The Impact of e-Book Technology on Book Retailing

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Abstract

In 2008, Amazon the dominant online book retailer unveiled Kindle, an e-book reader called by many observers the “iPod of books” as it is likely to transform how people read books. E-book technology offers a third important channel for delivering books to consumers and possibly transforming the book industry. Two other major channels of delivering books to consumers have been available so far: purchasing physical books from physical bookstores, predominantly book-chains like Barnes-and-Noble, or purchasing physical books online, from online book retailers like Amazon. The main objective of this article is to analyze how e-book technology affects strategic interaction in the book markets and ultimately impact book sellers, publishers and consumers. Developing a stylized game-theoretic model based on product differentiation literature and information goods literature, we examine how entry of an e-book seller affects competitive interaction in the book market. Factors explored include the differentiation of sellers in the physical book market, consumers’ preferences for e-books, and ownership of the e-book seller. Implications for managing in the book industry are discussed.

1. Introduction

In 2008, Amazon the dominant online book retailer unveiled Kindle, an e-book reader called by many observers the “iPod of books” as it is likely to transform how people read books. The Kindle device, which costs $299 (August 2009), is only one component of the e-book platform provided by Amazon. Other components include an e-book store providing the e-books and software that encodes and protects the books once downloaded into the device. Amazon has a deal with Sprint so customers can browse books and download the purchased books through Sprint’s 3G network. The original Kindle can hold up to 1,500 titles, it features screen technology that makes reading pleasant like reading paper, it includes dictionary, and it is lightweight. The popularity of the original Kindle, motivated Amazon to introduce Kindle DX in May 2009, a larger screen Kindle targeting the newspaper and textbook markets. Amazon also offers a software application for iPhone so people can continue reading their e-books using their iPhone for short-periods of time. Prices for Kindle e-books and newspaper subscriptions are typically cheaper than the paper versions. For instance, most best-sellers and new releases are $9.99, while the list price of the paper book is typically more than $20 (http://www.amazon.com).


E-book technology is likely to have a significant impact on the book markets. E-book technology offers a third important channel for delivering books to consumers. Two other major channels of delivering books to consumers have been available so far: purchasing physical books from physical bookstores, predominantly book-chains like Barnes-and-Noble, or purchasing physical books online, from online book retailers like Amazon. According to Publishers Weekly, book-chains and online stores hold 32.5% and 30% shares of consumer book purchases in 2008 [14]. Competition between online and physical sellers of products has been analyzed in the e-commerce and related channel-competition literature [4, 19].

E-book technology offers a third channel for book delivery to book readers, whereby a digital copy of a book (e-book) is delivered to a device used by the book-reader. E-book technology alleviates the need to produce, store and distribute (e.g. shipping) physical books and transforms the production costs of book publishing. The American Association of Publishers estimates that e-book sales in the US reached $113 million in 2008. This is still a fraction of the $24.3 billion book market, but e-book sales grew 68.4% in 2008, while total book sales decreased 2.8% [1].

The introduction of an e-book platform selling a digital good competing with pre-existing sellers of
physical books is a novel phenomenon analyzed in this research project as shown on Figure 1. The main focus is the strategic interaction in selling e-books and physical books in the book market.

![Diagram of book market transformation due to e-book technology](image)

**Figure 1: Overview of research framework.**

The main objective of this project is to analyze how e-book technology affects strategic interaction in the book market. Developing a stylized game-theoretic model based on the product differentiation literature [11, 16] and the information goods literature, we examine how the entry of an e-book seller affects competition of retailers selling physical books. Factors explored include the differentiation of sellers in the physical book market, consumers’ preferences for e-books, and ownership of the e-book seller. Our analysis provides strategic insights for managers in book and publishing industry, but it is also relevant, more generally, to managers of industries that undergo a digitization of their information products.

Extending Salop’s [16] “unit circle” modeling idea to study economic phenomena that involve spatial differentiation is a well-established approach in the IS economics literature. This approach was used for instance to study the effects of search cost reduction in electronic marketplaces [2] and the analysis of mass-customization strategies enabled by customer information on the Internet [10]. We adopt a similar “unit circle” modeling building-block to analyze the strategic interaction of digital and physical information goods sellers.

