경영정보학연구
제17권 제4호
2007년 12월

디지털 뉴스의 생산 및 가격 전략에 관한 연구

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Production and Pricing of Digital News

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Most traditional newspaper publishers provide online editions to counter the competition of online news providers. However, the relationship between the online and print editions of the same newspaper has not been clearly defined. Some see the online newspaper as a substitute, while others consider it a complement. A 2002 NAA online newspaper consumer survey indicated that one-third of its respondents said they were now using the print newspaper less. Others have argued that the online edition will not wipe out print consumption, and may even complement it. While the print edition offers particular advantages such as portability, less eye strain, and the tactile experience of a printed page, the online edition also offers specific advantages such as access to breaking news, continually updated information, access to old archives, etc. All these factors would tend to lower the degree of interchangeability between the products. However, recent empirical studies show that the online edition is a substitute for rather than a complement of the print edition. Still, to some print readers, the online edition provides additional value. In this paper, by capturing the two different aspects of online editions - the substitute aspect and the additional value added aspect - as well as other available online alternatives, we develop an analytical model to derive the optimal production and distribution strategies of both online and print editions. Confronting the "free versus fee" issue, we show that it is optimal to provide an online version of the print newspaper for free to non-print subscribers. However, the amount of free news content that the publishers need to put on the Web depends on the available alternatives on the online market. The "fee" and "free" options both have merits and demerits as well. If the publisher charges for the online version of the print newspaper, she can generate revenue from the fee charged to online readers. However, doing so will limit the size of the online audience and further reduce online advertising revenue. At the same time, by

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providing a high-quality online version and charging for it, the price of the print newspaper must stay low in order to lure high valued readers. On the contrary, if the publisher provides an online version of the print newspaper for free, she can obtain a larger audience for the online version. At the same time, by providing a low-quality online newspaper, the publisher can increase the print newspaper price to get more revenue from high valued offline readers, although no revenue is incoming from online version readers. Through systematic measuring of all the pros and cons, our analysis shows that the optimal option is not "fee" but "free."

Keywords : Online newspaper, pricing, newspaper publisher

Ⅰ. Introduction

Before the age of the Internet, newspaper publishers had some measure of monopolistic power due to the specific structure of the industry, and economies of scale. First, high fixed editorial investments were required to produce content that would attract readership. Second, it was expensive to build a distribution system that provided an entire specified geographic market with daily delivery. Finally, the cost of a printing plant was significant. These high costs created a huge barrier against entry into the newspaper industry. In fact, most large metro markets tended to be dominated by one or two leading newspapers.

However, the emerging media, i.e., the Internet, has reduced the monopolistic power of newspaper publishers by totally changing the way that news is delivered and consumed. An ideal information delivery channel, the Internet virtually eliminated the costs of distributing news. In addition, news delivered in digital form does not require a huge investment in a printing plant. Attracted by the low cost structure and the opportunity to take advantage of online advertising revenue, Internet-born content providers like Yahoo, and news broadcasters such as CNN, started to distribute news for free over the Internet. As the penetration of the Internet progressed and new entrants continued to expand, there was an increasing sense within the offline newspaper publishing community that their revenue might be threatened by online substitutes. Shaken, large newspaper companies cautiously began to counterattack by providing online editions.

An important issue in providing an online edition is how to generate revenue. The traditional revenue model for a print newspaper is the subscription model, supported by advertising revenue. Revenue generated from print newspapers has traditionally been roughly split 20%/80% between subscription and advertising income, respectively.[1] However, a similar revenue structure would be difficult for an online edition because of the unique characteristics of the Web. A 1998 GVU Internet Survey in-

1) Satistics are derived from the 1998 Inland Press Cost and Revenue Study.

dicated that of those individuals who refused to pay for information on the Internet, 44.5% did so because the information was available elsewhere for free on the Internet.

Nowadays, most newspaper publishers provide each day's online newspaper for free. For example, the *New York Times* gives away news for free and relies on advertising (which reaches massive flows of traffic) plus archive sales to generate additional revenue with its online edition. Unlike most publishers, *The Wall Street Journal* charges its readers not only for archive access, but also for its daily news at WSJ.com. It is noted that *The Wall Street Journal*'s online revenue model could work since its news is specialized and widely recognized as premium content. *The Wall Street Journal Online* charges $79 per year for the non-print subscriber and $39 per year for the print subscriber. Does this mean, then, that charging for today's online news is the best option for specialized news publishers like *The Wall Street Journal*? Unlike *The Wall Street Journal*, publishers of papers like *Fortune* and *Business Week*, who also produce specialized and premium content, provide limited free online information for the non-print subscribers instead of providing full content and charging for it.

