of Transacting. *Quarterly Journal of Economics* LXXXII:33-53.

de Neufville, Richard. 1990. *Applied Systems Analysis: Engineering Planning and Technology Management.* New York: McGraw-Hill.

Dertouzos, Michael. 1997a. Sloan Lecture Series: What Will Be: Wang Auditorium, Sloan School, MIT.

Dertouzos, Michael L. 1997b. *What Will Be: How the New World of Information Will Change Our Lives.* San Francisco, CA: HarperEdge.

Diamond, Peter. 1985. Search Theory: MIT Sloan School of Management.

Drake, William J., and Eli M. Noam. 1997. The WTO Deal on Basic Telecommunications. Big Bang or Little Whimper? *Telecommunications Policy* 21 (9/10):799-818.

Dwyer, F. Robert, Paul H. Schurr, and Sejo Oh. 1987. Developing Buyer-Seller Relationships. *Journal of Marketing* 51 (April):11-27.

Economides, Nicholas. 1994. The Economics of Networks: Stern School of Business, NYU.

Economist. 1997a. A Connected World: A Survey of Telecommunications. *The Economist* 1997 (September 13):1-34.

Economist. 1997b. In Search of the Perfect Market: A Survey of Electronic Commerce. *The Economist*, May 10-16, 1-18.

Farrell, Joseph, and Garth Saloner. 1987. Competition, Compatibility and Standards: The Economics of Horses, Penguins and Lemmings. In *Product Standardization and Competitive Strategy*, edited by H. L. Gabel. New York: North-Holland.

Ferguson, Charles H., and Charles R. Morris. 1993. *Computer Wars : How the West Can Win in a Post-IBM World.* New York: Times Books.

Firestone, Charles M. 1995. The New Intermediaries. In *The Future of Community and Personal Identity in the Coming Electronic Culture*, edited by D. Bollier. Washington, DC: Aspen Institute.

Fox, William F., and Matthew N. Murray. 1997. The Sales Tax and Electronic Commerce: So What's New? *National Tax Journal* 50 (3):573-92.

Frank, Robert H., and Philip J. Cook. 1997. *The Winner-Take-All Society: Why the Few at the Top Get So Much More Than the Rest of Us.* New York: Penguin.

Froomkin, A. Michael. 1996. The Essential Role of Trusted Third Parties in Electronic Commerce. *Oregon Law Review* 75 (1):49-116.

Furchgott, Roy. 1997. What Moves Mel Torme? The Web. *Business Week* (May 26).

Garcia, Linda D. 1995. Networking and the Rise of Electronic Commerce: The Challenge for Public Policy. *Business Economics* 30 (4):7-14.

Gardner, Elizabeth. 1998. Early Adopters: How Four Sites Created in the Web's Infancy are Faring in Midlife. *Internet World*, March 9, 76-78.

Gates, Bill. 1995. *The Road Ahead.* New York: Penguin Books.

Gehrig, Thomas. 1993. Intermediation in Search Markets. *Journal of Economics & Management Strategy* 2 (1):97-120.

Gellman, Robert. 1996. Disintermediaiton and the Internet. *Government Information Quarteriy* 13 (1):1-8.

Gibbons, Robert. 1992. *Game Theory for Applied Economists.* Princeton, NJ: Princeton University Press.

Gillett, Sharon Eisner, and Mitchell Kapor. 1997. The Self-Governing Internet: Coordination by Design. In *Coordinating the Internet*, edited by B. Kahin and J. H. Keller. Cambridge, MA: MIT Press.

Gupta, Alok, Dale O. Stahl, and Andrew B. Whinston. 1997. Priority Pricing of Integrated Services Networks. In *Internet Economics*, edited by L. W. McKnight and J. P. Bailey. Cambridge, MA: MIT Press.

Hagel, John, and Arthur G. Armstrong. 1997. *Netgain: Expanding Markets Through Virtual Communities*. Boston: Harvard Business School Press.

Hart, Oliver. 1989. An Economist's Perspective on the Theory of the Firm. *Columbia Law Review* 89 (7):1757-1774.

Hill, Richard. 1997. Electronic Commerce, the World Wide Web, Minitel, and EDI. *The Information Society* 13 (1):33.

