

전자책 무제한 정액제의 소비자 이용행태 분석: 가격제 선택과 구독 갱신, 그리고 전자책 구매에 관하여

Subscribing to an All-You-Can-Read E-Bookstore: Tariff Choice, and Contract Renewal for E-Book Purchases

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요약

최근 디지털 콘텐츠 시장의 패러다임이 소유에서 소비라는 관점으로 바뀌는 가운데, 전자책 시장에서는 무제한 정액 구독 서비스가 빠르게 보급되고 있다. 본 연구는 무제한 정액제가 새로이 도입되는 상황에서 소비자들의 가격제 선택 행태와 더불어, 구독 후 실제로 어떠한 전자책 구매 패턴을 보이는지에 대해 실증적으로 검증하였다. 분석 결과, 소비자들은 합리적 의사결정을 바탕으로 정액제에 지불한 금액 이상의 도서를 다운로드 받으며 경제적 실리를 취하고 있었다. 헤비유저일수록 정액제를 선호하였으며, 과거 구독을 통해 실제로 경제적 효용을 경험한 유저일수록 정액제 이용을 갱신하는 경향이 나타났다. 한편, 구독 기간과 관련해서는 1일 혹은 1달 단위의 정액제 구독 보다 1주일 정액제 이용 시에 경제적 효용이 가장 큰 것으로 나타나, 기간이 너무 짧거나 길지 않을 때 미래 수요를 가장 합리적으로 판단할 수 있음을 시사하였다. 마지막으로 인앱결제 기능 유무에 따라 iOS와 안드로이드 유저 간에 정액제 선호와 전자책 구매패턴이 다르게 나타남을 발견하였다.

키워드 : 전자책, 디지털재, 가격제, 정액제, 서브스크립션 기간

I. Introduction

Ubiquitous high-speed network connectivity, low-cost cloud-based storage and the availability of smart,

mobile devices enable consumers to instantly access digital content from anywhere at any time. These trends are enabling a shift from ownership to access models in digital content industries, where, consumers pay a flat fee for access to content for a fixed period of time. Consumers have been shown to prefer flat-fee subscription for access to a wide range of goods and services ranging from health clubs to software

† This work was supported by the Ministry of Education of the Republic of Korea and the National Research Foundation of Korea (NRF-2015S1A5A8016848).

and online, communication services (Choudhary, 2010; DellaVigna and Malmendier, 2006; Fishburn *et al.*, 1997; Goettler and Clay, 2011; Lee *et al.*, 2006; Miravete, 2003; Wu and Banker, 2010; Yang *et al.*, 2010). Pricing models in the online digital content industries are also evolving. In music, people are switching from individual song purchases to fixed-price streaming services such as Spotify, and Rhapsody.¹⁾ Apple acquired the subscription streaming service Beats Music as its worldwide song downloads declined sharply.²⁾ In the U.S., nearly one-third of music revenue is from streaming services. In the movie industry, online content streaming services such as Netflix are thriving. Amazon introduced the Kindle Unlimited e-book subscription service in July 2014, to compete with incumbent services such as Oyster and Scribd.³⁾

Consumers may prefer flat-fee subscription services because they overestimate service usage and want to reduce the cognitive burden of evaluating each individual purchase (Fishburn *et al.*, 1997).

Subscription services change the economics of content producers, service platforms and consumers. Content service platforms pay royalties to producers every time a song is played, a movie is watched or a book is read. For flat-fee subscription services

to succeed, benefits to consumers, producers and subscription service platforms need to be balanced. Consumers benefit when they save costs and experience a richer variety of content than they otherwise would not have purchased. However, consumers only maintain access to content if they maintain paid subscriptions. Subscription service providers gain when consumers subscribe, but do not actually consume much content, resulting in less royalties paid. However, this will reduce content producers' incentives to provide subscription options for their content, resulting in less content availability and hence threaten the viability of this model. Hence, it is critical that we understand how digital content subscription service stakeholders are affected economically when flat-fee subscriptions are introduced. Prior research of subscriptions to non-digital goods and services finds that consumers are in general worse off when they choose flat-fee subscriptions.

In this paper, we empirically examine the economics of flat-fee subscription models for digital contents with transaction data from a major Korean e-book retailer that offers three flat-fee subscription options varying in duration -1-day, 1-week, and 1-month. More specifically, we examine: Who adopts flat-fee subscriptions for e-books, and what contract time duration do consumers choose? Do consumers benefit economically from the all-you-can-read tariff? To what extent do consumers renew subscription plans? In short, we examine consumers' initial and subsequent renewal decisions of flat-fee e-book subscription plans, and the economic benefits that accrue to consumers given their actual consumption patterns in the initial and subsequent subscription plans chosen.

We find that over 80% of consumers benefit from flat-fee subscriptions. Power readers prefer flat-fee subscriptions, and those that have economically bene-

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- 1) Fixmer, A. (April 25, 2013). Apple's 10-year-old iTunes loses ground to streaming. Bloomberg Business. <http://www.bloomberg.com/bw/articles/2013-04-25/apples-10-year-old-itunes-loses-ground-to-streaming>.
 - 2) Karp, H. (October 24, 2014). Apple iTunes sees big drop in music sales. Wall Street Journal. <http://www.wsj.com/articles/itunes-music-sales-down-more-than-13-this-year-1414166672>.
 - 3) Mitroff, S. (October 2, 2014). Amazon Kindle Unlimited vs. Scribd vs. Oyster: E-book subscriptions battle it out. Cnet. <http://www.cnet.com/how-to/amazon-kindle-unlimited-vs-scribd-vs-oyster-e-book-subscriptions/>.

fited renew their subscription. Of the three contract duration options, consumers of the 1-week option benefited the most, i.e., consumers are most likely to accurately estimate their future consumption when the time scale is neither too short (1-day) nor too long (1-month). We also find that unavailability of in-app purchase affects transaction patterns as it increases transaction costs.

Our paper proceeds as follows: after an overview of the prior research on consumer choice of flat-fee subscription contracts, we describe the data, methods, and results. Finally, we discuss implications for digital content businesses and for research on pricing strategies in these industries.

