

The Linked World: Working Paper Series

Impact of ICT on Production of Goods and Services: Who Captures the Benefits of ICT? The Case of Digital Books

By

By Janet Hao (The Conference Board) and Randall Weiss (The Conference Board)

About The Linked World Project

Information and communication technology (ICT) has decisively established itself as a general purpose technology—one that affects an entire economy. Over the past four decades, ICT has spurred dramatic changes that will continue for the foreseeable future. Harder to predict, though, is the exact nature of those changes, and how they will play out across societies—in our economies, our cultural relationships and the way human beings interact.

This notion formed the basic motivation for embarking on the study, which the Telefónica Foundation agreed to underwrite in 2008. The purpose of *The Linked World: How ICT Is Transforming Societies, Cultures, and Economies* is to take stock of our knowledge on what the economic, social, and cultural impacts of ICT will be. How has it evolved, how much have we been able to quantify or to evaluate in a qualitative sense, and what does it mean for the challenges and opportunities ahead?

The Linked World: How ICT Is Transforming Societies, Cultures, and Economies is the result of a two-year global research project led by The Conference Board and underwritten by the Telefónica Foundation.

This working paper is one of a global series that forms the basis of the book *The Linked World: How ICT Is Transforming Societies, Cultures, and Economies* published by the Telefónica Foundation and Artel Press.

For more information about this project, including video summaries and online forums please go to:
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1. Introduction:

The development of digital technology and the expansion of broadband have significantly changed the book publishing and retailing industry. Brick-and-mortar bookstores used to be the major retailers in the 500-year-old book industry. By 2003, though, Internet retailers accounted for 12.7% of sales of new books and 67% of sales of used books in the US (Rappaport, 2004 and Wyatt, 2005). The latest major digital development in the book industry is the emergence of digital books. From 2002 to 2009 the sales of digital books grew by 71.0% annually on average from \$7.3 million to \$313 million in the US (Figure 1, Association of American Publishers (AAP), 2009). The sale of digital books grew much more rapidly after Amazon introduced its Kindle digital book reader in late 2007. Based on AAP's data, Forrester (2009) projected that 2010 sales will exceed \$500 million. In contrast, sales of paperback mass market paperbacks dropped by 2.2% annually, from \$1,217 million to \$1,042 million, during the 2002 to 2009 period (AAP, 2009).

Division of benefits from innovation

Digital books provide an excellent opportunity to examine who benefits from a new technology. First, ICT creates gains to be divided among customers, writers, publishing houses and retailers, lowering the production costs of books by about 27%, the amount of printing, binding and other direct costs (HM Publishing Corporation, 2005). Second, ICT allows new business models to evolve and changes the market power of different players. The distribution of market power determines how players divide the benefits.

It is important to evaluate how advances in technology change the distribution of benefits and losses. From the perspective of an individual firm, understanding such factors is the key to remaining competitive. . A firm that does not exploit new technologies to cut costs, reaches a larger consumer base, and improves productive efficiency risks losing its market share and falling behind its competitors. From the perspective of a social planner or policymaker, such an evaluation is important in understanding the balance between welfare maximization and benefit distribution. Understanding this distribution is pivotal in gauging the potential economic and political constraints on these new technologies in the future.

Teece (1986) reviews many cases in which the creators of technology innovations did not benefit from those innovations¹, and concludes that three elements determine who benefit from innovations: appropriate regime, complementary assets, and the dominant design paradigm. Appropriate regime is the business and legal environment that determines how difficult it is for a firm to protect its innovation in the form of a patent or a trade secret. Complementary assets determine how benefits are divided along the supply chain. Suppliers of

¹ For example, Electrical Musical Industries (EMI) created the EMI CAT scanner, the greatest breakthrough of radiology since the discovery of X-rays. EMI lost market share of the CAT scanner within six years and dropped out of that business two years later.

generic assets usually gain less than suppliers of specialized assets. A dominant design paradigm emerges when an innovation is mature and is at a turning point when competition shifts from design to price.

Using the analytical structure of Teece (1986), Dedrick, Kraemer and Linden (2010) examine two new products released in 2005, the iPod and the HP nc6230 notebook. They use “teardown” reports to examine the composition of each product, and use company financial statements to estimate the profit gained from each composition. They argue that Apple captured a large share of the value of the iPod, while HP captured a small share of the value of HP nc6230 notebook. In contrast to HP, Apple marketed iPod before a dominant design paradigm emerged for digital music, controlled content delivery (iTunes Music Store) and brand-specific accessories (external devices using iPod’s “dock” connector), and internally developed the highly specialized software of iPod and iTunes.

Media industry transformation

The impact of technology on media industries is not restricted to the book publishing industry. The newspaper and magazine publishing, movie, and music industries are experiencing tremendous transformation. Traditionally, the creation, production, and delivery of content in these industries included most or all of the following steps: (1) content creation, (2) selection and editing, (3) bundling of individual pieces into a suitable format for distribution, (4) application of the content bundle to a delivery medium (e.g., printing), (5) dissemination of a list of available bundles (marketing), and (6) delivery to the consumer. In each industry, a different pattern of entities performed different steps in the process. In the newspaper and magazine industries, publishing companies dominated all of these steps. In the music and book publishing industries, writers and performers (step 1) were typically distinct from publishers (steps 2, 3, and 4), who, in turn, were distinct from retailers (steps 5 and 6).

Digital technology and broadband have reduced costs and created new marketplace pressures at every step of this process. Media industries have also struggled (and continue to struggle) with technology’s impact on revenues from advertisers and from the end users of the content. In the first phase of technology’s impact, online retailing substantially reduced the value created in steps 5 and 6, although it also created new opportunities for retailers to control the format of content delivery (e.g., digital books that can be read only on a dedicated device). As broadband became more prevalent, content creators could skip steps 2 and 3 entirely and apply step 4 by themselves at little cost, thus putting pressure on the companies that traditionally carried out steps 2 and 3. For example, in the music industry online delivery of individual tracks eliminated production companies’ benefits from step 3 (bundling tracks into albums), leaving the value of their other functions (recruiting and selecting talent, production, distribution, and marketing) subject to increasing competition. For magazine and newspaper publishers, book publishers, and music producers, the ability of individual bloggers, authors, and musicians to deliver content directly to consumers leads to a direct marketplace measure of the value they create by recruiting, selecting, training, and editing talent. Indeed, because of

vastly increased access and lowered costs, much of the content available online is created by users themselves.

