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Ranjan Dutta

University of Texas at Austin

Sirkka Jarvenpaa

University of Texas at Austin

Kerem Tomak

University of Texas at Austin

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BEHAVIORAL ECONOMICS OF DIGITAL CONTENT

Ranjan Dutta, Sirkka Jarvenpaa, Kerem Tomak, Department of Management Science and Information Systems. University of Texas at Austin. Austin, TX 78712

Abstract

Increased use of the Internet for the distribution of digital products allows firms to embrace new business models. These models provide higher levels of product customization. In search of a better match between products and consumers' willingness to pay, many online and mobile content providers have recently started to add new charging methods to their existing pricing strategies. Currently, a gap exists between a firm's decision to implement a pricing mechanism and the firm's consideration of consumers' behavior towards acceptance of that pricing mechanism. What can firms do to better align their revenue models with consumers' behavioral norms? If an answer exists, and we will offer one, it will directly relate to the design, implementation and pricing of information goods. From the point of view of an online content provider this paper examines implications of one of the many types of consumers' economic anomalies: mental accounting (MA). More specifically, we look at how mental accounting (MA) of payment for and consumption of digital content at the consumer level impacts firm level choices of pricing strategies.

Our results show that MA of payments and consumptions change firms' pricing strategy for digital content. For the firm which has high digital content customization level, pay-per-use and pay-later strategies are always inferior to subscription. In contrast, under neoclassical assumptions, firms are equally well-off from employing any price scheme. Our results also show that in a duopolistic market for information goods, firms must be knowledgeable of MA's influence on the market. MA's influence is magnified if the level of customization is a further differentiating factor. We present general conditions under which profits increase with the intensity of MA. Also, our results offer insights into the choice of pricing schemes by content distribution networks as well as mobile service providers and may provide an explanation as to how economic and behavioral aspects of digital consumption may interact.

Keywords: Online Payment Systems, Mental Accounting, Game Theory, Digital Content.

1 INTRODUCTION

Motivated by the current usage and pricing mechanisms in the wired and wireless digital content distribution networks, this paper studies and analyzes pricing strategies that can be used by current and future digital content providers. For the last few years, researchers have looked into the provision of customized content as one of the burgeoning business models whose development has been bolstered by the growth of Internet (Carr, 2000). In the industry, content providers are envisioning to use Internet as a high-performance, reliable vehicle for delivering bandwidth intensive, rich multimedia content. Over the last year and a half, we have seen this viewpoint gaining in strength as mobile Internet commerce offered us glimpses of some even richer possibilities in that direction. A prime example of this is that of successful mobile service operator and content provider, NTT DoCoMo of Japan, which provides an array of popular customized content services like stock quotes, email services or weather information to its customers over the mobile internet (Alves et al., 2001).

Mobile internet also gives the content providers a better opportunity to reach the consumer at the moment when his/her demand for a particular customized content is at its highest. Note that when the consumer utility is at its peak, so also is her readiness to pay for that utility. Content provision through both wired and mobile Internet combined with other media may make it be possible to reap higher consumer surplus by providing customized content at the most appropriate instant.

Even though provision of customized online content may already be a technical feasibility, content provision will never be viable unless it is backed by an economically sustainable business model. The endeavor of this paper is to look into the pricing issues that are connected to the delivery of content-based services. What kind of pricing strategy should a content provider follow to maximize its own profits? Given their ability to provide customized content how should competing content providers strategically choose their pricing strategies? We have to stress the essence of this setup. Although we compute optimal prices, the final decision that the firms make is the choice of a price scheme, not the setting of an equilibrium price.

Over the last few years we have seen various online payment mechanisms being conceptualized - secured credit card like transactions, stored value systems, micropayments, mobile payment systems etc. (Deutsche Bundesbank Study, 1999; Mishra and Gustafson, 2001). Each of these payment mechanisms is different from the other in the way it is devised and each can be expected to have its own unique impact on a consumer. Research on behavioral decision theory has indicated that there can be significant impact on consumers, which arises out of differences in timing between payments and consumptions (Prelec and Loewenstein, 98). For example, in cases of online credit card payments or direct billing to access providers, actual consumption of digital content (like accessing a customized stock summary) precedes payment as aggregate payments are generally made at the end of a billing cycle (Blok, 2001). On the other hand, there are payment mechanisms like digital money where the consumers pay in advance against anticipated future consumptions. Similarly there are payment mechanisms, like direct debiting, where payment and consumption are simultaneous i.e. a consumer pays as she consumes, just like using cash or a debit card in a normal transaction.