Since traditional publishers produce both online and print newspapers, optimization of online pricing requires them to consider the relationship between the online and print editions. However, this relationship has not been clearly defined. Some see the online newspaper as a substitute whose growth will curtail the market for the print newspaper. A 2002 NAA online newspaper consumer survey indicated that one-third of its respondents said they were now using the print newspaper less. Others have argued that the online edition will not wipe out print consumption, and may even complement it. A 2002 survey of U.S. online readers by Belden Associates found that 21% of respondents reported buying more print copies since they began using the Internet. The same survey found that 7% had started a new print subscription since beginning to read online. As noted by Gentzkow [2004], while the print edition offers particular advantages such as portability, less eye strain, and the tactile experience of a printed page, the online edition also offers specific advantages such as access to breaking news, continually updated information, access to old archives, etc. All these factors would tend to lower the degree of interchangeability between the products. However, recent empirical studies showed that the online newspaper is a substitute for rather than a complement of the print newspaper [Filistrucchi, 2004; Gentzkow, 2004]. Gentzkow[2004] tested for substitutability, complementarity or independence between the *Washington Post* and its online edition, and found that there exists weak substitutability between the two. Filistrucchi [2004] showed that the online editions of major Italian newspapers appear to have a negative impact on the market shares of their print editions in Italy. Still, we cannot deny that to some print readers, the online edition provides added value. Cameron *et al.* [Cameron *et al.*, 1996] noted that newspapers' online editions are used to offer readers information not available in the print editions; this situation encourages readers to subscribe to both the online and print newspapers.

The complex relationship between the online and print editions of the same newspaper, the issue of revenue generation with the online edition, and the availability of online alternatives… all these issues compel publishers to establish totally new attitudes toward production and distribution of both online and print editions. In this paper, by capturing the two different aspects of the online edition - the substitute aspect and the additional value added aspect - as well as other available online alternatives, we derive the optimal production and distribution strategies of both online and print editions.

The specific managerial issues we address are as follows. First, is it optimal for traditional newspaper publishers to provide online editions? Second, should online editions be free? Isn't it better for traditional newspaper publishers to charge for online editions with offering high quality news? Third, how should the relationship between online and print editions be defined? Fourth, what effect do online market conditions have on the pricing strategy of print newspapers? Fifth, how can traditional publishers add value online? To answer all these questions, we develop a simple analytical model where the traditional newspaper publisher decides whether or not to provide an online edition, how to charge for both the online edition and the print newspaper, how to define the relationship between online and print newspapers, and how to add value online.

We present our basic model and analyze results in Section 2 and 3. In Section 4, we conclude our research with discussion of some implications of this study and possible future research directions.

Ⅱ. The Model

2.1 Reader attitude toward advertising in a newspaper

Since a newspaper publisher has two products to sell, the newspaper itself and advertising space within the newspaper, she receives income from two sources - its readers and its advertisers. If readers are advertisement-lovers, selling advertising space to advertisers enhances the size of the readership, so that both sources of revenue - readers and advertising - increase with an increase in advertising space. By contrast, if readers are advertising-averse, promotion of advertising sales slows down the circulation of newspapers. Therefore, reader attitude toward advertising is critical in determining the appropriate level of advertising in a newspaper. However, how to establish reader attitude has not been clearly defined, and is still a debatable issue.

Some researchers have insisted on the positive effect of press advertising on circulation because increases in advertising will increase the demand for the newspaper at any given price [Blair and Romano, 1993]. This view is supported by the empirical analysis of the American press industry [Rosse, 1980]. However, survey results in the study of Sonnac [2000] showed that about half of newspaper or magazine readers in European countries tended to be advertising-avoiders. 51% of newspaper readers in France and Italy, 48% of readers in Spain, and 54% of readers in Germany were reported as advertising-avoiders. The empirical study of Depkin and Wilson [2004] also found

it hard to determine the effect of advertising on readers. Investigating 95 U.S. magazines, they found that for 45 magazines advertising was unambiguously good, for 31 magazines it was unambiguously bad, and for the remainder advertising was moderately good. Therefore, in this paper, we assume that average readers are neutral in terms of their perception of advertising. Based on this assumption, we assume that advertising has no effect on readers' valuation of the print newspaper.

We confront the same issue when dealing with online newspapers. Here, it is still difficult to determine the effect of advertising on readers. The survey results of Schlosser *et al.* [1999] showed that reader attitude toward online advertising was evenly divided among positive, negative and neutral. Therefore, we also assume that advertising does not affect readers' valuation of the online newspaper.

2.2 The newspaper publisher before online substitutes

In our analytical model, we assume that a traditional newspaper publisher provided a print newspaper in a monopolistic situation before online news substitutes became available. We assume that all news content in the print newspaper, except for advertising content, is a bundle of information, and denote it as Content X. We assume that there exist N potential readers whose taste parameter for the print newspaper quality, θ, is distributed uniformly according to $U[0, 1]$. The publisher knows the distribution of the consumers' taste, but cannot identify θ for each consumer.

