Internet Exchanges for Used Books:
An Empirical Analysis of Welfare Implications

Anindya Ghose,[‡] Michael D. Smith,[†] and Rahul Telang[†]

aghose@stern.nyu.edu
{mds, rtelang}@andrew.cmu.edu

This Version: January 2005

Available from http://ssrn.com/abstract=584401

Acknowledgements: The authors thank Al Greco, Otto Koppius and participants at the 2004 INFORMS Annual Conference, the 2004 MISRC/CRITO Symposium on the Digital Divide, the 2003 International Conference on Information Systems, the University of California at Davis, and Carnegie Mellon University's Tepper School of Business and H. John Heinz III School of Public Policy and Management for valuable comments on this research. We also thank David Dewey, Samita Dhanasobhon, Steve Gee, Stoyan Arabadjiyski, Sumiko Hossain, Nat Luengnaruemitchai, and Sriram Gollapalli for outstanding research assistance.

[†] H. John Heinz III School of Public Policy and Management, Carnegie Mellon University, Pittsburgh, PA, 15213. (Smith: 412-268-5978; Telang: 412-268-1155)

[‡] Stern School, New York University, New York, NY, 10012. (212-998-0807)

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An Empirical Analysis of Welfare Implications and Policy Issues

ABSTRACT

Information technology-enabled exchanges have enhanced the viability of a variety of secondary markets, notably markets for used books. Electronic used book exchanges, in particular, offer a wider selection, lower search costs, and significantly lower prices than physical used bookstores do. The increased viability of these used book markets has caused concern among groups such as the Book Publishers Association and Author's Guild who believe that used book markets will significantly cannibalize new book sales.

This proposition, while theoretically possible, is based on speculation as opposed to empirical evidence. In this research, we use a unique dataset collected from Amazon.com's new and used marketplaces to estimate the impact of IT-enabled used book markets on new book sales. We use these data to calculate the impact of these secondary market exchanges on consumer and publisher welfare by calculating the cross-price elasticity of new books sales with respect to used book prices.

Our analysis suggests that IT-enabled secondary market exchanges increase consumer surplus by approximately $70 million annually. Further, we find that only 15% of used book sales at Amazon cannibalize new book purchases. The remaining 85% of used book sales apparently would not have occurred at Amazon's new book prices. This low cannibalization means that book publishers lose only $32 million in gross profit annually (about 0.2% of total gross profit) due to the presence of Amazon's used book markets. Further, the additional used book readership gain from these electronic markets may mitigate author losses through increased revenue from secondary sources such as speaking and licensing fees. These surplus changes, combined with the estimated $64 million the used book market added to Amazon's gross profits, show that IT-enabled used markets for books have a strong positive first-order impact on total welfare.

Keywords: *Publisher Welfare, Retailer welfare, Consumer Surplus, Price competition, Used Books Sales, Electronic Markets*

1. Introduction

> "…as a leader in the bookselling industry, Amazon's [used book] sales practices can have a significantly deleterious effect on new book sales. If your aggressive promotion of used book sales becomes popular among Amazon's customers, this service will cut significantly into sales of new titles, directly harming authors and publishers."
> *Author's Guild and American Association of Publishers, Open Letter to Jeff Bezos (CEO Amazon.com), dated April 9, 2002*

> "We've found that our used books business does not take business away from the sale of new books. In fact, the opposite has happened. Offering customers a lower-priced option causes them to visit our site more frequently, which in turn leads to higher sales of new books while encouraging customers to try authors and genres they may not have otherwise tried. In addition, when a customer sells used books, it gives them a budget to buy more new books."
> *Jeff Bezos, open letter to Amazon.com's used booksellers, dated April 14, 2002.*

Information technology reduces the search and transaction costs for buyers and sellers to locate and trade products, and can thereby facilitate the creation of technology-mediated electronic exchanges. These exchanges allow sellers to easily reach a worldwide market and allow buyers to easily locate items that frequently would be unavailable in traditional physical stores.

Consumer-to-consumer exchanges represent one prominent area where the low search and transactions costs in IT-enabled markets have enabled product exchanges that would not have been viable in a comparable brick-and-mortar environment. For example, Amazon.com has recently starting listing exchanges for used products, such as books, sold by individual customers alongside listings for Amazon's new products.

There is, of course, nothing new about the sale of used products. In the United States, the first sale doctrine (17 U.S.C. §109) allows for the resale of copyrighted works such as books, and used bookstores are common in physical settings. Rather, electronic exchanges alter the scale

and scope of what is possible with regard to the sale of used products. For example, in a physical environment new and used books are typically sold in separate brick-and-mortar stores, raising search costs for customers who wish to compare prices between the two outlets. Further, brick-and-mortar used bookstores have limited inventory-holding capacity, which makes it difficult to stock a full range of new and used titles in the presence of customers with heterogeneous preferences toward used offerings.[1] Finally, brick-and-mortar used bookstores only draw customers from a small geographic area, reducing the liquidity of these markets.

In contrast in Internet exchanges, search costs to compare prices for new and used books are much lower than in brick-and-mortar stores. This is in part because used books can be listed side-by-side with new books either by retailers (e.g., Amazon.com) or by shopping agents (e.g., BizRate.com). Likewise, Internet retailers do not face the same geographical or physical constraints as physical retailers do. Thus, these retailers can attract buyers from across the world and can add additional listings to their book offerings at a very low cost, and in most cases don't even have to take possession of the products.[2] For example, Amazon.com allows anyone wishing to sell a used book to list his or her product on Amazon's site. There is no listing fee, but if the book sells Amazon pays the seller $2.26 to cover their shipping fees and takes a 15% commission on the sale of the item plus $1. Because of this, Amazon "stocks" at least one used book for the vast majority the 2 million books in print, and for many out of print books as well; while a typical brick-and-mortar used bookstore stocks a total of between 5,000 and 30,000 titles. Moreover, the characteristics of Amazon.com's used book markets means that the retailer typically

[1] Note that used textbooks college bookstores are relatively more viable because of the narrow range of titles offered and the relatively homogeneous customer preferences toward quality differentiation and prices.
[2] New books can be drop shipped from book distributors directly to the customer (Brynjolfsson, Hu, and Smith 2003) and most used books sales are transacted directly from consumer to consumer with the retailer acting only as a broker.

stocks multiple copies of used books, creating significant price competition among sellers. As a result in section 3 below we show that the prices on used books are 38-75% lower than prices at even the largest brick-and-mortar stores in the United States.

Together, these characteristics appear to have caused an increase in the number of used books purchased online: the share of used books purchased online increased from 11.3% in 2001 to 54.4% in 2003 (Siegel and Siegel 2004).[3]

These changes in used book sales have raised concerns among publishers and authors. Groups such as the Author's Guild and the American Association of Publishers reason that since authors and publishers are only paid for the initial sale of a product, the increased selection and lower prices of online used book markets will cannibalize new book sales and cut into both publisher revenues and author royalty payments.

