Zero-Pricing in Bundle Offers: Evidence of Anti-Competitive Effects in the Telecommunications and Broadcasting Industry

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Abstract

Economists and antitrust practitioners have raised regulatory concerns regarding abuses of market power through the bundling of products in the telecommunications and broadcasting industry. Dominant firms may use bundles to transfer market power from one domain to another, and those leverage effects are intensified in multi-sided markets with constraints on negative pricing. Beyond their potential threat to competition, such marketing practices often entail false advertising whereby market-dominant operators frame bundle discounts as the "free" offer of a product (i.e., zero-price marketing)—a topic that remains relatively underexplored in the literature. By modeling the bundling of products with different levels of market competition in the telecommunications industry, we empirically show that consumers irrationally prefer zero-priced bundles over similarly priced groupings of products, further reinforcing the market power of a dominant player. Consistent with strategic foreclosure theory, we find that a mobile network operator can significantly raise its share in the pay-TV market using zero-price marketing. Such offers of “free” products often have hidden costs incurred by multi-year contractual arrangements and potential lock-in effects due to different contract termination dates among bundled services. Given consumers’ vulnerability to such “free” offers, their growing popularity in the market, and their potential anti-competitive effects, the risks of zero-priced bundles to consumer welfare cannot be ignored.

Keywords: false advertising, zero-pricing, telecommunications product bundles

1. INTRODUCTION

Barriers to entry into the telecommunications industry due to factors such as high initial investment, limited spectrum licenses, and network externality are well known. The development of information and communications technology (ICT) over the past decade has allowed a limited number of major telecommunications service operators to provide a full line of services including fixed voice, mobile, Internet, and subscription television services. The growing prevalence of such product bundling in the telecommunications market has prompted regulatory concerns—primarily regarding whether the practice may result in leverage effects, whereby dominant firms transfer market power from one domain to another—and many countries have strictly regulated sales of the product bundles until such concerns are resolved.

Leverage effects may be strengthened by arguably predatory discounts on bundles. Surprisingly, although regulatory authorities and researchers have investigated the anti-competitive aspect of bundling (e.g., Edelman 2014), market-dominant operators’ excessive discounts and false advertising of bundled products have remained relatively underexplored. Our research focuses on this issue, concentrating on “zero-pricing” strategies used to market telecommunications and broadcasting bundles. As an example, let us suppose that the monthly prices of mobile, fixed broadband (high-speed Internet), and pay-TV services are $60, $20, $20, respectively, but that a telecommunications company offers a bundled “triple-play service” providing all three at a discount of 20%, or $20 off. In such a case, the service operator can advertise that the fixed broadband or cable TV service is being included in the bundle “for free.” As research examining zero-pricing strategies in various industries has shown (e.g., Shampanier, Mazar, and Ariely 2007), consumers may overvalue the “free” product and irrationally prefer the zero-priced bundle to a similar but unbundled assortment of products—even at the same total cost.

The problem with framing bundled products as “free” is not only that it drives such consumer responses, thereby potentially increasing leverage effects, but that it regularly constitutes false advertising. Telecommunications product bundles often incur hidden costs. For instance, consumers may have to pay back the discounts or even pay penalties when they breach bundling contracts, and those penalties make it harder for customers to switch operators. The costs of switching become larger if the commitment periods of individual services in the bundle are not synchronized.

In our empirical evaluation of the effects of false zero-price advertising, we exploited a recent case in the Korean telecommunications industry that paralleled the example described above. In 2010 and 2013, two dominant mobile network operators in Korea, SK Telecom and Korea Telecom, launched bundling plans that offered “free” (that is, fully discounted) Internet services to consumers who subscribed to both mobile and Internet services as a package. In 2015, the Korea Communications Commission judged the advertising for those plans to be false or exaggerated, determining that it deceived consumers, and imposed penalties on both operators. The commission subsequently revised its guidelines that prohibit false advertising to include advertisements using the terms “free” or “zero” with regard to price.

To collect relevant data for our analysis, we designed a conjoint survey in which participants were asked to choose a set of three telecommunications services (mobile, Internet, and TV) from either or both of the two types of operators (i.e., a mobile network operator or a cable operator). It is worth noting that cable operators in Korea provide competitive Internet and pay-TV services but are able to offer mobile services only as mobile virtual network operators (i.e., wireless communications services providers that do not own the network infrastructure their services depend on), which are considered to be of lower quality and less reliable than mobile network operators. Therefore, mobile network operators have an absolute advantage in the competition for mobile services and bundles that include them. The mobile communications service is particularly important in the bundling strategy because revenues and profit margins are larger for mobile services than for fixed-line services, and that higher profit margin grants companies leeway to offer larger discounts on bundles, a practice known as cross-subsidization. Hence, we assume that only mobile network operators have the capacity to implement zero-price marketing by offering a discount equal to the full price of Internet services on mobile + Internet and mobile + Internet + pay-TV bundles.

Our estimation results from a hierarchical Bayesian Markov chain Monte Carlo model support the existence of a zero-price effect with an average monetary value of $4.60. However, a large standard deviation in the effect across consumers indicates that not every consumer overvalues mobile network operators’ “free” Internet. We further conducted simulations to compare preferences between bundles offered with and without zero-price marketing. Consistent with our theoretical prediction, our empirical results show that mobile network operators can lure a significant number of subscribers from cable operators via zero-price marketing, increasing their average revenue per user (ARPU), overall revenue, and adjusted revenue, all without incurring any cost.

The remainder of this paper proceeds as follows. Section 2 describes bundling practices and regulations in the telecommunications industry. Section 3 then briefly reviews the related literature. Section 4 presents our theoretical framework, and Sections 5 and 6 present our data and empirical results, respectively. Section 7 discusses the results and their real-world implications.

2. BUNDLES IN THE TELECOMMUNICATIONS AND BROADCASTING INDUSTRY

2.1 ICT Convergence and Regulations on Telecommunications Bundles

The competitive landscape of the telecommunications industry has rapidly changed in response to technological developments such as the digitalization of networks and high-capacity fixed access networks. The dissolution of boundaries between traditionally separate ICT services, networks, and business practices, known as ICT convergence, has further blurred the boundaries between telecommunications and broadcasting services. For instance, people now watch TV on the Internet and make phone calls using cable Voice over Internet Protocol technology. Consequently, communications service operators have been striving to cover a full line of services including fixed voice, mobile, Internet, and subscription television services through investment into their own networks or mergers and acquisitions.[1]

At the same time, firms have employed product-bundling strategies to maximize economies of scale in production and economies of scope in distribution by providing multiple products simultaneously on a single platform. Consumers who purchase product bundles may benefit not only through discounts but also by avoiding the inconvenience of receiving multiple bills from different firms.[2] In addition, bundling has introduced new and valuable functions through technological convergence (Organisation for Economic Co-operation and Development [OECD] 2011). For instance, consumers can now see their callers' ID or listen to voice mail messages using their television, which is possible only when phone and TV services are sold as a bundle. Consequently, bundling has become increasingly prevalent in the telecommunications industry.

In the European Union (EU), telecommunications bundles reached a household penetration rate of 50% by 2015 (European Commission 2015). This new prevalence has been driven by the convergence of mobile telephony and fixed telecommunications services in the marketplace. In Korea, mergers and acquisitions among wired and wireless telecom affiliates have been actively pursued, and for the most part, regulations on telecommunications bundles have been

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[1]In one well-known example from 2015, the acquisition of satellite television provider DirecTV enabled AT&T to provide nationwide television services in connection with its existing service, U-verse, raising concerns about the diminishing number of companies in the United States controlling access to information services (https://www.forbes.com/sites/greatspeculations/2015/07/27/att-closes-directv-acquisition-reviewing-the-concessions-and-benefits/#2076e97952cc).

[2]According to a household survey conducted in 2011, EU citizens value two main advantages of bundled telecommunications services: first, the convenience of having only one bill, and second, the lower cost for bundled services compared with the services as sold separately (European Commission 2011).

relaxed since 2007. As a result, the penetration rate of telecommunications bundles in Korean households has dramatically risen, reaching 86% in 2015, far higher than the rate in the EU (Korea Information Society Development Institute 2016).

At the same time, regulatory concerns regarding the potential abuse of market power through bundling have been raised. Many countries including France, the United Kingdom, and Japan have strictly regulated the provision of telecommunications bundles to avoid dominant providers' abuse of bundling strategies. For instance, France regulated the sale of fixed-mobile bundles by Orange, the country's dominant mobile telecommunications service operator, and allowed them only after the company's market dominance weakened (Autorité de la Concurrence 2009). Even after allowing sales of the bundled products, authorities have continuously monitored for anti-competitive factors such as lock-in effects (caused by excessive switching costs), exclusion of competitors, and club effects (whereby individuals primarily call other members of their "calling club"—mostly friends, family, and coworkers—coordinate on the same network, and then prefer to stay with that network; Gabrielsen and Vagstad 2008). Ofcom, the regulatory authority of the UK telecommunications market, prohibited British Telecom, the UK's dominant fixed-line service provider, from selling discounted fixed-service-included bundles until 2009, when the company was judged to no longer have "significant market power" in the majority of the nation's retail landline markets (Ofcom 2009). In Japan, NTT Docomo, a dominant telecommunications company, was allowed to offer bundled mobile and broadband services only after its market share plummeted ("NTT Docomo Bundles Mobile and Broadband," 2015).