We assume that the quality of the print newspaper is determined by information completeness or quantity of Content X, denoted as s_1, and physical appearance of the medium, denoted as k_1, which is based on characteristics such as easy portability, low eye strain, and the tactile experience of a printed page, all of which are valued by subscribers. Therefore, we denote the quality of print newspaper g_1 as $g_1 = s_1 k_1$. Since the level of s_1 is related to a fixed investment that is not easily changeable in the short term, we assume that s_1 is given. Also, we assume that the physical appearance aspect of the print newspaper, k_1, is exogenously given. For simplicity of analysis, we set k_1 as 1.

Each consumer's valuation of the print newspaper is determined by her taste parameter and the quality of the print newspaper. Thus, we define consumer willingness to pay as θg_1. The reader with θ will buy a print newspaper if $\theta g_1 - p_1^m \geq 0$, where p_1^m is the monopolistic price of the newspaper. From this, the demand for monopolistic newspaper n_1^m can be derived as

$$n_1^m(p_1^m) = (1 - p_1^m / g_1)N.$$

Then, the income from newspaper sales is $n_1^m p_1^m$.

We assume that while the publisher has monopolistic power in the readers' market, she is forced to charge the competitive price p_a per reader in the advertising market, since other media such as magazines, television, and radio provide a varying amount of competition for the newspaper. The income from advertising sales is $n_1^m p_a q_a^m$, where q_a^m is the quantity of advertisements per newspaper.

Then, the publisher will try to maximize the

following profit function,

$$\pi_m(p_1^m, q_a^m) = n_1^m(p_1^m - c) + n_1^m(p_a q_a^m - (q_a^m)^2),$$

where $n_1^m c$ is the total variable cost to produce n_1^m copies of a newspaper, and $n_1^m(q_a^m)^2$ is the cost of selling advertising space to local, national, and classified advertisers. $n_1^m(q_a^m)^2$, the cost function of selling advertising space is derived with following logic. Since the advertising price per user is given, the price of advertising space goes up as the size of the readership increases. Consequently, selling space to advertisers becomes more difficult. That is why the cost of selling advertising space depends on n_1^m. In addition, the cost function shows a diminishing marginal return in q_a^m, as in Chaudhri [Chaudhri, 1998]. In the profit function, $n_1^m(p_1^m - c)$ represents the net income from readers and $n_1^m(p_a q_a^m - (q_a^m)^2)$ is the net income from advertisers.

First, we derive the first-order condition for the variable q_a^m as follows:

$$\partial \pi^m / \partial q_a^m = n_1^m(p_a - 2q_a^m) = 0.$$

From this, we can get q_a^{m*}, which satisfies the first-order condition as $q_a^{m*} = p_a/2$. Since the second-order condition, $\partial^2 \pi^m / \partial q_a^{m2} = -2n_1 < 0$, is satisfied, q_a^{m*} maximizes the profit function. We can derive the net advertising revenue per reader by plugging q_a^{m*} into $p_a q_a^m - (q_a^m)^2$ as follows:

$$p_a q_a^{m*} - (q_a^{m*})^2 = p_a^2/4.$$

For simplicity, we denote $p_a^2/4$ as a_1.

Likewise, we can derive the optimal price of monopolistic newspaper p_1^{m*} that maximizes the profit function as

$$p_1^{m*} = (g_1 + c - a_1)/2.$$

Revenue generated from print newspapers has traditionally been roughly split 20%/80% between subscription and advertising income, respectively (advertising revenue includes the variable cost of producing a newspaper). Therefore, we assume $a_1 - c > 0$. For simplicity, we denote $a_1 - c$ as a. Then, we can rewrite p_1^{m*} as

$$p_1^{m*} = (g_1 - a)/2.$$

Since the variable cost per newspaper is quite small, we assume that even after subtracting the variable cost per newspaper c from net revenue per reader, a_1, $a(= a_1 - c)$ is still greater than p_1^{m*}.

$$a - p_1^{m*} > 0.$$

2.3 The newspaper publisher with online substitutes

Confronting the issue of online substitutes, the publisher provides an online version of Content X of the print newspaper. We assume that copying the content of the print edition and putting it on the Web does not require additional costs, and that the cost of providing one more online copy to an additional reader is zero.

Preference of information media depends on the nature of information and the purpose of its consumption. For example, for a researcher who is dealing with a large amount of financial data for statistical analysis purposes, the electronic form of data is much more attractive than the printed form because the data are eas-

ier to feed into computer programs or edit into her own report. However, since we are focusing on a general news circulation business with a significant advertising revenue source, we assume that for a given fixed set of news content, the traditional news media (paper) has several aforementioned advantages over the new electronic media, such as easy portability, low eye strain, and the tactile experience. That is, online physical appearance quality k_2 is assumed to be lower than that of print newspaper k_1. For example, even though the online edition of *The Wall Street Journal* includes all the news in the print newspaper, with the added feature of online-specific content such as coverage not found in the print edition, the publisher charges only $79 per year to online edition readers, while she charges $199 to print edition readers. The online version, despite its unique news content, may be priced lower because the online version of news is less attractive in terms of consumption preferences.