Previous IS research on information and digital goods focused on issues of piracy and the value of digital rights management (DRM) technology [9, 17, 18] and pricing issues like versioning [5] and bundling [3]. In addition, the availability of online book sales data led to several empirical studies, which show that price dispersion does not disappear on the Internet [7], social welfare increases substantially due to increased product variety at online retailers like Amazon [8], and only 16% of used-book sales cannibalize new book sales at Amazon leading to an increase of consumer and social welfare [12]. This literature has paid less attention to the theoretical analysis of the strategic interaction between digital and physical information goods.

Our study adds especially to theoretical and empirical research on e-books by Oestreicher-Singer and Sundararajan [15]. They analyze the value of digital rights in the context of a monopolist selling a physical and a digital book in the presence of piracy. They find that the monopolist should restrict certain digital rights, because of the threat of piracy, and that this threat affects monopoly pricing. While our model setup and the objective of our study is different, our analysis contributes to their call for more research on how digitization progressively transforms information-goods industries, as managers need to understand and manage this transformation.

### 2. The model

We consider a book market in which consumers have unit demands for either a physical or an electronic book. Consumers have a common reservation value $V$ for a given book title, independent of its electronic or physical format. Consumers are heterogeneous along two dimensions.

The first dimension captures consumer’s preferences for physical books in a circular spatial market as in Salop [16]. Customers are distributed uniformly on a circle of unit circumference. Two retailers A and B selling identical physical products (paper books) are located on the circle symmetrically at equal distance apart. Customers who are not located at A or B incur a unit-distance disutility (misfit cost) $t$ when they buy a physical book. Thus customers closer to A than B prefer A over B everything else being equal. The source of this heterogeneity could be due to transportation costs, convenience of shopping, loyalty to one retailer over the other, or other transaction costs.

The second dimension of consumer heterogeneity captures their preference for e-books. Consumers differ in their disutility (misfit cost) $t_e$ of buying the e-book. This disutility may depend on inconveniences of reading electronic text and more generally the “quality” of e-book technology, the need to purchase and learn an e-book device or install and learn e-book software etc. We assume that a customer’s e-book disutility $t_e$ can be $t_{e1}$ with probability $\rho$ and $t_{e2}$ with probability $1 - \rho$ and $t_{e1} < t_{e2}$. Furthermore, we assume that $V - t_{e1} > 0$ and $V - t_{e2} < 0$. That means that customers of type $t_{e1}$ (low e-book disutility) will consider e-books in their purchase decision and they...
may buy the e-book if it offers them greater surplus than the physical book. Customers with type $t_{high}$ (high e-book disutility) do not like e-books in general and they do not consider e-books in their purchase decisions. These customers are not technologically sophisticated [15], or they don’t like e-books for some other reason [1].

When a firm E selling e-books enters the book market, a consumer’s disutility on e-book $V_e$ does not depend on her location on the circle. This assumption implies also that there is no systematic difference in the e-book type of customers who preferred A or B in the physical book market segment. This assumption can be relaxed in future extensions.

The physical book retailers incur a marginal production and distribution cost $c$, while the e-book seller has a marginal cost zero, as it is typical in the information goods literature (e.g. [3]).

Because the focus of the study is the strategic interaction between sellers of physical and digital information goods, we do not distinguish online from physical sellers of physical books. So A or B can be online or physical retailers. We assume that this potential source of differentiation of A and B is captured by their location on the circle and the parameter $t$. We think this modeling assumption is sufficient for the purpose of the paper, and suitable especially for markets in countries where e-commerce is mature enough, most consumers have Internet access, and consumers have well-formed preferences about buying online or through physical stores (being “closer” to one or the other in the language of our model).

2.1. Duopoly market of physical book sellers

First, consider the book market when only the physical book sellers A and B are active and e-books are not available.