Objective of this study

Adding surplus analysis to the methodology of Teece (1986) and Dedrick, Kraemer and Linden (2010), this paper analyzes from two perspectives how different parties divide the benefit of digital books in the US market. The first is a benchmark estimation of the outcome of a hypothetical long-run equilibrium in which digital books replace all paperback books. It measures the size of the pie to be divided among producers and consumers. A long-run estimate is necessary because the book market currently is in turmoil, and short-run consumer and producer surplus can be significantly changed by random and temporary factors. We treat digital books in the same way as any new technology that lowers the costs of paperback books, and assume that digital books do not change the market power, as a group, of the various players involved in supplying books to consumers. Under these assumptions, we estimate that digital books will increase consumer surplus by 16.6% of current book revenues and will increase producer surplus by 13.4% of current book revenues. Using the current market size of \$9.16 billion for paperback trade and mass market books, digital books will increase consumer surplus by \$1.52 billion and will increase producer surplus by \$1.19 billion.

The second perspective does not provide a quantitative estimate like the first. Rather, the second perspective provides a snapshot of what the market is at the moment and gives insights into how the market may develop as digital books become more widespread. We estimate that currently publishers have benefited as much as 13% of the list prices of print books. Amazon has profited, on the average, the same from digital books as from print books, and in addition has made \$73 to \$213 from each Kindle digital reader. Although consumers pay less for digital books than print books, they have to pay a relatively high, albeit declining, price for digital readers like Kindle. We argue that this division of benefit will change, if and after Amazon or other Internet retailers establish the dominant design paradigm of digital books.

Section 2 of this paper describes the data and methodology and gives an overview of the book publishing and retailing industry. Section 3 provides the benchmark estimation in the long run if digital books take over the book industry. Section 4 analyzes how much publishers, retailers and consumers have benefited from digital books at the very beginning of this new trend. Section 5 is the conclusion.

2. Industry, Data and Methodology:

2.1. The Book Publishing and Retailing Industry:

The major players in the book industry are writers, publishers, wholesalers, retailers and consumers. The book industry has a hollow structure, with a large number of small players and

a small number of large players. A small number of writers account for a large portion of book sales. In 1994, for example, over 70 percent of total fiction sales were accounted for by just five authors: John Grisham, Tom Clancy, Danielle Steel, Michael Crichton, and Stephen King (Greco, 2005). The writers are generally represented by literary agents, who sharply increase the chances of publication but at a cost of about 15% of author's royalties (Sorensen, 2007).

The publishing industry has a large number of small publishing houses, a small number of large publishing houses and relatively few mid-sized publishing houses. Of roughly 2,600 publishers, 50 receive 80% of industry revenue (Hoover's industrial profile²). Larger companies enjoy greater economies of scale and advantages in bidding for authors and new manuscripts.

Retailers are small book stores, big bookstores (such as Barnes & Noble) and online retailers (such as Amazon.com). In the 1970s, big bookstores provided systematic book discounts that reduced the number of small bookstores. Big bookstores forced the remaining small stores to improve their service or to specialize in niche subjects. Beginning in the 1990s, big and small bookstores competed with online retailers for market share. The biggest online book retailer is Amazon.com, currently providing consumers with about 17 million different versions of books³.

The advent of computers and Internet profoundly changed the industry, affecting the writers, the publishing houses, the retailers and the readers. For authors, the ICT weakens the traditional role of publishing houses. Traditionally authors relied on publishing houses to publish their books. With new technology, authors can publish their books in digital forms through companies like *Smashwords*⁴, and receive significantly higher royalties than traditional publishing houses. In Mexico, *Tortilleria Editorial*⁵ acts like a cooperative for authors, with database, software and web site that allow members to print and sell their books (UNCTAD, 2008).

For publishing houses, the digital revolution lowered printing costs, improved information flow, and decreased the number of unsold books. The old printing process used photolithography and incurred large fixed costs associated with each print run, thus making it uneconomical to publish short press runs. As a result, publishers printed large runs and simply destroyed unsold books (Fleming, 1999). The computerization of printing lowered the fixed costs, and made short press runs more efficient, thus reducing the number of unsold books and encouraging publishers to print more books in short editions. The advent of digital books pushed these trends even further.

For retailers, the implementation of computer checkout systems and sophisticated enterprise software permitted real-time information on the quantity of the books sold, geographical distribution and even background information on customers. Online retailers provide

² <http://www.hoovers.com/industry/book-publishing/1462-1.html>, accessed on February 11, 2011.

³ We searched for the number of new print books on January 10, 2010 at Amazon.com. It provided 17,768,539 results.

⁴ At www.smashwords.com, accessed in September 15, 2009.

⁵ At <http://tortilleria.vientos.info/>, accessed in September 15, 2009.

customers with recommendation lists, book reviews and images of book pages. Customers can easily find the books they want and gain information about other books they might like. Actually, new technology dramatically changed the retail industry before digital books came along. For example, a major online retailer, Amazon.com, was founded in 1995 (Amazon.com Annual Report, 1997).

2.2. Data and Summary Statistics:

In this section we explain the details of price and sales data of New York Times bestsellers. Our basic data are the August 2009 Amazon.com prices and sales rank for 981 bestsellers. The specific titles include all that appeared on the best-seller lists from June 01, 2008 to Aug 16, 2009.⁶ The Times publishes the lists weekly, and each list contains 15 to 35 books. A book can stay in a list for several weeks. For example, *Outliers* by Malcolm Gladwell was on the list for 37 weeks. We consider only the bestseller lists of paperback nonfiction, paperback advice, trade fiction paperback, paperback books and mass market paperback. We focus on paperback bestsellers, because, as explained in the next section, our analysis compares paperback books with digital books.

Data include the number of pages of a paperback, Amazon sales rank, author, publisher, the list price of the paperback, the Amazon selling price of the paperback, the selling price of a Kindle book, and the selling price on Amazon.com of a used book. List price is the price printed on the books, set by publishers. The list price of a paperback averages \$11.59 with a minimum of \$4.99 and a maximum of \$30.00 (Table 1). The Amazon retail price of a paperback book averages \$9.54 with a minimum of \$4.86 and a maximum of \$25.95. The price of a Kindle book averages \$7.87 with a minimum of \$2.87 and a maximum of \$9.99. Retail price is on average 82% of list price, Kindle price is on average 68% of list price, and used price is on average 22% of list price. In our sample, books average 398 pages. The shortest book has 96 pages, and the longest book has 1104 pages. Some publishers have more bestsellers than others in our sample, with a range of 1 to 34 bestsellers. Averaging the sales rank of each author's books in our sample, we find that 26% of authors rank in the top 10,000. We define those authors as famous authors for the purpose of regression analysis.