We assume that the publisher has the ability to determine the amount of content that she puts in the online version. The publisher could put all of Content X or just a short summary of Content X online. Therefore, the information completeness of the online version of Content X, s_2, can vary in the range of $0 < s_2 \le s_1$, depending on the decision of the publisher. Then, the quality of online Content X can be expressed as $g_2 = s_2 k_2$, where $k_2 < k_1 = 1$. We redefine s_2 as $s_1 d_2$, where d_2 is the degree of degradation from the original printed Content X, and the available range of d_2 is $0 < d_2 \le 1$. Then, the quality of online Content X becomes $g_2 = s_1 d_2 k_2$. We also assume that the publisher decides "charge versus not-to-charge" for the online version of Content X .

Like in the print newspaper market, we assume that the online advertising market is fully competitive so that the publisher is a price-taker of market price p_A. Since competition for the advertising revenue within the online channel is higher than in the offline market, we assume $p_A < p_a$. We assume also that the cost of the advertising is $n_2 q_A^2$, where n_2 is the demand for the online version of Content X and q_A is the quantity of advertisements online.

There may exist online alternatives to traditional newspapers whose news is available without charge, and which generate income by selling online advertising space based on massive flows of traffic. Like the publisher's own online version of Content X, the physical appearance of the online channel for alternative news providers is denoted as k_2. Therefore, we can define the quality of online free substitutes as $g_c = s_c k_2$, where s_c is the exogenously given information completeness of free substitutes. Considering the monopolistic power of the newspaper publisher before the age of the Internet, we assume that the publisher still remains as a dominant news provider to potential market readers even after online substitutes become available. Therefore, information completeness in terms of news content of the newspaper is not less than that of online alternatives. In other words, we assume that $s_c \le s_1$. The level of s_c relates to the newspaper publisher's news content specificity. We can denote s_c as $s_c = s_1 e$, where e indicates the information specificity of the newspaper publisher. It is exogenously given in the range of $0 \le e \le 1$. If $e = 1$, online substitutes can maintain s_c at the

publisher's level s_1. Otherwise, if $e=0$, they cannot provide content that fully matches the publisher's content. The quality of online substitutes is given as $g_c = s_1 e k_2$.

The utility of a reader with θ when consuming Content X or free online substitutes can be defined as

$U_1 = \theta g_1 - p_1$ if a reader chooses the print newspaper;

$U_2 = \theta g_2 - p_2$ if a reader chooses the online version of Content X;

$U_c = \theta g_c$ if a reader chooses the free online substitutes,

where p_2 is the price of the online version of Content X. Then, a reader's optimal decision is represented as follows:

Choose the print newspaper if $U_1 \geq U_2$ and $U_1 \geq U_c$;

Choose the online version of Content X if $U_2 > U_1$ and $U_2 \geq U_c$;

Choose the free online substitutes if $U_c > U_1$ and $U_c > U_2$.

The reader's choices determine the demand for the print and online versions of the newspaper, n_1 and n_2, respectively.

As is widely known, the online edition of a newspaper includes unique features not found in the print edition, such as breaking news and old archive access. Hence, we distinguish these kinds of online-specific features as Feature Y. We limit the concept of Feature Y to the publisher's specialized features that readers cannot find for free elsewhere. We consider Feature Y to be supplementary to Content X. For example, as Gentzkow [2004] noted, reading a story about a news event in the morning may create the urge to get breaking updates on the event later in the day. Likewise, it may stimulate a reader's need to trace a story back through the old news archives. We assume that only readers who consume any version of Content X incur the need to consume Feature Y. Therefore, readers who consume the print or online versions of Content X are potential users of Feature Y, whose taste parameter of quality of online Feature Y, ι, is distributed uniformly according to $U[0, 1]$. We write the quality of online Feature Y as $g_y = s_y k_2$, where s_y is the completeness of accumulated information or the amount of Feature Y. Unlike the online version of Content X, we assume that Feature Y targets only one revenue source - the fee charged to readers of Feature Y, since the primary reason to provide Feature Y is cross-selling of content to the existing readers of Content X.

The utility a reader derives from consuming Feature Y is $U_y = \iota g_y - p_y$ if a reader who consumed Content X consumes Feature Y, where p_y is the price for Feature Y. Then, a reader's optimal decision is as follows:

Consume Feature Y if $U_y \geq 0$;

Do without if $U_y < 0$.