Because this is a symmetric market, we only need to solve the model for retailer A. Let $P_A$ be the price charged by retailer A and $c$ be the common marginal cost. The net valuation of a customer located at distance $x$ apart from retailer A is given by $V - P_A - tx$. We focus on the market-uncovered case, i.e., $t > 2(V - c)$ such that some customers are priced out of the market. This assumption is partly driven by our interest in examining the potential of e-book technology to expand the book market. If the physical books market was fully covered before the entry of e-book seller, then one would not be able to examine what factors may affect potential expansion of book readership. Expanding book reading time and book readership is probably one of the most interesting aspects of e-books, since readers can buy a book instantly, they can carry thousands of titles with them, and they can read at any time possible through a multitude of devices.

Now, let $y$ be the customer who is indifferent between purchasing the title from A and not participating in the market. Since $V - P_A - ty = 0$, we know that $y = (V - P_A)/t$.

Retailer A will choose the optimal price $P_A$ to maximize its net profit, which is given by equation (1):

$$\Pi_A = 2y(P_A - c)$$

Since the profit function is concave in price, solving the first order condition we have $P_A = (V + c)/2$ and $y = (V - c)/(2t)$. That is customers located within $(V - c)/(2t)$ distance from retailer A or B will purchase the physical book, and customers located further away from the retailers will not purchase any book.

**Lemma 1:** When only the physical book retailers A and B are active in the book market, at equilibrium the prices, market-shares, and profits are as follows in (1.1)-(1.3):

$$P_B = P_A = \frac{V + c}{2}$$

$$S_B = S_A = \frac{V - c}{t}$$

$$\Pi_B = \Pi_A = \frac{(V - c)^2}{2t}.$$  

As expected, prices are increasing in $c$, but shares and profits are decreasing in $c$. Shares and profits are also decreasing in the misfit parameter $t$, but prices are independent of $t$, because by our assumptions the market is uncovered and both retailers set prices like local monopolists.

2.2. Entry of an independent e-book seller

Next, consider the same physical book duopoly, but with a new e-book entrant. Because of technology improvement and the development of Internet and telecommunication networks, books (and other digital content) can now be distributed and accessed through an electronic reading device, which can simulate readers’ paper reading experience. An independent firm E sells e-books through an e-book platform which may consist of a specialized reading device, a Digital Rights Management (DRM) technology, and e-book software. In this case, both retailers (A, B) offer paper books and the new entrant (E) offers electronic books. Each customer in the market has a unit demand for a title, either in paper or electronic form.

The e-book technology may enhance some users’ reading experience. For example, it provides extra value-added features such as automatic bookmark, dictionary, note taking, search capability, and text-to-
voice function. The device can store multiple titles so that users can easily carry around a personal library with them in such a portable-size device. However, there are also downsides of using the device. The electronic books are often protected by a DRM technology, which limits a book owner’s capability of sharing. For example, users of the electronic device cannot share (lend) the titles they brought with their friends even though they all use the same type of electronic device. In addition, some customers may prefer the experience of holding and reading a paper book. Most importantly, in order to consume an e-book, customers need to first purchase the electronic device. In addition, some customers may prefer the experience of holding and reading a paper book over the e-book. The device can store multiple titles so that users can easily carry around a personal library with them in such a portable-size device. However, there are also downsides of using the device. The electronic books are often protected by a DRM technology, which limits a book owner’s capability of sharing. For example, users of the electronic device cannot share (lend) the titles they brought with their friends even though they all use the same type of electronic device. In addition, some customers may prefer the experience of holding and reading a paper book. Most importantly, in order to consume an e-book, customers need to first purchase the electronic device. In addition, some customers may prefer the experience of holding and reading a paper book over the e-book. The electronic device and worked through deals with content providers. It also applies when the paper-book retailers cannot observe which titles will be available on farm E’s electronic device. The e-book seller has an advantage since it can determine its price taking into account the retailers’ pricing response.