2.3. Methodology:

We do not consider digital books as new goods, but rather a new way to convey the same content. Our method is different from those used by Gentzkow (2007) and Goolsbee and Pentrin (2004) in related studies. Gentzkow (2007) uses a consumer survey on Washington Post and Washington Times, treats an online newspaper as a different good from a print newspaper, and estimates that online newspapers crowded out print newspapers and increased consumer surplus. Goolsbee and Pentrin (2004) use a consumer survey on television choices, and treat cable TV as a different good from direct broadcast satellites (DBS). They

⁶ Available at (http://developer.nytimes.com/docs/best_sellers_api).

estimate that the competition of DBS against cable TV decreased cable prices and increased the quality of cable service. They also estimate DBS provided its buyers a consumer surplus of \$2.5 billion per year, and increased the welfare of cable subscribers by \$3 billion per year.

We use a different method from them mostly because we have different data. Gentzkow (2007) and Goolsbee and Pentrin (2004) have a survey of each consumer's choice but have no data on quantity demanded at different price levels. Thus they cannot estimate the effect of price on demand but they can estimate the substitution effect of different goods. In contrast, we have no data on each consumer's choice, but we do have data on quantity demanded at different levels of price. So we can estimate the effect of price on demand, but not the substitution between the old goods and the new goods.

We assume that digital books perfectly substitute for paperback books. That assumption is conservative, and will most likely under-estimate the degree to which digital books increase consumer and producer surplus, because digital books will likely increase the demand for hardback books. Digital books create new sales of print books by increasing the visibility of the print versions. Hilton and Wiley (2010) use BookScan sales data of 41 books, and find that after the publishers release free digital versions, the sales of the print versions increase in the short term. Moreover, lower prices or increased quality of eReaders may increase demand for books.

We compare digital books with paperback books rather than hardcover books. Publishers release hardcover books at a higher price and earlier than paperback books to discriminate in favor of consumers who prefer good quality and timely access to new books (Clerides, 2002). Digital books cannot help publishers discriminate in favor of those consumers, so we assume that consumers of digital books are the same group as the consumers of paperback books.

We use the data on paperback books to estimate the relationship between cost reduction and price reduction and between price reduction and sales expansion. Unfortunately Amazon does not release sales information for Kindle digital books, the predominant type of digital book.

The book market is a market of oligopolists, as is described in Section 2.1. Famous writers, large publishers and large retailers all have some power to influence costs and/or price. Famous writers can negotiate with publishers for favorable royalty rates, large publishers can negotiate with retailers for a high wholesale price, and large retailers can set retail prices across many different books. Since our analysis does not impose the assumption of a competitive market, price does not equal marginal cost in equilibrium, and the zero variable cost of digital books does not translate into an equilibrium price close to zero.

3. Benchmark Estimation of Consumer and Producer Surplus:

Consumer surplus is the difference between price and willingness to pay. Producer surplus is the difference between price and costs. We do not estimate total consumer or producer surplus. Instead we estimate by the amount by which digital books will change surplus. We

assume that the value of convenience is equal to the cost of the digital reader, so the difference between the digital and paperback prices measures how much the new technology benefits consumers.

In this section we provide a hypothetical estimate of a long-run equilibrium in which digital books replace all paperback books. It measures the size of the pie that will be divided by authors, publishers, retailers and consumers. This long-run estimate is based on the relationship we observe between costs and prices and between prices and sales of paperback books in the last week of August 2009; we assume that these relationships remain constant.

We treat digital books in the same way as any new technology that lowers the production costs of paperback books. Since digital books lower production costs, price drops and sales increase. Consumer surplus increases because price drops and sales increase. Similarly, producer surplus increases because costs drop and sales increase. To estimate the increase in consumer and producer surplus, we need existing sales, change in costs, change in price and change in quantity. We estimate change in price using a cross-section regression of price against costs, and we estimate change in sales using a regression of the number of books sold against price.

3.1. Price Reduction Due to Digital Books:

Prices fall because digital books reduce production costs (Figures 2a and 2b), and part of the cost reduction passes through to price reduction, depending on the slopes of the demand curve and the marginal revenue curve (Bulow and Pfleiderer, 1983). Measuring costs directly is usually difficult, so researchers instead use proxies of costs. For example, Gron and Swenson (2000) proxy the costs of automobiles with US local wages, foreign local wages, and the shares of local and foreign inputs.

We estimate the share of cost reduction that will pass through to price reduction by looking at the supply side (authors, publishers and retailers) as a whole, and model the relationship between costs and retail prices. The costs include those related to authors (royalties), those related to publishers (editing, printing, binding, marketing, managing and other costs) and those related to retailers (shipping, storing and other costs). Following Gron and Swenson (2000), we assume a log linear relationship between price and costs. $price_i$ is the Amazon retail price of a paperback book. The key coefficient is b , the share of cost reduction that will pass through to price reduction. This equation implies that if costs increase by 1%, price will increase by $b\%$.

$$(1) \quad \ln(price_i) = a + b \ln(cost_i) + u_i$$

Although we lack data on cost, we do have data on list prices. We can derive an equation that can be estimated with available data by assuming that (1) variation in cost across titles leads to

an equal percentage variation in list price and (2) list prices are a function of publisher volume and author sales:

$$(2) \quad \ln(\text{list_price}_i) = c + \ln(\text{cost}_i) + d \cdot \text{rank_publisher}_i + e \cdot \text{fame_author}_i + \varepsilon_i$$

cost_i is the total costs of a book, list_price_i is the list price of a book, rank_publisher_i is the number of books that a publisher publishes in our sample, and fame_author_i equals 1 if the author is famous and equals 0 otherwise.

The assumption that list price is proportional to costs and unaffected by quantity sold of individual titles is reasonable, because publishers set list price *in advance of publication*. In contrast to list price, retail price varies significantly as a share of list prices because retail price reflects demand conditions. In our sample of 981 book titles, retail price ranges from 55% to 100% of list price.

