

# IS THE INFORMATION DIFFERENTIATION ADVANTAGEOUS TO E-TAILERS?: AN ECONOMIC VIEW

Seung C. Lee, University of Minnesota at Duluth, [slee@d.umn.edu](mailto:slee@d.umn.edu)

## ABSTRACT

*Although the Internet has enabled some new forms of sales practices to emerge, the majority of independent e-tailers merely act as slightly different types of electronic middlemen who sell largely undifferentiated products by performing virtually the same functions as what conventional retailers and wholesalers have been. Regardless of the type of intermediation, however, one of the critical problems facing product e-tailers is running out of funds due to non-materialization of profits, and the resulting risk of e-tailers yielding to these pressures by terminating their on-line presence or ceasing operations completely. To alleviate the pressure, some e-tailers have begun to provide online customers with differentiated information services such as one-click shopping tools and customer reviews. This paper is an attempt to explain why such information differentiation maneuver may not be effective in certain circumstances. For this purpose, we model the effect of information differentiation activities to explain that such a costly effort might not be rewarding but should be made to sustain and/or improve a given status at the current visitor level.*

**Keywords:** E-tailer, information differentiation, e-commerce platform, economic model

## INTRODUCTION

The unique characteristics of the Internet such as global accessibility and integrated presentation of multimedia via hyperlinks, the relatively low barriers to entry and imitation (9), and the explosive growth of the number of Internet users (7) have brought an unprecedented “dot com” phenomenon. Although the Internet has enabled some new forms of sales practices to emerge, the majority of independent e-tailers merely act as slightly different types of electronic middlemen who try to increase revenue through the sale of undifferentiated products by performing virtually the same functions as what conventional retailers and wholesalers have been performing in the traditional markets (3, 4, 5). One of the critical problems facing e-tailers, especially product e-tailers, is running out of funds due to non-materialization of profits, and the resulting risk of e-tailers yielding to these pressures by terminating their on-line presence or ceasing operations completely (15). To alleviate the pressure, some e-tailers have begun to provide online customers with differentiated information services such as one-click shopping tools and customer reviews.

This paper is an attempt to explain why such information differentiation maneuver may not be effective in certain circumstances. Stated earlier, the Internet has relatively lower barrier to imitation (9) because it was originally intended to grow on open standards and open source. Although the rules are changing as more and more Internet-related patents and legal battles are looming on the horizon, many informational elements are not legally defensible (11). To analyze why information differentiation activity may not be effective, we first introduce a necessary business-to-consumer e-commerce infrastructure called the e-commerce platform (6).

Based on this, we model the effect of e-tailers' information differentiation activities to explain that such a costly effort might not be rewarding but should be made to sustain and/or improve a given equilibrium at the current visitor level. The paper concludes with some implications of the model and suggestions for future research.

### **E-COMMERCE PLATFORM**

An e-commerce platform is an *infrastructure* necessary to implement the e-tailer's business model that is "made up of its customers, its brand, technology, e-commerce expertise, and its distribution capabilities" (6, p. 80). The development of a formal list of factors and the measurement of those factors has yet to be accomplished (11). These factors that are necessary to successfully implement businesses on the Internet are composed of both tangible and intangible elements. The most important fact is that building, providing, and maintaining an appropriate e-commerce platform is very costly. In addition, providing reasonable response times and distribution facilities, building brand names and attracting customers are also draining to the firm's financial resources. This is evidenced by recent examples, eBay and Amazon.com spent 42% and 25% of their revenues on promotion in 1999, respectively (2). The following list identifies essential elements of an e-commerce platform (Table 1).