**Lemma 2:** When an e-book seller enters the market anticipating the response of physical book retailers, at equilibrium the prices and market-shares are as follows in (4)-(7):

\[
P_B = \frac{8V + 8\rho - 2c\rho - \rho t(V - t_e) + 2\rho^2(V - t_e)}{16 - 8\rho} \tag{4}
\]

\[
P_e = \frac{2(1 - \rho)(V - t_e) + 2c - 2t_e}{8 - 4\rho} \tag{5}
\]

\[
S_B = \frac{8V - 8c + 6c\rho + \rho(t + 4t_e - 10V) + 2\rho^2(V - t_e)}{(8 - 4\rho)t} \tag{6}
\]

\[
S_e = \frac{\rho(2V + 2c - 2V\rho + t - 4t_e + 2t_1\rho)}{2t} \tag{7}
\]

**Case 1: The e-book seller anticipates the move of physical book retailers**

In the first case, the e-book seller sets its price, anticipating the move of retailers. This case applies when the paper-book retailers do not foresee the entry of the new comer E, who secretly developed the electronic device and worked through deals with content providers. It also applies when the paper-book retailers cannot observe which titles will be available on firm E’s electronic device. The e-book seller has an advantage since it can determine its price taking into account the retailers’ pricing response.

**Lemma 2:** When an e-book seller enters the market anticipating the response of physical book retailers, at equilibrium the prices and market-shares are as follows in (4)-(7):

\[
P_B = \frac{8V + 8c - 2c\rho - \rho t(V - t_e) + 2\rho^2(V - t_e)}{16 - 8\rho} \tag{4}
\]

\[
P_e = \frac{2(1 - \rho)(V - t_e) + t + 2c - 2t_e}{8 - 4\rho} \tag{5}
\]

\[
S_B = \frac{8V - 8c + 6c\rho + \rho(t + 4t_e - 10V) + 2\rho^2(V - t_e)}{(8 - 4\rho)t} \tag{6}
\]

\[
S_e = \frac{\rho(2V + 2c - 2V\rho + t - 4t_e + 2t_1\rho)}{2t} \tag{7}
\]

**Case 2: The physical book retailers anticipate E’s entry**

In the second case, the paper-book retailers have an advantage since they can anticipate the entry of firm E and adjust their prices before E sets its price. This special case enables the study of entry under adverse market condition for the entrant firm.

**Lemma 3:** When the physical book retailers anticipate E’s market entry, at equilibrium the prices and market-shares are as follows in (8)-(11):

\[
P_B = \frac{8V + 8c - 4c\rho - 8\rho V + t + 4t_e\rho}{16 - 8\rho} \tag{8}
\]

\[
P_e = \frac{2t(1 - \rho)(V - t_e) + t + 2c - 2t_e + t_e\rho - c\rho - t\rho}{8 - 4\rho} \tag{9}
\]

\[
S_B = \frac{8V - 8c + 4c\rho + \rho(t + 4t_e - 8V)}{8t} \tag{10}
\]

\[
S_e = \frac{\rho(1 - \rho)(8V + 4c + t - 12t_e) + 4c + 3t - 4t_e}{(8 - 4\rho)t} \tag{11}
\]
2.3. Entry of an e-book seller owned by one of the two physical book retailers

Next, consider the case in which A and E is an integrated company. In other words, retailer A, while competing with B in the paper book market, also starts selling e-books. By developing an e-book platform, including a specialized electronic device and possibly DRM technology, retailer A can provide some book titles in an electronic format. Customers who acquire the electronic device from retailer A can then purchase and consume e-books offered by A. Clearly, e-books directly compete with retailer A’s paper-book offering, raising possible cannibalization concerns. However, retailer A may gain by taking market share from retailer B and serving previously un-served customers. In this case, retailers may charge different prices for the paper book.

Following similar derivation process, we can represent retailer A and B’s profit functions in equations (12) and (13):

\[
\Pi_A = 2(P_A - c)[(V - P_A)/t - \rho(V - P_e - t_e 1)/t] + 2cP_AD_e
\]

\[
\Pi_B = 2(P_B - c)[(V - P_B)/t - \rho(V - P_e - t_e 1)/t]
\]

where \(D_e = \frac{V}{2} - (p_e + t_e 1 - P_A)t - (P_e + t_e 1 - P_B)t\). We again focus on the Stackelberg game with retailer A as the leader.