This paper is an attempt to derive some intuitive understanding of how these pricing strategies may be employed by the digital content providers. We present a game theoretic model where two content providers compete for consumer market share. To keep the model generic in nature, we have not differentiated between the media (landed Internet, mobile Internet or anything else) through which the content providers may reach their customers. Firms are differentiated simply by their ability to provide customized content and their pricing strategies.

Our model uses concepts from behavioral decision theory to derive results that can be significant for revenue structures employed by digital content providers. We have refrained from establishing any link between these strategies and actual payment mechanisms like credit cards, e-cash etc. Each strategy is simply dependent on when the consumer is making a payment vis-à-vis her consumption.

2 PRIOR RESEARCH ON DIGITAL CONTENT PRICING

In recent times, both academic and practitioner research has looked into the issue of content delivery and pricing of content (Lippman, 2000). Two generic revenue models are discussed by a number of academic scholars -- "advertising" model (indirect), where content is free with revenue coming from advertisements and "pay-for-content" model (direct), where consumers pay for use of content. Winder (2001) professed that unlike other media, Internet content delivery mechanisms should rely more on "pay-for-content" models over "advertising" models since Internet allows more interactivity between the consumer and the content provider. In a more restricted setting, Yuan et al. (1998) explored the question whether traditional practices of bundling advertisements with content will prevail or become less common on the Internet. In a similar direction of research, Dewan et al. (2002) theorized the significance of balance between advertising and content on the profitability of websites. As the utility to the consumer from content services seems to be on the rise (with more interactivity or with more customization), the general direction of research appears to indicate a use of more "pay-for-content" models.

Quite a few researchers have looked into pricing of Internet content provision by differentiating between access services and content delivery -- access being provided by the network provider while content is being produced and delivered through the network by the content provider. Content is essentially looked upon as a pre-existing information product with high development costs and low variable costs. As few firms compete in the such markets, the content providers are seen as near monopolies (Jones and Mendelsohn, 1997). In a distribution channel based study, Dewan et al. (2000) show that content providers prefer Internet channels to direct channels only if the access market is sufficiently competitive.

Mackie-Mason et al. (1996) analyzes how differences in network systems affect offering of content to consumers. Here content pricing is considered as a sub-strategy of the network provider. The authors analyzed pricing strategies for three kinds of networks -- "application aware, content aware", "application aware, content unaware" and "application unaware" networks. An aware network controls content selection, thus order choices for consumers are based on profits generated by each content offering. Content is treated more like mass produced low value items. On the other hand, in a blind network like the Internet, consumers control content selection. Thus content offerings are ordered by consumers' maximal willingness-to-pay which make them characteristically similar to high value niche items like consumer durables.

Jaganathan (2002) studies two primary transaction models for selling content -- "quoted price" model and "sealed-bid auction" model, where customer quoted a price. However, unlike other research, he acknowledged presence of both dynamic consumer behavior (i.e. consumer behaving differently at different points of time) and diversity among consumers.

We can see that prior research on online content pricing strategies essentially conceived "content" as just another consumer durable. The primary question was, how could content providers generate revenue from such products? In our paper, we take a different approach. Firstly, demand for any customized content is a variable and given a context, the content provider also has a varying capability to satisfy that demand. Secondly, behavioral decision theories have indicated that individuals do not always act rationally (in an economic sense) and they differ from one another in their behavior towards a given stimuli (Kahneman and Tversky, 1979). More specifically, individuals differ in the degrees to which payments attenuate pleasure of consumption (attenuation) or consumption buffers pain of payment (buffering) (Prelec and Loewenstein, 1998).

3 BENCHMARK CASE

As the benchmark case, we start with a duopoly market for content providers. They play a discrete price setting game in which each firm has three pricing strategy choices. For simplicity, we take the

length of the consumption period as two. At each time period, a consumer has desired utility $u \sim U(0,1)$. Strategies are differentiated on the basis of when the consumers are required to make their payments p against these consumptions. They are diagrammatically shown in Figure 1. A firm can choose to induce the consumer to pay at the beginning of the consumption period. In another strategy, consumer pays for what she consumes and in the third, the consumer pays at the end of second period. Note that the game is not a two stage game but rather a one stage game with strategies by the firms chosen at the beginning of the first period but the consumption takes place over two time periods.