However, these concerns, while theoretically possible, remain untested and many potentially countervailing effects remain unexplored. For example, the availability of a resale market may increase user valuation of these goods and thereby increase the prices retailers are able to charge (Miller 1974). This is precisely what happened to prices for used textbooks following the large-scale introduction of campus used book exchanges. Likewise, there may be only weak demand linkages between the two markets such that easy availability of used book markets has little impact on new book purchases, but instead leads to increased purchases from highly price sensitive customers who would not otherwise have participated in the market.

We first analyze this question by developing a simple model to analyze the impact of used book markets on publisher and retailer welfare. Our analytic model suggests that publishers face two

[3] As a point of comparison, the Internet accounts for only 12.7% of new book sales as of 2003 (Rappaport 2004).

countervailing effects from used book markets: cannibalization of new book sales will reduce publisher and author revenue while the increased viability of used book sales may increase the willingness to pay of new book purchasers, allowing publishers to charge more for books and thereby increasing revenue. The critical factor to determining which of these two effects dominates is the cross-price elasticity of demand for new books with respect to used books, with low elasticities suggesting that publishers are less likely to be hurt by used book sales.

However, to date, the publishing industry has been unable to precisely measure this elasticity because both Amazon's new and used book quantities sold have been unobservable. For example, Tedeschi (2004) quotes Paul Aiken, the Executive Director of the Author's Guild as saying "[t]here has always been used-book sales, but it's always been a background noise sort of thing. Now it's right there next to the new book on Amazon…We think it's not good for the industry and it has an effect, ***but we can't measure it***" (emphasis ours). Likewise, Kelly Gallagher, chairperson of the Book Industry Study Group's Committee on Used Book Sales observes "everybody has anecdotal evidence to show used books' cannibalization of new books, ***but we don't have any accurate numbers***" (emphasis ours, quoted in Publishing Trends 2004). Thus, the second part of this study represents the first attempt to empirically measure the impact of used book markets on new book sales and the resulting first-order impact on publisher, retailer, and consumer welfare.

To do this we use unique dataset collected from Amazon.com's new and used marketplaces to estimate the impact of online used book markets on new book sales. Our data cover a 180 day sample collected from September 2002 to March 2003 and a separate 85 day sample collected from April to July 2004, and include over 9.8 million new and used price observations for 393 individual book titles. These data suggest that only 15% of used book sales at Amazon cannibal-

ize new book purchases. The remaining 85% of used book sales apparently would not have occurred at Amazon's new book prices. This low cannibalization means that without raising prices, book publishers lose approximately $32 million in gross profit (about 0.2% of total gross profit) from the presence of Amazon's used book markets. Further, the presence of used book markets raises Amazon.com's gross profit by $64.1 million. Most significantly, however, these IT-enabled exchanges increase consumer surplus by $70.2 million annually. Thus, together these IT-enabled markets result in a net welfare gain of approximately $102 million to society. Further, our analysis suggests that the losses to publishers and authors may be mitigated by two factors. First, as noted above, the increased viability of used book markets may increase the willingness to pay of new book purchasers allowing publishers to charge more in equilibrium for new books. Second, the additional readership gained through the used book markets may mitigate author losses to the extent that authors earn money from indirect sources such as speaking fees, licensing fees, and advances on future books.

The rest of the paper is organized as follows. In section 2, we discuss the literature relevant to our present work. In section 3, we present an analytical model which highlights the difference in the impact of secondary markets on publishers and retailers. In Section 4, we compare the characteristics of the brick-and-mortar used book market to the Internet used book market to argue that the Internet may have a significant effect on used book sales. We describe our data in section 5 and present our empirical model and results in section 6. We discuss the implications of our results in Section 7.

2. Literature

Our research is related to three streams of extant work. The first relates to literature on piracy, copyright enforcement, and the impact of piracy on a legitimate producer's welfare. While the

sale of used goods is allowed under copyright law, the piracy literature provides many interesting parallels to our work. For example, Liebowitz (1982 and 1985) shows that legitimate demand may increase with buyers' supply of copies to others and Gopal and Sanders (1997) have similar findings for sharing among peer users. Piracy may also increase legitimate demand by enabling the producer to credibly commit to not reduce its price in the future (Takeyama 1997). In other work, Chen and Png (2003) consider how the government should set the fine for copying, or tax and subsidy the legitimate software. Another stream of relevant literature relates to study durable goods markets. This includes Anderson and Ginsburgh (1994), Hendel and Lizzeri (1999), among others who highlight the impact of secondary markets on a monopolist supplier. Ghose, Krishnan and Telang (2003) consider the impact in a duopoly setting and show that both publisher and retailers can benefit with secondary markets.

Our research also draws on prior research that developed techniques to estimate welfare effects from introduction of new goods. Classic economic theory shows that if the price of an existing good changes from p_0 to p_1, the resulting change in welfare measure is given by how much the consumer would pay, or would need to be paid, to be just as well off after the price change as they were before the price change. This measure corresponds to Hicks' (1942) compensating variation measure. To measure the welfare change from the introduction of a new good, Hausman (1997a) proposed to modify Hick's measure by using the product's "virtual price" — the price that would set demand to zero — as p_0 and the introductory price as p_1. This technique has been applied to measure welfare gains for new goods ranging from Honeynut Cheerios (Hausman 1997b) to increased product variety on the Internet (Brynjolffson, Hu and Smith 2003). We apply this technique in this present paper to analyze welfare changes resulting from readily available used book markets on the Internet.

Our research also draws on the academic literature relating to competition on the Internet and consumer price sensitivity on the Internet (e.g., Brynjolfsson and Smith 2000; Clay, Krishnan and Wolff 2001). Goolsbee (2000) finds large cross-price elasticity of online retail and online computers with respect to physical retail prices. Ellison and Ellison (2001) find large elasticities for computer memory and motherboards from data on a private computer parts retailer. Chevalier and Goolsbee (2003) directly estimate the elasticities of demand facing both Amazon and BarnesandNobles.com. Their results show significant price sensitivity at both merchants but demand at BarnesandNobles.com is much more price-elastic than the demand at Amazon. Chevalier and Mayzlin (2003) examine the effect of consumer reviews on book sales at Amazon.com and BarnesandNoble.com, finding that positive reviews can lead to increased book sales and better fit with customer preferences.

3. Model

In this section, we develop a simple model of the impact of secondary markets on the welfare of publishers, retailers, and consumers. Since the major focus of our paper is the empirical estimation, we present this simple model to highlight that depending on the assumptions and the parameter values, one can reach different conclusions on the impact of used good markets on publishers and retailers. This happens because used good markets lead to two countervailing effects, the details of which we provide subsequently.