Since only the consumers of Content X consider buying Feature Y, the demand function of Feature Y is $n_y = (n_1 + n_2)(1 - p_y / g_y)$.

Then, the publisher's profit function is derived as

$$\pi(p_y, p_1, p_2, q_a, q_A, d_2) = n_1(p_1 - c) + n_1(p_a q_a - q_a^2) + n_2 p_2 + n_2(p_A q_A - q_A^2) + n_y p_y$$

At this point, the publisher's problem is optimizing p_y, p_1, p_2, q_a, q_A and d_2 to maximize the profit function. We present our main results in the ensuing subsection.

Ⅲ. Analysis of the model

Proposition 1. It is optimal for the traditional newspaper publisher to provide an online version of the print newspaper.
Proof. See Appendix A.

If the publisher provides an online version of the print newspaper, she can capture the online advertising revenue. However, our model shows that this is not the only role that the online version plays. By providing the online version, she can also diminish the effect of online threats on her print newspaper.

If the publisher decides not to provide an online version of the print newspaper, the optimal price of the print newspaper is derived as p_1^{i*}, where $p_1^{i*} = (4g_1 - 4g_c - g_y - 4a)/8$. On the other hand, if the publisher decides to provide an online version of the print newspaper, the optimal price of the print newspaper is derived as p_1^{r*}, where $p_1^{r*} = (g_1 - g_c - a + a_2)/2$. Comparing p_1^{i*} with p_1^{r*}, we can easily observe that $p_1^{i*} < p_1^{r*}$. This indicates that without a free online version, the publisher should lower the price of the print newspaper.

We can infer from this analysis that even though the online market is very tough, the traditional publisher needs to enter it not only for the purpose of capturing online advertising revenue, but also for diminishing the effect of online threats on her print newspaper.

Proposition 2. The optimal strategy of the traditional newspaper publisher is to provide the online version of the print newspaper for free.
Proof. From the proof of Proposition 1, $p_2^* = 0$.

When the news is specialized ($0 \le e \le 1 - (4a_2 + g_y)/4s_1k_2$), the publisher is confronted with the "free versus fee" issue in online newspaper pricing. In this case, the publisher can charge for the online version of the print newspaper if all content in the print newspaper is re-published through the online channel. She cannot charge for the online version of the print newspaper if she limits its quality to the level of free online substitutes. The "fee" and "free" options both have merits and demerits as well. If the publisher charges for the online version of the print newspaper, she can generate revenue from the fee charged to online readers. However, doing so will limit the size of the online audience and further reduce online advertising revenue. At the same time, by providing a high-quality online version and charging for it, the price of the print newspaper must stay low in order to lure high valued readers. On the contrary, if the publisher provides an online version of the print newspaper for free, she can obtain a larger audience for the online version. At the same time, by providing a low-quality online newspaper, the publisher can increase the print newspaper price to get more revenue from high valued offline readers, although no revenue is incoming from online version readers. Through systematic measuring of all the pros and cons, our analysis shows that the optimal option is not "fee" but "free."

Free pricing of digital content has been large-

ly explained by online advertising revenue stream [Gallaugher *et al.*, 2001]. Therefore, when this revenue stream is not sufficient, the publisher considers pricing its content online. However, our result shows that even though this revenue stream is small, free pricing is always desirable for the newspaper publisher who distributes its content via both online and offline.

Among 1,456 daily newspapers in U.S., 1415 newspapers provide today's news for free on their Web site [Seelye, 2005]. Even though the rest of newspaper companies, which is very few, choose "fee" instead of "free" edition in online, our result explains why advertising model is dominant revenue model for most newspaper publishers in online.

Proposition 3. The quality of the online version of the print newspaper must only equal that of free online alternatives.

Proof. From the proof of Proposition 1, $g_2^* = g_c$.

Proposition 4. The optimal price of the print newspaper is $(g_1 - g_c - a + a_2)/2$. The price decreases as the quality of online substitutes improves, and increases as online advertising revenue increases.

Proof. From the proof of Proposition 1, $p_1^* = (g_1 - g_c - a + a_2)/2$, $\partial p_1^* / \partial e = -1/2 * \partial g_c / \partial e < 0$, and $\partial p_1^* / \partial a_2 = 1/2 > 0$.

As competition increases, the quality of the online version of a print newspaper needs to be increased. At the same time, as the quality of the online version increases, the price of the print newspaper needs to be decreased because it is hard to justify a high price for the print newspaper when a high-quality version of it is available for free online.

It has been reported that the circulation of print newspaper declines due to fiercer online threat [Angwin and Hallinan, 2005]. We can infer from this proposition that as the publisher possesses specialized content that is not easily provided by online competitors, it can secure its print newspaper business without lowering the price for print edition. However, when the content provided by the publisher is so general and easily searchable online, not only its online business but also its print newspaper business is exposed to competition. Hence, it cannot avoid price reduction of print edition.