II. Theoretical Background

Research on tariff options has proliferated in consonance with their increasing strategic importance with respect to consumer welfare and competitive dynamics in diverse market environments. Among numerous theoretical reflections and empirical studies, consumers' preferential behaviors called tariff-choice biases (Lambrecht and Skiera, 2006) are of particular relevance to the present work. We review previous studies on the evidence of existence of flat-rate biases, its potential causes and consequences of the tariff choice. The first delves primarily into the empirical investigation of "flat fee bias," wherein consumers habitually overestimate their future consumption and prefer a flat fee option for unlimited access, even though their overall expenses can be substantially lower with other tariff alternatives (e.g., pay-per-use). The following group of studies seeks plausible economic and psychological explanations of consumers' explicit preferences for flat-fee-based contracts, viewing such predispositions as paradoxical from a rational choice perspective. The last

stream of research focuses extensively on consumers' propensities for contract renewal and their reactions to non-linear pricing in short- and long-term horizons. In what follows, we articulate the theoretical and empirical aspects of these bodies of research and highlight the key findings in light of consumers' selection of flat-fee tariff options.

2.1 Consumer Preferences in Tariff Options

For many product and service categories, ranging from mobile phone contracts to gym memberships, firms offer consumers several tariff options to choose from, including pay-per-use and flat fixed-fee mechanisms. A rational consumer is assumed to be capable of accurately estimating the variances of his or her future demand during purchase deliberation and to prefer securing pre-commitment by paying up front for uncertain future consumption. Nevertheless, because most consumers are, in reality, unable to precisely forecast their future consumption and fluctuations in demand structures *ex ante*, they often exhibit *ex post* regret after selecting the "wrong" tariff choice (Miravete, 2003). DellaVigna and Malmendier (2006) empirically demonstrate that consumers subscribing to health club services engage in "irrational" behaviors when considering their contractual choices and actual usage frequencies. The study analyzed the contractual preferences and actual gym usage records of 7,752 health club members and found that consumers who chose to pay monthly flat-fee tariffs pay an average of 70 percent more than what they would have paid had they chosen the pay-as-you-go option for the same number of visits. In a similar study on tariff options attached to local telephone services that allow consumers to make an unlimited number of local calls within specific geographical regions,

65 percent of consumers who opted for the flat tariff option would have saved money with alternative tariffs (e.g., measured billing services) (Kridel *et al.*, 1993). Miravete (2003) also found that 59 percent of households overestimated their future consumption of phone services at the time of contract selection, thereby resulting in more than 20% overspending as a consequence of the flat rate option. Likewise, 59 percent of shoppers who used online home delivery services overpaid in choosing flat fee programs over measured delivery services. Finally, 48% of consumers who subscribed to Internet services with flat tariff options would have been better off had they selected for pay-per-use alternatives (Lambrecht and Skiera, 2006). A direct comparison of the results from these diverse service categories should be assessed carefully since there is wide variation across these service categories in terms of contract duration and price scale. Approximately 50~70 percent of consumers who choose flat tariffs appear to be “cursed” by their *ex ante* demand overestimation. Such flat-fee bias held by overconfident consumers can be a “blessing” to sellers who profit *ex post* without exhausting their resources.

2.2 Causes of Flat Tariff Bias

Why do consumers favor flat-fee tariffs over pay-per-use or pay-per-visit options despite the potential risk of paying for more than what they actually use? Numerous plausible explanations have been put forward to account for this seemingly paradoxical consumer behavior, which may cause irreversible harm to their welfare - the taxi meter effect, time inconsistency, consumer overconfidence, convenience, and risk-aversion. The taxi meter effect refers to consumers’ tendency to experience discomfort when monitoring a taxi meter’s continuous ticking

(Lambrecht and Skiera, 2006). Many taxi passengers are partial to flat rate pricing over meter-based schemes, even though they incur more expenses from the former. The rationale for this proclivity is that consumers harbor a natural tendency to detach themselves from the disutility that arises when they cognitively connect every extra unit of usage to an elevation in price. While pay-per-use schemes reduce the joy of consumption, flat rate plans decouple usage from payment and thus keep the disutility derived from paying at the time of service to a minimum (Soman and Gourville, 2001).

The paradoxical preference for sub-optimal tariffs can also be explained by consumers’ overconfidence about their ability to exercise self-control during costly activities; such self-assurance drives consumers to overestimate future consumption levels (DellaVigna and Malmendier, 2006). When consumers commit to a New Year’s resolution to lose weight by going to the gym three to four times a week, follow-through typically involves the said number of visits but on a yearly rather than a weekly basis. Time-inconsistency, in which consumers behave erratically over time because of unpredictable fluctuations in preferences can explain such sub-optimal decisions (Hoch and Loewenstein, 1991). Convenience is understandably a significant driver of susceptibility to flat-fee bias, given the perceived elimination of the need to repeatedly undergo cumbersome processes involved in acquiring a product/service; that is, flat rate schemes are seen to minimize the transaction costs incurred from pay-as-you-go plans (Prelec and Loewenstein, 1998). Finally, risk-averse consumers opt for flat tariffs to eliminate any uncertainty associated with price fluctuations and to insure themselves against potentially excessive costs in periods of greater-than-average consumption (Train, 1987).

2.3 Changes in Contract Choice over Time

The issues pertaining to tariff choice become increasingly complex when the sustainability of tariff options in the form of contract renewal is taken into account. Do consumers who are vulnerable to flat rate bias renew their contracts? After a flat rate contract is renewed, how do consumption quantity and, subsequently, the consumer surplus change? Relative to studies on the initial choice between flat rates and pay-per-use schemes, little effort has been extended to systematically investigate the consumption patterns that underlie contract choice over time, and post-renewal. One exception is the work of DellaVigna and Malmendier (2006), who compared the renewal patterns of monthly and annual flat rate subscribers in the context of health clubs. The authors' key findings indicate that average attendance in the gym is about 10% higher under the annual plan than under the monthly scheme. In addition, after a two-year contract, subscribers who were initially enrolled in the annual membership program stayed with the gym longer than did consumers who were initially enrolled in the monthly membership subscription. The authors attest that learning through experiences motivates low-attendance consumers to switch to other pricing options. This explanation is also articulated by Miravete (2003), who found that after the initial "mistake" in selection, consumers who subscribe to local phone services tend to switch tariff choices in anticipation of reducing their monthly payments. A recent study by Goettler and Clay (2011) examined the flat fee bias within the rational choice framework on the basis of Bayesian learning models. The study focused on new products subject to high uncertainty and found that consumers weighing heavily on posteriors tend to overestimate the utility de-

rived from new product consumption when updating beliefs.