List price is also a function of the bargaining power of publishers and authors. Large publishers may be able to set a higher list price (and thus wholesale price) than others. Famous authors may be able to command higher royalties than other authors. We average the sales rank of an author's books in our sample. A small sales rank means the book is popular. If the average rank is less than 10,000, we define the author as a famous author.

We do not consider retailers' costs in our model, because Amazon is the only retailer in our sample, and we assume that all books sold by Amazon have similar retailer costs proportional to their list prices; those costs become part of the constant term of the model.

Solving (1) and (2) to eliminate cost, we derive:

$$(3) \quad \ln(\text{price}_i) = a - bc + b \ln(\text{list_price}_i) - b \cdot d \cdot \text{rank_publisher}_i - b \cdot e \cdot \text{fame_author}_i - b\varepsilon_i + u_i$$

Table 2 presents an ordinary least squares (OLS) estimate of equation (3), where *price* is the Amazon retail price. We estimate that if cost decrease by 1%, price will decrease by 0.57%, and that influential publishers usually ask for a lower list price, and that books of famous authors will have a slightly lower list price than books of other authors. Since digital books will lower production costs on average by 27.3% of existing production costs⁷, we multiply 27.3% by 0.57, and thus estimate that paperback prices would drop by 15.7% in our hypothetical long-run equilibrium.

The error terms could be correlated with costs, and it is ambiguous whether we would over-estimate or under-estimate the ratio of pass-through. Our estimated ratio seems reasonable

⁷ Total costs of paperback books are 47.7% of list prices. Digital books lower costs by 13% of list prices, the amount of printing, binding and other direct costs (Table 3). $13\%/47.7\%=27.3\%$. Digital books may also lower the shipping and storage costs, but we have no data on those costs and choose to ignore them. So our estimation of cost reduction is conservative.

though. Our estimated ratio is 0.57, close to the pass-through ratio of 0.47 of US automobiles (Gron and Swenson, 2000).

3.2. Sales Increase Due to Price Reduction.

The second source of surplus is increased sales. We estimate the price elasticity of demand using the following equation.

(4)

$$\ln Q_i = \alpha + \beta \ln(\text{price}_i) + \gamma \ln(\# \text{ pages}_i) + \phi \cdot \text{fame_author}_i + \rho \cdot \text{rank_publisher}_i + \xi_i$$

where Q_i is the quantity sold of a book title and $\# \text{ pages}_i$ is its number of pages .

Amazon does not provide quantities sold of individual titles, but does provide sales rank. We formulate the relationship between Amazon sales rank and weekly sales as

$Quantity_i = \delta \cdot Rank_i^\theta$. Brynjolfsson, Smith and Hu (2003) use a sample of 321 books, and estimate that $Quantity_i = e^{10.521} \cdot Rank_i^{-0.871}$. Chevalier and Goolsbee (2003) estimate that the elasticity of quantity to sales rank is -0.855. Weingarten (2001) and Poynter (2000) respectively estimate that the elasticity is -0.952 and -0.834. We use the estimation of Brynjolfsson, Smith and Hu (2003) because they have a large sample of books. We do not impose the value of δ , because it reflects the expansion and contraction of the book market. We insert $Quantity_i = \delta \cdot Rank_i^{-0.871}$ into equation (4) and obtain:

$$(5) \quad \ln Rank_i = \frac{\ln \delta}{0.871} - \frac{\alpha}{0.871} - \frac{\beta}{0.871} \ln \text{price}_i - \frac{\gamma}{0.871} \ln(\# \text{ pages}_i) - \frac{\phi}{0.871} \text{fame_author}_i - \frac{\rho}{0.871} \text{rank_publiher}_i - \frac{\xi_i}{0.871}$$

OLS estimation is a standard approach in the literature of Internet book demand (Ghose, Smith and Telang, 2006, and Chevalier and Goolsbee, 2003). The problem that the market simultaneously determines price and quantity is less severe for books than for other goods, because Amazon sets book prices at a standard level, so that sales of a particular book does not seem to affect its price.

Table 4 shows that if price increases, quantity decreases. At the same price, a book of more pages sells better than a book of fewer pages. Good sales of a particular title are associated

with famous authors, but not with successful publishers. Since $-\frac{\beta}{0.871} = 0.874$, the price elasticity of sales to price (β) is -0.761, implying if price drops by 1%, quantity will increase by 0.761%. Since in the hypothetical long-run equilibrium digital books are estimated to drop price by 15.7%, quantity sold is estimated to increase by 11.9%.

3.3. Increased Consumer and Producer Surplus:

In a hypothetical long-run equilibrium in which digital books replace paperback books, consumer surplus increases because price drops for existing quantity sold and because sales increase. For existing consumers (the effect of price reduction), book prices drop by 15.7%, increasing total consumer surplus by 15.7% of existing revenues. Additional books sold generate a surplus ranging from 0% to 15.7% of book price for each book. Some of these additional books yield a surplus of 15.7% of book prices for each book; the purchasers are indifferent between buying and not buying a book at the old higher price. For some of the other additional books, the surplus is 0% of price; these purchasers are indifferent between buying and not buying a book at the new low price. All other additional sales generate a consumer surplus between 0% and 15.7% of prices. Averaging their consumer surplus, we estimate that new books sold on average have a surplus of about 7.9% of book prices. We multiply 7.9% by 11.9%, and estimate that sales expansion creates a consumer surplus of 0.9% of existing revenues. (See Table 5 for summary of calculations.)

Adding up the effect of price reduction and sales expansion, digital books will increase consumer surplus by 16.6% (15.7%+0.9%) of existing revenues. The existing revenues of the paperback trade and mass market books are \$9.16 billion in 2008 (Association of American Publishers, 2009), so digital books increase consumer surplus by \$1.52 billion in the hypothetical long-run equilibrium.

Producer surplus increases because costs drop for existing quantity sold, and because sales increase. For digital books, producers' marginal costs are a constant and equal to royalties, so we estimate producer surplus using new sales and the difference between reduction in marginal costs and reduction in price. Total sales now equal 111.9% (100%+11.9%) of existing sales. Costs drop by 27.3%, and prices drop by 15.7%, so the difference between reduction in marginal costs and reduction in price is 11.6% of existing price. We multiply 11.6% by 111.9%, and estimate that digital books increase producer surplus by 13.4% of existing revenues or \$1.19 billion in the hypothetical long-run equilibrium.