In the Korean communications market, virtually all bundled products were prohibited until 2007, when bundled sales were allowed as long as their discount rates did not exceed 10%.

As evaluations by regulatory authorities continued to find no suppression of competition in the market, the maximum discount rate was gradually increased to 20% in 2008 and to 30% in 2009. Also in 2007, the US Antitrust Modernization Commission proposed prohibiting sales of bundled competitive products below their incremental cost after allocating all the discounts and rebates attributable to the bundle.

Concerns about the potential abuse of market power through bundling have become a crucial issue in the merger of communications firms. For instance, the Portuguese government carefully investigated the impact of mergers between Zon and Optimus and between Altice and PT Portugal on competition in the market for bundled products—in particular, triple-play bundles. Pereira et al. (2013) empirically showed that the market for triple-play bundles in the Portuguese telecommunications industry constitutes a relevant product market.[3] In line with these findings, Pereira et al. suggested that future regulatory actions must take into consideration the potential existence not only of markets of products consisting of individual services but also of markets of products consisting of bundles of services. Indeed, the OECD (2011, 2015) has recommended that the regulatory authority of each country should determine the possible harms of telecommunications bundles and perform regulatory activities such as securing the transparency of prices, lowering switching costs, and prohibiting bundling strategies as a means of market-power transfer.

2.2 The Growing Use of False Zero-Price Advertising

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[3]In many antitrust cases, the market relevant to the case needs to be defined. A relevant product market in this context is defined as a set of products that are substitutable and therefore hinder marketers' attempts to raise prices on any one of the products alone.

Zero-pricing has been used as an effective marketing strategy in various industries—for instance, in the form of "buy one, get one free" offers in the retail markets for grocery items, clothing, cosmetics, and more. When the term "free" indicates only that the consumer is paying nothing for an additional product, and that no more than the regular price for the item or items it accompanies is charged, no concerns about consumer welfare arise.[4] However, when a firm describes the bundle discount as a "free offer" and deludes consumers into believing that a component of the bundle is provided for free, consumer welfare is put at risk. Indeed, most bundle services in the telecommunications industry are offered with a contractual arrangement that may involve hidden costs. For example, if consumers choose to terminate or change their service plan before a 2- or 3-year contract ends, they may have to pay back the original discount and may also have to pay additional penalties. Unsubscribing from any of the services in the bundle will be even harder if their contract termination dates differ. The threat to consumer welfare in the form of losses caused by false advertising cannot be ignored, particularly given the large and increasing proportion of household spending devoted to telecommunications services: As of 2011, the average percentage of total household consumption expenditures devoted to ICT goods and services in 29 countries was estimated at around 4.9% (OECD 2013).

This zero-pricing strategy has been observed in the telecommunications industry because the coexistence of highly profitable products (mobile services and devices) and cheap products (Internet, in Korea) in the market make it possible for providers to offer discounts on bundles that

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[4]As determined in the US Code of Federal Regulations, the public generally understands that, except in the case of introductory offers, an offer of "free" merchandise or services is based on the payment of the regular price for merchandise or services, which must be purchased by consumers who wish to avail themselves of the "free" component (Code of Federal Regulations, 1971).

exceed the price of component products. For example, when service operators promote a triple-play service bundling mobile, Internet, and TV, the total amount of the bundle's discounts equals the stand-alone cost of Internet, which allows companies to mislead consumers into perceiving the Internet broadband service as "free." As described in the introduction, the Korea Communications Commission intervened in the Korean bundle market in 2015, judging that such offers of "free" Internet services constitute false or exaggerated advertising and prohibiting the terms "free" and "zero price" in advertisements for bundled services.

3. THEORETICAL BACKGROUND

3.1 Welfare-Reducing Effects of Bundling: Perspectives from the Literature and Law

Bundling refers to a firm's strategy to sell more than one product in a package. In contrast to "pure bundling," which requires consumers to purchase products only as a package, "mixed bundling" allows products to be sold either as part of a bundle or separately, and is often considered beneficial or at least neutral to competition. However, when the price discounts offered with bundles are so large that purchasing the component products individually would make no sense, mixed bundling becomes "forced" pure bundling.

Concerns about the anti-competitive effects of forced bundling have been voiced by scholars and antitrust practitioners for over a century. Proponents of "leverage theory" argued that bundling is bad for consumer welfare because it allows monopolistic firms with market power in one product (referred to as the "bundling product") to transfer that power to a complementary and competitive product (the "bundled product") by bundling the two together. Motivated by such concerns, US courts have repeatedly found the tying of various products (e.g., sprocketed projector with film in *Motion Pictures Patents Co. v. Universal Film Mfg. Co.,* 1917; accounting machines with paper punch cards in *International Business Machines Corp. v. United States*, 1936; and salt processing machines with salt in *International Salt Co. v. United States,* 1947) to be unlawful.[5] Furthermore, the US Supreme Court stated that tying was per se illegal in *International Salt Co. v. United States* and *Northern Pacific R. Co. v. United States* (1958).

This view of per se illegality of bundling has been challenged since the Chicago School criticized traditional leverage theory (e.g., Director and Levi 1956; Posner 1976; Bork 1978). The main argument of the Chicago School can be summed up by the phrase "single monopoly profit," which refers to the idea that a monopolist in the bundling-product market cannot monopolize the bundled-product market without an overall loss in profits from both. Relatedly, in *Jefferson Parish Hosp. Dist. v. Hyde* (1984), the Supreme Court confirmed the continued role of a per se analysis, but it required stricter conditions for per se illegality. Furthermore, in the *Illinois Tool Works Inc. v. Independent Ink, Inc.* (2006), the Court acknowledged that "[m]any tying arrangements . . . are fully consistent with a free, competitive market" (DOJ, accessed 21 June, 2017).[6]

Since game theory was adopted in antitrust research in the 1980s, however, the leverage theory of bundling has been revisited. For instance, Whinston (1990), an advocate of "strategic foreclosure theory," showed that a monopolistic firm could use bundling to deter competitors'

[5] Note that many of the cases discussed here referred to "tying" rather than "bundling." "Tying" is sometimes used by economists specifically when the proportion of individual products that are purchased is not fixed; however, the two terms are generally interchangeable.

[6] https://www.justice.gov/atr/chapter-5-antitrust-issues-tying-and-bundling-intellectual-property-rights#N_21_

entry into a market or drive them out altogether. If consumers prefer purchasing bundles, and the monopolist sells the bundled product only along with the bundling product, then the market may not be big enough for an entrant that sells only the bundled product, even if that product is of better quality or provided more efficiently, because it can be sold only to consumers who do not wish to buy the bundling product (Carlton and Waldman 2002).

Bundling's risks to consumer welfare do not stop there. Firms that use bundling strategies to leverage market power may also suppress dynamic competition. The US Department of Justice argued in *United States v. Microsoft Corp.* (2001) that a purpose of Windows Explorer bundling was to prevent Netscape from threatening Microsoft's monopoly on operating systems (Nalebuff 2008). As seen in the Microsoft case, bundling can discourage research and development and innovation among rival firms.

As many researchers have shown, product bundling has effects and incentives similar to those of price discrimination, such that it allows companies to maximize profits from consumers with heterogeneous preferences between two products (Adams and Yellen 1976; Bakos and Brynjolfsson 1999; McAfee, McMillan, and Whinston 1989; Stigler 1963; Schmalensee 1984). Like price discrimination, bundling is not uniformly negative—it can be profitable for firms and can increase consumer welfare by making goods available that otherwise would not be provided—but it can also leave consumers worse off because it allows firms to extract additional money from consumers (that is, consumer surplus) by designing more customized price schemes through bundling. Further, bundling can be a means of product differentiation, which may soften competition and thus decrease consumer welfare.

3.2 The Psychology of Zero and of Free Products

The most influential research on human psychology surrounding the concept of zero is Kahneman and Tversky's (1979) study on probabilities, which revealed the existence of a substantial and disproportionate difference between perceptions of zero probability and of very small probability in the context of gambling. Research in other domains has revealed ample evidence that the transition from small positive numbers to zero is discontinuous (e.g., Festinger and Carlsmith 1959). Shampanier et al. (2007) demonstrated the psychology of zero in the domain of pricing, showing that when people were faced with a choice between two products, one of which was free, they tended to overvalue the free product. Specifically, Shampanier et al. contrasted two choice conditions: "cost" and "free." The "free" condition involved a constant difference in the price discounts of two products, such that the lower-valued product's discounted price became zero. Aggregate inconsistency in participants' preferences between the two conditions revealed that, on average, preferences for the free product were contingent on its being free.