III. Determinants and Consequences of Subscription-based Pricing in e-Book Markets

3.1 Motivating Factors for Adopting e-Book Subscription

A variety of factors, including convenience, overconfidence, and time-inconsistency, motivate e-book consumers to choose subscription-based pricing over a pay-per-use program or ownership through a purchase arrangement. The amount of perceived economic savings can also incentivize the adoption of all-you-can-read pricing. Heavy e-book consumers are naturally more attracted to subscription-driven pricing than are light consumers because the former potentially secure higher benefits from such program. The tendency to overestimate the gains accrued from flat-fee subscription reduces sensitivity to price more strongly among heavy users than among light users; the former may therefore exhibit more risk-taking behaviors by paying large bills up-front for their unused consumption. Moreover, regular readers, who steadily consume e-books over time, are projected to more readily embrace subscription-based pricing than irregular readers, who radically vary their e-book consumption from period to period. This estimation is based on the ability of regular users to predict their future consumption more accurately than can irregular users. Such ability enables regular consumers to select a rational, forward-looking choice that results in high utility. In addition to this frequency-based valuation, recency of past purchase indicates

consumers' life-time value and propensities toward long-term commitment. With all factors being equal, consumers who recently purchased e-books are expected to more likely adopt a subscription-based mechanism than consumers with distant purchases. This behavior is attributed to the fact that recent-purchase consumers are more likely to pre-commit than distant-purchase consumers. In summary, an e-book consumer's propensity to adopt subscription-based pricing rests on several determinants, including his or her extent of e-book consumption, stability of consumption patterns, and recency of past e-book purchases.

3.2 Economic Payoffs of e-Book Subscription

As described earlier, many consumers who choose flat-fee tariffs over pay-as-you-go plans are susceptible to overpaying for unused future services. How do e-book consumers who adopt the subscription-based pricing structure perform? How much economic benefit do they obtain from such pricing mechanisms? Subscription to digital goods (e.g., e-books) may differ fundamentally from that to investment goods or physical services (e.g., health club services) in terms of the nature of economic advantage. Digital goods are easily accessible and usable through personal mobile platforms anywhere, any time. Such on-demand accessibility and usability, however, are severely limited for physical services or investment goods that often present high transportation costs. The fact that the consumption of digital goods offers instant and immediate gratification also encourages continued usage. By contrast, investment goods deliver only delayed payoffs (e.g., improved health), which may fail to sustain the interest and habit of making investments (i.e., physical training). Furthermore, the

more flexible and shorter contractual designs presented by e-book subscription enable users to precisely forecast their future consumption, thus earning them additional economic payoffs. The immediate payoff, high on-demand accessibility, and flexible contractual designs that are inherent to e-book subscription arrangements thus motivate users to maximize their economic benefits.

Another issue that deserves further exploration is how the duration of an e-book subscription contract influences the volume of its economic benefits derived from it. For example, among three subscription-based pricing options that vary in duration (e.g., day-, week-, and month-long plans), which arrangements offer e-book consumers maximum savings when costs (i.e., subscription fees) are also factored into the payoff equation? This question is interesting in itself, but a relevant issue that invigorates such investigation is the pricing structure employed by e-book sellers. That is, they use non-linear pricing structures in which higher monetary discounts are applied to contracts of longer duration (e.g., 1-month plan). Given that an increase in contract duration non-linearly augments savings, the economic surplus of e-book consumers are maximized under longer subscription plans provided that their reading interest is sustained over the contract period.

IV. Empirical Setting and Data

We collected e-book transaction panel data at an individual user level from a leading e-book retailer in Korea - EbookCo (pseudonym). EbookCo provides various genres of original e-books as well as digital versions of print books. In May 2013, EbookCo launched a new subscription-based service plan. The subscription allows unlimited access to e-book titles during a fixed contractual period -1-day, 1-week,

〈Table 1〉 Variable Description

Variable	Description
<i>Adoption</i>	A binary indicator of subscription service adoption (Yes: 1, No: 0)
<i>Renew</i>	A binary indicator of subscription service renewal (Yes: 1, No: 0)
<i>SavingAdoption</i>	A binary indicator of cost-saving upon flat-fee plan initial adoption (Yes: 1, No: 0)
<i>SavingRenew</i>	A binary indicator of cost-saving upon flat-fee plan renewal (Yes: 1, No: 0)
<i>AvePrice</i> (\$)	Average price per download (Subscription fee/number of downloads)
<i>AveSaving</i> (\$)	Savings per unit title (Unit Sales Price - Average Price per Download)
<i>PriorUsageIntensity</i>	Mean of monthly purchase quantity prior to flat-fee plan introduction
<i>PriorUsageIrregularity</i>	Variance of monthly purchase quantity prior to flat-fee plan introduction
<i>PriorUsageRecency</i>	Number of months from the consumer's last purchase date to flat-fee plan introduction date
<i>Gender</i>	Male (1) and Female (0)
<i>Age</i>	User age
<i>PriorMobile</i>	Proportion of mobile transactions prior to flat-fee plan introduction
<i>InAppUnavailable</i>	Proportion of iOS mobile transactions prior to flat-fee plan introduction
<i>Duration</i>	Contract duration of subscription adopter's initial trial

or 1-month. Access to a downloaded title is only allowed during the contract duration, and once the subscription period expires, all downloaded e-book titles become inaccessible. Such subscription-based unlimited content provision is becoming an increasingly popular revenue model for digital products. (e.g., Amazon's Kindle Unlimited offers unlimited access to its e-books and audiobooks for \$9.99 per month; Spotify provides premium streaming music services to its subscribers for \$9.99 per month.) While pay-per-title pricing charges \$0.94⁴⁾ for a single title, EbookCo charges a fixed amount fee for unlimited access to its e-books, and the subscription fee varies by contract duration. EbookCo charges a subscriber an equivalent of \$3 for a daily subscription, \$10 for a weekly subscription, and \$30 for a monthly subscription. Flat-fee subscribers receive an additional discount for long-term commitment. Subscriptions are not automatically renewed; subscribers need to opt-in to renew their contracts. Among various e-book categories, subscription services were first

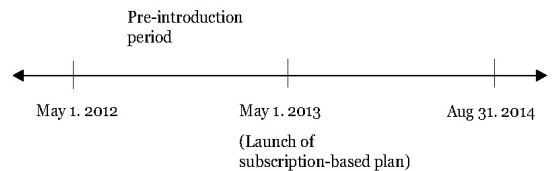
launched for genre fiction novels (or commercial fictions) such as romance, fantasy, science fiction, mystery and thrillers. This fiction categories are among the most popular category in e-book markets. Particularly in our empirical setting, 90% of revenue came from those fictions in the data period.