It should be noted that a portion of the new sales estimated above may result from additional titles being produced rather than an increase in average sales per title. Digital technology lowers the cost of producing each title, and lower storage cost allows titles to be made available for a longer period of time. Increased producers' surplus, because of an expanding market and retained monopoly over individual titles, will continue to provide incentives to produce new content.

These estimates are based on a number of assumptions, and may turn out to be conservative. For example, a major difference between print books and digital books is that digital books require a computer or a digital reader such as Kindle. However, for those that purchase a digital reader, the value of convenience and lower prices exceeds the cost of the readers. As the prices of eReaders continue to decline, we suspect the value of convenience (which we have not separately measured) will greatly exceed the cost of readers. Several other factors may affect the size of the pie. If digital readers drive up the demand of digital books, that will increase the size of the pie. If one publisher or retailer dominates the market of digital books, that monopolist may control price and shrink the size of the pie. If digital books replace only a fraction of paperbacks, the size of the pie shrinks accordingly.

Case study: Text books.

Digital books have many advantages over print books (Wikipedia, 2009). For example, consumers have immediate access to over 2 million free books to download in August 2009; children's books have motion capability; senior readers can enlarge the font for easy reading; readers can search for text. Here we focus on estimating the dollar value of one benefit, cheaper textbooks for students.

A typical undergraduate spends \$4488 on textbooks in a four-year public school (College Board, 2009). After digital books replace print textbooks, a student is estimated to pay 15.7% less for textbooks. If students value convenience at least as much as the price of Kindle digital reader, each student saves \$704.6 during the four-year college experience.

4. Current Division of Benefits:

The long-run hypothetical equilibrium in the previous section will exist, if at all, many years in the future. This section provides a snapshot of what the market is at the moment, and gives insights into the issues that will affect how it may develop as digital books continue to be more and more widespread. As books become digital, printers and wholesalers lose some business. As to the winners and losers among publishers, retailers and consumers, we analyze the current market following a similar structure as Dedrick, Kraemer and Linden (2010). They study how different players on the supply side divide the profits from the iPod and notebook PCs, and explain why Apple successfully captured the profit from iPod while HP failed to capture most of the profit from a new model of a notebook PC. We examine how much consumers, publishers and retailers benefit from digital books in the current market.

The previous section does not consider changes in the distribution of market power. But as Teece (1986) shows, market power is a key determinant of whether an innovator will benefit

from its innovations, so it is important to examine how digital books may have changed at least temporarily the market power of publishers, retailers and consumers. Since we are at the beginning of a new trend we need to understand the dynamics of market power in order to examine the general condition of the book industry

Current developments in the use of digital technology in the book industry are at an early stage. Generally, technological evolution starts with the introduction of the new product. Then the evolution enters the early stages when firms compete on many different designs of the new product (Abernathy and Utterback, 1978 and Dosi, 1982). As competition goes on, one design or one type of design emerges as the standard design that meet a complete set of users' needs. After the dominant design emerges, firms stop competing on design and start competing on price. If a firm controls the dominant design, the firm can capture a large market share of the new product.

The digital book market is following this pattern. In 2003, a European company, Cytale, introduced the first eBook reader and failed. There are now more than 40 different designs of eBook readers available, most of which were introduced after 2008 (Wikipedia, 2010). Amazon's Kindle captured 60% of the market share of digital readers in the US in 2009, and an even greater share of digital book sales (Forrester, 2009).

It appears that Amazon's Kindle strategy is similar to the strategy Apple used with iPod to establish its product as the dominant design (Dedrick, Kraemer and Linden, 2010). First, both Apple and Amazon carried out a marketing campaign. Apple spent \$200 million on advertising in the first four years after iPod was introduced, far more than rivals. Amazon lists Kindle on the front page of its US website, using homepage traffic to advertise Kindle. The marketing campaign expands the customer base of Kindle.

However, the platform battle may be more complex for digital books than for music. The Kindle reader is essentially dedicated to ebook reading, with limited additional uses. In January 2010, Apple announced the introduction of the iPad, a "tablet" computer which has many of the functions of a laptop computer in addition to serving as an eBook reader. With Apple's strong reputation among consumers and the establishment of the iBooks digital book store, the iPad quickly became a strong competitor to Amazon in the markets for digital readers and books.

Second, both Apple and Amazon use the sale of devices to bolster their sales of content and link the two types of transactions through closed platforms using digital rights management. For digital music, Apple controls iTunes software and the iTunes store, while, for digital books, Amazon controls the formatting and retailing of Kindle books. The iPod most conveniently plays music that iPod owners buy from the iTunes store. Similarly, Kindle reader owners have to buy their ebooks from Amazon. On the other hand, other eBook reading devices (including the iPad and other dedicated ebook readers) accommodate more open formats

Third, both Apple and Amazon internally provide a large range of the assets complementary to the products. As Dedrick, Kraemer and Linden (2010) show, depending on the negotiation power of the lead firm (innovator) and its suppliers and distributors, suppliers and distributors could capture more profit than the lead firm. To minimize the profit captured by other firms along the supply chain, Apple internally developed the iPod and iTunes client software, licensed (or patented) the dock connector interface of iPod, and used Apple Stores to market iPod. Similarly, Amazon controls the format of Kindle books, uses the Amazon webpage to market Kindle, and uses the Amazon webpage to sell Kindle books. It leverages its long list of digital titles by also making them available to owners of other devices (including the iPad).

4.1. Retailers:

For the paperback books in our sample, we estimate that Amazon makes a profit equal to 18% of list prices from both Kindle books and print books. Our sample shows that the paperback price is 82% of list prices, and Amazon's gross margin is 22% (Wingfield, 2003), so profit is 18% of list prices (multiplying 22% by 82%). Amazon's gross margin on Kindle digital books is also 18% of list price. The wholesale price of Kindle books is 50% of paperback list prices, and retail prices are 68% of list prices on average (Table 1).

On the other hand, Amazon appears to have been incurring a loss on the digital editions of new hardcover bestsellers. Since, until 2010, its top price for a digital book was \$9.99, the wholesale price of a digital book was the same as for a print book, and the wholesale price of a print book is about 50 percent of its list price, Amazon was losing money on the ebook edition of any print book with a list price exceeding approximately \$20. Presumably, it was incurring this loss to boost profits from sales of its Kindle reader and to maintain its dominant position in the ebook marketplace.