On the other hand, as online advertising revenue increases, so does the profitability of the online version. In this case, the publisher can charge a higher price for the print newspaper in order to target the higher valued readers.

Proposition 5. The optimal price of the online premium content that is not available in the print newspaper is $g_y/2$.

Proof. In the proof of Proposition 1, the optimal price of Feature Y is derived as $g_y/2$.

Unlike online news content that competes with the print newspaper, the online premium features that are not available in the print newspaper require a fee. In fact, the scheme is practiced in the real world by many publishers. For example, the *New York Times* charges for old archive access while providing current news for free.

Ⅳ. Conclusion

The main contribution of this study is that it provides information as to which is the optimal

strategy for a newspaper publisher intending to offer both online and print editions in terms of production and distribution. Up to now, in dealing with the "free versus fee" issue of the online newspaper, publishers mostly considered online competition and online advertising revenue. Considering the effect of the relationship between the online and print newspapers in terms of this issue was not easy because the relationship between the two has not been clearly defined. In this paper, by capturing two different features of the online edition - the substitute feature and the additional value added feature - we investigate the impact of the relationship between the online and print versions of a newspaper on the optimal production and distribution strategies of both online and print editions. Even though we focused on the newspaper industry in this paper, the results may be applicable to other circulation industries.

Our results show that it is optimal for the traditional publisher to provide an online version of the print newspaper. Confronting the "free versus fee" issue, we show that it is optimal for a firm to provide the online version of the print newspaper for free to non-print subscribers. However, the amount of free news content on the Web depends on the level of information provided by the alternatives in the online news market. If they provide very high-quality information, the publisher needs to put the entire content of the print newspaper on the Web. If not, she need only provide a very limited version of the print newspaper on the Web. We have also shown that there are relationships between online market conditions and print newspaper prices.

Our research is limited since we assume that online providers' news is given and that they provide it for free. To a certain extent, this setting reflects the real world situation. However, further research must consider various online news providers and their reactions. Providers can also be divided into multichannel providers such as CNN, and pure online providers such as Yahoo. Reactions of multichannel providers to the choices of newspaper publishers may be different from those of pure online providers. In further research, consideration should be placed on competition between the publisher and a multichannel provider, or between the publisher and a pure online provider.

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[Appendix A] Proof of Proposition 1

Since the range of e is $0 \le e \le 1$, we can explain Proposition 1 by aggregating three different cases: Case I (where $e=1$), Case II (where $1-(4a_2+g_y)/4s_1k_2 < e < 1$), and Case III (where $0 \le e \le 1-(4a_2+g_y)/4s_1k_2$).

Case I

When $e=1$, online content providers can provide an alternative, the quality of which is $g_c = s_1k_2$. If the newspaper publisher sets $g_2 < g_c$, then no one will consume the online version of Content X even though the publisher provides it for free. In this case, the readership is split between the print newspaper and the free online substitutes. Note that superscript i represents the case of fixing $p_2=0$ when $g_2 < g_c$ and $e=1$. The demand for the print newspaper in this case is

$$n_1^i(p_1^i) = (1-p_1^i/(g_1-g_c))N.$$

The demand for Feature Y is $n_y^i(p_y^i, p_1^i) = n_1^i(1-p_y^i/g_y)$.

Then, the publisher will try to maximize the following profit function,

$$\pi^i = n_1^i(p_1^i - c) + n_1^i(p_a q_a^i - (q_a^i)^2) + n_y^i p_y^i. \quad (1)$$

From the first- and second-order conditions, we can easily get the optimal $p_y^{i*} = g_y/2$ and $q_a^{i*} = p_a/2$. Likewis

e, the optimal p_1^{i*} is derived as $p_1^{i*} = (4g_1 - 4g_c - g_y - 4a)/8$, where $a = p_a^2/4 - c$. In our model, to reflect the reality of the news business, the positive price for the printed version is assumed.

If the publisher sets $g_2 = g_c$, and provides the online version of Content X for free, then $U_2 = U_c$. Based on our assumption, readers consume the online version of Content X instead of the free online alternatives. Therefore, the readership is divided between the print newspaper and the free online version of Content X, provided by the newspaper publisher. Note that superscript r represents the case of fixing $p_2=0$ when $g_2 = g_c$ and $e=1$. The demand for the print newspaper in this case is

$$n_1^r(p_1^r) = (1-p_1^r/(g_1-g_2))N.$$

The demand for the online version of Content X is $n_2^r(p_1^r) = (p_1^r/(g_1-g_2))N$, and the demand for Feature Y is $n_y^r(p_y^r, p_1^r) = (n_1^r + n_2^r)(1-p_y^r/g_y)$. Then, the publisher will try to maximize the following profit function,

$$\pi^r = n_1^r(p_1^r - c) + n_1^r(p_a q_a^r - (q_a^r)^2) + n_2^r(p_A q_A^r - (q_A^r)^2) + n_y^r p_y^r. \quad (2)$$

We then derive the optimal $p_y^{r*} = g_y/2$, $q_a^{r*} = p_a/2$ and $q_A^{r*} = p_A/2$. Likewise, the optimal p_1^{r*} is derived as $p_1^{r*} = (g_1 - g_2 - a + a_2)/2$, where $a_2 = p_A^2/4$, and a_2 represents net online advertising revenue per reader. Since $g_2 = g_c$, we can rewrite p_1^{r*} as $p_1^{r*} = (g_1 - g_c - a + a_2)/2$.