The dataset includes contractual choices and download transactions for e-books from 8,496 users over 28 months. In principle, we took a random sample of e-book users from the company's database. However, there exist high sparseness in transaction data for certain consumers (i.e., light or/and occasional users). As we aim to examine the longitudinal behavioral changes associated with flat-fee tariff choices, we only included retained and repeated buyers in our sample. To be specific, illustrated in <Figure 1>, our sample includes consumers who purchased at least three times during the one-year period prior to the launch of the flat-fee subscription plans (i.e., May 1, 2012 to April 30, 2013). <Table 1> presents the key variables. While most variables are germane to the subscription-based flat-fee plans, some variables pertain to purchase patterns prior to the in-

4) The currency is converted to USD.

introduction of the flat-fee plans. For example, *PriorUsageIntensity* represents the average monthly purchase volume preceding the launch of the flat-fee subscription plans. *PriorUsageIrregularity* measures purchase irregularity in a form of coefficient of variation in inter-purchase times (Coussement and Bock, 2013). We also included purchase recency, namely *PriorUsageRecency*, to incorporate recency effect. Users often use multiple devices such as smartphone, PCs, and tablets in the process of consuming e-books. Our data enable us to identify the device that was used at the time a user buys a pay-per-title version or enrolls into a flat-fee contract. Furthermore, the data contain information regarding the specific operating system of the device - e.g., Apple iOS, Android OS. Further, in our empirical setting, iOS users cannot purchase titles within the native app (the ebook com-

pany’s mobile app) but instead need to browse and pay through mobile web browsers, whereas Android users can buy any titles directly from the native app. Except for the in-app purchase availability, all user interfaces are completely indifferent between the two operating versions. Hence, proportion of iOS mobile transactions prior to flat-fee plan introduction are included to investigate the impact of the availability of in-app purchase functionality on one’s contractual decisions as it increases transaction costs.



〈Figure 1〉 Data Setup and Analysis Design

〈Table 2〉 Descriptive Statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
All Users					
<i>Adoption</i>	8496	0.159	0.365	0	1
<i>PriorUsageIntensity</i>	8496	3.672	5.938	0.25	84.727
<i>PriorUsageIrregularity</i>	8496	1.337	0.721	0	5.274
<i>PriorUsageRecency</i>	8496	4.043	3.336	1	13
<i>Gender</i>	8496	0.891	0.312	0	1
<i>Age</i>	8496	39.149	10.034	13	86
<i>PriorMobile</i>	8496	0.662	0.429	0	1
<i>InAppUnavailable</i>	8496	0.169	0.363	0	1
Flat-Fee Tariff Subscribers Only					
<i>Renew</i>	1347	0.575	0.494	0	1
<i>SavingAdoption</i>	1347	0.660	0.474	0	1
<i>AvePrice</i> (\$)	1347	1.606	3.775	0.027	30
<i>AveSaving</i> (\$)	1347	-0.706	3.775	-29.100	0.873
<i>Duration</i>	1347	1. Daily subscription (62.14%) 2. Weekly subscription (20.79%) 3. Monthly subscription (17.07%)			
Flat-Fee Tariff Renewal Users Only					
<i>SavingRenew</i>	775	0.822	0.383	0	1

〈Table 3〉 Correlation Matrix

	<i>Adoption</i>	<i>PriorUsage Intensity</i>	<i>PriorUsage Irregularity</i>	<i>PriorUsage Recency</i>	<i>Gender</i>	<i>Age</i>	<i>Prior Mobile</i>	<i>InApp Unavailable</i>
<i>Adoption</i>	1							
<i>PriorUsage Intensity</i>	0.195	1						
<i>PriorUsage Irregularity</i>	0.107	0.170	1					
<i>PriorUsage Recency</i>	-0.200	-0.330	-0.318	1				
<i>Gender</i>	-0.001	0.015	0.079	0.118	1			
<i>Age</i>	0.095	0.156	0.102	-0.088	0.077	1		
<i>Prior Mobile</i>	-0.128	-0.053	-0.020	0.015	-0.062	-0.273	1	
<i>InApp Unavailable</i>	-0.001	0.014	0.034	-0.004	-0.022	-0.068	0.190	1

<Table 2> provides the descriptive statistics of our key variables. Approximately 15.9% of the users adopted at least one of the subscription-based flat-fee plans of varying contractual periods. Notably, 66.0% of subscribers pay less than \$0.9 per download, which is the price of the pay-per-title. This suggests that the subscribers saved money through choosing the subscription-based flat fee plans, holding constant the number of downloads. Among the initial flat-fee subscribers, 57.5% renewed to a subscription plan with either the same contractual duration or a different contractual length, and 82.2% of the users who renewed saved money under their flat-fee subscription plans, i.e., a greater proportion (82.2%) of repeat flat-fee plan subscribers saved money on their subscription compared to first-time flat-fee subscribers. This increase implies that users who selected into contract renewal are *ex-post* more likely to be heavy users. Although more than a half of first-time and renewed subscribers saved money choosing the flat-fee plans, their distribution is quite skewed towards a few users who paid substantially more than the pay-per-title price. We computed the average

price per download by dividing the subscription fee by the number of actual title downloads. Flat-fee plan subscribers paid an average of \$1.61 per title, which is 79% higher than what they could have paid with an alternative pay-per-title option. The correlation matrix in <Table 3> suggest inconsequential collinearity among the explanatory variables.

V. Empirical Analysis

Our empirical analysis consists of three major blocks of analyses. First, we examine the key determinants of adoption of subscription-based flat-fee plans for e-books and contractual choices by consumers. Then we perform cost-benefit analyses to investigate whether it is economically worthwhile to buy such flat-fee plans. Second, we explore post-adoption behaviors by examining the dynamics of subscription renewal decisions. Third, we study how IT specific features such as in-app purchase options affect e-book transaction patterns and examine how flat-fee plan choices by users come into play with e-book sales concentration patterns.

5.1 Initial Adoption and Cost-Benefit Analyses

We analyze the determinants of the initial adoption of subscription-based flat-fee plans with varying contractual duration and examine its economic consequences by quantifying the monetary value of such subscription plans compared to the pay-per-title option. For our analyses, we aggregated the original user-specific time-series data up to individual users, combining repeated observations from varying time points into one batch, and ran cross-sectional regressions. This is because our focus is to examine the economic consequences of one’s tariff choices with varying contractual durations, and such economic consequences (e.g., the amount of cost-saving, renewal decisions) can be characterized as a scalar amount or an incident variable during a given specified time period (e.g., a day, a week). Further, these events of interest occur only once for each individual.