Hirschman, Albert O. 1970. *Exit, Voice, and Loyalty: Responses to Decline in Firms, Organizations, and States*. Cambridge, MA: Harvard University Press.

Hitt, Lorin, and Erik Brynjolfsson. 1994. Crating Value and Destroying Profits? Three Measures of Information Technology's Contributions: Sloan School of Management, MIT.

Hodges, Mark. 1997. Is Web Business Good Business? *Technology Review*, August/September, 22-32.

Hoffman, Donna L., and Thomas P. Novak. 1996. Marketing in Computer-Mediated Environments: Conceptual Foundations. *Journal of Marketing* (July).

Hoffman, Donna L., Thomas P. Novak, and Patrali Chatterjee. 1995. Commercial Scenarios for the Web: Opportunities and Challenges. *Journal of Computer Mediated Communication* 1 (3).

Hoffman, Thomas. 1995. No More Middlemen. *Computerworld* 1995 (July 17):55.

Hotelling, Harold. 1929. Stability in Competition. *The Economic Journal* XXXIX:41-57.

Houser, W., J. Griffin, and C. Hage. 1996. EDI Meets the Internet: Network Working Group, Internet Engineering Task Force.

Iansiti, Marco, and Alan MacCormack. 1997. Developing Products on Internet Time. *Harvard Business Review* 1997 (September-October):108-117.

IDC. 1997. The Global Market Forecast fo Internet Usage and Commerce. Framingham: International Data Corporation.

Imparato, Nicholas, and Oren Harari. 1995. Squeezing the Middleman. *The Futurist*, May-June, 15.

Isard, Peter. 1977. How Far Can We Push the "Law of One Price"? *American Economic Review* 67 (5):942-948.

Jaffray. 1997. The Electronic Commerce Report. Minneapolis: Piper Jaffray.

Kahin, Brian. 1995. The Internet and the National Information Infrastructure. In *Public Access to the Internet*, edited by B. Kahin and J. Keller. Cambridge, MA: MIT Press.

Kahn, Alfred Edward. 1988. *The Economics of Regulation : Principles and Institutions*. Cambridge: MIT Press.

Kalakota, Ravi, and Andrew B. Whinston. 1996. *Frontiers of Electronic Commerce*. Reading, MA: Addison-Wesley.

Kalakota, Ravi, and Andrew B. Whinston. 1997a. *Electronic Commerce: A Manager's Guide*. Reading, MA: Addison Wesley.

Kalakota, Ravi, and Andrew B. Whinston, eds. 1997b. *Readings in Electronic Commerce*. Reading, MA: Addison-Wesley.

Kalil, Thomas. 1995. Public Policy and the National Information Infrastructure. *Business Economics* 30 (4):15-20.

Kambil, Ajit. 1995. Electronic Commerce: Implications of the Internet for Business Practice and Strategy. *Business Economics* 30 (4):27-33.

Kambil, Ajit. 1997. Doing Business in the Wired World. *IEEE Computer* (May):56-61.

Katz, Michael L., and Carl Shapiro. 1985. Network Externalities, Competition, and Compatibility. *American Economic Review* 75 (3):424-440.

Katz, Michael L., and Carl Shapiro. 1994. Systems Competition and Network Effects. *Journal of Economic Perspectives* 8 (2):93-115.

Kavassalis, Petros, Thomas Y. Lee, and Joseph P. Bailey. 1997. Sustaining an Independent Bearer Service Market. Paper read at Bridging Digital Technologies and Regulatory Paradigms, at Berkeley, CA.

Klemperer, Paul, and A. Padilla. 1997. Do Firms' Product Lines Include too Many Varieties. *Rand Journal of Economics* 28 (3):472-488.

Lee, Ho Geun. 1998. Do Electronic Marketplaces Lower the Price of Goods? *Communications of the ACM* 41 (1):73-80.

Levy, Daniel, Mark Bergen, Shantanu Dutta, and Robert Venable. 1997. The Magnitude of Menu Costs: Direct Evidence from Large U.S. Supermarket Chains. *The Quarterly Journal of Economics* 112 (3):791.