<b><u>Hypermediaries</u></b>	<b>Content providers, Affiliate sites, Authenticators, Search engines, Portals, ISPs, Software makers, Marketing intermediaries</b>
<b><u>Customer Base</u></b>	<b>Acquisition, Maintenance, Empowerment</b>
<b><u>Disclosure</u></b>	<b>Information about the business, Information about goods and services offered online, Information about online transaction itself, Terms of the online transaction, Terms of delivery, Information</b>
<b><u>Respectful Information Practices</u></b>	<b>Privacy, Notice/awareness, Choice/consent, Access/participation, Integrity/security, Enforcement/redress, Unsolicited email</b>
<b><u>Technology</u></b>	<b>Managing bursty business, Design, Speedy downloading, Incorporation of new technologies</b>
<b><u>E-commerce Expertise</u></b>	<b>Advertising and marketing, Solid business model, Experienced people</b>
<b><u>Distribution Capabilities</u></b>	<b>Inventory management, Delivery management, Alliance with suppliers</b>

**Table 1. E-commerce Platform**

The above list represents a minimal set of provisions that serious e-tailers must take into consideration to accomplish efficient and effective e-tailing on the Internet. Although most of these terms need no further explanation, some issues should be addressed here. First of all, hypermediaries are new breeds of intermediaries that have emerged from the electronic marketplace and are positioned between the customer and the e-tailer and take most of the profit (5). To increase sales volumes and efficiencies e-tailers will give away a large share of their profits to the owners of specialized review sites and the infrastructure companies. Another issue is product shipping and handling and on-time delivery. They are key factors to gain customer loyalty (1). Along with on-time delivery, the cost and convenience of shipping and handling are critically important to the overall consumer experience. However, it might be difficult for e-tailers to charge shipping and handling fees because, unlike the conventional catalogers, they at least for now sell undifferentiated and easily available products. Charging shipping and handling fees could stall the surge of e-shoppers (10). This could be another cost factor the e-tailer must seriously take into account.

## INFORMATION DIFFERENTIATION

In analyzing information characteristics provided by a set of e-tailers, we may start with the assumption that all the e-tailers provide homogeneous information about a product. Visitors therefore are assumed to be indifferent about which e-tailer's information they consume. This leads to the assumption that the information quality about a product by all e-tailers incurs the same costs or benefits to visitors. Such an assumption may be widely in conflict with many real-world electronic marketplaces. E-tailers often devote considerable resources to differentiating their information from those of their competitors through such devices as information quality, timeliness, effective display layout, depth, breadth, shorter navigation route, wording, complementary information, and the like. All these activities require e-tailers to employ additional resources, and e-tailers will choose to do so if average purchase, visitors, popularity, or eventually profits are thereby increased. In other words, e-tailers try to differentiate their information about a product by employing various differentiation mechanisms. Such attempts at information variation also will result in a relaxation of the notion of identical information quality, since now the electronic marketplace will consist of information that varies across e-tailers, and visitors may have preferences about which e-tailer to patronize.

We assume that the electronic marketplace is composed of  $n$  e-tailers, each providing slightly different information about a product, but that their information about a product can be considered a single information group. More precisely, the information about a product provided by the  $n$  e-tailers, which shares a common set of characteristics, constitutes an *information group* if the substitutability in those e-tailers' information (as measured by the cross-cost elasticity of information or the cross-benefit elasticity of information) is very high relative to the substitutability between those e-tailers' information and other information generally (e.g., bookseller's and CD seller's information). Very high substitutability means that visitors will move to another e-tailer's site for even slight difference in information characteristics. The cross-cost elasticity of information ( $\epsilon_{IC}$ ), where the cost is incurred by disutility and switching costs such as more time for navigation and processing. In contrast, the cross-benefit elasticity of information ( $\epsilon_{IB}$ ), where the benefit comes from utility enhancing factors such as more convenience and other benefits such as a desirable product mix. Cross-cost elasticity of

information,  $\epsilon_{IC} = \frac{\partial I}{\partial C'} \cdot \frac{C'}{I}$ ,  $\epsilon_{IC} \geq 0$ , measures the change in the amount of consumed information

of an e-tailer, and hence the change in the number of visitors switched to the e-tailer due to changes in the cost of consuming the information provided by some other e-tailer. Cross-benefit

elasticity of information,  $\epsilon_{IB} = \frac{\partial I}{\partial B'} \cdot \frac{B'}{I}$ ,  $\epsilon_{IB} \leq 0$ , measures the change in the amount of