Whereas Shampanier et al. (2007) examined the zero-price effect only as it applied to two separate, individual products, other researchers have explored the effect in the context of bundles (e.g., Chandran and Morwitz 2006; Darke and Chung 2005; Nunes and Park 2003; Nicolau and Sellers 2012). Specifically, these studies have considered bundling products offered as part of a volume discount (e.g., a "buy two, get one free" offer) or as a complimentary service (e.g., free breakfast offered to guests at a hotel, free shipping costs for online shoppers). Results have shown that promotions promising a "free" product or service induce greater intentions to purchase among consumers compared with monetary discounts (even if the ultimate cost for the consumer is the same), supporting the existence of the zero-price effect in the bundling context. To the best of our knowledge, however, the literature contains no explorations of whether the zero-price effect emerges in the context of the bundling of products from industries with different levels of market competition. The telecommunications industry offers just such a bundling context. We conjecture that consumers may irrationally prefer zero-priced bundles over similarly priced groupings of products, and that preference may intensify the leverage effect of bundling in the telecommunications industry.

3.3. Anti-Competitive Effects of Zero-Pricing

Offers of free goods can be driven by either for-profit or non-monetary motives. Some of those motives, mostly for-profit motives, raise anti-competitive concerns. For instance, a widely shared concern in multi-sided markets is that below-cost pricing on one side may attract enough consumers for the other, profit-generating market to be tipped. Another relatively new regulatory issue is that information acquired through zero-pricing (e.g., information on consumers' preferences gleaned through their search histories) can be an entry barrier for certain downstream markets (e.g., AI-assisted online shopping); recently, French and German antitrust authorities published a joint research paper that identified access to a big data as a source of market power and discussed anticompetitive conducts, such as mergers and exclusion, related to the use of such data (Autorité de la concurrence and Bundeskartellamt, 2016).

In this study, we focus specifically on the anti-competitive effects of zero-pricing in the form of bundle discounts. Monopolistic firms may sell the individual component products of bundles at prices higher than they would have been but for the bundle discount, thereby forcing consumers to buy the bundle. If the price of such a component product exceeds its but-for price, and the firm has market power, then bundle discounts may represent the same anti-competitive threat as forced bundling (Elhauge 2009). However, our analysis does not consider cases in which firms deceive consumers in such a way. Given that price cuts are usually pro-competitive unless they are predatory, what are the possible anti-competitive effects of providing discounts through zero-priced bundling?

First of all, zero-pricing amplifies the welfare-reducing effects of bundling. As described above, bundling in general may drive exclusion effects, but with zero-pricing, a dominant player can achieve the goal of exclusion more easily (with less loss), given that consumers irrationally prefer zero-priced goods. Furthermore, the entry of new businesses into the market will be more difficult if consumers become used to paying "zero" for a bundled good. And increased switching costs are more easily disguised with bundles, given that consumers may take the free good as a "gift" without recognizing the costs that will be incurred if they "untie" the bundle.

The leverage effects of zero-pricing with bundles are salient when the bundling good is provided in multi-sided markets and there is a non-negative price constraint. Negative pricing can be rationalized in multi-sided markets when the loss on one side can be recouped from other sides, but such monetary subsidies may be impractical when opportunistic consumers receive them yet fail to match with customers on the other sides (e.g., a shopping mall can offer free gifts to attract customers, but customers might not actually purchase products from shops at that mall after taking the gifts). To overcome non-negative price constraints, firms can provide free complements with purchased products (Amelio and Jullien 2012).

Choi and Jeon (2016) recently showed that there are incentives for monopolistic firms to bundle their monopolized product with another product in a two-sided market with a non-negative price constraint. Under such conditions, firms do not bear negative profits from any side of the two-sided platform; thus, an additional surplus can be extracted through bundling. A non-negative price constraint also limits the aggressive response of rival firms to the monopolist's bundling using zero-pricing or negative pricing. Broadcasting is a well-known example of a two-sided market, and the development of mobile Internet has made mobile communications a multi-sided business. Therefore, a telecommunications or broadcasting operator has an incentive to offer bundles with free complements and thereby limit its competition.

Rival firms in a bundled-product market cannot respond aggressively in the long run if monopolistic firms can maintain zero-pricing through cross-subsidies from the monopolized bundling-good market. For example, in Korea, per-subscriber profits are much higher for mobile telecom services than for pay TV. Therefore, Korean mobile telecommunications operators can provide free TV to exclude competing cable TV service providers and still draw positive net profits from the bundle. Even if rival firms survive in the long run, zero-pricing may thus mute price competition. The effects of dampened price competition on consumer welfare are mixed. On the one hand, limited price competition can lead to more quality competition, which can benefit consumers. But on the other hand, zero-pricing can lower the quality of products by squeezing companies' profits (Gal and Rubinfeld 2016).

4. A SIMPLE THEORETICAL MODEL: TWO FIRMS AND TWO PRODUCTS

As a simple theoretical model, we applied the zero-price model (Shampanier et al. 2007) to a context in which two hypothetical firms compete against each other with a mixed bundling strategy.

Specifically, we consider two competing firms (X and Y), each of which sells two products (A and B) and allows consumers to purchase A and B either as a bundle or individually (i.e., mixed bundling). Assuming that consumers need both products (e.g., mobile and Internet services), regardless of which firm sells them, consumers can choose any one of the following four alternatives: (1) a bundle of Products A and B from Firm X ($A^X B^X$), (2) a bundle of Products A and B from Firm Y ($A^Y B^Y$), (3) Product A from Firm Y and Product B from Firm X ($A^Y B^X$), or (4) Product A from Firm X and Product B from Firm Y ($A^X B^Y$).

Now suppose that each firm j provides individual product i at price p_i^j and that both firms provide the same price discount δ for the bundle. Consumers value the product i of firm j at V_i^j $(i = A, B,\ j = X, Y)$, with the value of Products A and B being linearly additive. For computational simplicity, we define a differenced value between firms, V_A and V_B, and a differenced price between firms, $\overline{p_A}$ and $\overline{p_B}$, as

$$V_A \equiv V_A^X - V_A^Y,\ V_B \equiv V_B^X - V_B^Y,\quad \overline{p_A} \equiv p_A^X - p_A^Y,\quad \overline{p_B} \equiv p_B^X - p_B^Y.$$

For example, a consumer prefers $A^X B^X$ over $A^Y B^Y$ $(A^X B^X \succ A^Y B^Y)$ if and only if

$$(\quad V_A^X + V_B^X) - (p_A^X + p_B^X - \delta) > (V_A^Y + V_B^Y) - (p_A^Y + p_B^Y - \delta)$$

$$\Leftrightarrow V_A + V_B > \overline{p_A} + \overline{p_B}. \qquad (1a)$$

Similarly, we can derive other conditions as follows:

$$A^X B^X \succ A^X B^Y \Leftrightarrow V_B > \overline{p_B} - \delta \qquad (1b)$$

$$A^X B^X \succ A^Y B^X \Leftrightarrow V_A > \overline{p_A} - \delta \qquad (1c)$$

$$A^Y B^Y \succ A^X B^Y \Leftrightarrow V_A < \overline{p_A} + \delta \qquad (1d)$$

$$A^Y B^Y \succ A^Y B^X \Leftrightarrow V_B < \overline{p_B} + \delta \qquad (1e)$$

$$A^X B^Y \succ A^Y B^X \Leftrightarrow V_A - V_B > \overline{p_A} - \overline{p_B} \ . \qquad (1f)$$

Thus, consumers will choose alternative $A^X B^X$ if inequalities (1a), (1b) and (1c) hold, alternative $A^Y B^Y$ if inequalities (1d) and (1e) hold but (1a) does not hold, alternative $A^X B^Y$ if inequality (1f) holds but (1b) and (1d) do not hold, and alternative $A^Y B^X$ if inequalities (1c) and (1e) hold but (1f) does not hold. Given that V_A and V_B of consumers are heterogeneously distributed, we can illustrate segments of consumers choosing different alternatives in a two-dimensional space. As seen in Figure 1, there exist four mutually exclusive segments, each of which corresponds to consumers selecting one of the four alternatives.

<Figure 1 about here>

Taking into account that a firm's excessive discounts on a bundled product can expand its dominance in one market to another, relatively competitive market, we next consider the following situation. Firm X has a competitive advantage in Product A and dominates the market (similar to mobile network operators in the mobile market), whereas Firm Y is competitive in the market for Product B (similar to cable operators in the pay-TV market): $V_A > 0$ and $V_B < 0$. Thus, only Firm X is able to conduct zero-price marketing, offering a discount that equals the full price of Product B and advertising Product B as "free." Because the bundled product is presented as free, consumers' intrinsic valuation of bundle increases by α (> 0), as in Shampanier et al.'s (2007) zero-price model. Then, the conditions (1a), (1b), and (1c) are replaced by (2a), (2b), and (2c):

$$A^X B^X \succ A^Y B^Y \Leftrightarrow V_B > \overline{p_A} + \overline{p_B} - \alpha \tag{2a}$$

$$A^X B^X \succ A^X B^Y \Leftrightarrow V_B > \overline{p_B} - \delta - \alpha \tag{2b}$$

$$A^X B^X \succ A^Y B^X \Leftrightarrow V_A > \overline{p_A} - \delta - \alpha. \tag{2c}$$

Figure 2-1 presents the demand distribution when zero-price marketing is not legally allowed. Figure 3-2 presents the changes in the choice-based segments of consumers when Firm X can engage in zero-price marketing, consisting in the widespread switching of consumers from $A^Y B^Y$ and $A^X B^Y$ to $A^X B^X$. This implies that Firm X can easily lure consumers from Firm Y using zero-price marketing even without changing the price of the bundling product. Furthermore, Firm X can benefit from up-selling and, potentially, from lock-in effects, because consumers who previously purchased only Product A from Firm X are now also purchasing Product B through the bundle.