\textit{Case 3: Retailer A sets its prices (\(P_A\) and \(P_e\)) anticipating the move of retailer B}

In this case, retailer A has an advantage since it anticipates firm’s B response to the e-book introduction.

\textbf{Lemma 4:} When retailer A owns the e-book seller E and it anticipates retailer B’s response to e-book introduction, at equilibrium prices and market-shares are as follows in (14)-(19):

\[
P_A = \frac{4V + 4c - 2c\rho + 4\rho V}{8 - 6\rho} \quad (14)
\]

\[
P_e = \frac{3(1 - \rho)(V - t_e 1) + t + c - t_e 1}{8 - 6\rho} \quad (15)
\]

\[
P_B = \frac{c(8 - 5\rho) + \rho(t + 4t_e 1 - 11V) + 3\rho^2(V - t_e 1) + 8V}{16 - 12\rho} \quad (16)
\]

\[
S_{A\text{-paper}} = \frac{V - c + \rho(t_e 1 - V)}{t} \quad (17)
\]

\[
S_{A\text{-book}} = \frac{\rho(V + 3c - V\rho + t - 4t_e 1 + t_e 1\rho)}{2t} \quad (18)
\]

\[
S_B = \frac{8V - 8c + 7c\rho + \rho(t + 4t_e 1 - 11V) + 5\rho^2(V - t_e 1)}{(8 - 6\rho)t} \quad (19)
\]

\textbf{Proposition 1:} When the physical book retailers anticipate the entry of an independent e-book seller, then the physical book prices may increase compared to the physical book duopoly case. The condition for that to happen is \(V < t_e 1 + \rho V/4\), i.e. the disutility are relatively large.

3. Impact of e-book technology on book market

The entry of the e-book seller has a significant impact on the paper-book retailers. When the independent e-book seller is the leader in the Stackelberg game (case 1), comparing with the physical book duopoly case, the paper-book retailers charge a lower price in response to the entry of the independent e-book seller, i.e., \(P_A = P_B < (V + c)/2\). The market shares of the paper-book retailers are also reduced. Thus, the paper-book sellers’ profits are lower as well.

However, when the paper-book retailers are leaders in the Stackelberg game (case 2), the price of paper book can be lower or higher than the price in the duopoly case depending on the parameter conditions. It is a little surprise to see that the entry of an independent e-book seller can sometimes lead to a price increase for the paper books. This happens when consumers’ reservation value is relatively low, i.e., \(V < t_e 1 + \rho V/4\). In this case, the entry of e-book seller forces paper-book retailers to focus more on customers near the retailer’s location only, or loyal customers. On the other hand, when consumers’ reservation value is relatively high with \(V > t_e 1 + \rho V/4\), the price of paper book is lower than the price in the duopoly case. Whether the price of paper book is lower or higher than that in the duopoly case, paper-book retailers’ market shares are lower than that in the duopoly case.

Figure 3 represents the half circular market in case 1, with retailer A located at zero and retailer B located at 1/2 (parameter values for this example: \(V = 26, c = 10, \ t = 35, \ t_e 1 = 20, \text{ and } \rho = 0.2\)). Customers are uniformly distributed in the x-y space, with the x-axis...
representing customer preference for the paper-book retailers (i.e., location on the circle) and the y-axis representing customer preference for the e-book. For example, customers below the line of \( \rho = 0.2 \) have a low disutility \( t_{ci} \) on e-books and will consider e-books in their purchase decision.

The vertical dotted line represents the customers who are indifferent between purchasing the paper book and not buying in the physical book duopoly case (before e-book entry). The solid vertical line \( y_p \) represents the new marginal customers when an independent e-book seller enters. In this case, the price of paper book is lower than that in the duopoly case, so some customers who were previously priced out of the market are able to purchase the paper book when the independent e-book seller enters. The solid vertical line \( y_p \) represents the marginal customers who are indifferent between the paper and e-book. So customers located in \([y_p, y]\) with type \( t_{ci} \) will now purchase the e-book instead of purchasing from A. Similar situation applies to retailer B. Thus, when the independent e-book seller enters and as the leader in the Stackelberg game retail B gains in their purchase decision.