We use the following general logit model in equation 1 to model a latent variable, y_i^* , which represents the unobservable index of user i ’s willingness to adopt the subscription service. We also use a set of consumer-specific observables, X_i and observe the binary decision of whether a consumer adopts the subscription service or not, Y_i .

$$\begin{aligned}
 &y_i^* = \beta_i' X_i + u_i \quad i = 1, \dots, N \\
 &y_i = \begin{cases} 0 & \text{if } y_i^* \leq 0 \\ 1 & \text{if } y_i^* > 0 \end{cases} \quad (1)
 \end{aligned}$$

where i denotes an individual user and N is the total number of users in the sample.

The left panel of <Table 4> lists the results of the logit analysis on initial adoption. As anticipated from standard consumer preferences, usage-intensive consumers are more likely to adopt subscription. For

a one-unit increase in the *PriorUsageIntensity*, the expected change in odds of flat-fee plan adoption as opposed to non-adoption is calculated to 3.9 % (i.e., $\exp(0.0378) = 1.039$). The positive estimate of *PriorUsageIrregularity* indicates that consumer-who exhibit irregular usage patterns prior to the introduction of flat-fee plans are more likely than those with regular usage patterns to adopt such subscription schemes. This finding suggests that users whose demand levels highly fluctuate are likely to opt for flat tariffs because these options enable them to eliminate any uncertainty regarding their future demand. Also, *PriorUsageRecency* in <Table 4> is negative and statistically significantly, which indicates that recency effect is at work, positively associated with flat-fee adoption. The odds of adopting flat-fee plans for mobile-only users are 53.2% lower than PC-only users. Similarly, in-app purchase unavailability increases the odds of adoption by 20.4%. These results suggest that device type and in-app functionality have relatively larger effects on adoption compared to prior usage patterns.

Upon the adoption of flat-fee plans, users need to select the contractual duration. We employ a multinomial logit model on the contract-length decision. Specifically, using a non-adopter group as a base case option, we investigated how our explanatory variables account for one’s choice of contractual durations. The right panel of <Table 4> reports the determinants of contract duration choice for subscription adopters among the three contractual periods (1-day, 1-week, and 1-month). Results show that consumers with high usage intensities prior to the introduction of flat fee programs are more likely to choose a subscription plan with longer periods. This tendency can be interpreted as a *sorting effect* based on their prior usage experiences. Heavy users with varying usage patterns selected into the sub-

scription plans with longer contract periods at enrollment. This result implies that both adoption and duration choice for subscription plans are consistent with the notion of rational expectation and standard preference. In addition, we found that consumers who subscribed to the 1-week flat-fee service option *ex post* maximized their saving from their subscription renewals. <Figure 2> demonstrates that significantly higher proportions of users saved money from choosing the weekly subscription in their repeated renewal decisions rather than daily or monthly counterparts, indicating that users are most likely to be able to accurately estimate their future consumption when the time scale is not too short and

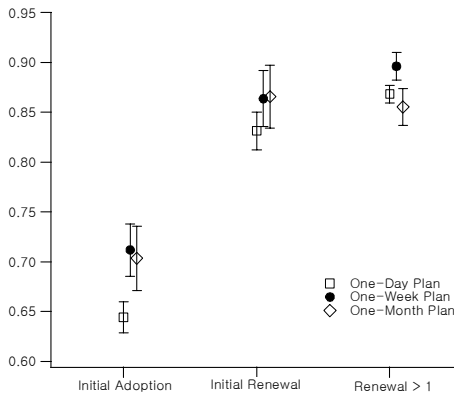
not too long. For example, the proportion of users who saved money from the weekly subscription increased from approximately 72% in the initial adoption to 87% and 90% in the first renewal and repeated renewals, respectively, which is substantially higher than in a similar flat-fee context such as gym membership (e.g., DellaVigna and Malmendier, 2006). While investment goods such as gym membership require high transportation costs and offer delayed pay-offs, hedonic goods such as e-books are easily accessible and offer immediate gratification. These distinctive features may have contributed to user's rational expectation of future consumption and demands for e-books.

<Table 4> Initial Adoption and Contract Duration Decisions

Model	Binary Logit (initial adoption)	Multinomial logit (contract duration)		
Dep. Var.	Adoption	One-day	One-week	One-month
<i>PriorUsageIntensity</i>	0.0378*** (0.00501)	0.0271*** (0.00598)	0.0441*** (0.00696)	0.0546*** (0.00690)
<i>PriorUsageIrregularity</i>	0.148*** (0.0412)	0.192*** (0.0487)	0.253*** (0.0753)	-0.131 (0.0923)
<i>PriorUsageRecency</i>	-0.180*** (0.0140)	-0.166*** (0.0160)	-0.189*** (0.0326)	-0.241*** (0.0398)
<i>Gender</i>	0.0118 (0.101)	0.0199 (0.122)	-0.246 (0.192)	0.323 (0.241)
<i>Age</i>	0.00786** (0.00309)	0.000272 (0.00375)	0.0211*** (0.00603)	0.0202*** (0.00679)
<i>PriorMobile</i>	-0.756*** (0.0728)	-0.930*** (0.0879)	-0.717*** (0.142)	-0.138 (0.162)
<i>InAppUnavailable</i>	0.186** (0.0875)	0.219** (0.106)	0.266 (0.171)	0.00142 (0.201)
<i>Constant</i>	-1.350*** (0.173)	-1.478*** (0.207)	-3.468*** (0.355)	-3.818*** (0.367)
		(Base = No-adoption)		
<i>N</i>	8,496	8,496		
<i>Log likelihood</i>	-3391	-4602		

Robust Standard errors in parentheses; a base case for multinomial logit is a daily subscription.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.



95% confidence intervals in vertical error bars.
 (Figure 2) Proportion of Users Who Saved Money from Flat Fee Subscription Plans

In addition, we investigate the determinants of *ex post* saving from flat-fee tariff subscription. Here, we only included individuals who signed up for flat-rate plans. So the source of our identification comes from the degree of variation in each of the independent variables we included in the logit regression equation.⁵⁾ <Table 5> presents the logit result of whether a user saved from subscription plans. *PriorMobile*, the proportion of mobile transactions preceding to the flat-fee plan introduction, is significantly positively associated with money saving from flat-fee subscription, which suggests that mobile-oriented users are *ex-post* more likely to be heavy e-book users. Further, we examine *ex post* average price per download, *AveSaving*, which is derived from the ratio of paid subscription fee and the actual number of downloads during the subscription. It is worth noting that, as we discussed in Empirical Setting and Data section, the distribution of the number of actual

5) We found that each independent variable indeed show substantial degree of variation among the users who adopted the flat-rate plans as the coefficient of variation ranges between 37 and 230.

downloads is quite skewed towards a few users who downloaded e-book titles only once or twice, if not none, during her subscription period. To address this issue, we employ a quantile regression, which relates the conditional median (instead of mean) of the dependent variable to independent variables. This approach is considered more robust to outliers than linear regressions (Koenker and Bassett, 1978). <Table 6> demonstrates that weekly subscription plan appears to be most cost-saving on average. This result lends further support that there exists a sweet spot in the time scale in which users are able to accurately estimate their future consumption, such that one week is not too short and not too long.