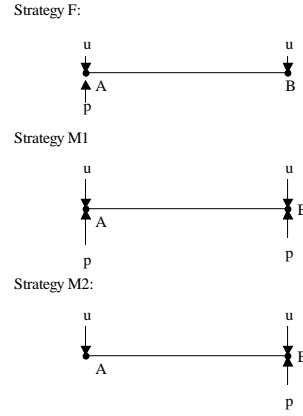


Figure 1. Strategy timeline

Let the strategy space be given by $\Omega = \{F, M_1, M_2\}$. Content providers have different abilities to satisfy a consumer's desired utility u . The ability to provide the desired consumer utility is captured by a factor $\theta \sim U(0,1)$. It can also be interpreted as the quality of the content in terms of how well it matches the consumer's expectations. If a content provider chooses the strategy F , net utility to the consumer is $(1 + \delta)\theta u - p$ where p is the payment made at the beginning of stage1 (point A in Figure 1) and δ is the discount factor. Using the same notation, net consumer utilities under the strategy choices M_1 and M_2 are derived as $(1 + \delta)(\theta u - p)$ and $\theta u + \delta(\theta u - p)$ respectively.

We assume that a consumer either chooses one of the two content providers to satisfy her desired utility or simply decides not to use any of the two services (when her net utility from payment and consumption becomes less than 0). Let p_1 and p_2 be the prices charged by Firm 1 and 2 respectively. Also let θ_1 and θ_2 signify the degrees to which the Firms 1 & 2 satisfy a consumer's desired utility u . We calculate the payoffs for each firm as follows. (We demonstrate the calculation method for the strategy (F, F) . Rest of the payoffs are calculated similarly). A consumer who is indifferent between the two content providers equates the net consumer surplus from each

$$(1 + \delta)\theta_1 u - p_1 = (1 + \delta)\theta_2 u - p_2$$

Similarly, the consumer who is indifferent between buying from a firm, say Firm 2, and not buying at all solves

$$(1 + \delta)\theta_2 u - p_2 = 0$$

Solving for u , we have the utility level of the marginal consumer

$$u^* = \frac{p_1 - p_2}{(1 + \delta)(\theta_1 - \theta_2)}$$

Let those consumers with utility level above u^* purchase content from the provider 1 and the rest from provider 2. Then demand for content providers' services can be written as

$$D_1 = 1 - \frac{p_1 - p_2}{(1 + \delta)(\theta_1 - \theta_2)}$$

$$D_2 = \frac{p_1 - p_2}{(1 + \delta)(\theta_1 - \theta_2)} - \frac{p_2}{(1 + \delta)\theta_2}$$

and the profits are

$$\pi_1 = p_1 \left(1 - \frac{p_1 - p_2}{(1 + \delta)(\theta_1 - \theta_2)} \right)$$

$$\pi_2 = p_2 \left(\frac{p_1 - p_2}{(1 + \delta)(\theta_1 - \theta_2)} - \frac{p_2}{(1 + \delta)\theta_2} \right)$$

Equilibrium prices are found by maximizing each profit level with respect to the corresponding prices:

$$p_1^* = \frac{2}{4\theta_1 - \theta_2}$$

$$p_2^* = \frac{1}{4\theta_1 - \theta_2}$$

Finally, the payoffs are

$$\pi_1^* = \frac{4\theta_1^2 - \theta_2^2}{(4\theta_1 - \theta_2)^2}, \quad \theta_2 \leq 4\theta_1, \quad \theta_1 \geq \theta_2$$

$$\pi_2^* = \frac{\theta_1 - \theta_2}{(4\theta_1 - \theta_2)^2}, \quad \theta_2 \leq 4\theta_1, \quad \theta_1 \geq \theta_2$$

We find that the payoffs are the same for all the other strategy options that the firms have. Note that although equilibrium demands and prices for services from the two content providers are different for each strategy combination, optimal profits (payoffs) derived for each cell are found to be exactly the same as above. It does not make any difference whether the consumer pays earlier, or later or as she consumes *in terms of the resulting payoffs the firms receive*. Hence we have proved the following theorem:

Theorem *Under perfect expectations assumption, in equilibrium, digital content providers remain indifferent between any of the three price schemes. Furthermore, there is no strong Nash equilibrium of the game in which the firms choose price schemes.*

4 MENTAL ACCOUNTING CASE

It is plausible that consumers differ from one another in their sensitivity to timing of payments and consumption (Gourville 1998). Mental accounting allows us to incorporate these differences in our model. In the first game we differentiate between the acts of consumption and payment. Consumption is looked upon as a utility and payment is looked upon as a disutility. But mere separation of consumption and payment does not produce any differentiation between the three revenue collection schemes since we use net benefit to analytically derive the demands and calculate the profits. Hence, in the MA case, in addition to separation of consumption from payment, a notion of residual effects is incorporated into the model.