consumed information of an e-tailer, and hence the change in the number of visitors switched to the e-tailer due to changes in the benefit of consuming the information provided by some other e-tailer. If an e-tailer provides proprietary, inherently unique, difficult to replicate, or legally protected information, and if the information generates benefits for visitors (in contrast, if the information reduces the cost of visitors), the e-tailer can reach a long-run stability by inducing visitors from other e-tailers. If the information provided by the e-tailer does not bear such properties, and if the information generates benefits for visitors (in contrast, if the information reduces the cost of visitors), the e-tailer can reach a short-run stability by inducing visitors from

other e-tailers. It is short run because other e-tailers will try to replicate the new information characteristics. We have seen such a case through the legal conflict between Amazon.com and bn.com.

Specifically, we are interested in the temporal effect of information differentiation because other competitors can replicate such differentiation after some period of time. This means that the e-tailer that introduced some information differentiation would enjoy a certain degree of competitive advantages until others replicate it. Again, we will assume that there are  $n$  e-tailers competing in a particular information group. Each e-tailer can choose the amount it spends on attempting to differentiate its information from those of competitors. We will denote the resources used by the  $i$ th e-tailer for this purpose by  $d_i$ , which might include spending on special features such as product reviews. The e-tailer's costs now are given by Total Costs =  $TC_i(E_i, d_i)$ , where we denote  $E_i$  as the cost incurred to the  $i$ th e-tailer to establish the current level of e-commerce platform (platform cost) other than information differentiation that the  $i$ th e-tailer has spent to maintain visitors at the current equilibrium. Because there are  $n$  slightly different pieces of information in the information group, we must allow for the possibility of a different "visitor pull parameter" (which represents the difference between the increase in the number of visitors and the decrease in the number of visitors *per dollar* spent on an information differentiation activity) for each piece of information in the information group (and hence different visitor pull parameters for each e-tailer's information differentiation activity). Such parameters will be

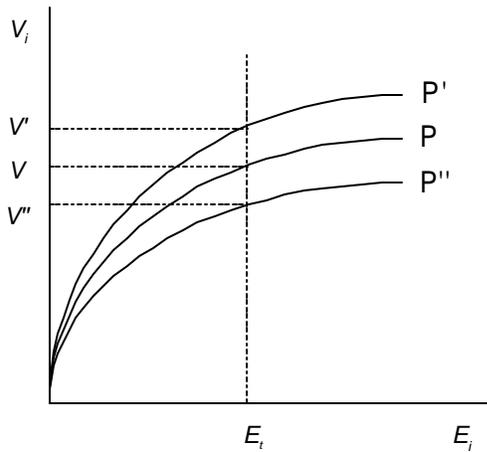


Figure 1. Information differentiation effects

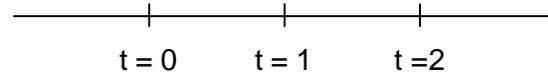


Figure 2. A time line

denoted by  $P_1, \dots, P_n$  (although some of these may be equal). The visitor demand facing the  $i$ th e-tailer shows how the visitor pull parameter retained depends on the amount of effort made by the e-tailer ( $E_i$ ), on visitor pull parameters being maintained by all other e-tailers ( $P_j$  for  $j \neq i$ ), and on the  $i$ th e-tailer's and all other e-tailers' attempts to differentiate their information ( $d_j, j = 1 \dots n$ ). In its most general form then,  $P_i = h(E_i, P_j, d_i, d_j)$ , and, therefore, the visitor function is  $V_i = f(E_i, P_i)$ , where the terms  $P_j$  and  $d_j$  are intended to include all other visitor pull parameters and differentiation activities, respectively. Presumably, in the short run we can think of  $\partial h / \partial E_i \geq 0$ ,  $\partial h / \partial P_j \leq 0$ ,  $\partial h / \partial d_i \geq 0$ , and  $\partial h / \partial d_j \leq 0$ . Also probably,  $\partial f / \partial E_i \geq 0$  and  $\partial f / \partial P_i \geq 0$ . That is, the visitor curve, which shows the *ceteris paribus* relationship among the visitor pull parameter,

platform cost, and the number of visitors attracted, facing the individual e-tailer is upward sloping. The extended visitor curve will be shifted inward by visitor pull parameter increases by its competitors. Information differentiation activities by competitors will also shift the curve inward, whereas such activities by the  $i$ th e-tailer may shift the curve outward. The inward and outward movements are shown in Figure 1.