The model consists of a single publisher selling a new book through a retailer at a commission k. The retailer, in turn, sells the product to a mass of consumers. Without loss of generality, the marginal cost of the book to the publisher is set to zero. Consumers are heterogeneous in their valuation for books based on book quality-whether it is new or used. Suppose there are two

groups of consumers. One group, Group 1, consisting of N_1 users has a higher valuation (P_N) and prefers the new book. The other group, Group 2, consisting of N_2 users has lower valuations (P_U) and can afford to buy only used books, when they are available.

3.1. No Secondary E-Marketplace

We begin by modeling the case when used goods are absent. Since there is no secondary market, consumers can only buy a new good. When there is no used book market, and if $P_N N_1 > P_U (N_1 + N_2)$ then the publisher sells only to consumers in Group 1 by setting the price of new books to P_N. Now, the publisher makes the profit of $(1- k) P_N N_1$ and the retailer accrues a profit of $k P_N N_1$. Group 2 consumers are obviously left out of the market.

3.2. Retailer establishes a Secondary E-Marketplace

Next, we consider the case when the retailer opens a used book market where consumers can buy and sell used books with minimal transaction costs, which we set to zero without loss of generality. Whenever a consumer sells the used book through this secondary market, she gets a sum equivalent to the used book price minus the used book commission, which is kept by the retailer. We are again interested in finding out what happens to the profits of the publisher and retailer. Since the willingness of the second segment of users is P_U, that would be the price of the used books sold. Let k_u denote the commission charged by the retailer to the used book seller. This implies that the consumer keeps $(1- k_u) P_U$ of the used sale price, with the remainder accruing to the retailer.

As expected, higher valuation consumers buy new books and lower valuation consumers buy used books. Note that the presence of a used book market allows buyer of new books to sell

them later.[4] Rational consumers will, of course, take into account the ability to sell their book when purchasing a new book. The publisher would also realize this trade-in value and would instead sell the new book at the price $P_N + (1- k_u) P_U$ and generate the profit of $(1-k) (P_N + (1- k_u) P_U) N_1$. This is the *price-increase effect*. Clearly then the profit of the publisher increases in the presence of a secondary market. This is the argument of Miller (1974) and Swan (1980) where they argue that the second-hand markets need not hurt the publisher because publishers will anticipate the resale value of their product and thereby, increase the new book price accordingly.

But Waldman (1996) and Hendel & Lizzeri (1999) argue that the used book market also creates a *substitution effect* which the models above ignore. The substitution effect accrues from the fact that new books face competition from used books. Accordingly, some consumers from Group 1 will shift to the used-book market because of such a substitution effect. Thus, the availability of used books cannibalizes the sales of some new books, thereby reducing the new book demand. When this happens then the publisher can suffer a loss. The net effect can go either way.

To show this, suppose that α proportion of consumers from Group 1 buy used books when used books are available. Now publishers can only sell new books to $(1- \alpha) N_1$ users of Group 1. The remaining αN_1, and some users from group 2 buy used books. Hence, the publisher's profit is given by

$$(1- \alpha) N_1 (1-k) (P_N + (1- k_u) P_U).$$

where $(P_N + (1- k_u) P_U)$ is the new price charged by publishers. Comparing the profit to the no-used market case, publishers will profit in the presence of the used book market as long as

[4] A more sophisticated model could also consider the fact that some of the new book sellers may like to hold onto their books. However, any such complexities would still provide us with the similar insights. To focus on the empirical analysis, we avoid such details.

$$(1-\alpha)\, N_1\, (1\text{-}k)\, (P_N + (1-k_u)\, P_U) \;>\; N_1\, (1\text{-}k)\, P_N$$

$$(1-\alpha)\, (P_N + (1-k_u)\, P_U) \;>\; P_N$$

$$(1-\alpha)\, (1-k_u)\, P_U \;>\; \alpha\, P_N$$

$$\frac{1-\alpha}{\alpha} > \frac{P_N}{(1-k_u)P_U} \qquad (1)$$

Since α is the cannibalization factor, a higher α increases the publisher's loss. The retailer, on the other hand, generates profits from both new and used book sales through the respective commissions, k and k_u. Hence, while it loses some money due to the cannibalization of new book sales, it compensates for that loss through profits from the used book sales. Note that since only $(1-\alpha)\, N_1$ copies of used books are available, the retailer's profit is given by

$$(1-\alpha)\, N_1\, k\, (P_N + (1-k_u)\, P_U) + k_u\, (1-\alpha)\, N_1\, P_U.$$

The first term is the retailer commission from selling new books and the second term is the retailer commission from $(1-\alpha)\, N_1$ customers selling used books to rest of the group 1 and some of the group 2 customers. This implies that the retailer is better off in the presence of used book market if and only if

$$(1-\alpha)\, N_1\, k\, (P_N + (1-k_u)\, P_U) + k_u\, (1-\alpha)\, N_1\, P_U \;>\; k\, P_N\, N_1$$

$$(1-\alpha)\, [k\, P_N + k\, (1-k_u)\, P_U + k_u\, P_U] \;>\; k\, P_N$$

$$(1-\alpha)\, [k\, P_U + k_u\, P_U \;-\; k\, k_u\, P_U] \;>\; \alpha\, k\, P_N$$

$$\frac{1-\alpha}{\alpha} > \frac{kP_N}{\left[(k+k_u)P_U - kk_U P_U\right]} \qquad (2)$$

Note that, for a given k and k_u,(wholesale discounts on new books charged by publishers to retailers are set between 43 -51% of list prices, whereas the used book commission set by Amazon

is fixed at 15% of sale price), equation (2) holds for a very wide range of the parameter space. Thus, the retailer can benefit while the publisher can lose depending on the cannibalization factor α, consumer's valuation of used books (P_U) and the publisher's new book pricing strategy (P_N).[5] Even though we have a simple model, the basic intuition is quite robust.

In summary, the prediction of the theoretical models of used good markets critically depends on the parameter values, which are inherently empirical in nature. Therefore, in the following sections, we empirically quantify the actual *loss* to publishers and the *gain* to retailers (such as Amazon) that have established a secondary electronic market by estimating the value of α, and by observing the information on the other model parameters such as new and used book prices (P_N , P_U) and new and used good commissions (k, k_u).

3.3. Analysis of Brick-and-Mortar versus Internet Used Book Markets

For the Internet to have an impact on used book sales, one must first show that the characteristics of Internet markets are significantly different from those of brick-and-mortar markets. To do this, in June 2004, we generated a list of 30 randomly selected books from the October 2002 Bowker Books in Print listings, and 30 randomly selected books from the 2002 New York Times bestseller lists. These lists are useful because they are old enough to include books that would generally be available in physical bookstores and they contain a mix of popular and less popular titles.

We searched for these books at Amazon.com and found that at least one used copy was available for each of the 60 books, even though 13 of the books were out of print and did not have new copies available from Amazon itself. Moreover, for the random books, there were an average of

[5] It is important to point out that in our data we do not see any evidence of the price effect. That is, we do not observe any increase in the new book prices despite the availability of used books. This implies that the publisher will always lose if there is some cannibalization.