<Figure 2-1 and 2-2 about here>

5. DATA AND EMPIRICAL SETTING

5.1 Data Description

To empirically evaluate the effect of zero-price false advertising, we conduct a conjoint analysis. Note that the conjoint survey avoids the biases that might result from having a questionnaire directly ask consumers to purchase a product, instead presenting a situation that is as close as possible to the consumers' actual purchase choice (McFadden 2001). In collaboration with Korea Research Inc., we recruited a sample of 1,000 Korean residents using a proportionate stratified sampling method.[7] Although all respondents were asked to select all of three services (mobile, Internet, and pay TV), they were free to choose the type of service provider for each (i.e., mobile network operator or cable operator) and how the products would be bundled (i.e., they could subscribe to all products singly, subscribe to two bundled services—known as a "double-play service"—and one single service, or subscribe to a triple-play service). In Table 2, we provide the 14 combinations of service plans available as options in the survey.

<Table 2 about here>

Among the 14 service plans available as options, we created variations in the prices of service plans and the discount rates of bundles. Although each conjoint card presented a service plan of mobile, Internet, and pay-TV services with various prices and discount rates, respondents were fully informed of the following characteristics of all three services as well as the discount rates associated with bundles before participating in the conjoint survey. Because mobile network operators in Korea typically require purchasers of zero-price bundles to have at least two mobile subscriptions—for themselves and for at least one family member—the monthly charges for mobile service were set to range between $80 and $100,[8] or twice the basic mobile service price. Internet broadband speed was set at 100 Mbps, and the price of the Internet service was set to range between $20 and $30.[9] In the case of pay TV, the price—whether for Internet Protocol television

[7]Strata were distributed according to a stratification scheme based on age cohort (20–29, 30–39, 40–49, and 50–59), region (Seoul, Busan, Daegu, Gwangju, and Daejeon), and gender.

[8]We conducted the conjoint survey with prices expressed in Korean currency, won. For easier interpretation of monetary values, we converted the Korean won into US dollars at the exchange rate of 1,000 KRW= 1 USD. Note that $1 is approximately equal to 1,145 won as of July 2, 2017.

[9]100 Mbps services are the average standard in urban Korean homes, and the companies within the country are rapidly rolling out 1 Gbps connections at $20 per month, which is roughly 142 times as fast as the world

from a mobile network operator or digital cable from a cable operator—was set to range between $15 and $20. (See Table 6 for detailed information on prices.) Consistent with regulations on the discount rate of bundled services in Korea, we set the discount rate of bundles at up to 30% of the total price. Specifically, there were five types of discount: no discount, 10% off, 20% off, 30% off, and free Internet. The free-Internet option was available only when the market-dominant mobile network operator offered bundled mobile and Internet services (i.e., as a discount option with Service Plans 7 and 13, as shown in Table 2).[10]

For each choice task, a respondent chose one of the three sample cards presented. Choice tasks were repeated 15 times for each of 1,000 respondents, for a total of 15,000 observations in the sample. Example conjoint cards representing the options in a single choice task are shown in Figure 3. Card 1 represents the choice of subscribing to bundled double-play mobile and Internet services from a mobile network operator and pay TV from a cable operator, with no bundle discount. In this case, the cost to consumers is $120. Card 2 represents the choice of subscribing to mobile service from a mobile network operator and double-play Internet and pay TV from a cable operator with a 20% discount, for a final cost of $80. Card 3 shows the subscription choice of a triple-play service from a mobile network operator with free Internet. In this case, respondents estimate the final price to range from $100 to $110, knowing that the basic price of Internet is

average and 79 times as fast as the average speed in the United States as of 2016.

[10] In Korea, mobile network operators' provision of Internet Protocol TV service is conditional on a subscription to Internet service because the TV service requires Internet access, and a cable operator can provide a mobile service only as a mobile virtual network operator. Thus, we exposed respondents to a situation that is as close as possible to real-world conditions.

between \$20 and \$30.

<Figure 3 about here>

5.2 A Random-Coefficients Logit Model

The indirect utility function of consumer i ($i = 1,2,\cdots,N$) choosing service plan j ($j = 1,2,\ldots,J$) at time t ($t = 1,2,\ldots,\mathrm{T}$) can be expressed as follows:

$$U_{ijt} = ap_{ijt} + B_i X_{ijt} + \epsilon_{ijt}$$

$$= \alpha p_{ijt} + \beta_i^1 \cdot Zero_{ijt} + \beta_i^2 \cdot Bundle_{ijt} + \beta_i^3 \cdot Brand_{ijt} + \epsilon_{ijt} \quad (3)$$

where p_{ijt} represents the total price of the service plan; $Zero_{ijt}$ is an indicator variable that takes the value of 1 if the service plan j is offered under zero-price marketing; $Bundle_{ijt}$ is the 4×1 vector of indicator variables, in which each variable represents the specific bundle composition; $Brand_{ijt}$ is the 6×1 vector of indicator variables, in which each variable takes the value of 1 if the service (whether bundled or separate) is provided by a mobile network operator; and ϵ is the error term following Type-I extreme value distribution.

We estimate a fixed parameter α and individual parameter B_i of the random-coefficients logit model using a hierarchical Bayesian approach, following Train (2009). Without any prior information on the sign of each parameter, we assume $B_i \sim MVN(b, W)$ (Allenby and Rossi 1998). The probability of the consumer's choice sequence, $y_i = \{y_{i1}, y_{i2}, \ldots, y_{iT}\}$, given α and B_i is expressed as

$$L(y_i|\alpha, B_i) = \prod_t \frac{e^{\alpha p_{iy_{it}t} + B_i X_{iy_{it}t}}}{\sum_j e^{\alpha p_{ijt} + B_i X_{ijt}}}. \quad (4)$$

The prior on mean b is assumed to follow a diffuse normal distribution (i.e., with an extremely large variance), and the prior on variance W is the diffuse inverted Wishart, both of which are natural conjugate priors for convenience (Allenby and Rossi 1998). We estimate a fixed parameter for price to avoid problems in inferring the monetary value for each component of a given service plan (Train 2009). For example, when an individual price sensitivity is estimated to be close to zero, the implied monetary value can be extremely high.

For estimation, we use Gibbs sampling (e.g., Casella and George 1992; Geman and Geman 1993) for b, W, α, and θ_i at i = 1, …, N, where the posterior is

$$b, W, \alpha \ \ , and \ \ B_i \ \text{ for } \ i = 1, \ldots, N \ \ \propto \prod_{i=1}^{N} L(y_i|B_i) \cdot \varphi(\,B_i|b, W) \cdot \text{prior}(b, W) \qquad (5)$$

with the layers of the Gibbs sampling for the four sets of parameters constructed as follows:

$$B_i|\alpha, b, W \qquad \forall i = 1, \ldots \ , N$$

$$\text{b}|W, B_i \qquad \forall i = 1, \ldots \ , N$$

$$W|b, B_i \qquad \forall i = 1, \ldots \ , N$$

$$\alpha|B_i \qquad \forall i = 1, \ldots \ , N. \qquad (6)$$

The first layer for each individual-specific parameter $B_i|a, b, W$ utilizes the Metropolis-Hastings algorithm (e.g., Chib and Greenberg 1996; Hastings 1970). With the Bayesian method, we can make inferences at the individual level of decision units (Allenby and Rossi 1998) and characterize the degree of uncertainty in these inferences without relying on asymptotic approximations as classical methods do, because the distribution rather than the point estimate is estimated (Rossi and Allenby 2003). Note that estimating individual-specific parameters using classical methods is considerably more computationally demanding than using the full Bayesian method (Allenby and Rossi 1998). Furthermore, under mild conditions, Bayesian procedures can attain consistency and efficiency with regard to the number of draws used in a simulation (Rossi and Allenby 2003; Train 2009). Finally, compared to classical methods, Bayesian procedures can handle full covariance matrices while avoiding computational failures in locating the maximum likelihood (Train 2009).

6. RESULTS AND DISCUSSION

6.1 Estimation Results

We present parameter estimates in Table 2. First, we find that the price coefficient is significantly negative (-0.067) and that the zero-price effect (0.308) is significantly positive. Thus, the monetary value associated with the zero-price effect is \$4.60 (0.308/0.067), on average.[11] That is, when consumers perceive one of the bundle products as free, they attribute to the bundle an additional monetary value of \$4.60. Interestingly, even though the mean value of the zero-price effect parameter is positive, its standard deviation is quite large (1.531). This indicates that a certain proportion of consumers may evaluate zero-price marketing negatively.

<Table 2 about here>

Our estimation results suggest that most of the bundles have lower utility than groupings of individual subscriptions. In particular, double-play mobile and Internet and triple-play service bundles show significant ($p < .05$) negative bundle effects. This could potentially be explained as

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[11]We compute the monetary value for each component of each service plan following Small and Rosen (1981).

resulting from consumers' uncertainty about penalties for violating contracts and lock-in effects, which might overwhelm attractive aspects of bundling (e.g., the convenience of having only one bill).