When the independent e-book seller is the leader, its price and market share are both increasing in \( \rho \). However, when the paper-book retailers are the leaders, the price of e-book can increase or decrease in \( \rho \) depending on parameter values. In particular, when consumers’ reservation value is relatively low, i.e., \( V < t_{ci} + t/4 \), we have \( \partial P^i_j / \partial \rho > 0 \) (\( i = A, B \)) and \( \partial P^e / \partial \rho > 0 \). While more customers having a lower disutility on e-books should intensify the competition between paper and e-book sellers, with the paper-book retailers focus more on loyal customers (recall that \( P_A = P_B > (V + c)/2 \) in this case), the price competition is actually relaxed. As the e-book seller increases its price when \( \rho \) increases, the paper-book retailers’ market shares are actually increasing in \( \rho \), i.e., \( \partial S_j / \partial \rho > 0 \) (\( i = A, B \)). Therefore, the paper-book retailers can benefit when more customers have a lower disutility on e-books.

**3.2. Distribution of consumers’ e-book preferences**

It is also interesting to note that the change in \( \rho \), the fraction of customers with type \( t_{ci} \), has different impact on prices depending on parameter values or who is the leader in the Stackelberg game. An increase in \( \rho \) means more customers have a low disutility \( t_{ci} \) on e-books, and this is in favor of the e-book seller.

When the independent e-book seller is the leader, its price and market share are both increasing in \( \rho \). However, when the paper-book retailers are the leaders, the price of e-book can increase or decrease in \( \rho \) depending on parameter values. In particular, when consumers’ reservation value is relatively low, i.e., \( V < t_{ci} + t/4 \), we have \( \partial P^i_j / \partial \rho > 0 \) (\( i = A, B \)) and \( \partial P^e / \partial \rho > 0 \). While more customers having a lower disutility on e-books should intensify the competition between paper and e-book sellers, with the paper-book retailers focus more on loyal customers (recall that \( P_A = P_B > (V + c)/2 \) in this case), the price competition is actually relaxed. As the e-book seller increases its price when \( \rho \) increases, the paper-book retailers’ market shares are actually increasing in \( \rho \), i.e., \( \partial S_j / \partial \rho > 0 \) (\( i = A, B \)). Therefore, the paper-book retailers can benefit when more customers have a lower disutility on e-books.

**Proposition 2:** When retailers anticipate E’s entry, then all shares are increasing in \( \rho \). However, all prices are increasing in \( \rho \) if \( V < t_{ci} + t/4 \), and all prices are decreasing in \( \rho \) if \( V > t_{ci} + t/4 \).

**3.3. Ownership of e-book platform**

When retailer A also offers e-books and acts as the leader in the Stackelberg game, it will charge a higher price than that in the duopoly case, but in response retailer B will charge a lower price than before, i.e., \( P_A > (V + c)/2 > P_B \). This suggests that the introduction of Kindle by Amazon creates a price pressure to Barnes and Noble selling only physical books, which explains
the interest of Barnes and Noble to move into the e-book market segment.

Similar to the independent e-book cases, B’s price is increasing in \( t_{e1} \), and the price of the e-book is decreasing in \( t_{e1} \). But now A’s price of paper book is independent of the disutility parameter \( t_{e1} \). Again in the context of Kindle, this means that the perceived “quality” (inverse of disutility) of Kindle in the eyes of customers considering e-books (type \( te_{1} \)) does not affect Amazon’s physical book prices.