<Table 5> Determinants of Money Savings from Subscription-based Plans

Model	Binary Logit
Dep. Var.	SavingAdoption
<i>PriorUsageIntensity</i>	0.0180** (0.00800)
<i>PriorUsageIrregularity</i>	-0.110 (0.0900)
<i>PriorUsageRecency</i>	0.0222 (0.0264)
<i>OneWeek</i>	0.300** (0.151)
<i>OneMonth</i>	0.294* (0.168)
<i>Gender (Male)</i>	0.108 (0.187)
<i>Age</i>	-0.00278 (0.00631)
<i>PriorMobile</i>	0.407*** (0.146)
<i>InAppUnavailable</i>	0.0510 (0.171)
Constant	0.356 (0.362)
<i>N</i>	1,347
Log likelihood	-850.2

Robust Standard errors in parentheses
 *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

<Table 6> Determinants of Amount of Saving from Subscription-based Plans

Model	Quantile Regression
Dep. Var.	AveSaving
<i>PriorUsageIntensity</i>	0.00289 (0.00255)
<i>PriorUsageIrregularity</i>	-0.0489 (0.0317)
<i>PriorUsageRecency</i>	0.00156 (0.00913)
<i>OneWeek</i>	0.113** (0.0520)
<i>OneMonth</i>	0.0952* (0.0570)
<i>Gender (Male)</i>	0.00335 (0.0659)
<i>Age</i>	-0.00170 (0.00223)
<i>PriorMobile</i>	0.130** (0.0513)
<i>InAppUnavailable</i>	0.0310 (0.0585)
<i>Constant</i>	0.345*** (0.128)
<i>N</i>	1,347
Pseudo R-sq	0.0046

Robust Standard errors in parentheses
 *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

5.2 Renewal and Post-Adoption Behavior

The results of the logit analysis on renewal and its consequent ex post money-savings are summarized in <Tables 7> and <Tables 8>, respectively. The positive estimate of *SavingAdoption* in <Table 7> indicates that consumers' cost-saving experience in prior enrollment motivates renewal. <Table 8> shows that cost-saving from renewal is highly related to *ex post* transactions on initial enrollment. That is, users who benefit from initial enrollment are likely to acquire the same advantage from re-subscription. This rational tendency suggests the presence of sorting-out effects derived from learning.

<Table 7> Renewal Decision

Model	Binary logit
Dep. Var.	Renew
<i>PriorUsageIntensity</i>	0.0458*** (0.00937)
<i>PriorUsageIrregularity</i>	0.137 (0.0938)
<i>PriorUsageRecency</i>	-0.0289 (0.0256)
<i>SavingAdoption</i>	1.333*** (0.124)
<i>Gender</i>	-0.0285 (0.183)
<i>Age</i>	0.00396 (0.00633)
<i>PriorMobile</i>	0.182 (0.149)
<i>InAppUnavailable</i>	-0.296* (0.165)
<i>Constant</i>	-1.148*** (0.377)
<i>N</i>	1,347
Log likelihood	-831.3

Robust Standard errors in parentheses
 *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

<Table 8> Cost-Benefit Analyses Upon Renewal

Model	Binary Logit
Dep. Var.	(1) SavingRenew
<i>PriorUsageIntensity</i>	0.0161 (0.0123)
<i>PriorUsageIrregularity</i>	-0.115 (0.149)
<i>PriorUsageRecency</i>	0.00257 (0.0462)
<i>SavingAdoption</i>	1.222*** (0.207)
<i>Gender</i>	0.0608 (0.312)
<i>Age</i>	0.00391 (0.0108)
<i>PriorMobile</i>	0.156 (0.247)
<i>InAppUnavailable</i>	0.294 (0.311)
<i>Constant</i>	0.372 (0.657)
<i>N</i>	775
Log likelihood	-342.3

Robust Standard errors in parentheses
 *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

How are *ex post* transactions changed by the renewal of flat-fee subscriptions? <Table 9> compares the *ex post* transaction volume for cost-saving consumers and cost-increasing consumers when they renew subscription. Transaction volume is measured by the average price per download, which is inversely related to transaction volume. Consumers who are at a disadvantage in their first enrollment increase their usage (i.e., decrease in price per unit) when they renew subscriptions. This result can be explained as rational updating based on consumers' desire to get their money's worth. On the contrary, the average price per download for consumers who earn benefits at initial adoption increases with renewal. This notable decrease in transaction may be explained by updating based on time-depreciation in enthusiasm or subscription preference. Presumably, flat-fee pricing benefits firms in the long-run.

<Table 9> Mean-reversion

Subgroup	SavingAdoption = 1	SavingAdoption = 0
Dep. Var.	AvePrice (\$)	AvePrice (\$)
<i>Renewal</i>	0.1823 ^{***} (0.02357)	-2.198 ^{***} (0.2670)
Constant	0.1795 ^{***} (0.03359)	6.084 ^{***} (0.3280)
Observations	5,777	2,283
R-squared	0.028	0.136

Robust Standard errors in parentheses
^{***} $p < 0.01$, ^{**} $p < 0.05$, ^{*} $p < 0.1$.

5.3 Effect of in-app Purchase on Contract Choice

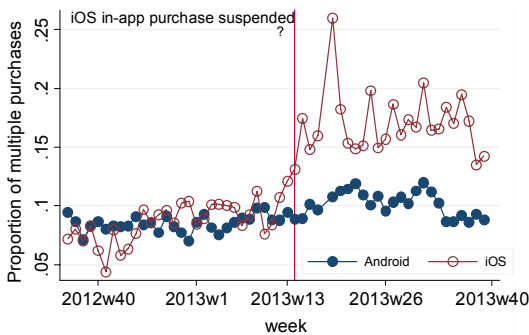
In the earlier section, our analysis on adoption identified that *InAppUnavailable* have a positive effect on subscription decision. Considering a unique feature of the e-book context, we further investigated

the underlying mechanism of the association between contractual decision and the availability of in-app purchase functionality. Prior studies on mental accounting suggest the pain of paying as one source of cognitive flat-fee biased preference (Prelec and Loewenstein, 1998). They predict that consumers prefer to choose a flat-rate contract even though they purchase little if paying per each incident involves large disutility and inconvenience. Our focus here is a unique purchase pattern associated with the in-app purchase unavailability.