The concept of residual effects adapted from vast literature on MA is as follows: a consumer's utility of consumption is attenuated by a residual disutility of payment that she associates with that utility of consumption (Prelec 1998). Similarly, consumer's disutility of payment is buffered by a residual (positive) utility of consumption that she associates with her payment. We coin these residual effects "payment blow effect" and "consumption bliss effect".

When payment and consumption are simultaneous, the link between the payment and the specific consumption act becomes salient to the mind of the consumer (Thaler 1999). But when payment is separated from consumption, each event triggers its own cognitive processes and during a given event there are only residual effects from associated payments or consumption. Payment blow is the residual effect that reduces the pleasure of consumption by reminding the consumer about payments that she associates with that consumption. Consumption bliss is the residual effect that reduces the pain from making a payment by reminding the consumer about the pleasure she associates with that payment. Magnitude of temporal separation between payment and consumption is also believed to play a crucial role (Gourville 1998, Gourville 2002). In our model we disregard the magnitude of temporal separation and concern ourselves with only coupling /decoupling of payments from consumption.

The concept of coupling coefficients is as follows: Each utility of consumption is attenuated by a disutility of making a payment. Similarly, each disutility of payment is buffered by a (positive) utility of consumption. We use $\alpha \in (0,1)$ and $\beta \in (0,1)$ to calculate net utility of consumers where α represents the degree to which payments attenuate pleasure of consumption and β represents the degree to which consumption buffers the pain of payment. Each consumer is assumed to have her own levels of α and β . Thus differences in consumers are captured by these two coefficients in our model.

An example will make the use of the above concept clearer. Let's consider a consumer who uses content provided by one of the firms employing pricing strategy F . Consumption utility for this strategy will be $u - \alpha \bar{p}_A$ where \bar{p}_A is the imputed cost of consumption. Imputed cost of consumption at any point can be imagined to be a net attenuation in experienced utility of the consumer arising due to making of a payment at the same point. Similarly, disutility of making payments is buffered by the imputed benefit derived from each payment. Thus payment disutility for strategy F will be $p - \beta \bar{u}_A$ where \bar{u}_A is the imputed benefit of payment.

When the content provider chooses the pricing strategy F , a consumer has consumption experiences at points A and B and payment experience at point A (Figure 1). Then, imputed cost of consumption at point A, is $\frac{p}{2}$ and imputed cost of consumption at point B, is 0. Thus, the consumer's utility from consumption experience when the content provider chooses strategy F can be written as follows: $u - \alpha \frac{p}{2}$. Similarly, imputed benefit from payment at point A is equal to $2\alpha u$.

. Thus, the consumer's utility from payment experience is $\frac{2\theta}{2}p$. Thus, net consumer utility for strategy F can be written as

Like in the benchmark game, payoffs are optimal profits. We assume in this case that $\theta_1 = 1$ and denoting $\theta_2 = \theta$. Thus, θ can now be interpreted as the degree to which Firm 2 approaches Firm 1 in its ability to satisfy a consumer's demand. Net consumer utilities with these changes are as follows:

Pricing Strategy F: $\frac{2\theta}{2}p$

Pricing Strategy M1: $\frac{2\theta}{2}p$

Pricing Strategy M2: $\frac{2\theta}{2}p$

And finally, we compute the payoffs in this case as in Table 1.

Strategy	Pay-off
(F, F)	$\frac{16\theta(1-\theta)}{9(1-\theta)^2}, \frac{4\theta(1-\theta)}{9(1-\theta)^2}$
(F, M_1)	$\frac{16\theta(1-\theta)}{9(1-\theta)^2}, \frac{2\theta(1-\theta)}{9(1-\theta)^2}$
(F, M_2)	$\frac{32\theta(1-\theta)(1-\theta)}{9(1-\theta)^2}, \frac{4\theta(1-\theta)(1-\theta)}{9(1-\theta)^2}$
(M_1, F)	$\frac{8\theta(1-\theta)}{9(1-\theta)^2}, \frac{4\theta(1-\theta)}{9(1-\theta)^2}$
(M_1, M_1)	$\frac{8\theta(1-\theta)(1-\theta)}{9(1-\theta)^2}, \frac{2\theta(1-\theta)(1-\theta)}{9(1-\theta)^2}$
(M_1, M_2)	$\frac{16\theta(1-\theta)(1-\theta)}{9(1-\theta)^2}, \frac{4\theta(1-\theta)(1-\theta)}{9(1-\theta)^2}$
(M_2, F)	$\frac{2\theta(1-\theta)(1-\theta)}{9(1-\theta)^2}, \frac{\theta(1-\theta)(1-\theta)}{9(1-\theta)^2}$
(M_2, M_1)	$\frac{2\theta(1-\theta)(1-\theta)}{9(1-\theta)^2}, \frac{\theta(1-\theta)(1-\theta)}{9(1-\theta)^2}$
(M_2, M_2)	$-\frac{8(2+\beta)(-1+\theta)}{(2+3\alpha)(-4+\theta)^2}, -\frac{2(2+\beta)(-1+\theta)\theta}{(2+3\alpha)(-4+\theta)^2}$

