Computers & Industrial Engineering 113 (2017) 369–381

Contents lists available at ScienceDirect

Computers & Industrial Engineering

journal homepage: www.elsevier.com/locate/caie

Intertemporal mixed bundling strategy of information products with network externality

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ARTICLE INFO

Keywords:
Intertemporal mixed bundling strategy
Information products
Network externality
Two-period optimization

ABSTRACT

This paper proposes a two-period model of intertemporal mixed bundling for two information products with network externality, in which a profit-maximizing monopolist offering two information products in the first period decides the optimal time of bundle release and the adoption of "Complete My Bundle" option. "Complete My Bundle" is an option offered by App Store, with which customers can enjoy the bundle discount even if they purchase all components within the bundle in different time. We demonstrate that the seller should promptly release the bundle in the first period when network externality is moderate-to-high, or the bundle release should be delayed to the second period when network externality is low. The impact of network externality on optimally pricing individual products and bundles depends on the time of bundle release. Offering "Complete My Bundle" option is advantageous in a large number of situations when the seller makes an optimal choice for the time of bundle release. Our analysis provides insightful explanations to real-world practices of intertemporal mixed bundling strategies, and also supports the optimal choices for intertemporally bundling information products.

1. Introduction

Mixed bundling, which sells component products individually as well as all components in a package at a discount, has attracted many providers of information products. For example, App Store allows developers to create app bundles besides offering individual apps.[1] Microsoft offers several separate office productivity applications and Office Suites.[2] Kaspersky provides businesses with both standalone protection for targeted areas and integrated security solutions.[3] Adobe sells the single creativity apps and also offers the entire collection of creative apps.[4] Two-folded reasons account for the prevalence of mixed bundling strategy for information products. First, bundling can reduce the dispersion of consumer valuations, which allows a seller to better extract customer surplus (Stigler, 1963; Bakos & Brynjolfsson, 1999). Second, offering individual products at full prices and bundles at discounts facilitates customer segmentation and price discrimination (Adams & Yellen, 1976; Schmalensee, 1984; Chen & Riordan, 2013).

Network externality is broadly observed among information products (Shapiro & Varian, 1999). For a product exhibiting network externality, customer valuations increase with the size of the user base. The causes of network externality are varied. For online games, social network platforms and electronic mail systems, the larger number of players or users in the network, the more direct utility that a customer derives from using the product. In addition, as the size of users enlarges, customers can easily share information and get responses to their issues in the online community, or they can get benefit from software upgrading or complementary services offered by other developers.

In the presence of network externality, customers who do not have enough willingness to pay toward a product may make the purchase later considering the incremental valuations caused by a larger user base. When it comes to situations where the firm adopts mixed bundling strategy to sell multiple products, some customers may purchase all components within a bundle in different time. In practice, different firms use different strategies to charge customers with cross-period purchasing behavior. For example, Microsoft Inc. charges these customers a full price without providing any discount, but Apple Inc. offers a "Complete My Bundle" option to allow customers to enjoy a bundle discount.[5] More specifically, if two components are both priced at $5 and the bundle is priced at $8, the customers who buy two components in different time have to pay $10 in Microsoft Store but only $8 in

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[1] https://developer.apple.com/app-store/app-bundles/.
[2] https://www.microsoftstore.com/store/msusa/en_US/cat/Compare-Office-suites/categoryID.68155000?icid= All_Office_subnav_09122015_Compare.
[3] http://www.kaspersky.com/business-security/small-to-medium-business.
[4] https://creative.adobe.com/plans?promoid=P3KMQZ9Y&mv=other.
[5] https://support.apple.com/en-us/HT201162.

http://dx.doi.org/10.1016/j.cie.2017.09.019
Received 16 February 2017; Received in revised form 5 August 2017; Accepted 14 September 2017
Available online 18 September 2017

iTunes Store. The "Complete My Bundle" option can increase customer demand by charging a lower price. Sellers balance the benefit from a larger customer demand and the loss caused by a lower price to make the decision of offering "Complete My Bundle" option or not.

The release time of a bundle is also well conceived in practice. After the launch of all individual products, some managers like to promptly release the bundle. For example, Microsoft simultaneously released Word 2016, Excel 2016, PowerPoint 2016 and the corresponding Office Suite in September 2015. But some sellers tend to delay the introduction of the bundle to the market. Alawar Entertainment, a famous game developer, published 4 casual games in 2014, but released the bundle of these games as "Click and Play Bundle" until July 2015.[6] Houghton Mifflin Harcourt, a large educational publisher, launched 4 educational apps in 2013, and offered their bundle "Curious George" in September 2014.[7]. When the bundle is not offered in the early time, customers who have high valuations toward all products will purchase them at a full price. But the size of the user base can be smaller compared with situations where the bundle is promptly released. Therefore, a profit-maximizing seller who needs to decide the time of bundle release faces a trade-off between charging higher prices and creating larger user bases.

The extant bundling studies commonly assume that customers have constant valuations, i.e., a customer who buys nothing on the release day will never purchase anything in the future. Also, the seller is assumed to simultaneously launch the individual products and the bundle (Venkatesh & Kamakura, 2003; Basu & Vitharana, 2009; Sheikhzadeh & Elahi, 2013). However, industrial practices indicate that neither the release of individual products and the bundle nor the customer purchase may occur at an identical point of time. The intertemporal mixed bundling strategy can better characterize the bundling problem in the real world.