Brand effects for separate products turns out to be consistent with norms in the industry, whereby consumers generally tend to prefer mobile services from mobile network operators and pay TV from cable operators. We also find that consumers prefer every bundling product provided by a mobile network operator over that provided by a cable operator. In particular, the double-play mobile and Internet services and triple-play bundles show high brand effects, implying that mobile network operators' bundling products have a competitive edge due to the companies' market dominance in mobile service.

6.2 Two-Product Setting

Corresponding to our theoretical model presented in Section 4, the objective of two-product setting is to (1) show the effect of zero-pricing on consumers' choices, both intuitively and graphically, and (2) provide empirical evidence for our theoretical model. To reduce the three types of products to two types of products (i.e., such that consumers choose between four alternatives: $A^X B^X$, $A^Y B^Y$, $A^Y B^X$, and $A^X B^Y$), we treat double-play Internet and TV as one product. Thus, our mobile network operator is represented as Firm X, our cable operator as Firm Y, mobile service as Product A, and double-play Internet and pay TV as Product B. The parameter estimates in Table 2 show that the brand effect of mobile service is significantly positive (0.349), and the summed brand effect of Internet and pay TV is significantly negative (-0.632). Such results are consistent with the fact that cable operators in Korea (represented by Firm Y here) provide competitive Internet and pay-TV services (Product B) but are able to offer mobile services (Product A) only as mobile virtual network operators, which are considered inferior to mobile network operators (represented by Firm X). That is, mobile network operators in Korea have an advantage in the competition for mobile-inclusive bundles.

Recall that mobile service is particularly important in the bundling strategy because the revenue and profit margin of mobile service are larger than those of fixed-line services, which gives a company dominant in the mobile market latitude to offer a excessive discount on bundles in the form of zero-price marketing. Therefore, based upon the parameter estimates, we compare consumers' choices under two scenarios—one in which zero-price marketing is not feasible (no-zero-pricing scenario) and one in which zero-price marketing is feasible (zero-pricing scenario), but only for the market-dominant mobile network operators for Alternative 1 ($A^X B^X$). In Figure 4-1 and Figure 4-2, we provide scatter plots depicting consumers' predicted choices in the no-zero-pricing scenario and the zero-pricing scenario, respectively. In Figure 4-2, we plotted predicted choices only for consumers who chose $A^Y B^Y$ or $A^X B^Y$ in the no-zero-pricing scenario. Despite the heterogeneous distributions of the zero-price effect and the bundle effect among consumers, we find that the switching patterns of consumers are in line with our theoretical predictions depicted in Figure 2-1 and 2-2.

<Figure 4-1 and 4-2 about here>

Table 3 presents the specific changes in consumer segments. Overall, a significant proportion of consumers switch to $A^X B^X$ under the zero-pricing scenario.[12] Specifically, 263 out

[12]Some participants selected Alternative 3 in the zero-pricing and no-zero-pricing scenarios. This results is

of 738 consumers who choose $A^Y B^Y$ under the no-zero-pricing scenario switch to $A^X B^X$ under the zero-pricing scenario, and 12 out of 87 consumers who choose $A^Y B^X$ under the no-zero-pricing scenario switch to $A^X B^X$ in zero-pricing scenario. Also, 2 out of 10 people who choose $A^X B^Y$ in the no-zero-pricing scenario switch to $A^X B^X$. Interestingly, we observed that a small number of consumers who previously chose $A^X B^X$ switch to another service plan, which indicates that the zero-price effect is negative for some consumers.

<Table 3 about here>

Table 4 shows parameter estimates and average demographic profiles for each segment. Here, $Segment_{i \to j}$ refers to the group of participants who choose Alternative i in the no-zero-pricing scenario and choose Alternative j in the zero-pricing scenario. Comparing $Segment_{A^Y B^Y \to A^X B^X}$ and $Segment_{A^Y B^Y \to A^Y B^Y}$, the zero-price effect of $Segment_{A^Y B^Y \to A^X B^X}$ is much larger (1.333) than average (0.311), whereas the zero-price effect of $Segment_{A^Y B^Y \to A^Y B^Y}$ is negative (-0.242). In other words, among the consumers who choose $A^Y B^Y$ in the no-zero-pricing scenario, those who respond positively to zero-price bundling switch to $A^X B^X$ in the zero-pricing scenario. Since $Segment_{A^Y B^Y \to A^X B^X}$ has a zero-price effect with a monetary value of almost \$20, the cable operator would have to provide a substantial discount of \$20 to recover that segment. Similar principles apply to $Segment_{A^X B^Y \to A^X B^X}$ and $Segment_{A^X B^Y \to A^X B^Y}$, although there is only a small number of observations for each case. Note that the behavior of some

counterintuitive because people prefer mobile service from mobile network operators over cable operators and prefer double-play Internet and pay-TV services from cable operators over mobile network operators (see parameter estimates in Table 2). This can be explained as revealing a greater-than-average brand effect of this particular double-play bundle.

consumers (e.g., $Segment_{A^X B^X \to A^Y B^Y}$ and $Segment_{A^X B^X \to A^Y B^Y}$) would indicate a dislike of zero-pricing, which implies that mobile network operators may lose some triple-play subscribers through zero-price marketing. The zero-price effect for $Segment_{A^X B^X \to A^Y B^Y}$ and $Segment_{A^X B^X \to A^Y B^X}$ is negative, whereas the zero-price effect for $Segment_{A^X B^X \to A^X B^X}$ is higher than the average. Although there were few differences in the average demographic profiles of consumers across segments, we detected that $\mathrm{Segment}_{A^Y B^Y \to A^X B^X}$ consumers had relatively lower levels of education and income. We thus conjecture that consumers' overestimation of the zero-priced bundle can be partly associated with their level of education. Given that consumers choosing bundle products can hardly opt out of the services due to penalties for violating contracts (i.e., lock-in effects), low-income consumers appear to be vulnerable to such a zero-price marketing.

<Table 4 about here>

As shown in Table 5, estimated market shares under the zero-pricing and no-zero-pricing scenarios indicate that the mobile network operator can lure consumers from the cable operator without any cost by using zero-price marketing. In order to do so without zero-price marketing, the mobile network operator has to offer an additional price discount of approximately $6 on Alternative 1 ($A^X B^X$) (see Columns 5–7). Of note, consumers would pay more for a triple-play service in the zero-pricing scenario than in the $6-discount scenario. Given that consumers' choices stay almost the same across these two scenarios, we can say that zero-price marketing negatively impacts consumer welfare.

<Table 5 about here>

6.3 Simulations with the Full Array of Products

Given that consumers choose among the 14 telecommunications service plans (see Table 2) in the actual market, we estimated the market share of the mobile network operator and the cable operator in the zero-pricing and no-zero-pricing scenarios. The price of service plans was constructed using the average price of three dominant mobile network operators and two cable operators, as shown in Table 6.

<Table 6 about here>

Utilizing 1,000 draws of individual parameter estimates from the Bayesian estimation, we calculated the market shares of the 14 service plans for each draw such that consumers selected the option with the highest choice probability. In Table 7, we provide the simulated market shares after averaging out the market shares computed from 1,000 draws. Note that the mobile network operator's zero-price marketing is applicable only to Service Plan 7 (double-play mobile and Internet service) and Service Plan 13 (triple-play service).

<Table 7 about here>

We find that with zero-price marketing, the market shares of Service Plans 7 and 13 increase by 2.54 and 11.1 percentage points, respectively. Because the changes in market share cannot fully explain changes in profit, we further calculated mean ARPU, revenue, and adjusted revenue[13] for each operator under the zero-pricing and no-zero-pricing scenarios at the firm-

[13]Adjusted revenue is calculated based on guidelines in a report by the Korean Ministry of Science, ICT and Future Planning ("Competition in Korean mobile telecommunications market," 2016). The mobile

product level. Table 8 displays the results.

<Table 8 about here>

The mobile network operator appears to generate higher profits through zero-price marketing.[14] It is worth noting that increases in subscribers to the mobile network operator's triple-play and double-play mobile and Internet bundles drive an increase in the mobile network operator's ARPU. In turn, the cable operator loses its subscribers to the mobile network operator in all double- and triple-play bundles as well as individual services. Critically, the mobile network operator steals 17.1% of the cable operator's triple-play subscribers, its most profitable customer segment, a result consistent with strategic foreclosure theory (Whinston 1990), according to which monopolistic firms can drive out competitors—even more efficient ones—through bundling. Our simulation results are also in line with Choi and Jeon's (2016) arguments about zero-price marketing in the context of a two-sided market with a non-negative price constraint (i.e., telecommunications or broadcasting operators have an incentive to offer bundles with free complements to limit competition): The mobile network operator's share in the pay-TV market increases by 11.0%, from 22.6% to 33.6%, as a result of zero-pricing. Although mobile network operators are not dominant in the pay-TV market in our hypothetical Korean example, our results show that bundling with "free" goods can be an effective strategy for luring rival companies' customers in a multi-sided market.

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network operator takes 50% of the cable operator's revenues from mobile service (i.e., serving as a mobile virtual network operator).

[14]Given that information on the firm-product-level marginal cost is not publicly available, we assume that there would be no changes in the price-cost margin.