We assume that the e-tailer introduced some information differentiation at time  $t = 0$  and that other e-tailers replicate the differentiation at time  $t = 1$  (see Figure 2). The latter assumption means that each piece of information in the information group becomes the same or other e-tailers' information may be better because they may further differentiate their information in addition to the replication. We might generally expect that the period between the time marks is very short if the information differentiation is not protected by any types of measures. Upon facing this situation, the e-tailer would introduce another differentiation at time  $t = 1$ . At time  $t = 2$ , other competing e-tailers would provide the same or better information about a product, and so on. Then, the  $i$ th e-tailer's profits at time  $t = 0$  (before differentiation activity takes place) are given by  $\mathbf{p}_{i0} = AR_{i0} * f(E_{i0}) - TC_{i0}(E_{i0}) = AR_{i0} * f(E_{i0}) - AC_{i0} * f(E_{i0})$ . The  $i$ th e-tailer's profits at  $t = 1$  (it would be reasonable because other e-tailers' replication does not take effect immediately) can be given by (for notational purpose, we use  $d_{i0}$  to represent the amount of resources spent by the  $i$ th e-tailer before  $t = 0$ , and  $d_{i1}$  spent before  $t = 1$ , and so on)

$$\begin{aligned} \mathbf{p}_{i1} &= AR_{i1} * f(E_{i1}, d_{i1}) - TC_{i1}(E_{i1}, d_{i1}) \\ &= [AR_{i0} * f(E_{i0}) - AC_{i0} * f(E_{i0})] + [P_{i1} * d_{i1} * AR_{i1} - d_{i1} - P_{i1} * d_{i1} * AC_{i1}] \end{aligned}$$

where  $AR_i$  and  $AC_i$  represent average revenue and average cost calculated over the total visitors, not over the change in the total visitors due to information differentiation.

At this point, let's revisit the cross-cost and cross-benefit elasticity, which have been defined as

$$\epsilon_{IC} = \frac{\partial I}{\partial C'} \cdot \frac{C'}{I} \quad \text{and} \quad \epsilon_{IB} = \frac{\partial I}{\partial B'} \cdot \frac{B'}{I}, \quad \text{respectively.}$$

We can assume that the change in information consumption with respect to the increase in other e-tailer sites' costs ( $\frac{\partial I}{\partial C'}$ ) is positive and the

decrease in benefits ( $\frac{\partial I}{\partial B'}$ ) is negative. This implies that  $\epsilon_{IC} \geq 0$  and  $\epsilon_{IB} \leq 0$ . This also implies

that, in either case, the e-tailer should spend more resources on its site. If other e-tailers incur more costs to visitors, the amount of information consumption of the e-tailer will increase which in turn means the e-tailer will have more visitors. To provide the appropriate level of e-commerce platform, the e-tailer should spend more resources. On the other hand, if other e-tailers give more benefits to visitors, the amount of information consumption of the e-tailer will decrease which in turn means the e-tailer will have fewer visitors. Now the e-tailer might be in trouble due to the decrease in the visitors. The e-tailer, therefore, will try to regain the visitors by increasing the expenditure on its information differentiation and probably also on their e-commerce platform. The e-tailer would be able to cope with this situation, without more spending, by increasing the average revenue per visitor (AR) and by decreasing average cost (AC) per visitor. Then, the  $i$ th e-tailer's profits at time  $t = 1$  can be given by