In our empirical setting, the mobile users are classified into two groups- in-app purchasable (i.e., Android) users and non-in-app purchasable (i.e., iOS) users. Subjects in both groups are statistically indifferent at a significance level of 0.05 with respect to demographic characteristics and purchase patterns. Except for the in-app purchase availability, all user interfaces are completely indifferent between the two operating versions. The firm has been distributing e-books through both website and native mobile app. The mobile app is not just a reading platform, but also serves as a shopping channel for both iOS and Android users. However, one month prior to the introduction of flat fee plans, the shopping and payment function was removed from iOS apps due to high costs of maintaining this feature. This means that iOS users cannot conveniently purchase titles within the native app, but instead need to browse and pay through mobile web browsers. We speculate that unavailability of in-app purchase will result in larger transaction costs as a result of such payment inconvenience.

The change in the number of multiple item purchases provide suggestive evidence that in-app purchase unavailability may incur transactional disutility. When consumer inconvenience from payment transactions, they are prone to pay a number of items

at once, rather than spreading payment over a number of incidents for each item. <Figure 3> indeed shows a substantial increase of multiple-item purchases just after the suspension of in-app purchase function only among the iOS user group. This is also confirmed from a difference-in-difference estimation as shown in <Table 10>. Here, we extracted single-homing users of Android and iOS. *TreatGroup* is a binary indicator of iOS user (i.e., treatment group). Both groups of iOS users and Android users are measured on the multiple purchases in March 2013, one month



<Figure 3> Suggestive Evidence of Increased Transaction Costs

<Table 10> Effect of In-app Purchase Suspension

	Proportion of multiple purchase
<i>Suspension</i>	0.00989 (0.0107)
<i>TreatGroup</i>	-0.0927 (0.0700)
<i>Suspension</i> × <i>TreatGroup</i>	0.141* (0.0728)
Constant	0.126*** (0.00758)
Observations	2,759
R-squared	0.004

Robust Standard errors, in parentheses
 *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

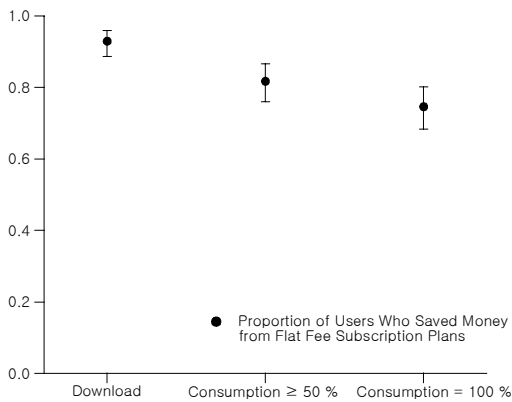
prior to the suspension of in-app purchase within the iOS app. Both groups are again measured in April 2013 after this change in in-app purchase functionality is introduced between the two groups. The positive estimates of the interaction term shows increased multiple-item purchases. This provides empirical evidence on increased psychological transaction cost (i.e., transactional convenience) in non-in-app purchasable users since multiple purchases reflects consumers' desire to avoid frequent payment transactions.

5.4 Robustness Check (Download Versus Consumption)

We acquired the actual consumption data of e-books which have been purchased and downloaded between July 2, 2015 and August 22, 2015 (approximately 7 weeks). This novel data includes user- and book-specific time-series of page number collected when a user closes one's reading app, and we converted such time-series page-number data into a continuous variable (i.e., consumption rate) which is defined as the ratio of the current page number to the last page number of the book. For example, suppose that a book has 100 pages, then 90% of consumption rate indicates that a user completed reading 90 pages of the book.

The result that the proportion of users who saved money from the flat-fee tariffs is still substantially higher than other similar flat-fee contexts is robust to using actual consumption instead of download. By using the e-book consumption data, we re-identified cost-saving conditional on actual consumption of an e-book. To incorporate the varying degree of actual consumption, we have looked at two different threshold levels - 50% (less conservative) and 100% (most conservative) - to determine whether a user

eventually finishes reading a book, and accordingly calculated the *AveSaving* amount variable. <Figure 4> shows proportion of users who saved money from flat-fee subscription plans under the two threshold levels. Results reveal that even under the most conservative criterion (i.e., consumption proportion = 100%), the proportion of users who saved money from the flat-fee tariffs exceeds 80%, which is still substantially higher than approximately 20% in other similar flat-fee contexts such as gym membership.



<Figure 4> Proportion of Users Who Saved Money from Flat Fee Subscription Plans

VI. Discussion

6.1 Implications

This study has a number of implications for research and practice. Although tariff choices and their implications on consumer welfare have been documented in the context of non-digital, service goods, little is known about whether consumers who purchase digital goods (e.g., e-books) are capable of choosing a “sensible” tariff option with the highest utility and about how they arrive at decisions to

renew flat rate plans. The findings indicate that more than 80 percent of e-book consumers gain economic benefits because they are afforded access to a sufficient number of books to justify the expense. An essential issue for consideration however, is that flat fee bias persists in the digital goods market, as indicated by the nearly 20 percent of e-book subscribers who would have saved money had they chosen alternative pricing options. Nevertheless, the extent of the winner’s curse driven by the subscription options in our study is significantly lower than that reported in previous literature wherein 50 to 80 percent of consumers who choose flat rate schedules pay more than they would have under alternative tariff options. Subscription-based digital goods are generally easy to access; by virtue of such accessibility, these commodities therefore also induce frequent consumption, are inherently hedonic and addictive, and offer a wide selection of items (e.g., Amazon’s Kindle Unlimited offers 800,000 titles). Given these enticements, consumers are highly motivated to obtain benefits provided by flat-fee pricing structures. This result accords with the theoretical intuition drawn from the rational choice framework. Short contract durations may also partially explain the higher proportion of consumers who obtain economic surplus versus consumers who choose from relatively longer contracts (e.g., quarterly, semi-annual, annual memberships). When all else is equal, consumers can better predict their future demand structures in the short-term than in the long-term.