More importantly, an increase in subscribers to the mobile network operator's triple-play and double-play mobile and Internet service is driven by the fact that a significant proportion of consumers irrationally prefer the zero-priced bundle because they overestimate the value of "free" goods. However, most bundled services in the telecommunications industry are offered through multi-year contractual arrangements that come with hidden costs. Indeed, an increase in zero-priced triple-play and double-play mobile and Internet bundles would result in an increase in consumers facing switching costs (i.e., lock-in effects). And if the contract termination dates differ across individual services in the bundle, then the cable operator will have even more trouble recovering those customers.

7. CONCLUSION

This study is in part a response to the rapidly increasing sales of bundles in the telecommunications and broadcasting industry, which have been further spurred by ICT development and mergers and acquisitions among wired and wireless telecom affiliates over the past decade. Although regulatory concerns regarding the anti-competitive aspect of bundling have been on the rise, economists and antitrust practitioners have mainly delved into how bundling contributes to leveraging and monopolization. This is because abuses of market power through bundling have the potential to reduce consumers' welfare by setting up insurmountable barriers to entrants to the bundled-product market, thereby monopolizing the market and reducing consumer choice and industry innovation. However, the same attention has not been paid to the welfare-reducing effects of false advertising by market-dominant operators that frame bundle discounts as the "free" offer of a product even though the bundle may in fact incur hidden costs.

Zero-pricing is a well-known and increasingly popular marketing strategy. Inspired by the unique prohibition of false advertising using the terms “free” or “zero price” in the Korean telecommnications and broadcasting industry, we empirically showed that a significant proportion of consumers irrationally prefer zero-priced telecommunications bundles, overestimating the value of so-called free goods. Given the frequent risks of such bundles—the hidden costs incurred by multi-year contractual arrangements and the potential lock-in effects caused by variance in the contract termination dates of bundle services—and the fact that telecommunications services account for a large and increasing proportion of global household spending, this issue cannot be ignored and has far-reaching policy implications.

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TABLES AND FIGURES

Table 1. Service Plans Used in the Conjoint Survey

Service plan	Operators	Bundle Type
1	Mobile (CO), Internet (CO), pay TV (CO)	Single
2	Mobile (CO), Internet (MNO), pay TV (CO)	Single
3	Mobile (MNO), Internet (MNO), pay TV (CO)	Single
4	Mobile (MNO), Internet (CO), pay TV (CO)	Single
5	Mobile (CO), Internet (CO), pay TV (CO)	$\mathrm{DPS}_{\mathrm{MT}}^{\mathrm{CO}}$
6	Mobile (CO), Internet (MNO), pay TV (CO)	$\mathrm{DPS}_{\mathrm{MT}}^{\mathrm{CO}}$
7	Mobile (MNO), Internet (MNO), pay TV (CO)	$\mathrm{DPS}_{\mathrm{MI}}^{\mathrm{MNO}}$
8	Mobile (CO), Internet (CO), pay TV (CO)	$\mathrm{DPS}_{\mathrm{MI}}^{\mathrm{CO}}$
9	Mobile (CO), Internet (CO), pay TV (CO)	$\mathrm{DPS}_{\mathrm{IT}}^{\mathrm{CO}}$
10	Mobile (CO), Internet (MNO), pay TV (MNO)	$\mathrm{DPS}_{\mathrm{IT}}^{\mathrm{MNO}}$
11	Mobile (MNO), Internet (CO), pay TV (CO)	$\mathrm{DPS}_{\mathrm{IT}}^{\mathrm{CO}}$

12	Mobile (MNO), Internet (MNO), pay TV (MNO)	$\mathrm{DPS}_{\mathrm{IT}}^{\mathrm{MNO}}$
13	Mobile (MNO), Internet (MNO), pay TV (MNO)	$\mathrm{TPS}^{\mathrm{MNO}}$
14	Mobile (CO), Internet (CO), pay TV (CO)	$\mathrm{TPS}^{\mathrm{CO}}$

Note: CO = cable operator; DPS = double-play service; IT = Internet + TV; MI = mobile + Internet; MT = mobile + TV; MNO = mobile network operator; Single = all services purchased individually; TPS = triple-play service.

Table 2. Parameter Estimates and Standard Errors

Parameter	Mean	SD
Price	-0.067** (0.001)	
Zero-price	0.308** (0.052)	1.531** (0.127)

Bundle		
MI	-0.252* (0.091)	2.784** (0.321)
MT	-0.163 (0.101)	0.970** (0.192)
IT	-0.227* (0.086)	2.418** (0.268)
MIT	0.013 (0.096)	3.444** (0.341)
Brand		
MI	-0.165* (0.080)	0.777** (0.132)
IT	0.693* (0.250)	0.694** (0.201)
MIT	0.516* (0.224)	0.741* (0.240)
Mobile	0.349** (0.041)	0.529** (0.069)
Internet	0.020 (0.060)	0.464** (0.094)
Pay TV	-0.652* (0.217)	0.907** (0.247)

Note: IT = Internet + pay TV; MI = mobile + Internet; MT = mobile + pay TV. Standard errors are shown in parentheses

* $p < .05$

** $p < .01$

Table 3. Consumer Segments Under Zero-Pricing and No-Zero-Pricing Scenarios

WO-Z \ W-Z	$A^X B^X$	$A^Y B^Y$	$A^Y B^X$	$A^X B^Y$
$A^X B^X$	126	35	4	0
$A^Y B^Y$	263	475	0	0
$A^Y B^X$	12	0	75	0
$A^X B^Y$	2	0	0	8

Note: WO-Z = without zero-pricing; W-Z = with zero-pricing.

Table 4. Parameter Estimates and Average Demographic Profiles of Each Segment

	Whole	Seg. $A^XB^X \rightarrow A^XB^X$	Seg. $A^XB^X \rightarrow A^YB^Y$	Seg. $A^XB^X \rightarrow A^YB^X$	Seg. $A^YB^Y \rightarrow A^XB^X$	Seg. $A^YB^Y \rightarrow A^YB^Y$	Seg. $A^XB^Y \rightarrow A^XB^X$	Seg. $A^XB^Y \rightarrow A^XB^Y$
Price	-0.067	-0.067	-0.067	-0.067	-0.067	-0.067	-0.067	-0.067
Zero-price	0.311	0.582	-0.695	-0.680	1.333	-0.242	1.081	0.286
	(0.974)	(0.628)	(0.465)	(0.627)	(0.671)	(0.732)	(0.730)	(0.242)
Bundle								
MI	-0.252	-0.179	-0.467	-0.732	-0.365	-0.061	-1.832	-1.564
	(1.232)	(0.939)	(0.958)	(1.036)	(1.171)	(1.251)	(1.177)	(1.426)
MT	-0.162	-0.019	-0.011	-0.261	-0.182	-0.104	-0.755	-0.692
	(0.415)	(0.390)	(0.294)	(0.240)	(0.382)	(0.385)	(0.211)	(0.298)
IT	-0.226	-0.436	0.322	0.017	-0.506	-0.139	-0.330	0.350
	(1.155)	(0.964)	(0.855)	(1.203)	(1.032)	(1.225)	(1.332)	(1.375)
MIT	0.014	0.391	1.090	-0.587	-0.090	0.180	-1.732	-1.449
	(1.416)	(1.104)	(1.080)	(1.193)	(1.272)	(1.428)	(1.360)	(1.722)
Brand								
MI	-0.166	-0.364	-0.295	-0.444	-0.196	-0.040	-0.726	-0.602
	(0.331)	(0.334)	(0.232)	(0.426)	(0.307)	(0.288)	(0.038)	(0.163)
IT	0.693	0.711	0.658	0.881	0.643	0.684	0.761	0.796
	(0.219)	(0.214)	(0.200)	(0.164)	(0.216)	(0.212)	(0.344)	(0.273)
MIT	0.516	0.615	0.421	0.505	0.618	0.460	0.452	0.328
	(0.219)	(0.189)	(0.144)	(0.257)	(0.184)	(0.218)	(0.111)	(0.155)
Mobile	0.349	0.938	0.812	1.001	0.279	0.185	1.339	1.045
	(0.435)	(0.444)	(0.296)	(0.335)	(0.285)	(0.337)	(0.702)	(0.101)
Internet	0.021	0.297	0.117	0.179	0.078	-0.105	0.241	-0.032
	(0.260)	(0.249)	(0.158)	(0.313)	(0.216)	(0.221)	(0.236)	(0.193)
Pay TV	-0.654	-0.558	-0.411	-0.637	-0.750	-0.603	-1.270	-1.078
	(0.299)	(0.263)	(0.209)	(0.399)	(0.271)	(0.282)	(0.005)	(0.316)
Average Demographic Profiles								
Female	0.499	0.516	0.6	0.75	0.510	0.478	0.5	0.5
Age	39.682	38.373	40.943	39.75	40.133	39.933	45	37.5
Education Level								
High school diploma or less	0.173	0.183	0.086	0.250	0.202	0.162	0	0.250
College or university degree	0.652	0.635	0.743	0.750	0.646	0.663	0.500	0.625
Graduate degree	0.175	0.183	0.171	0	0.152	0.175	0.500	0.125
Married	0.352	0.429	0.171	0.5	0.327	0.337	0	0.5
Income (monthly)								
Less than $3,000	0.253	0.222	0.229	0.500	0.293	0.251	0	0.250
$3,000–$6,000	0.542	0.524	0.457	0.250	0.540	0.547	0.500	0.500
$6,000–$9,000	0.139	0.183	0.200	0.250	0.106	0.131	0.500	0.250
More than $9,000	0.066	0.071	0.114	0	0.061	0.072	0	0
Number of Respondents	1,000	126	35	4	263	475	2	8

Note: Standard deviations are shown in parentheses. IT = Internet + pay TV; MI = mobile + Internet; MT = mobile + pay TV.