Lu, Jing. 1997a. 'Lemons' in Cyberspace: A Call for Middlemen. Paper read at Global Networking '97, June, at Calgary.

Lu, Jing. 1997b. Middlemen in Cyberspace. Paper read at Global Networking '97, June, at Calgary.

Machlup, Fritz. 1962. *The Production and Distribution of Knowledge in the United States*. Princeton, NJ: Princeton University Press.

MacKie-Mason, Jeffrey K., and Hal R. Varian. 1994. Economic FAQs About the Internet. *Journal of Economic Perspectives* 8 (3):75-96.

MacKie-Mason, Jeffrey K., and Hal R. Varian. 1995. Pricing the Internet. In *Public Access to the Internet*, edited by B. K. a. J. Keller. Cambridge: MIT Press.

Malone, Thomas W., and Stephen A. Smith. 1988. Modeling the Performance of Organizational Structures. *Operations Research* 36 (3):421-436.

Malone, Thomas W., JoAnne Yates, and Robert I. Benjamin. 1987. Electronic Markets and Electronic Hierarchies. *Communications of the ACM* 30 (6):484-497.

Markus, M. Lynne, and Daniel Robey. 1988. Information Technology and Organizational Change: Causal Structure in Theory and Research. *Management Science* 34 (5):583-598.

McKnight, Lee W., and Joseph P. Bailey, eds. 1997a. *Internet Economics*. Cambridge, MA: MIT Press.

McKnight, Lee W., and Joseph P. Bailey. 1997b. Internet Economics: When Constituencies Collide in Cyberspace. *IEEE Internet Computing* 1 (6):30-37.

McKnight, Lee W., Joseph P. Bailey, and Bruce A. Jacobson. 1996. Modeling the Economics of Interoperability: Standards for Digital Television. *Revue d'Economie Industrielle* 0 (75):187-210.

McLure, Charles. 1997. Electronic Commerce, State Sales Taxation, and Intergovernmental Fiscal Relations. *National Tax Journal* 50 (4):731-749.

MITI. 1997. Committee on the Improvement of the Environment for Electronic Commerce Interim Report on Main Points. Tokyo: Ministry for International Trade and Industry.

Morgan, David. 1997. Net Innovations Could Mean More Downsizing: Reuters.

Nakagawa, Satoru. 1997. Pricing Strategy on the Internet for Nonperishable Physical Products. S.M., Sloan School of Management, Massachusetts Institute of Technology, Cambridge, MA.

Neil, Suzanne, Lee McKnight, and Joseph Bailey. 1995. The Government's Role in the HDTV Standards Process: Model or Aberration? In *Standards Policy for Information Infrastructure*, edited by B. Kahin and J. Abbate. Cambridge, MA: MIT Press.

Neuman, W. Russell, Lee W. McKnight, and Richard J. Solomon. 1997. *The Gordian Knot: Political Gridlock on the Information Highway*. Cambridge, MA: MIT Press.

Nielsen, Jakob, and Joseph Squier. 1998. Deconstructing Barnes & Noble. *Internet World*, March 9, 82.

Nohria, Nitin, and Robert G. Eccles, eds. 1992. *Networks and Organizations: Structure, Form, and Action*. Boston, MA: Harvard Business School Press.

NRC. 1994. *Realizing the Information Future: the Internet and Beyond*. Washington, D.C.: National Research Council, National Academy Press.

NRC. 1996. *The Unpredictable Certainty: Information Infrastructure Through 2000*. Washington, DC: National Research Council, National Academy Press.

OECD. 1997a. Communications Outlook 1997. Paris: Organisation for Economic Co-Operation and Development.

OECD. 1998. Electronic Commerce: Prices and Consumer Issues for Three Products: Books, Compact Discs, and Software. Paris: Organisation for Economic Co-Operation and Development.

OECD. 1997b. Global Information Infrastructure -- Global Information Society (GII-GIS): Policy Recommendations for Action. Paris: Organisation for Economic Co-Operation and Development.

Petreley, Nicholas. 1997. Reliable Technological Interdependence Will Shape Computing's Future. *InfoWorld* 19 (28):108.