$$\begin{aligned} \mathbf{p}_i &= AR_{i1} * f(E_{i1}, d_{i1}) - TC_{i1}(E_{i1}, d_{i1}) - \mathbf{DTC}_{i1}(E_{i1}, d_{i1}) \\ &= [AR_{i0} * f(E_{i0}) - AC_{i0} * f(E_{i0})] + (P_{i1} * d_{i1} * AR_{i1} - d_{i1} - P_{i1} * d_{i1} * AC_{i1}) - \mathbf{DTC}_{i1}(E_{i1}, d_{i1}) \\ &= [(AR_{i0} - AC_{i0}) * f(E_{i0})] + [(AR_{i1} - AC_{i1}) * P_{i1} * d_{i1}] - [d_{i1} + \mathbf{DTC}_{i1}(E_{i1}, d_{i1})] \\ &= [(AR_{i0} - AC_{i0}) * f(E_{i0})] + AR_{i1} * P_{i1} * d_{i1} - [AC_{i1} * P_{i1} * d_{i1} + d_{i1} + \mathbf{DTC}_{i1}(E_{i1}, d_{i1})] \end{aligned}$$

where  $\mathbf{DTC}_{i1}(E_{i1}, d_{i1})$  represents an additional increase in total costs to accommodate increasing visitors due to information differentiation (accommodation costs) or to regain visitors that have been decreased by other e-tailers' replication of the information differentiation plus some possible enhancements by other e-tailers in addition to the replication.

If the  $i$ th e-tailer continues to differentiate information, the  $i$ th e-tailer's profits at time  $t = 2$  can be given by

$$\begin{aligned} p_{i2} &= AR_{i2} * f(E_{i2}, d_{i2}) - TC_{i2}(E_{i2}, d_{i2}) - \mathbf{DTC}_{i2}(E_{i2}, d_{i2}) \\ &= [AR_{i1} * f(E_{i1}) - AC_{i1} * f(E_{i1})] + (P_{i2} * d_{i2} * AR_{i2} - d_{i2} - P_{i2} * d_{i2} * AC_{i2}) - \mathbf{DTC}_{i2}(E_{i2}, d_{i2}) \\ &= [(AR_{i1} - AC_{i1}) * f(E_{i1})] + [(AR_{i2} - AC_{i2}) * P_{i2} * d_{i2}] - [d_{i2} + \mathbf{DTC}_{i2}(E_{i2}, d_{i2})] \\ &= [(AR_{i1} - AC_{i1}) * f(E_{i1})] + AR_{i2} * P_{i2} * d_{i2} - (AC_{i2} * P_{i2} * d_{i2} + d_{i2}) - \mathbf{DTC}_{i2}(E_{i2}, d_{i2}), \end{aligned}$$

and so on. The profit equation implies several important things: (1) if  $AR$  does not exceed  $AC$  either before or after a certain information differentiation effort ( $AR_{it} < AC_{it}$ ,  $t = 0, 1, \dots$ ), the  $i$ th e-tailer will always have a negative profit, (2) even in the case of  $AR > AC$ , if the additional revenue generated by an information differentiation does not cover the "first-hand" additional costs ( $AR_{it} * P_{it} * d_{it} < AC_{it} * P_{it} * d_{it} + d_{it}$ ,  $t = 0, 1, \dots$ ) incurred by the information differentiation, the  $i$ th e-tailer will not get a positive effect from it, (3) furthermore, even in the case where the second argument above holds true, if the "second-hand" additional costs ( $\mathbf{DTC}_{it}(E_{it}, d_{it})$ ,  $t = 0, 1, \dots$ ) exceeds the margin ( $AR_{it} * P_{it} * d_{it} - AC_{it} * P_{it} * d_{it} + d_{it}$ ,  $t = 0, 1, \dots$ ), the  $i$ th e-tailer cannot make any profit from the information differentiation, and (4) the  $i$ th e-tailer must take care of  $AR$ ,  $AC$ , and  $P$  at the same time to get any positive effect from the information differentiation. If an e-tailer just performs some information differentiation without increasing  $AR$  and without decreasing  $AC$ , the effort would end up with a loss. After some point, an e-tailer may ignore information differentiation. Instead, the e-tailer may focus its resources on increasing  $AR$  and decreasing  $AC$  without enlarging the customer base. However, e-tail customers are not very loyal (8). If the e-tailer has no good relationships with customers, the e-tailer might eventually lose their customer base, which may lead to less popularity and which may require more resources to restore their customer base after a while. It can be said that "to differentiate or not to differentiate" is a dilemma facing e-tailers.