Table 5. Expected Mobile Network Operator and Cable Operator Market Share in a Two-Product Setting

Operator	Market	Market Share				
		Baseline (No Zero-Pricing)	Zero-Pricing	$5 Discount	$6 Discount	$7 Discount
Mobile network operator	Mobile	17.5%	41.1%	34.7%	40.8%	45.0%
	Internet + pay TV	25.2%	48.2%	42.2%	48.1%	52.3%
Cable operator	Mobile	82.5%	58.9%	65.3%	59.2%	55.0%
	Internet + pay TV	74.8%	51.8%	57.8%	51.9%	47.7%

Table 6. Price of Telecommunications and Broadcasting Services in Korea

Service	Provider				
	SK Telecom	Korea Telecom	LGU+	Mobile Network Operators	Cable Operators
Individual Service					
Mobile	81.5	93	77	83.83	76
Internet	25	25.25	25	25.08	23.55
Pay TV	18	14.8	20.5	17.77	17.075
Bundle					
TPS	15	25.3	13	17.77	18.04
DPS_{MI}	10	20	10	13.33	15.85
DPS_{IT}	5	5.3	3	4.43	6.84
DPS_{MT}					9.79

Note: The prices of service plan were constructed using the average price of three dominant mobile network operators (i.e., KT, SKT, and LGU+) and two cable operators (i.e., CJ Hellovision and CMB). The prices of mobile, Internet and pay-TV services are for an individual subscription. When consumers buy a bundle, they pay the sum of the individual service prices reduced by the corresponding bundle discount. For example, the price of Service Plan 7 (i.e., mobile + Internet from a mobile network operator and pay TV from a cable operator) can be calculated as (83.83 + 25.08 - 13.33) + 17.075. DPS = double-play service; IT = Internet + pay TV; MI = mobile + Internet; MT = mobile + pay TV; TPS = triple-play service.

Source: Homepages of mobile network operators and cable operators as of February, 2014.

Table 7. Expected Market Share at the Service Plan Level with the Full Array of Products

Service Plan	Components	Market Share	
		Without Zero-Pricing	With Zero-Pricing
1	Single: Mobile (CO), Internet (CO), pay TV (CO)	3.8% (1.1)	3.28% (0.99)
2	Single: Mobile (CO), Internet (MNO), pay TV (CO)	3.3% (0.87)	2.48% (0.74)
3	Single: Mobile (MNO), Internet (MNO), pay TV (CO)	1.01% (0.4)	0.71% (0.33)
4	Single: Mobile (MNO), Internet (CO), pay TV (CO)	1.03% (0.45)	0.80% (0.38)
5	DPS_{MT}^{CO}: Mobile (CO), Internet (CO), pay TV (CO)	13.7% (2.17)	11.69% (1.78)
6	DPS_{MT}^{CO}: Mobile (CO), Internet (MNO), pay TV (CO)	5.02% (1.38)	3.67% (1.08)
7	DPS_{MI}^{MNO}: Mobile (MNO), Internet (MNO), pay TV (CO)	0.95% (0.38)	3.49% (0.8)
8	DPS_{MI}^{CO}: Mobile (CO), Internet (CO), pay TV (CO)	11.87% (1.92)	9.38% (1.62)
9	DPS_{IT}^{CO}: Mobile (CO), Internet (CO), pay TV (CO)	8.91% (1.24)	7.82% (1.13)
10	DPS_{IT}^{MNO}: Mobile (CO), Internet (MNO), pay TV (MNO)	2.98% (0.71)	2.77% (0.69)
11	DPS_{IT}^{CO}: Mobile (MNO), Internet (CO), pay TV (CO)	0.38% (0.23)	0.33% (0.21)
12	DPS_{IT}^{MNO}: Mobile (MNO), Internet (MNO), pay TV (MNO)	1.46% (0.44)	1.54% (0.46)
13	TPS^{MNO}: Mobile (MNO), Internet (MNO), pay TV (MNO)	18.2% (1.59)	29.30% (1.57)
14	TPS^{CO}: Mobile (CO), Internet (CO), pay TV (CO)	27.43% (2.12)	22.74% (1.82)
Total		100%	100%

Note: Standard deviations of market shares obtained by 1,000 draws are shown in parentheses. CO = cable operator; DPS = double-play service; IT = Internet + TV; MI = mobile + Internet; MT = mobile + TV; MNO = mobile network operator; Single = all services purchased individually; TPS = triple-play service.

Table 8. Expected Revenue at the Firm-Product Level with the Full Array of Products

	Number of Simulated Subscribers	ARPU ($)	Revenue ($)	Adjusted Revenue ($)
Without Zero-Price Marketing				
Mobile Network Operator				
TPS	182.0	109	19,820	19,820
$DPS1_{MI}$	9.5	96	906	906
$DPS2_{IT}$	44.4	38	1,705	1,705
Mobile	38.8	84	3,253	31,150
Internet	93.0	25	2,334	2,334
	Mean ARPU = 76.2		28,018	55,915
Cable Operator				
TPS	274.3	99	27,046	16,727
$DPS1_{MI}$	118.6	84	9,929	5,466
$DPS2_{IT}$	92.9	34	3,141	3,141
$DPS3_{MT}$	187.2	83	15,596	8,553
Mobile	159.8	76	12,143	6,071
Internet	185.3	24	4,373	4,373
Pay TV	219.2	17	3,748	3,748
	Mean ARPU = 76.2		75,976	48,079
With Zero-Price Marketing				
Mobile Network Operator				
TPS	293.0	109	31,906	31,906
$DPS1_{MI}$	34.9	96	3,337	3,337
$DPS2_{IT}$	43.1	38	1,657	1,657
Mobile	33.9	84	2,843	25,862
Internet	68.6	25	1,723	1,723
	(Mean) ARPU = 76.2		41,466	64,484
Cable Operator				
TPS	227.4	99	22,418	13,864
$DPS1_{MI}$	93.8	84	7,851	4,322
$DPS2_{IT}$	81.5	34	2,756	2,756
$DPS3_{MT}$	153.6	83	12,793	7,016
Mobile	135.8	76	10,318	5,159
Internet	157.7	24	3,721	3,721
Pay TV	201.4	17	3,444	3,444
	(Mean) ARPU = 76.2		63,301	40,282

Note: The total number of simulated subscribers exceeds 1,000 because consumers can subscribe to both firms' services (e.g., DPS_{MI} from a mobile network operator and pay TV from a cable operator). ARPU = average revenue per user; CO = cable operator; DPS = double-play service; IT = Internet + TV; MI = mobile + Internet; MT = mobile + TV; MNO = mobile network operator; Single = all services purchased individually; TPS = triple-play service.

Figure 1. Segments of Consumers Who Choose Alternatives $A^X B^X, A^Y B^Y, A^Y B^X$, and $A^X B^Y$