22.6 competing used book offers for each book and for the former New York Times bestsellers, there were an average of 241.3 competing offers. These multiple offers create competition among sellers to lower their prices, and as a result the random books have an average 40.1% discount off the new book list price and the former bestsellers have an average 84.5% discount off list price. As a point of comparison, Amazon's new books had an average 9.1% and 30% discount off list price for these random and former bestseller titles.

To understand how the selection of used titles available at Amazon would compare to the selection of a typical physical used bookstore, we searched the catalogs of four local used bookstores that advertised themselves as having a "general selection." Three of the four stores did not carry any of the 60 books on our list. The fourth, Eljay's Used Books, carried none of the random books and only six of the former bestsellers. Moreover, Amazon's used price was an average of 75% ($8.16) lower than the price at Eljay's for these six books.

As another point of comparison, we used ABEbooks.com to search for the "best" used bookstore in the United States in terms of selection. ABEbooks catalogs the inventory of 7,680 used bookstores in the United States. Siegel and Siegel (2004) estimate that there are between 8,000 to 10,000 used booksellers in the United States, and thus ABEbooks catalogs the vast majority of used bookstores in the country.

Using ABEbooks' listings, we found that Powell's Books of Portland, Oregon had the best selection of any of these 7,680 bookstores for the books in our sample — but still only carried 11 of the 30 random titles and 29 of the 30 former bestsellers. Moreover, the used price at Amazon averaged 38% ($4.93) lower than Powell's price on the random books and 67% ($7.03) lower than Powell's price on former bestsellers.

Thus, a used book shopper at Amazon.com would have lower search costs to locate a book, significantly larger selection (both in terms of availability and the number of competing offers), and dramatically lower prices than they would find at even the best physical used bookstore. These lower search costs, greater selection, and lower prices may increase the number of used books purchased in the United States. Moreover, because new and used books are listed side-by-side, new book shoppers can more easily become aware of used book offerings than they could in a typical physical bookstore and might be tempted by the wide selection and low prices to buy a used book instead of a new book.

In short, Internet markets for used books have substantially higher product variety, lower search costs, and lower prices than comparable used book markets. These characteristics have likely driven the explosive popularity of used book sales online, which in 2003 accounted 54.4% of all used book sales versus just 11.3% in 2001 (Siegel and Siegel 2004).

4. Data

Our data are compiled from publicly available information on new and used book prices and sales rankings at Amazon.com (see Figures 2 and 3). The data are gathered using automated perl scripts to access and parse HTML pages downloaded from the retailer.[6] The data were collected in two separate samples. The first was collected over a 180 day time period from September 2002 to March 2003 and includes 273 individual book titles. This panel of books includes an equal number of books from each of five major categories — New York Times best sellers, former New York Times best sellers, Amazon Computer best sellers, best selling Text Books, and "New and Upcoming Books." New York Times bestsellers were selected at random from the current New York Times list at the beginning of the sample and replaced as they were removed

[6] Recently a few papers have used similar methodologies (using PERL or Java) to collect data by parsing HTML pages on the Internet.(See, for example, Bapna, Goes and Gupta 2003)

from the list. Former bestsellers were selected at random from bestsellers in the year 1999. Computer bestsellers and new and upcoming books were selected at random from the respective list at Amazon.com. Finally, bestselling textbooks were selected from the facultyonline.com bestseller list.

Figure 2: Sample New Book Listing at Amazon.com

In early 2004 Amazon.com added a new variable to their XML data feed to developers, allowing us to obtain accurate measures of their used book sales (which we describe in more detail below). At this point, we created a similar sample of books, drawing 40 books from each of four categories: current bestsellers, former bestsellers, new and upcoming, and random. New and upcoming books were selected in the same way as the first sample. Current and former bestsellers were drawn from the current list of Amazon bestselling books and Amazon's top selling books in 2002. Finally, random books were selected at random from all Amazon.com titles listed in the

"browse" section (which we believe includes all titles offered for sale by Amazon). In this sample we dropped 15 books (10 random titles and 5 former bestsellers) that were out of print and therefore did not have new Amazon prices. These data were collected over an 85-day period from April to July 2004. Our total data sample includes 41,994 observations.[7]