Amazon made between \$73 and \$213 from each Kindle reader sold. Amazon incurred a cost of \$186 to make a Kindle digital reader (iSuppli.com, 2009), and charged \$399 for a reader in 2008, and \$259 in 2009 (Amazon.com). Thus, Amazon made \$73 from each reader it sold for \$259 and \$213 for a reader sold for \$399. Since there are over 3 million Kindles in use (Auletta 2010), the sale of Kindle readers appears to have been a significant source of profit.

In the long run, if Amazon were to establish Kindle as the major digital book reader as the iPod became for music, Amazon may capture surplus from publishers and consumers in several ways. For example, Amazon could negotiate with publishers to reduce the wholesale prices of digital books and raise the prices of Kindle books to capture some of the consumer surplus book by book.

However, the digitization of books presents established book retailers with significant new competition from other companies that have staked out a position in less specialized aspects of the digital world but are new entrants to book retailing. Apple's iPad and iBooks store, a prime example of this phenomenon, represents significant competition to Amazon. This competition

has recently led to large cuts in the prices of the Kindle and other eReaders, undercutting Amazon's effort to use low eBook prices to generate sales for its devices. Apple has agreed with major publishers on a pricing model that appears to involve higher eBook prices for best sellers than Amazon has been charging. As of this writing, Amazon appears to be adopting this pricing model, which may lead to somewhat less growth in sales and an erosion of its market share. Further, Google has announced the launch of its own digital bookstore – Google Editions – that may present additional significant competition. In addition, other consumer electronics manufacturers (such as Sony) and digital retailers (such as telecom operators in many countries) are vying for a piece of the overall revenue that consumers spend on published book content and delivery.

4.2. Publishers:

A publisher is a monopolist for each book it publishes; this gives publishers the ability to protect their profit margins to some extent. Until the change in the pricing model associated with the iPad introduction, publishers retained the benefit of cost reduction—they charge Amazon the same price for digital books as print books, 50% of the list price of paperbacks (Publishers Weekly, 2009). Thus, for each digital book, publishers increased their profit by at least the saved direct costs, 13% of list price. However, publishers became concerned that the low price at which Amazon was selling digital books would lead to reductions in the retail price of print books, thus threatening the viability of their other retail distribution channels, especially brick-and-mortar bookstores. As a result, in order to achieve the higher retail prices resulting from the new pricing model negotiated with Apple, publishers apparently agreed to lower the wholesale price of digital books, allowing retailers to capture a greater share of digital book revenue.⁸

Publishers, however, will continue to face pressure from the unbundling in the steps of the media value chain that are described at the beginning of this paper. Authors' ability to connect directly with readers through a multiplicity of sales channels may tend to limit publishers' roles.

4.3. Consumers:

The direct impact of the eBook phenomenon on consumers is to lower the price of published book content. A consumer switching from a print book to a Kindle book paid 40.5% of list price less for Kindle books than for paperback books. For Kindle books, consumers pay 68% of list price, and for print books, consumers pay 108.5% of list price (pay 82% of list price for the book and 34% of list price for shipping, and on average receives 7.5% of list price because they can

⁸ See Auletta (2010) for a description of the relative positions of eBook publishers and retailers as of the spring of 2010.

sell the used book)⁹. (For each new print book, the consumer pays \$3.99 for shipping -- 34% of the average list price in our sample). Price sensitive markets with techno-savvy readers -- such as textbooks -- may be especially sensitive to this change.

Beyond price reduction, however, ICT has changed the consumer experience of buying and reading books. In effect, eBooks have become a new product in many respects, making conservative the previous section's analysis of the market expansion that digitization will generate; that analysis reflected only the impact of cost reduction. Digital readers can allow the convenient viewing of video clips placed in children's books or other interactive content and of related information anywhere on the internet. Senior readers can enlarge the font for easy reading. Readers can search for specific text. Books of short stories can be unbundled and sold separately. Digital books can be easily bundled for sale with related digital content and be the focal point for social networking activities; both of these may create unique marketing advantages in some situations.

Digital books are convenient. Some consumers value the convenience of eReaders more than others. Some consumers have bought Kindle readers at a price of \$259 or higher. They amount to less than 10% of American readers. About 90% of American readers value the convenience at less than \$250 for the useful life of a Kindle reader. About 60% of American readers value the convenience at less than \$98, and they will not buy Kindle readers or Kindle books unless Amazon lowers the price of Kindle readers to \$98 (Forrester Research, 2009).

5. Conclusion:

Both consumers and producers benefit from digital books. The cost reduction due to ICT will significantly expand the market. In a long-run equilibrium if digital books replace paperback books, digital books would increase consumer surplus by \$1.52 billion or 16.6% of existing sales, and producer surplus by \$1.19 billion or 13.0% of existing sales, of paperback trade and mass market books, if digital books do not change the market power of the supply side of the market (authors, publishers, and retailers as a group). Certainly, as with other innovations, the relative positions of these traditional players in the market will be substantially disrupted.

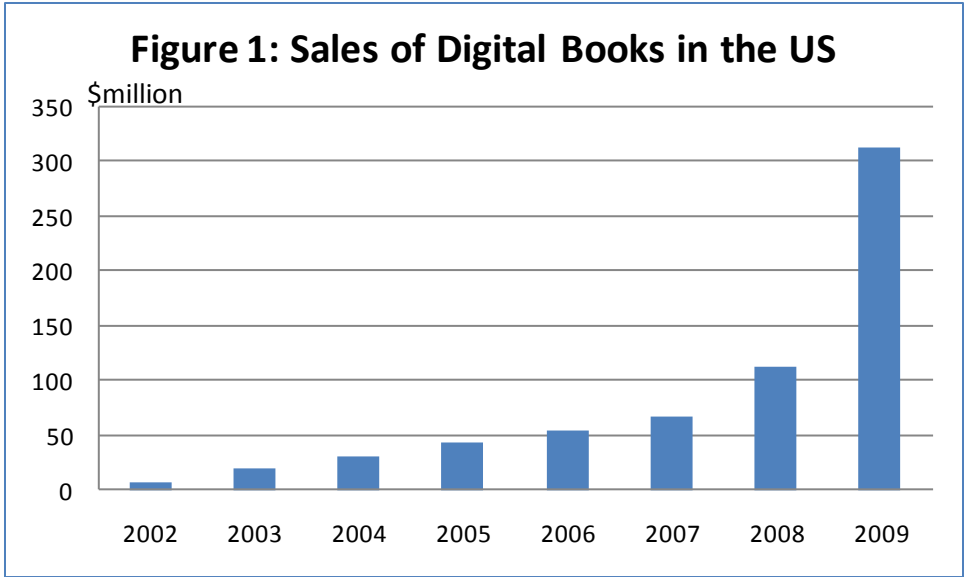
Several other factors may affect the size of the pie. If the convenience, ties to social networking, and/or multimedia features of digital books drive up their demand, that will increase the size of the pie. If one publisher or retailer establishes a platform that dominates the market of digital books, that monopolist may control price and shrink the size of the pie. If digital books replace only a fraction of paperbacks, the size of the pie shrinks accordingly.