Pindyck, Robert S., and Daniel L. Rubinfeld. 1995. *Microeconomics*. Englewood Cliffs, NJ: Prentice Hall.

Pine, B. Joseph, Don Peppers, and Martha Rogers. 1995. Do You Want to Keep Your Customers Forever? *Harvard Business Review* 1995 (March-April):103-114.

Pool, Ithiel de Sola, ed. 1977. *The Social Impact of the Telephone*. Cambridge, MA: MIT Press.

Pool, Ithiel de Sola. 1983. *Technologies of Freedom*. Cambridge: Harvard University Press.

Porat, Marc Uri. 1977. The Information Economy: Definition and Measurement: Office of Telecommunications, U.S. Department of Commerce.

Porter, Michael E. 1985. *Competitive Advantage: Creating and Sustaining Superior Performance*. New York: The Free Press.

Preston, Lee E. 1963. Markups, Leaders and Discrimination in Retail Pricing. *Journal of Farm Economics* XLIV (2):291-306.

Preston, Lee E., and Reed Hertford. 1962. The Anatomy of Retail Price Competition: A Study of Advertised Food Prices. *California Management Review* IV (3):13-30.

Ramanathan, Ramu. 1993. *Statistical Methods in Econometrics*. San Diego, CA: Academic Press.

Rayport, Jeffrey F., and John J. Sviokla. 1994. Managing in the Marketspace. *Harvard Business Review* November-December:141-150.

Reagle, Joseph M. 1996. Non-Transferable Characteristics in a Crypto-Economy. Cambridge, MA: Research Program on Communications Policy, MIT.

Reich, Robert B. 1990. Who Is Us? *Harvard Business Review*:53-64.

Reiley, David H. 1996. Magic on the Internet: Experimental Tests of Auction Theory. Ph.D., Department of Economics, Massachusetts Institute of Technology, Cambridge, MA.

Reilly, Patrick M. 1997. Barnes & Noble Sues Rival Amazon.com. *The Wall Street Journal*, May 13, B3.

Resnick, Paul, Richard Zeckhauser, and Chris Avery. 1995. Roles for Electronic Brokers. In *Toward a Competitive Telecommunication Industry: Selected Papers from the 1994 Telecommunications Policy Research Conference*, edited by G. W. Brock. Mahwah, NJ: Lawrence Erlbaum Associates.

Rubinstein, Ariel, and Asher Wolinsky. 1987. Middlemen. *The Quarterly Journal of Economics* August:581-593.

Salop, Steven, and Joseph Stiglitz. 1977. Bargains and Ripoffs: A Model of Monopolistically Competitive Price Dispersion. *Review of Economic Studies* 44:493-510.

Salop, Steven C. 1979. Monopolistic Competition with Outside Goods. *The Bell Journal of Economics* 10 (1):141-156.

Sarkar, Mitrabarun, Brian Butler, and Charles Steinfield. 1996. Cybermediaries in Electronic Marketspace: Towards Theory Building. *Journal of Business Research*.

Sarkar, Mitra Barun, Brian Butler, and Charles Steinfield. 1995. Intermediaries and Cybermediaries: A Continuing Role for Mediating Players in the Electronic Marketplace. *Journal of Computer Mediated Communication* 1 (3).

Schiller, Zachary, and Wendy Zellner. 1994. Making the Middleman An Endangered Species. *Business Week*, June 6, 114-115.

Schwartz, Evan I. 1997. *Webonomics: Nine Essential Principles for Growing Your Business on the World Wide Web*. New York, NY: Broadway Books.

Shapiro, Carl. 1983. Premiums for High Quality Products as Returns to Reputations. *Quarterly Journal of Economics* 68:659-679.

Shepard, Andrea. 1991. Price Discrimination and Retail Configuration. *Journal of Political Economy* 99 (1):30-53.

Sheshinski, Eytan, and Yoram Weiss, eds. 1993. *Optimal Pricing, Inflation, and the Cost of Price Adjustment*. Cambridge, MA: MIT Press.

Sheskin, David J. 1997. *Handbook of Parametric and Nonparametric Statistical Procedures*. New York, NY: CRC Press.