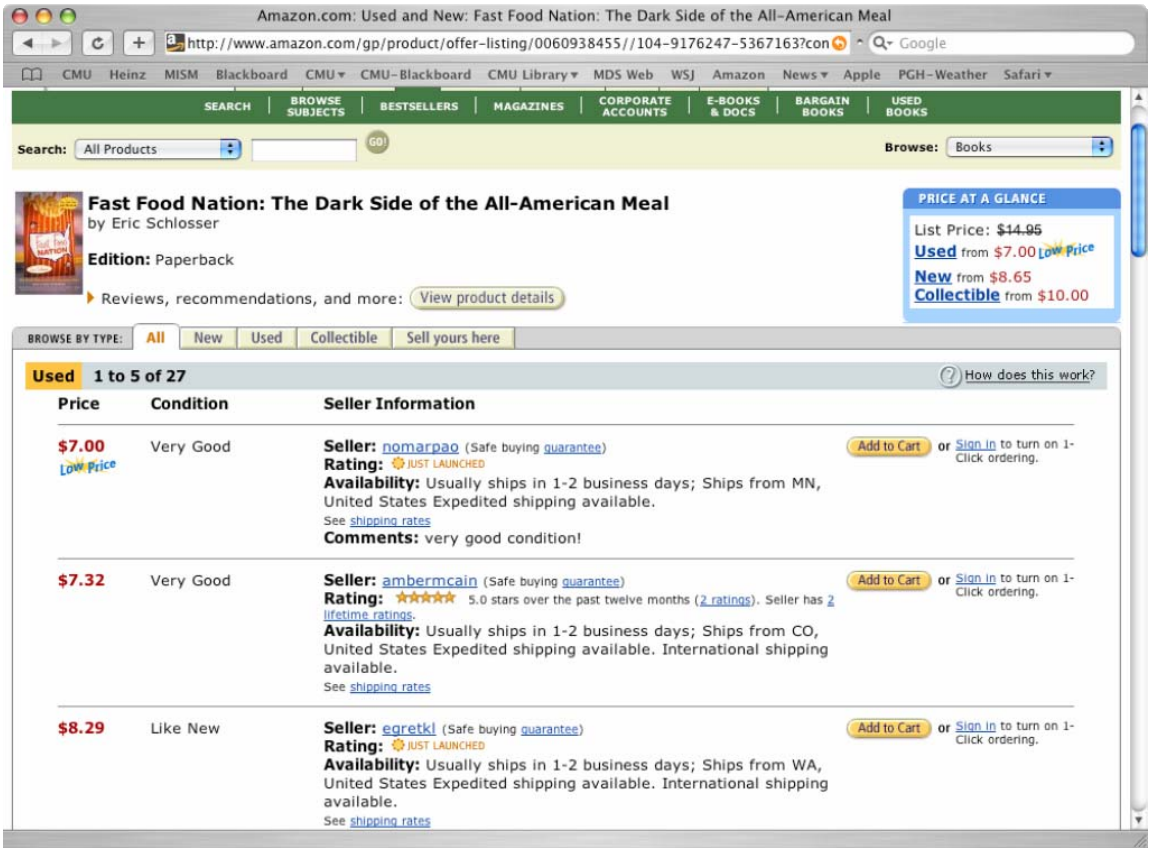

Figure 3: Sample Used Book Listing at Amazon.com

For each sample, we collect data on the Amazon.com sales rank (which serves as a proxy for quantity sold as described in Section 6), new book prices charged by Amazon.com, and the book prices by Amazon.com marketplace sellers. Our marketplace data includes the price, condition, and seller rating for each used book listed for sale. Condition is self-reported by the seller and can be either "like new," "very good," "good," or "acceptable." Seller rating is on a 0-5 scale

[7] Note that not every book was observed on ever day for two reasons. First, in the initial data sample, as noted above, we dropped and replaced many bestselling titles over time. Second, in both samples we occasionally experienced server errors that prevented a particular book from being gathered on a particular day.

based on the reported experiences of prior buyers. Note that Amazon allows even some of its competitors like ABEbooks and Powell's Books to sell books on its marketplace. Thus our data also takes into account some of the competitive effects on prices.

In the second sample, we were also able to add data regarding used book sales using Amazon.com's XML data feed for website. Between March 2003 and April 2004, Amazon added a unique product identifier for each product listed in the used book market. We infer that a sale has occurred when a product identifier that appeared in the previous collection period does not appear in the current collection period's XML listings.[8] We collected this marketplace sales data once every 2 hours for books ranked lower than 10,000 and every 6 hours for all other titles. In our empirical estimates below, for cases where multiple sales are observed in a time period we assume that the lowest priced book sold first. This is consistent with the strong preference we observe in our data for low priced books (20% of the sales in our data occur for the lowest priced book in the session). To the extent that this assumption is incorrect it will inflate our estimates of the own price elasticity of used book demand and mean that our consumer surplus estimates are a lower bound on the true consumer surplus gain.

Table 1 lists summary statistics for our data. All prices listed are the lowest price for each category for each ISBN. We did this because many of the used and new non-Amazon prices in our data set were substantially higher than the lowest price for the same condition listed for the same book on the same date. This likely occurs for three reasons. First, the "market price" for any particular condition changes rapidly as listings are added and as listed items are sold. Second, sellers

[8] Amazon claims on its site that books are removed from the marketplace listings after 30 days without a sale. However, when we listed the amount of time between when a book was listed in Amazon's marketplace and when we inferred a sale we saw no unusual rise in "sales" around the 30 day mark. Therefore we include all inferred sales in our analyses regardless of the number of days before a sale occurs. (Removing all imputed sales after 30 days would result in no appreciable change to our results.)

face potentially high menu costs to change the price of their listing. And, third, because Amazon does not charge sellers a fee to maintain their listing, and thus the seller faces no penalty for listing a non-competitive offer.

Table 1: Summary Statistics

Variable	*Obs.*	*Mean*	*St. Dev.*	*Min*	*Max*
Amazon Rank	41,994	74,169	238,283	1	2,556,356
List Price	41,994	30.60	30.05	5.99	299.99
Amazon Price	41,994	24.04	26.47	1.95	209.99
Best "Like New" Used Price	41,492	15.16	21.32	0.01	194.25
Best "Very Good" Used Price	33,517	11.26	18.41	0.01	207.60
Best "Good" Used Price	31,939	11.24	16.42	0.01	200.00
Best "Acceptable" Used Price	20,368	7.86	15.70	0.01	222.35
Best Used Price (All Conditions)	41,994	13.14	19.16	0.01	151.95
Seller Rating	41,994	3.97	1.65	0	5
Count of Used Books	41,994	81.15	131.78	1	753
Days Since Release	41,994	717.87	1,336.94	1	21,235

5. Results

5.1 Empirical Methodology

Until recently it was difficult to calculate the price elasticity for products sold on the Internet because, while the price of individual items could be readily observed, the quantity sold remained unobserved. Two recent papers address this problem by providing a way to map the observable Amazon.com sales rank to the corresponding number of books sold. In both cases, the authors find on a stable relationship between the ordinal sales rank of a book and the cardinal number of sales, using roughly the following Pareto relationship:

$$Quantity = \delta \cdot Rank^{\beta} \tag{3}$$

Chevalier and Goolsbee (2003) calibrate this relationship using a creative and easily executed experiment where the authors obtain a book with a known number of weekly sales, purchase several copies of the book in rapid succession from Amazon.com and track the Amazon sales

rank before and shortly after their purchase. Using these two points, they estimate β=-0.855.[9] They also estimated this parameter from similar sales-rank experiments conducted by Weingarten (2001) and Poynter (2000) as –0.952 and –0.834 respectively.

Brynjolfsson, Hu and Smith (2003) calibrate this relationship using data from a book publisher mapping the Amazon sales rank to the number of copies the publisher sold to Amazon. The data include weekly sales and rank observations for 321 books with sales ranks ranging from 238 to 961,367 observed over the course of weeks in the summer of 2001. [10] Using these data they estimate β=-0.871. For the purposes of this paper, we will use Brynjolfsson, Hu, and Smith's estimate because they are based on 861 data points as opposed to 2 data points in the experiments; however our results are not particularly sensitive to this choice versus one of the other estimated parameter values. Note that the β parameter will be stable over time as long as customers' relative tastes for popular and obscure books do not change. Increases in sales over time (holding tastes constant) will only shift the δ parameter. Also note that any such shifts in customer preferences for new books that resulted from the introduction of used book marketplaces would be incorporated into this parameter estimate as the sales-rank data used by both Goolsbee and Chevalier (2003) and Brynjolfsson, Hu, and Smith (2003) were gathered well after the December 2000 (Frishberg 2000) introduction of Amazon's used marketplace.