⁹ Used books make up 23% of total new and used book sales at Amazon.com (Ghose et al., 2006). We roughly estimate that 30% of new book buyers sell their books later ($23\% / (100\% - 23\%) = 30\%$). The price of a used book is about 50% of new book, and Amazon takes away half of that revenue as commission. So used books bring buyers of new books a revenue equal to $(30\% * 25\%) = 7.5\%$ of list price.

Competition is not over costs. Rather competition is over design, marketing and the control of content. Since digital books are in the early stage of technological evolution, Kindle is competing with other eBook readers to become the dominant design paradigm. Similar to Apple's marketing strategy with iPod, Amazon is trying to establish Kindle as the dominant design paradigm of ebook readers. Moreover, Amazon controls most of the supply chain of Kindle books to capture a large share of value of the new product. Amazon controls the format of Kindle books, and markets Kindle on its own website. The case of digital books reflects a general trend in the knowledge economy. ICT decreases variable costs to almost zero in many industries. In order to capture profit, companies invest heavily in upfront fixed costs such as R&D, design and brand equity to build up market power.

If Amazon were as successful with Kindle as Apple is with iPod, Amazon most likely could earn large profits in the future. Apple introduced iPad in April 2010, competing with Amazon's Kindle. Following the introduction of iPad, big publishers sparred with Amazon over the pricing of digital books on Amazon.com. In June 2010 Barnes & Noble dropped the price of its digital reader, Nook, to \$199, and Amazon dropped the price of Kindle to \$189. The fight is affected by many factors, such as digital rights management and the interchangeability of formats. We are still at the opening of the contest and we dare not predict if Amazon will be the winner.

Because of distinctive characteristics of the book publishing industry, the digital revolution may not affect other media industries in the same way. Moreover, we analyze digital books under the US regulatory framework; increased surplus may be even larger in other countries that have more regulations governing retail competition.



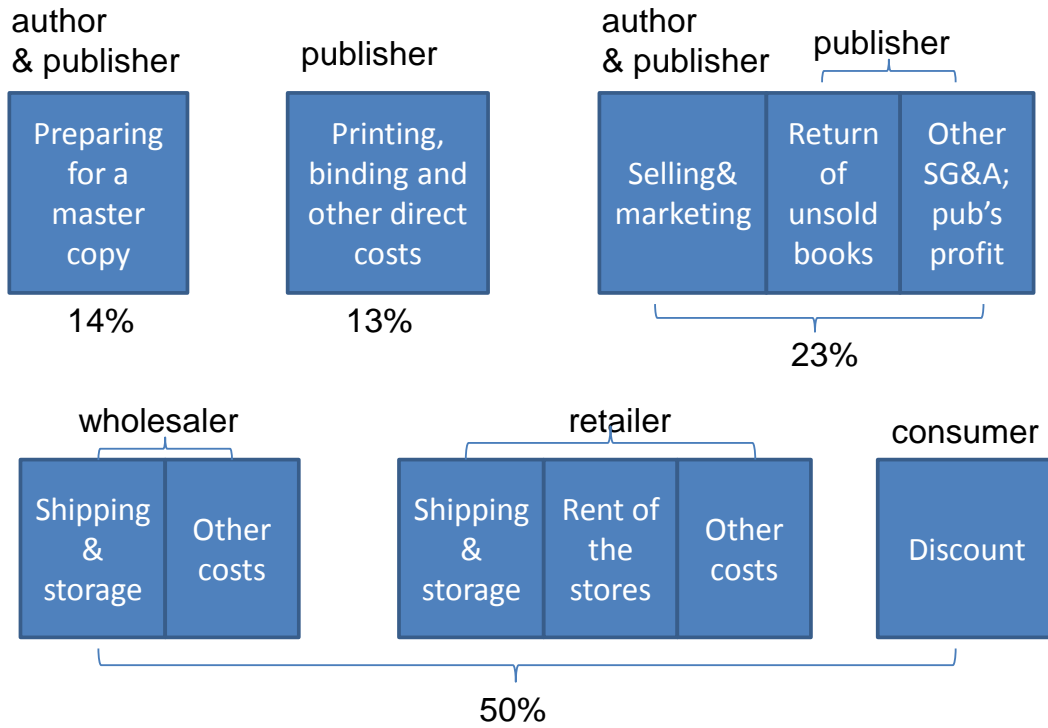
Source: Association of American Publishers - <http://www.publishers.org/>

Table 1. Summary Statistics

Variable	Mean	Std. Dev.	Min	Max	Mean price as % of list price
list price	11.59	4.22	4.99	30.00	n.a.
new paperback price	9.54	2.20	4.86	25.95	82%
Kindle book price	7.87	1.79	2.87	9.99	68%
number of pages	398	137	96	1104	n.a.
sales rank	83053	172727	8	2133468	n.a.
author's avg. sales rank<10000 (yes, 1, no, 0)	0.26	0.44	0	1	n.a.
#books a publisher has in our sample	10.65	9.20	1	34	n.a.