It can be easily shown that $\pi^{r*} > \pi^{i*}$. This implies that putting all Content X on the Web and providing it for free is optimal to the publisher when $e=1$.

Case II

If $e<1$, g_2 can be greater than g_c if the publisher sets $d_2 > e$. In this case, the publisher can consider charging for the online version of Content X. Then prospective readers will be divided between those who choose the print newspaper, those who choose the online ver-

sion of Content X, and those who choose free online substitutes. Note that superscript t represents the case of charging for the online version of Content X when $g_2 > g_c$ and $e < 1$. The demand for the print newspaper in this case is

$$n_1^t(p_1^t, p_2^t, d_2^t) = (1 - (p_1^t - p_2^t)/(g_1 - g_2^t))N.$$

And, the demand for the online version of Content X is

$$n_2^t(p_1^t, p_2^t, d_2^t) = ((p_1^t - p_2^t)/(g_1 - g_2^t) - p_2^t/(g_2^t - g_c))N.$$

The demand for Feature Y is

$$n_y^t(p_y^t, p_1^t, p_2^t, d_2^t) = (n_1^t + n_2^t)(1 - p_y^t/g_y).$$

Then, the firm will try to maximize the following profit function,

$$\pi^t = n_1^t(p_1^t - c) + n_1^t(p_a q_a^t - (q_a^t)^2) + n_2^t p_2^t + n_2^t(p_A q_A^t - (q_A^t)^2) + n_y^t p_y^t. \quad (3)$$

We can now derive the optimal $p_y^{t*} = g_y/2$, $q_a^{t*} = p_a/2$, $q_A^{t*} = p_A/2$, $p_1^{t*} = (4g_1 - 4g_c - g_y - 4a)/8$, and $p_2^{t*} = (4g_2^t - 4g_c - g_y - 4a_2)/8$. However, if $1 - (4a_2 + g_y)/4s_1k_2 < e < 1$, then $p_2^{t*} < 0$, even with the maximum quality level maintained by the setting $d_2^t = 1$. In this case, charging for the online version of Content X is not optimal.

Therefore, even though $d_2 > e$, charging for the online version of Content X is not an available option for the publisher. By fixing the price for the online version of Content X as zero, the readership is only split between print newspaper readers and readers who consume the free online version of Content X, provided by the publisher. Since we assume that even though $d_2 = e$, readers consume the online version of Content X instead of free online alternatives, the demand and profit functions of (4) are valid in the range $d_2 \geq e$, and the condition $d_2 \geq e$ is equivalent to $g_2 \geq g_c$. Note that superscript w represents the case of fixing $p_2 = 0$ when $g_2 \geq g_c$ and $e < 1$. The demand for the print newspaper is thus

$$n_1^w(p_1^w, d_2^w) = (1 - p_1^w/(g_1 - g_2^w))N.$$

And the demand for the online version of Content X is

$$n_2^w(p_1^w, d_2^w) = (p_1^w/(g_1 - g_2^w))N.$$

The demand for Feature Y is

$$n_y^w(p_y^w) = (n_1^w + n_2^w)(1 - p_y^w/g_y).$$

Then, the publisher will try to maximize the following profit function,

$$\pi^w = n_1^w(p_1^w - c) + n_1^w(p_a q_a^w - (q_a^w)^2) + n_2^w p_2^w + n_2^w(p_A q_A^w - (q_A^w)^2) + n_y^w p_y^w. \quad (4)$$

The resulting optimal choices are $p_y^{w*} = g_y/2$, $q_a^{w*} = p_a/2$, and $q_A^{w*} = p_A/2$. Likewise, the optimal p_1^{w*} is derived as $p_1^{w*} = (g_1 - g_2^w - a + a_2)/2$. Now we can derive the optimal d_2^w. Since $\partial\pi^w(p_y^{w*}, p_1^{w*}, q_a^{w*}, q_A^{w*}, d_2^w)/\partial d_2^w < 0$ in the interval $e \leq d_2 \leq 1$, we can conclude that the optimal d_2^w is the minimum level within the given range. In other words, $d_2^{w*} = e$.