To use this mapping in our study, we must first confirm that Amazon's sales rank is calculated based only on new book sales as opposed to new and marketplace sales. To do this, we located a high ranked book and observed the rank of this title over the course of several weeks. During our observation periods the sales rank of the book varied between 596,625 and 606,439, and based

[9] Note that the θ reported by Chevalier and Goolsbee corresponds to $-1/\beta$.
[10] Note that not every book was observed every week.

on the movement of the rank, the book appeared to have 1 sale every 2 weeks. Having established the typical rank of the book, we then listed five used books for this title in Amazon's used book marketplace and purchased them on Monday, October 23, 2002 using 5 different Amazon.com buyer accounts. The sales rank before we made the purchase was 599,352 and it remained stable until the following Monday (October 30) when it changed to 601,457. On that Monday, we purchased 5 copies of the new book using the same Amazon accounts and the next morning the sales rank was 4,647.[11] We infer from this marketplace sales are not included in Amazon's sales rank figures.[12]

Using this relationship, we can then estimate models of the form:

$$Log(Rank_{bt}) = c + \alpha Log(P_{A_{bt}}) + \Gamma' Log(P_{M_{bt}}) + \Omega' X + \varepsilon_{bt} \quad (4)$$

where, *b* and *t* index book and date. The dependant variable is the log of rank. The independent variables are Amazon price (P_A), a vector of Amazon marketplace prices (P_M), and a vector of other control variables (X). We do not include shipping and handling charges in our estimates because Amazon charges customers the same amount of shipping new and used books, and thus the relative prices in our estimates would not change. Our control variables include the log of the time since the book was released, the condition of the lowest priced used book, the seller rating for the lowest priced used book, the log of the number of used books offered for sale for a particular book, and interaction terms for fiction, hardcover, and bestselling book types.

We also note that because of the structure of this industry, quantity and price are not jointly determined, and thus we do not face the endogeneity concerns as would normally arise in demand

[11] Note that assuming this book had 1 sale every two weeks at a rank of 599,352, or estimated β parameter for this experiment would be -.877.
[12] We confirmed this to be the case through a personal conversation with Andreas Weigend, Amazon.com's chief scientist, on December 13, 2003.

regressions. With regard to Amazon's own price, we follow Chevalier and Goolsbee (2003) in noting that the quantity of new books Amazon can sell is predetermined (and usually virtually infinite) at the time they set their price based on pre-printed stocks of books available from the publisher. Likewise, used price is not a function of current period sales at Amazon, as used copies typically would take some time (the amount of time it takes the first purchaser to read the book) before they enter the used book market.

5.1. Estimation

Table 2 presents results for regression results on equation (4). We estimate this equation by progressively adding control variables to check the stability of our estimates.

One can show from (3) and (4) that own- and cross-price elasticity are given by $\beta\alpha$ and $\beta\Gamma i$ respectively. Thus, using $\beta = -0.871$, we see that Amazon's own price elasticity is approximately –1.17, while the cross price elasticity of new book sales to used books prices is approximately 0.088.[13] Both results have the expected signs. Amazon's own price elasticity is close to -1, which is consistent with what one might expect from a firm with significant market power. The cross-price elasticity estimates are quite low, suggesting that most Amazon customers are insensitive to the prices of used books. We discuss this interpretation in more detail in Section 5.3.[14]

[13] Cross price elasticities for the old and new samples are .089 and .079 respectively. Own price elasticities for the old and new samples are -1.16 and -1.40 respectively.

[14] We also ran this regression using separate price coefficients for each of the used book conditions. These regressions yield similar results to those shown above, but exhibit collinearity between the used book prices. Because of this, we rely on the minimum used price as the strongest signal of competition to Amazon's new book sales. The minimum used prices is likely the strongest signal of competition from used book sales because this is the price shown to viewing Amazon's new book page (see highlighted regions of Figure 2).

Table 2: Elasticity Results

Indep. Vars.	*1*	*2*	*3*	*4*
Constant	-2.059**	-2.067**	-2.078**	-2.161**
	(0.161)	(0.161)	(0.161)	(0.162)
Ln(Amazon Price)	1.347**	1.347**	1.347**	1.345**
	(0.048)	(0.048)	(0.048)	(0.048)
Ln(Min. Used Price)	-0.105**	-0.105**	-0.105**	-0.102**
	(0.010)	(0.010)	(0.010)	(0.010)
Ln(Days Since Release)	1.142**	1.140**	1.140**	1.120**
	(0.015)	(0.015)	(0.015)	(0.015)
Condition Rating		0.009*	0.008	0.008
		(0.004)	(0.004)	(0.004)
Seller Rating			0.003	0.003
			(0.003)	(0.003)
Ln(Number of Used for Sale)				0.057
				(0.011)
No. of Observations	41,994	41,994	41,994	41,994
Pseudo R^2	0.229	0.229	0.229	0.228

The dependent variable is ln(rank) of new book sales. Standard errors are listed in parenthesis; ** and * denote significance at 0.01 and 0.05, respectively. All models use book-level fixed effects.

Note that the parameters of interest (Amazon and used prices) are precisely estimated and the parameter estimates and associated standard errors are all quite stable across specifications, suggesting that the estimates are robust and that multi-collinearity is not a significant problem in the model. The other control variables suggest that, as expected, sales of new books decrease over time, and used books with better conditions are closer substitutes for new book sales. Both seller rating and condition are insignificant in our regressions. Recall that these variables measure the rating and condition of the lowest priced book, and thus this doesn't necessarily mean that condition and/or rating are unimportant to used book purchasers (a hypothesis we will explore in the next section).[15]

Table 3 shows results for our regressions including interaction terms for book types of interest to publishers: fiction, hardcover, and current bestseller. These results suggest that new purchasers

[15] Not surprisingly, the variables identifying the lowest price in each condition are highly collinear and result in unreliable parameter estimates.

are less sensitive to the used prices of fiction, hardcover, and bestselling books. Particularly in the case of hardcover and bestselling books, these results should be encouraging for publishers. Hardcover books, which command high prices, are typically used as a price discrimination strategy for publishers before the release of lower priced paperback versions of a book (and this strategy is particularly common among fiction titles). Similarly, publishers may be more concerned about the cannibalization of particularly popular titles than they are of other titles.

Table 3: Elasticity Results with Book Type Interactions

Indep. Vars.	***5***
Constant	-1.368**
	(0.195)
Ln(Amazon Price)	1.307**
	(0.044)
Ln(Min. Used Price)	-0.440**
	(0.023)
Ln(Days Since Release)	1.149**
	(0.014)
Condition Rating	0.008
	(0.004)
Seller Rating	0.004
	(0.002)
Fiction * Ln(Min. Used Price)	0.295**
	(0.021)
Hardcover * Ln(Min. Used Price)	0.143**
	(0.018)
Bestseller * Ln(Min. Used Price)	0.130**
	(0.018)
No. of Observations	41,994
Pseudo R^2	0.221

The dependent variable is ln(rank) of new book sales. Standard errors are listed in parenthesis; ** and * denote significance at 0.01 and 0.05, respectively. All models book-level fixed effects.

5.2 Welfare Estimations

5.2.1 Publisher Welfare

As noted in Section 3, publishers are guaranteed to be worse off in the presence of a used book marketplace if there is no increase in the price of new books after the introduction of used books. We point out that we saw no evidence of new book price changes across the two periods when the data was collected.[16] In this section, we use our estimates above to estimate the loss in publisher profit from the presence of Amazon's used book market. To do this, we note that from the definition of elasticity, the change in new book sales should be given by:

$$\Delta Q_A = Q_A \times \eta \times \left(\frac{P_A - P_{used}}{P_A} \right) \tag{5}$$

where Q_A is the total number of new books sold by Amazon per year, η is the cross price elasticity of new book sales with respect to used book prices, and the fourth term corresponds to the average discount of used books with respect to new books.