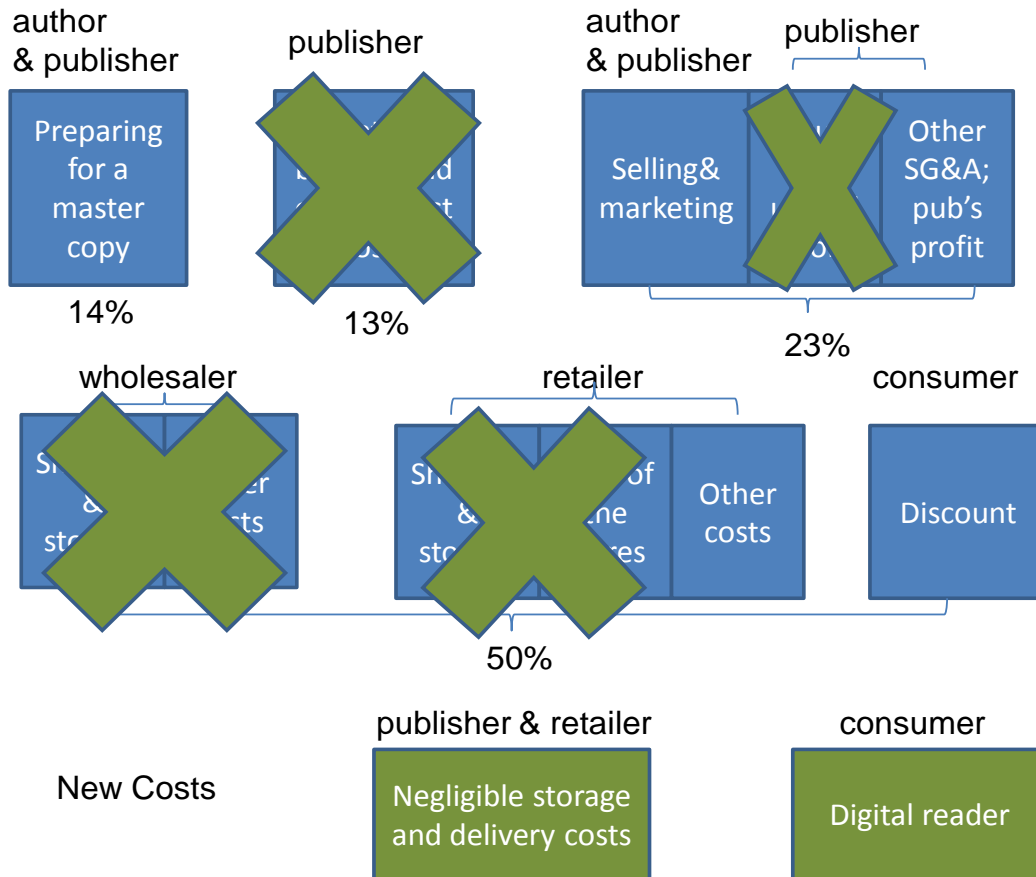
Source: Our data are the prices, the number of pages, sales rank, author and publisher of 981 New York Times paperback bestsellers sold in Amazon.com. These data are not time series; they are the values during the last week of August 2009, when we accessed and parsed Amazon webpage. Mean prices are calculated as a percentage of list prices, using list prices as the weight.

Figure 2a: Digital Books Changed the Value Chain of the Book Industry
the Old Value Chain



Source: 2005 Annual report of HM Publishing Corporation.

Figure 2b: Digital Books Changed the Value Chain of the Book Industry
the New Value Chain



Source: 2005 Annual report of HM Publishing Corporation for the old value chain.

Table 2. The Effect of Costs Reduction on Price Reduction

	Log paperback price	Log paperback price	Log paperback price
Ln list price	0.54 (51.19)***	0.55 (50.46)***	0.57 (49.73)***
Rank of publisher (1-34) (#books by a publisher in our sample)		0.0006 (2.32)**	0.0005 (1.83)*
Fame of author =1 if the average sales rank of books by that author is <10000, and =0, otherwise			-0.06 (-7.67)***
Constant	0.94 (39.31)***	0.92 (36.32)***	0.89 (34.36)***
R-squared	0.84	0.84	0.85
obs	981	981	981

Source: Sources: Our data are the prices, the number of pages, sales rank, author and publisher of 981 New York Times paperback bestsellers sold in Amazon.com. Our data are not time series. They are the values during the last week of August 2009, when we accessed and parsed Amazon webpage.

Note: OLS regressions and robust standard errors. *, ** and *** respectively denote significance at 90%, 95% and 99% confidence level.

Table 3. Breakdown of the Price of Printed Books

Components	% of list price
Royalties	7
Other costs to produce a master copy of books	7
Printing, binding, and other direct costs	13
General selling and administrative costs	20
Total costs	47.7
Publisher's profit	2.3
Difference between wholesale price and list price	50
Total	100

Source: 2005 Annual report of HM Publishing Corporation.

Note: The operation of HM Publishing Corporation includes K-12 publishing, college publishing, trade and reference publishing and other publishing. We estimate a price breakdown from the costs breakdown in 2005 financial statements. Our price breakdown is close to that of trade books in the UK provided by the Booksellers Association (1998). For more information, please see the text.

Table 4. The Determinants of Sales Rank

	Log sales rank of a paperback book
Log price	0.874 (3.17)***
Log number of pages	0.07 (0.42)
Fame of author =1 if the average sales rank of books by that author is <10000, and =0, otherwise	-3.09 (-24.76)***
Rank of publisher (#books by a publisher in our sample)	0.003 (0.63)
Constant	8.31*** (7.09)
#obs	981
R-squared	0.44

Source: Our data are the prices, the number of pages, sales rank, author and publisher of 981 New York Times paperback bestsellers sold in Amazon.com.

Note: OLS regressions and robust standard errors. *** denotes significance at 99% confidence level. Our data are not time series. They are the values during the last week of August 2009, when we accessed and parsed Amazon webpage.

Table 5. Summary of Cost, Price, and Surplus Calculations

Cost reduction from digital books

Printing, binding, and other direct costs (13% of list price) – from Table 3

÷ Total costs (47.7% of list price) – from Table 3

= Cost reduction from digital books: 27.3%

Price reduction from digital books

Cost reduction from digital books (27.3%)

X Pass-through to price (.57) – from regression analysis

= Price reduction from digital books: 15.7%

Increase in consumer surplus

From Current sales: price reduction (15.7%) X sales (\$9.16 billion) = \$1.44 billion

From New Sales: average surplus (.5x 15.7%) x new sales (11.9% [from regression] x \$9.16 billion)
= \$0.8 billion

Total increase in consumer surplus: \$1.44 billion + \$0.8 billion = \$1.52 billion

Increase in producer surplus

Cost decrease (27.3%) – price decrease (15.7%) = profit increase (11.6%)

Profit increase (11.6%) X sales (111.9% x \$9.16 billion)

= Increase in producer surplus: \$1.19 billion

NOTE: See text for explanation of calculations

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