Table 1. Payoffs for each firm.

We solve the normal form game derived from the results in the table above by comparing the payoffs to each other and solve for the highest payoff strategy. We show in Dutta and Tomak (2003) that M_1 strategy is dominated by F and M_2 strategies and the following theorem follows:

Theorem *If an existing consumer group exhibits consumption characteristics in accordance to mental accounting, digital content providers choose either fixed up-front or delayed payment scheme in equilibrium. Hence the only Nash implementable strategies are (F, M_2) , (M_2, M_2) , (M_2, F) .*

5 CONCLUSION

Information systems literature on digital content provision uses traditional microeconomic theories to analyze pricing problems and naturally, overlooks consumer anomalies in decision making. In contrast, mental accounting (MA) research studies consumers' cognitive processes but do not investigate the implications of MA on firm level pricing strategies. This paper, motivated by an IT driven phenomenon, looks at firm level pricing strategies in a market under the influence of MA. We do not profess whether consumers maintain or do not maintain mental accounts. Within MA literature, Prelec and Lowenstein (1998) show that consumers do maintain mental accounts and prefer pre-payments over post-payments. Ariely (2002) investigates the value of micropayment or pay-per-use strategies to consumers. But a key question remains, and it is the one that we answered: how should firms select pricing schemes given these consumer preferences? Our results show that firms need to be knowledgeable about the existence of MA. When consumers exhibit MA characteristics, not only does a firm have greater incentives to choose different but relevant pricing strategies but awareness of MA characteristics also generates higher profits. In fact, complementary to what Prelec and Loewenstein (1998) or Ariely (2002) posit, we show that in a duopolistic content provisioning environment it still makes sense for a firm to adopt a post-payment strategy over pre-payment or micropayment strategies. By taking the firms' perspective, we build the bridge between their findings at the consumer level and the firm level strategies from an analytical perspective. We foresee several directions for future research.

Various technology enabled payment schemes have already been conceptualized to provide payment options to content providers and other firms that conduct business over the Internet. Many of these schemes are influenced by the timing of payments and consumptions. MA theorizes that decoupling payments from consumption do matter to consumers. Do IT rich environments reinforce or diminish these residual effects that consumers experience? As firms control the payment methods and the information revealed to the consumer, how does the technology change the mental accounts of the consumers and lead to outcomes which are undesirable for the consumers? The role of technology in payment mechanisms has only rarely been investigated in the MA literature (Dutta et al. 2003). As business models incorporate more Internet based payment mechanisms and as the consumers face an ever-increasing amount of choices for payments, it is of paramount importance to analyze the interaction between consumers' purchase decisions and information goods.

In this paper, we investigated only a static game where both firms assume that consumers maintain mental accounts. From a firm strategy perspective, there can be several ways to empirically and analytically extend our findings to include more complicated scenarios. One possibility is to look at an asymmetric information scenario where only one of the two firms has knowledge about the existence or non-existence of MA. This is a situation when one firm has more knowledge about consumers but the other firm blindly assumes all consumers to be rational decision-makers. Another extension may be that the market need not only constitute MA or neoclassical consumers, but may contain a mixture of both. In such a situation, it is interesting to find out how firms strategize. It may be interesting to see whether the same equilibrium strategies, in symmetric and asymmetric information scenarios - as well as in cases where the market has a mix of consumers - hold in an experimental setup. Cooperation between firms as a result of firm level adaptive learning can also constitute a direction for future research. Finally, consumer learning may have an effect on the firms' strategies. This can arise in a situation where consumers which exhibit MA characteristics learn to behave (or are taught to behave) like a rational decision maker over time. Several of these ideas are subjects of our current studies.

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