An intriguing finding, however, is that the monetary payoffs accrued from flat-rate subscriptions are not necessarily linearly associated with contract duration. An optimal reward is offered to consumers subscribing to a mid-duration contract (1-week) rather than to those who select the high (1-month) or low (1-day) end of the selection. This finding is somewhat

inconsistent with that found by DellaVigna and Malmendier (2006), who revealed that average savings are higher under the annual plan than under a monthly scheme. Although tariff choice has attracted considerable research interest, relatively little attention has been paid to the effects of contract duration on subscription payoffs. Because subscription-based schemes are becoming widely accepted in markets for digital goods, research would be advanced by a more nuanced examination of the identification of optimal contract durations for such products. Furthermore, given the scarcity of empirical evidence for the effects of contract renewal on subscription payoffs, scholars should devote efforts to the longitudinal and dynamic dimensions that typify consumers' tariff choice behaviors. In this regard, our study lays a foundation for further research.

Our findings also present important managerial implications for e-book vendors. The results bring to light important regularities with regard to consumers' tariff choices and renewal patterns, all of which are crucial guiding issues in formulating and refining pricing strategies. The findings suggest that e-book vendors can maximize profits under long-term contracts. E-book retailers are thus advised to review their contract designs and consider extending the contract durations on offer. Sellers should also encourage consumers to renew their subscription contracts because this plan of action not only stabilizes revenue streams, but also enhances the profitability that accrues from consumers' sustained consumption of e-books. Monetary incentives that stimulate contract renewal can be an effective strategy. Some vendors offer automatic renewal, whereas others provide it as an optional service. A caveat here is that although automatic renewal schemes can perpetuate consumer subscription for longer periods, they may discourage new consumers from experimenting with flat-fee

subscriptions. E-book vendors are advised to balance these costs to optimize revenue potential. The findings also provide sellers with insights into how in-app purchase functionalities influence the adoption of flat-fee tariffs for e-book purchases. Vendors may consider offering users special free trial promotions to encourage them to adopt subscription-based pricing plans even when they perceive less need to do so when provided with the convenience of in-app purchase functionalities.

Finally, while our research was conducted in the context of e-book subscriptions, our results have implications for the design of subscription plans for consumers of digital goods ranging from music and movies to newspapers and other types of periodicals where consumers have the choice of individual item purchases versus a flat fee subscription plan for unlimited access to all digital contents on the platform. Further research is needed to examine consumers' ongoing choices of flat-fee subscription plans for access to other types of digital contents that may require less time investment compared to books to fully consume (e.g., a 4-minute song, a 2-hour movie, a 2-page newspaper article etc.).

6.2 Limitations and Further Research

Our study has several limitations that suggest directions for further research. While our study demonstrates strong evidence of an exceptional all-you-can-do case where the tariff-choice bias is not prominent, it still does not explicitly elucidate the underlying mechanism. Are typical cognitive or motivational drivers significantly alleviated in this context? What specific feature of e-books cause such a consequence? Our data-driven approach lacks consumer perception of their own spending and purchases, even though it enables us to examine whether subscribers'

enrollment decisions end up providing corresponding economic utility to prepaid costs in a quantitative manner. An important avenue for future research is to investigate the underlying factors that determine the extent of flat-fee bias by adopting a systematic qualitative inquiry and experimental approach that allows counterfactual interpretation.

Another limitation is potential sample biases in the data. Observational data inherently lacks randomization. Even though we confirmed indifferent purchase patterns and an observable user profile across iOS and Android users, unobservable user characteristics may be confounded in our results for the in-app purchase functionality. Also, the findings need to be interpreted with some caution in terms of generalizability. Our data was collected from a single electronic market that mainly focuses on hedonic commercial fiction e-books. Tariff decisions and their consequences might differ depending on the underlying consumption goals of consumers. Future research could be conducted in broader categories to identify the impact of consumer and product heterogeneities.

VII. Conclusion

The e-book market is currently experiencing a period of dramatic transformation given the emergence of pricing innovations. For many e-book categories, subscription-based tariffs are becoming increasingly popular, indicating their potential to replace traditional a la carte pricing approaches. Despite this radical transition occurring in one of the most active digital goods markets, however, there remains a limited and tenuous understanding of the effects of all-you-can-read pricing on consumer surplus. This study aspires to fill this void by exploring consumer preferences in relation to tariff se-

lection and contract renewal patterns on the basis of novel e-book transaction data. The findings reveal several important empirical regularities. Most e-book users obtain economic benefits from a subscription model, but the gains derived diminish as they opt for renewal. Of the three contract options studied, the 1-week flat-fee service plan provides consumers larger savings than does either the 1-day or 1-month option. Users of mobile platforms that have limited in-app purchase functionalities are more inclined to select subscription-based plans due to increased disutility.

These findings reinforce the need for e-book vendors to ensure that their pricing strategies are congruent with consumers' tariff choice and purchase preferences. Formulating and sustaining effective contract designs are multi-faceted and complex processes that require continuous innovation and improvement. As the production of digital content increases exponentially, the "all-you-can-do" models will become progressively prevalent price structures. Nonetheless, e-book vendors must take advantage of the insights acquired from the all-you-can-eat pizza model, in which consumer satisfaction is inversely related to amount of consumption (Just and Wansink 2011). Consumers may perceive reduced utility as the average unit price of items per consumption diminishes on account of flat rate services. Quantity simply cannot replace quality- a dictum that applies to both physical and digital goods.

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Subscribing to an All-You-Can-Read E-Bookstore: Tariff Choice, and Contract Renewal for E-Book Purchases

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Abstract

E-book markets are currently moving through a period of disequilibrium as new pricing structures (i.e., flat-fee subscriptions) are rapidly embraced by major vendors. On the basis of a novel dataset, we investigate how the availability of “all-you-can-read” pricing programs influences consumers’ tariff choice and contract renewal behaviors. Consistent with the rational choice framework, the findings suggest that most e-book consumers significantly gain from subscription-based tariffs. Power readers prefer flat-fee subscriptions, and those that have economically benefited renew their subscription. However, we also find some other intriguing results. Among the three subscription designs examined, the 1-week plan affords consumers more economic benefits than do 1-day or 1-month programs. Finally, iOS users are more inclined to select subscription models than are Android users because of the absence of in-app purchase functionalities for the former. The unavailability of in-app purchase affects tariff choices and transaction patterns as it increases transaction costs.

Keywords: e-Book, Digital Good, Pricing, Flat-Fee, Subscription Duration

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논문접수일 : 2019년 07월 27일

게재확정일 : 2019년 11월 04일

1차 수정일 : 2019년 10월 21일