Simon, Herbert A. 1971. Designing Organizations for an Information-Rich World. In *Computers, Communications, and the Public Interest*, edited by M. Greenberger. Baltimore, MD: John Hopkins Press.

Sirbu, Marvin, and J. D. Tyger. 1995. NetBill: An Internet Commerce System Optimized for Network Delivered Services: Carnegie Mellon University.

Smith, Adam. 1776. *The Wealth of Nations*. 1985 Edition ed. New York: Random House.

Spulber, Daniel F. 1996. Market Microstructure and Intermediation. *Journal of Economic Perspectives* 10 (3):135-152.

Steinfield, Charles, Robert Kraut, and Alice Plummer. 1996. The Impact of Interorganizational Networks on Buyer-Seller Relationships. *Journal of Computer-Mediated Communication* 1 (3).

Stigler, George J. 1961. The Economics of Information. *Journal of Political Economy* LXIX (3):213-225.

Stiglitz, Joseph E. 1989. Incentives, Information, and Organizational Design: NBER.

Sun, Karl. 1997. Micropayments as a Form of Market-Based Intellectual Property Protection. Masters, Technology and Policy, Massachusetts Institute of Technology, Cambridge.

Tapscott, Don. 1996. *The Digital Economy: Promise and Peril in the Age of Networked Intelligence*. New York: McGraw-Hill.

Townsend, Robert M. 1978. Intermediation with Costly Bilateral Exchange. *Review of Economic Studies* 45 (3):417-425.

U.S. 1996. Katzman v. Victoria's Secret Catalogue. New York: United States District Court.

U.S. 1997. National Association of College Bookstores, Inc. v. Cambridge University Press, et al. New York: United States District Court.

U.S. Congress. 1936. Robinson-Patman Act. Washington, D.C.: United States Congress.

U.S. Congress. 1996. Telecommunications Act of 1996. Washington, D.C.: U.S. Congress.

van Alstyne, Marshall. 1996. The Balkanization of Cyberspace and the Myth of the Global Village. Cambridge, MA: Sloan School of Management, Massachusetts Institute of Technology.

Varian, Hal R. 1989. Price Discrimination. In *Handbook of Industrial Organization*, edited by R. Schmalensee and R. Willig. Amsterdam: North Holland.

Varian, Hal R. 1992. *Microeconomic Analysis*. New York: W. W. Norton & Company.

Varian, Hal R. 1996. The Information Economy: How Much Will Two Bits be Worth in the Digital Marketplace? *Educom Review* 1996 (January-February):44-46.

Varian, Hal R. 1997. Versioning Information Goods. Berkeley, CA: School of Information Management and Systems, University of California, Berkeley.

Viscusi, W. Kip, John M. Vernon, and Jr. Joseph E. Harrington. 1997. *Economics of Regulation and Antitrust*. Cambridge, MA: MIT Press.

Wang, Qiong, Jon M. Peha, and Marvin A. Sirbu. 1997. Optimal Pricing for Integrated Services Networks. In *Internet Economics*, edited by L. W. McKnight and J. P. Bailey. Cambridge, MA: MIT Press.

Werbach, Kevin. 1997. Digital Tornado: The Internet and Telecommunications Policy. Washington, D.C.: Office of Plans and Policy, Federal Communications Commission.

Wigand, Rolf T. 1997. Electronic Commerce: Definition, Theory, and Context. *The Information Society* 13 (1):1-16.

Wigand, Rolf T., and Robert I. Benjamin. 1996. Electronic Commerce: Effects on Electronic Markets. *Journal of Computer-Mediated Communication* 1 (3).

Williamson, Oliver. 1975. *Markets and Hierarchies: Analysis and Antitrust Implications*. New York: Free Press.

Williamson, Oliver E. 1979. Transaction-Cost Economics: The Governance of Contractual Relations. *Journal of Law and Economics* 22 (October):233-261.

Wilson, Robert. 1993. *Nonlinear Pricing*. New York: Oxford University Press.

Yavas, Abdullah. 1992. Marketmakers versus Matchmakers. *Journal of Financial Intermediation* 2:33-58.

Zettelmeyer, Florian. 1995. The Strategic Use of Consumer Search Cost. Cambridge, MA: Sloan School of Management, MIT.