Brynjolfsson, Hu, and Smith (2003) calculate that Amazon sells approximately 100 million books per year. The average price of used books sold in our sample is $8.76, which is 50.6% of the Amazon.com price for these books. [17] Using our elasticity estimates above we find that the number of lost new book sales due to the presence of the used book markets is 4.5 million.

We can further characterize the loss in net profit from this change by noting that according to Brynjolfsson, Hu, and Smith (2003), the wholesale cost of books is between 43-51% of the list price for the book and that publisher gross margins on sales are typically 56-64%. The average

[16] Since we ignore the price-increase effect, this estimate on publisher's welfare loss is an upper bound.
[17] Note that the average used price that leads to a sale ($8.76) is less than the average price of all used books listed in the marketplace (Table 1) as one would expect. Also note that Amazon never takes possession of the product and thus revenue is approximately equal to gross profit.

list price of a book in our sample is $32.01 and thus publisher lost gross profit from Amazon.com's used book market is approximately $31.9 million. As a point of comparison, publisher net sales in 2002 were $26.3 billion (Greco *et al.* 2003) with a gross profit of $15.8 billion.

5.2.2 Retailer Welfare

It is also obvious that Amazon.com incurs a loss from the decrease in the quantity of new books sold, which may be mitigated by an increase in revenue from other used book marketplace sales. Since we observe Q_n and P_n and the relevant cross price elasticities, we can measure the net change in retailer welfare from these two effects.

In analyzing the impact of used book sales on Amazon's revenue, it is notable that Amazon's margins on new and used sales are approximately the same. Wingfield (2003) notes that Amazon's gross margins on new book sales are approximately 22%. Thus, given that Amazon lost approximately 4.5 million new book sales due to cannibalization from used book sales and that new book prices averaged $24.04 in our sample, Amazon lost approximately $23.8 million in gross profit from these lost new book sales.

Of course, Amazon also earns revenue of $0.99 plus 15% of the sale price on their used book sales.[18] In addition, Amazon charges buyers $3.49 for shipping and reimburses sellers $2.26 for their shipping costs, and thus earns $1.13 on shipping per unit sold. Given that the average price of used books in our sample that are sold is $8.76, Amazon's margins on used book sales are approximately 34%, and their lost profit from these cannibalized sales is approximately $13.2 million.

[18] Amazon.com waives the $0.99 fee for "Pro Merchant Subscribers." Pro Merchant Subscribers are charged $19.99 per month for membership. While we have no way of knowing how many of Amazon's sales come from these Pro Merchant Subscribers, we assume it to be 50%. We believe this is a conservative assumption and it also ignores any additional revenue gains to Amazon from Pro Merchant membership fees.

This would suggest that Amazon loses money on their used book marketplace. However, it is important to note that Amazon gains incremental customers from the presence of these marketplaces — customers who otherwise would not have made a new book purchase. Our results suggest these incremental customers could be quite substantial. Milliot (2002) notes that across all product categories sold at Amazon.com, used products accounted for 23% of Amazon's sales. Moreover, used sales in the book category were one of the strongest of any product category according to Jeffrey Bezos. Thus, 23% may be an underestimate of the actual proportion of used sales in the book category.[19]

If Amazon sold 100 million new book copies and used book sales made up 23% of total (new and used) book sales, then Amazon sold approximately 29.9 million used book copies in 2002. Recalling that only 4.5 million of these sales cannibalized new book sales, we see that Amazon sold approximately 25.4 million used book copies that would not otherwise have been sold new on the site. Said another way only 15% of Amazon's used book sales directly cannibalize new book sales, while the remaining 85% apparently would not have occurred at the new book prices on Amazon's site. Using our figures above, these additional used book sales add approximately $87.9 million to Amazon's profitability. Thus, on balance, the presence of Amazon's used book market added $64.1 million to the company's profitability.

5.2.3 Consumer Surplus

Finally, we can use our data to obtain an estimate of the consumer surplus gain from the introduction of Amazon's used book markets. To do this we use the fact that we observe each of the marketplace offers shown to Amazon's used book customers along with the offer each customer chose to purchase. Because of this, we can use the multinomial logit model (Ben-Akiva and

[19] In our data we find that after weighting our data to reflect Amazon's sales, 27% of total sales are used books sales.

Lerman 1985, Guadagni and Little 1983) to determine the sensitivity of customers to the parameters of the offered products.[20]

Specifically, under the multinomial logit model we assume that used book customers maximize an indirect utility function of the form:

$$u_{ij} = z_j\theta + \varepsilon_{ij} \tag{6}$$

where u_{ij} represents the utility of user i for offer j which is a linear combination of the observed product characteristics (z) and their associated parameters (θ) and a mean zero random disturbance (ε_{ij}). If consumers select the offer that maximizes their utility and if ε_{ij} follows a type-I extreme value distribution then the conditional probability that offer j will be selected is given by:

$$P_j = \frac{\exp(z_j\theta)}{\sum_{r=1}^{J}\exp(z_r\theta)} \tag{7}$$

Table 4: Multinomial Choice Results for Used Book Sales

Indep. Vars.	***1***	***2***	***3***
Used Price	-0.055**	-0.054**	-0.054**
	(0.001)	(0.001)	(0.001)
Rating		0.039**	0.032**
		(0.003)	(0.003)
"Very Good" Condition			0.191**
			(0.011)
"Good" Condition			0.163**
			(0.015)
"Acceptable" Condition			0.068*
			(0.027)

The dependent variable is whether a used book is sold. Standard errors are listed in parenthesis; ** and * denote significance at 0.01 and 0.05, respectively. We observe 9.8 million offers across 56,091 choice sets.

[20] Note that we use the multinomial logit regression instead of an OLS regression of used quantity sold onto the lowest used price, Amazon's price, and various control variables because we are interested in the own price elasticity faced by individual offers and this result can only be obtained using disaggregated data.

Using this model, Table 4 provides estimates of the taste parameters (θ) for Amazon.com's used book customers. We first note that the parameters are precisely estimated and stable across specifications. The signs of the parameters suggest that, as expected, higher priced used books are less likely to be purchased and books with higher rated sellers are more likely to be purchased. Further, books in "very good" condition are preferred to "good" condition books, which are in turn preferred to "acceptable" books. It is surprising however that each of these conditions is preferred to "like new" condition books, the referenced category. We suspect that this is because customers are very sensitive to price (the lowest priced offer is selected 20% of the time in our data), while "like new" condition books carry much higher prices than the other used categories.