When the publisher sets $d_2 < e$, no one will consume the online version of Content X. Then the profit function will be the same as π^t in equation (1), and it can be easily shown that $\pi^{w*} > \pi^{t*}$. This implies that it is optimal to provide a limited version of Content X for free that matches the level of online substitutes when $1 - (4a_2 + g_y)/4s_1k_2 < e < 1$.

Case III

When $0 \leq e \leq 1 - (4a_2 + g_y)/4s_1k_2$, if the publisher sets d_2 as $d_2 \geq (4a_2 + 4g_c + g_y)/4s_1k_2$, then $p_2^{t*} \geq 0$.

In other words, in the range of $d_2 \geq (4a_2 + 4g_c + g_y)/4s_1k_2$, charging for the online version of Content X becomes a viable option. We assume that the exogenous condition satisfies the condition $p_2^{t*}/(g_2^t - g_c) < (p_1^{t*} - p_2^{t*})/(g_1 - g_2^t)$. This condition guarantees coexistence within the market of the online version of Content X and the print newspaper.

Then, in the range of $(4a_2 + 4g_c + g_y)/4s_1k_2 \leq d_2 \leq 1$, the profit function of the publisher is π^t in the equation (3). In this range, $\partial\pi^t(p_y^{t*}, p_1^{t*}, q_a^{t*}, q_A^{t*}, d_2^t)/\partial d_2^t < 0$ if $d_2 < d_2$, and $\partial\pi^t(p_y^{t*}, p_1^{t*}, q_a^{t*}, q_A^{t*}, d_2^t)/\partial d_2^t \geq 0$ if $d_2 \geq d_2$ where

$$d_2 = (4ag_c + 4a_2g_1 - 4a_2g_c + g_1g_y)/s_1k_2(4a + g_y).$$

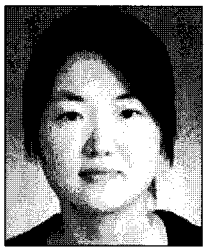
This means that d_2^{t*}, which maximizes the profit function, is located at the boundary in the interval $(4a_2 + 4g_c + g_y)/4s_1k_2 \leq d_2 \leq 1$. However, even though d_2^{t*} is derived in the range of $(4a_2 + 4g_c + g_y)/4s_1k_2 \leq d_2 \leq 1$, the optimal profit π^{t*} needs to be compared with the optimal profit in the range of $d_2 < (4a_2 + 4g_c + g_y)/4s_1k_2$ in order for the publisher to derive global optimal profit.

In the range of $e \leq d_2 < (4a_2 + 4g_c + g_y)/4s_1k_2$, charging for the online version of Content X is not optimal. Instead, the publisher fixes the price for the online version of Content X as zero, $p_2^w = 0$. Then, the profit function will be π^w in equation (4). Since $\partial\pi^w(p_y^{w*}, p_1^{w*}, q_a^{w*}, q_A^{w*}, d_2^w)/\partial d_2^w < 0$, the optimal d_2^{w*} is the minimum level within the given range. In other words, $d_2^{w*} = e$. Since $\pi^{w*} > \pi^t(d_2^t = (4a_2 + 4g_c + g_y)/4s_1k_2)$ and $\pi^{w*} > \pi^t(d_2^t = 1)$, we can conclude that π^{w*} is greater than all possible π^{t*}. This implies that π^{w*} is the optimal profit in the range of $e \leq d_2 \leq 1$.

In the range of $d_2 < e$, the profit function will be π^i in equation (1). Compared with π^{w*} and π^{i*}, we can get $\pi^{w*} > \pi^{i*}$.

Overall, in the range of $0 \leq d_2 \leq 1$, π^{w*} is the optimal profit. This implies that it is optimal to provide a limited version of Content X for free that matches the level of the online substitutes when $0 \leq e \leq 1 - (4a_2 + g_y)/4s_1k_2$.

◆ 저자소개 ◆



김은진 (Kim, Eunjin)
2007년 8월 KAIST에서 경영공학 박사 학위를 받고 현재 KAIST 테크노경영대학원에서 대우 교수로 재직하고 있다. 현재 관심 연구 분야는 CRM 시스템의 전략적 활용 및 투자에 관한 연구, 기업의 IT 투자 전략 분석, 디지털 컨텐츠 사업자의 전략 분석이다.

이병태 (Lee, Byungtae)
현재 KAIST 테크노경영대학원 교수로 재직하고 있다. The University of Texas at Austin에서 박사학위를 받은 후 The University of Illinois at Chicago 및 The University of Arizona에서 교수로 재직하였다. 관심 연구 분야는 IT 생산성 측정 및 투자 평가, 전략적인 IT 투자에 관한 분석, 이비즈니스, 온라인 옥션 마켓에 대한 분석이다.

◈ 이 논문은 2007년 07월 06일 접수하여 1차 수정을 거쳐 2007년 09월 13일 게재확정되었습니다.