The shares of paper books are increasing in \( t_{e1} \), and the share of e-book is decreasing in \( t_{e1} \) (as in the independent e-book seller case). Interestingly, the total market share of A is decreasing in \( t_{e1} \). This happens because, as \( t_{e1} \) increases, the increased share in physical books is not big enough to offset the decreased share in e-books. Conversely, if Amazon’s customers perceive an improvement of Kindle’s “quality” (lower \( t_{e1} \), Amazon’s total share will increase, because the Kindle share will increase more than the reduction of Amazon’s physical book share. Thus, as \( t_{e1} \) decreases, the market-expansion effect of e-books offsets the cannibalization effect, and that benefits a company like Amazon that introduces the e-book platform.

While \( t_{e1} \) does not affect A’s physical book price, the fraction \( \rho \) of customers considering e-books does affect A’s physical and e-book prices. When that fraction of customers increases, we have \( \partial P_p / \partial \rho > 0 \), \( \partial P_e / \partial \rho < 0 \), \( \partial S_{A-paper} / \partial \rho < 0 \), and \( \partial S_{e-book} / \partial \rho > 0 \). That is, when \( \rho \) increases, the integrated retailer A will focus more on the loyal customers (customers close to A’s location) in the paper book market and increase its price on e-books. Again, in this case even though the e-book’s price is increasing in \( \rho \), the market share of the e-book also increases in \( \rho \).

As \( \rho \) increases the total market share of A may increase or decrease. This means that the cannibalization effect may offset the market expansion effect of e-books for A. The effect of \( \rho \) on B’s physical book price and market-share may also be positive or negative.

**Proposition 3:** When retailer A owns the e-book platform, then A’s total market-share is decreasing in \( t_{e1} \), but it can be increasing or decreasing in \( \rho \). B’s share and price can also be increasing or decreasing in \( \rho \). A’s prices (physical and e-book) are increasing in \( \rho \).

This analysis suggests that investment in an e-book platform that allows a book seller like Amazon to sell e-books to customers is an important strategic factor in the competitive interaction in the book market and it will be explored further in our study.

4. Discussion

The Internet and IT advances enable digitization of books, transforming the competitive forces in the book industry. This article developed a stylized game-theoretic model that captures the effects of e-book entry on book markets. Our analysis showed that e-book entry leads to intricate price adjustments, and share and profit changes. E-book technology offers the potential of market expansion, which can be quantified in our research model. In order to manage the entry of e-book technology (e.g. Amazon) or the response to that entry, managers need to consider several factors including the differentiation and intensity of competition in the pre-existing physical book market, the cost difference between e-books and physical books, the competitive “leadership”, the fraction of customers considering e-books in their purchase decisions, and the perceived “quality” of e-books for those customers that consider e-books as an option. In high-velocity information-goods markets, some of these factors may change fast, so optimal decisions under the current market conditions may need to be adjusted in the near future.

Research and industry data [1, 13, 15] suggest that the book industry is in its early stages of transformation due to IT and e-book technology. In our model this implies that there is a small but increasing fraction of consumers that consider e-books in their purchase decisions (\( \rho \) is low and increasing). We can also conjecture that the “quality” of e-book technology is low, but it is improving, so \( t_{e1} \) is high and decreasing. Given these conditions, our analysis in section 3.2 has shown for example that prices will change in a non-linear way in the future. This is shown qualitatively on Figure 4, where the dashed-arrow represents the expected direction of change of market parameters.

![Figure 4: As market shifts to lower \( t_{e1} \) and \( \rho \) increases (dashed-arrow), prices in the book market will change in a non-linear way.](image-url)
In the next steps we will complete the analysis of the current model examining additional cases, for example the “covered” physical book market case, and competition of e-book sellers. Transit
In extensions of the current model, we will further analyze in detail the impact of electronic distribution of digital content (e-books) on consumers, intermediaries, and publishers. As leading tech companies like Amazon and Google, are maneuvering strategically for the control of the growing e-book market segment, power changes in the book industry’s value-chain are possible. Anecdotal evidence suggests that publishers are increasingly concerned about the increasing control of e-books by Amazon’s Kindle platform. We will examine intermediary or platform competition, which includes the strategic behavior of publishers and their incentives to offer e-book versions of their titles. Exploring these directions is necessary in order to shed more light on the transformational power of e-books and IT.

References