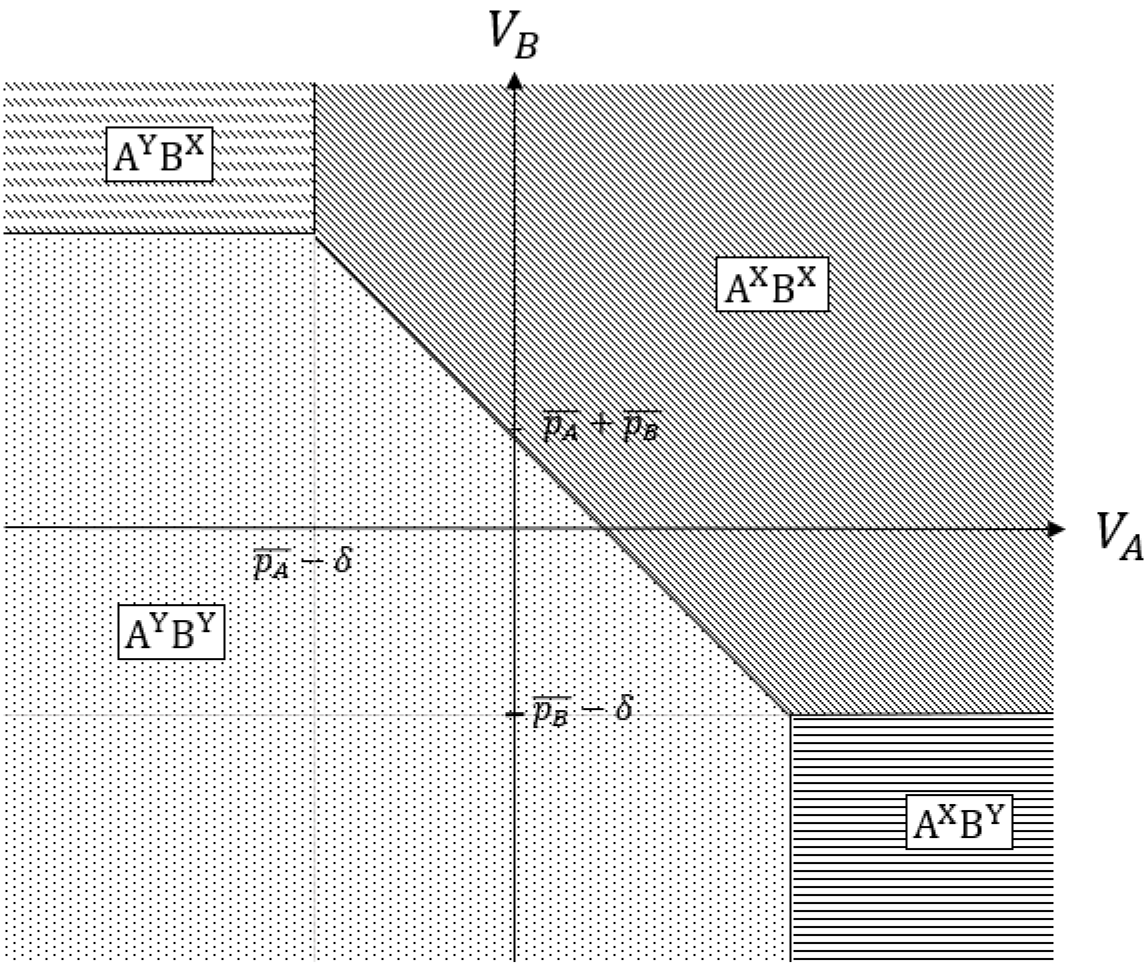


Figure 2-1. Segments of Consumers without Zero-Price Marketing

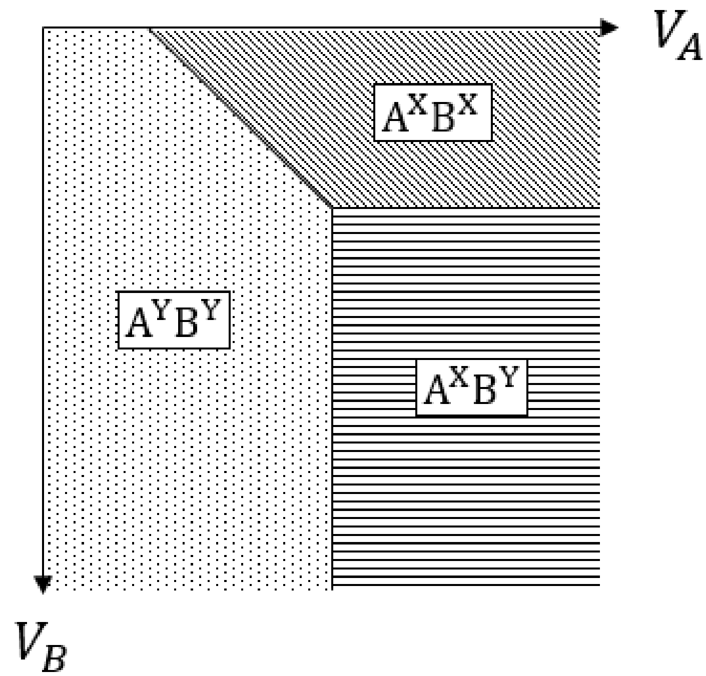


Figure 2-2. Segments of Consumers with Zero-Price Marketing

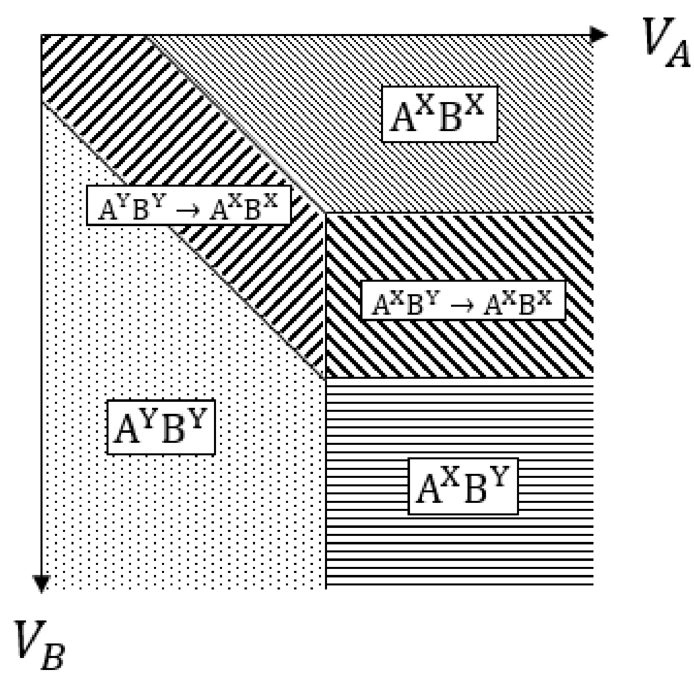


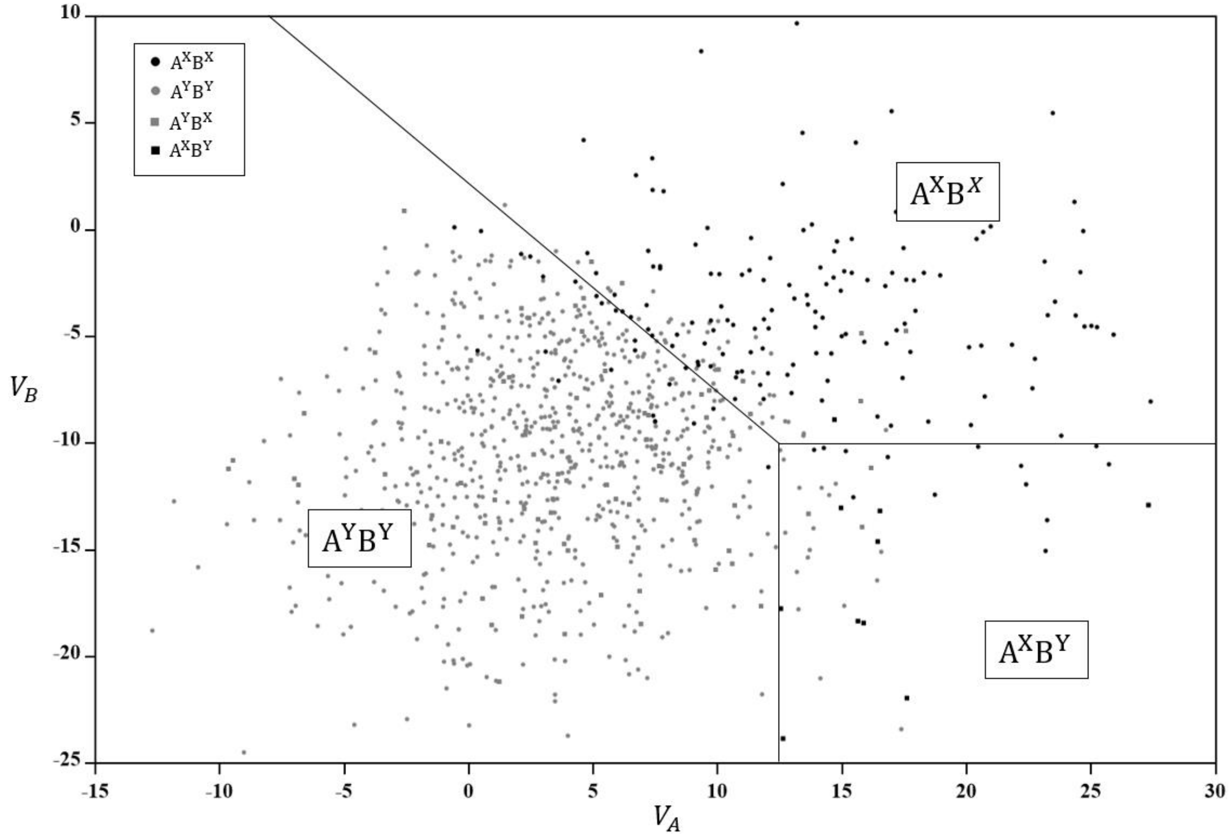
Figure 3. Examples of Conjoint Cards

Card 1	Card 2	Card 3
• Mobile + Internet (MNO), pay TV (CO) • Basic price : $120 • No discount	• Mobile (MNO), Internet+ pay TV (CO) • Basic price : $100 • 20% off	• Mobile + Internet + pay TV (MNO) • Basic price : $130 • Free Internet

Note: CO = cable operator; MNO = mobile network operator.

Figure 4-1. Consumers' Predicted Choices among Four Alternatives in the No-Zero-Pricing

Scenario



10
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-5
-10
-15
-20
-25
V_B
-15
-10
-5
0
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10
15
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25
30
V_A
A^XB^X
A^YB^Y
A^YB^X
A^XB^Y
A^XB^X
A^YB^Y
A^XB^Y

Figure 4-2. Switching in the Zero-Pricing Scenario for Consumers Who Chose A^YB^Y or A^XB^Y in the No-Zero-Pricing Scenario