## DISCUSSION AND FUTURE RESEARCH

The contribution of this paper lies in two areas. First, the formalization of e-commerce/e-tail concepts through a discussion and summary of components of an e-commerce infrastructure. Second, an intuitive economic model to help describe and interpret e-tailers' information differentiation effort. At the time of this writing, it is apparent that the honeymoon for e-tailers and other "dot coms" is over. This is evidenced by many failures and a general desertion of investors. In the recent past, having an attractive web site, some product or service that has more than limited appeal, or, occasionally, simply having some technological gimmicks were enough to attract interest from both private and institutional investors. This is evidenced by a formerly commonly cited advantage of e-tail sites being their extraordinary market caps (11). However, it has also become apparent that these same characteristics are not sufficient in themselves to attract and retain customers.

The suggested economic model highlights the importance of information differentiation and provides a method for its valuation. In addition to these insights it can be used as a basis for

management of e-tail firms to plan needed upgrades in their e-commerce platform in addition to being able to project if and when profitability is possible. The importance of this is demonstrated by the holiday buying season of 1999 where 40% of on-line shoppers experienced various problems, much of which was attributable to insufficient infrastructure (11). The e-tailer's profitability dilemma is easily observed in the current environment. The more difficult task lies in the analysis of contributing factors and the development of tools needed to avoid and/or resolve this dilemma in current and future e-tail businesses. This paper represents a step in that direction. The primary limitation of these theoretical models is the lack of empirical evidence available to support them. Herein lies the primary area of future research resulting from this effort.

## REFERENCES

1. BizRate.com. (2000). How to Win Customer Loyalty. Retrieved April 18, 2000, from the World Wide Web: <http://www.businessweek.com/ebiz/0004/dm0425.htm>.
2. Buchan, M. (2000). The Profitability Dilemma. Retrieved May 30, 2000, from the World Wide Web: <http://herring.com/mag/issue76/mag-dilemma-76.html>.
3. Brynjolfsson, E. and Smith, M. D. (1999). Frictionless Commerce. A Comparison of Internet and Conventional Retailers. Retrieved August 2000, from the World Wide Web <http://ecommerce.mit.edu/paper/friction>.
4. Brynjolfsson, E. and Smith, M. D. (2000). Frictionless Commerce? A Comparison of Internet and Conventional Retailers, Management Science, 46(4), 563-585.
5. Carr, N. G. (2000). Hypermediation: Commerce as Clickstream, Harvard Business Review, 78(1), 46-47.
6. Hof, R. D., Green, H. & Brady, D. (2000, February 21). Suddenly, Amazon's Books Look Better, Business Week, 78-84.
7. Lange, L. (1999). Technology 1999 Analysis & Forecast: The Internet, IEEE Spectrum, 36(1), 35-36.
8. Leon, M. (2000, June 12). On-line Retail Success Lies Behind the Scenes, Infoworld, 35.
9. Makadok, R. (1998). Can First-mover and Early-mover Advantages be Sustained in an Industry with Low Barriers to Entry/Imitation?, Strategic Management Journal. 19(7), 683-696.
10. Neuborne, E. (2000). The Delivery Dilemma Could Box-in E-Commerce. Retrieved May 10, 2000, from the World Wide Web: <http://www.businessweek.com/ebiz/9905/ep0510.htm>.
11. O'Reilly, T. (2000). The Internet Patent Land Grab, Communications of the ACM, 43(6), 29-31.
12. Parker, R.P. & Grove, C. B. (2000). Census Bureau Moves Ahead on Measuring E-business, Business Economics, 63-65.
13. Rosen, K.T. & Howard, A.L. (2000). E-Retail: Gold Rush or Fool's Gold, California Management Review, 42(3), 72-100.
14. Sterlicchi, J. & Gengler, B. (2000, June). E-tailers Costly Lessons, Upside, 195-200.
15. Willoughby, J. (2000). Burning Up. Warning: Internet Companies are Running out of Cash—Fast. Retrieved March 2000, from the World Wide Web: <http://interactive.wsj.com/articles/BarronsCoverMain.htm>.