In this study, we use a two-period model to describe product release of the monopolistic seller and purchase behavior of the customers, and we further analyze the design of intertemporal mixed bundling strategy. Although both prompt-bundle-releasing strategy and delayed-bundle-releasing strategy are pervasively observed in the market and "Complete My Bundle" option may be offered or not by different firms, it's difficult to suggest when to use one strategy or the other. We aim to answer the following research questions in this paper: (1) When should the seller release the bundle? (2) Under what conditions should the seller offer "Complete My Bundle" option? (3) How does the network externality impact the optimal prices?

We find that the design of intertemporal mixed bundling strategy depends on the network externality and marginal costs of the products. The seller should promptly release the bundle when the network externality is moderate-to-high or delay the release of the bundle when the network externality is low. With increasing marginal costs, the domain of optimality for strategies to delay the bundle release enlarges. Besides, if the seller chooses a proper time to release the bundle, offering "Complete My Bundle" option can bring more profit to the seller except for situations where network externality is very low and marginal costs are moderate or where network externality is moderate and marginal costs are low. Moreover, our results suggest that the effect of network externality on optimal prices significantly relies on the time of bundle release.

The rest of this paper is structured as follows. In Section 2, we review the related literature. Section 3 gives assumptions and models. In Section 4, we analyze the optimal time to release the bundle, the adoption of "Complete My Bundle" option, and the impact of network externality on optimal prices. Section 5 concludes findings, provides managerial implications, and suggests future research directions.

[6] http://www.wildtangent.com/games/click-and-play-bundle.

[7] https://itunes.apple.com/us/app-bundle/curious-george/id917669481?mt=8.

2. Related literature

The seminal theories on bundling strategy can be traced back to Stigler (1963), Adams and Yellen (1976) and Schmalensee (1984). They demonstrated the advantage of bundling strategy on segmenting markets and price discrimination. Recently, some literature examined bundling strategy by considering different features of products and market environment, including the complementarity and substitutability (Raghunathan & Sarkar, 2016; Venkatesh & Kamakura, 2003), the correlation among customer valuations (Banciu & Ødegaard, 2016; Cao, Stecke, & Zhang, 2015; Chen & Riordan, 2013), product heterogeneity (Liu & Chou, 2015; Meyer & Shankar, 2016; Sheikhzadeh & Elahi, 2013), product differentiation (Banciu, Gal-Or, & Mirchandani, 2010), consumer knowledge of a product (Basu & Vitharana, 2009), myopic or strategic behavior of consumers (Prasad, Venkatesh, & Mahajan, 2015), and demand uncertainty (Chen & Zhang, 2015).

This paper focuses on the impact of network externality on the design of intertemporal bundling strategy, which is mostly related to the following two streams of bundling research. The first stream involves the studies on intertemporal mixed bundling strategy. Although there have been abundant bundling studies as mentioned above, most of them examined static mixed bundling strategy where individual products and bundles are launched at the same time. There are a few articles on intertemporal mixed bundling strategy. DeGraba and Mohammed (1999) focused on concert markets, where tickets are only sold in bundles in the first period and the remaining tickets are sold individually in the second period. This selling mechanism can create a buying frenzy among customers due to the constrained capacity of the seller. Different from the static mixed bundling strategy, the bundle price exceeds the sum of the individual prices under such an intertemporal mixed bundling strategy. Duran, Swann, and Yakıcı (2012), Duran, Özener, and Yakıcı, Özener, and Duran (2014) and Yakıcı, Özener, and Duran (2014) also considered the intertemporal mixed bundling strategy in the entertainment and sports industries. Duran, Swann, and Yakıcı (2012) examined the optimal time for switching from the bundle-selling period to the individual-selling period. Duran, Özener, and Yakıcı (2014) further investigated league scheduling and game bundling together. Yakıcı et al. (2014) studied the decision of which event tickets to include into the bundles.

Using numerical methods, the above literature on intertemporal mixed bundling has provided plentiful insights on the design of intertemporal bundling strategy in the entertainment and sports market, where the products are offered as a bundle in the first period and sold separately in the second period. Their findings suggest that intertemporal mixed bundling strategy has unique features compared with static mixed bundling strategy. Different from these literature, our study investigates another kind of intertemporal mixed bundling strategy in market of information products, where the individual products are offered at the beginning and the seller decides the time to release the bundle as well as the adoption of "Complete My Bundle" option.

The second stream looks at the bundling of products with network externality. Prasad, Venkatesh, and Mahajan (2010) formulated a static model to study the impact of network externality and marginal costs on the choice of bundling strategy, where the monopolistic seller simultaneously offers components and the bundle. Their results suggest that mixed bundling strategy converges to pure bundling strategy when components have higher network externality or lower marginal costs. Our study differs from theirs in that the bundle may not be released with individual products at the same time. Other than setting prices of individual products and the bundle, the monopolistic seller decides when to release the bundle and whether to offer "Complete My Bundle" option.

Pang and Etzion (2012) considered bundling strategy for a product and its complementary online service, but only the service exhibits