To calculate the consumer surplus gain from the introduction of Amazon's used book markets, we apply the methodology employed by Brynjolfsson, Hu, and Smith (2003) to calculate the consumer surplus from the introduction of Amazon.com's new book sales. Specifically, following Hausman and Leonard (2002), the consumer surplus gain from the introduction of the used book market at Amazon.com should be given by:

$$CV = -\frac{p_u q_u}{(1+\eta_u)} \tag{8}$$

where p_u is the average price of used book sold, q_u is the number of used books sold and η_u is the own price elasticity of used book demand.[21]

Under the multinomial logit model, the own price elasticity of demand for an individual offer is given by (Ben-Akiva and Lerman 1985, p. 111):

[21] Following Brynjolfsson, Hu, and Smith, this formula assumes that income elasticity for used books is negligible. If income elasticity were positive for books, as seems likely, including income elasticity would increase our consumer surplus estimates.

$$\eta_{jk} = \alpha_k p_k \left(1 - P_j\right) \tag{9}$$

where α_k is the estimated parameter of used price, p_k is used price itself, and P_j is the conditional choice probability defined above. Using this equation, we calculate the average own price elasticity imputed for offers in each session and take the average of this across sessions to obtain an own price elasticity of -4.73.[22] Given this elasticity and the average sale price of used books and the quantity of used books sold, we estimate that the consumer surplus gain from the introduction of Amazon.com's used book market is $70.2 million. We discuss the implications of this finding in Section 6 below.

6 Discussion

While many papers in the IT, economics, and marketing literatures have analyzed the characteristics of new books sold in electronic markets (e.g., Brynjolfsson and Smith (2000); Clay, Krishnan, and Wolff (2001); Pan, Ratchford, and Shankar (2002)), used books — and other used products — sold in IT-enabled exchanges may have a potentially larger impact on both electronic and physical markets.

Electronic markets for used products are able to aggregate supply and demand over a global marketplace, making it easier for buyers to find sellers and for sellers to find buyers. Because of this, these markets have significant advantages in terms of price and selection over physical markets. As noted above, while Amazon's used book marketplace features at least one used book for almost every book in print and many out of print books, a typical physical used bookstores carries only between 5,000 to 30,000 unique titles. Likewise, prices of used books sold on the Inter-

[22] Calculating elasticity at the session level as opposed to the offer level is common in the literature and we believe is appropriate in our case because it imputes less weight to sessions with a large number of offers. The offer level elasticity in our data is -4.1. Using the offer level elasticity instead of the session level elasticity would increase both the resulting consumer surplus and total welfare in our results.

net are 38-75% lower than comparable prices in physical stores.[23] Finally, Siegel and Siegel (2004) find that 54.4% of used book sales take place on the Internet, versus 8.4% of new book sales in the same channel (Rappaport 2002).

The question remains: how will these IT-enabled exchanges impact social welfare? Specifically, the increased viability of used product sales in electronic markets poses a potential threat for many categories of information goods — such as books, music, and videos — where there is no significant degradation in the quality of the good over time and where artists and publishers are only compensated for the initial sale of the product. In these product categories, the increased variety, low prices, and low search costs available in online used product markets may attract customers who would have otherwise purchased a new copy of the product to purchase a used copy instead. If cannibalization of new product sales were to become widespread, it could undermine the profitability of the publishing business and reduce authors' and artists' creative incentives. Because of this, the American Association of Publishers and the Authors' Guild have asked Amazon to create artificial search costs for new book shoppers to locate used book copies by separating the two markets on Amazon's site — threatening to delink their products from Amazon if the retailer does not comply.

In this research, we analyze the impact of used book markets on new book sales at Amazon.com. We find that the while 29.9 million used book sales took place in 2002 on Amazon.com's site, only 4.5 million of these sales cannibalized new book sales. The remaining sales apparently would not have occurred at Amazon's new book price. While these cannibalized sales result in an estimated $31.9 million loss to publishers annually, the total welfare *gain* to society from this

[23] As a point of comparison Brynjolfsson and Smith (2000) find that new book prices are *only* 15.5% lower online than in physical stores.

IT-enabled market is $102.4 million annually after considering the $64.1 million gain in Amazon.com's gross profits and the $70.2 million gain in consumer surplus.

The implication of this finding for publishers is that, at least at the present, used book markets do not significantly cannibalize new book sales — even in a market that lists used copies side-by-side with new. Additionally, our estimates by individual book type suggest that customer are less sensitive to low used book prices for hardcover and fiction titles and current bestsellers, some of the categories that publishers may be most interested in protecting from cannibalization.

Further, this loss must naturally be viewed in the context of the many ways the Internet has helped publishers by increasing sales. For example, competition on the Internet has lowered new book prices by 15.5% over comparable physical bookstore prices, while wholesale prices have remained relatively stable (Brynjolfsson and Smith 2000). These lower prices have undoubtedly allowed customers to purchase books, when they would not have done so at the higher prices in physical stores. The Internet has also provided access to customers who otherwise would not have had easy access to a physical bookstore. Brynjolfsson and Smith (2000) note that 20% of customers in the United States live more than 8 miles away from the closest bookstore, and 8% live more than 20 miles away from the closest bookstore. Finally, the increased variety available on the Internet has allowed customers to purchase copies of books they would not have otherwise been able to locate in physical stores with limited inventory (Brynjolfsson, Hu, and Smith 2003). For example, Frank Urbanowski of MIT Press attributed the 12% increase in sales of backlist titles directly to increased accessibility to these titles through the Internet (Professional Publishing Report 1999). Given that 40% of sales at Amazon.com occur in books that would not otherwise have been available at a physical bookstore (Brynjolfsson, Hu, and Smith 2003), this increase in sales could be quite large for book publishers.

Our findings also contain some good news for authors. While authors lose royalty payments from lost sales of new titles, like publishers the net impact of the Internet on total sales is likely to be strongly positive. However, authors may experience an additional, indirect, gain through used book sales from increased readership. As noted above, 85% of used book sales on Amazon.com's site apparently would not have occurred at the new book price. Authors may accrue some added income from these additional readers through speaking fees, licensing deals, or advances on future books — even if they don't benefit directly through royalty payments. Similarly, these new readers may buy new versions of subsequent releases by the same author(s). Our results are therefore consistent with observations by Susan Siegel of Book Hunter Press that used books are helpful to the industry because "anything that encourages people to read and buy books is good" (Publishing Trends 2004) and Greg Greeley, Amazon's vice president for media products who noted at "the lower prices of used books allow people to experiment with authors and genres in ways they might not have otherwise" (Tedeschi 2004).

Thus, while the increased availability of used books through electronic markets is having a small negative impact on publishers and possibly authors, the overall impact of used book sales on society as a whole is overwhelmingly positive. Moreover, online used book markets provide access and ownership of books to a segment of society which otherwise would not have been able to own them. Together our results suggest that these IT-enabled markets may have a strong positive impact on society as a whole and to consumers in particular.

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