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Selling information products: Sale channel selection and versioning strategy with network externality

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ABSTRACT

The purpose of this paper is to provide a quantitative analysis of selling information products, aiming to determine the best sale channel and versioning strategy in the presence of network externality. An information product supply chain consisting of an information supplier, a retailer, and consumers is considered. In this supply chain, a Stackelberg game exists between the supplier and retailer, in which the supplier is the leader and the retailer is the follower. This paper analyzes the decision behaviors of the supplier, the retailer, and consumers in selling or buying information products. In our tractable analyses, consumer valuation for the product is uniformly distributed, and network externality intensity ranges from 0 to 1. A sale channel model is developed to maximize the supplier's profit based on the fixed-fee policy in the presence of the network externality. By comparing different channels, we determined the best sale channel and versioning strategy for a supplier. Our main findings include: A supplier prefers the versioning strategy when network externality exists in the market, whereas the single-version strategy is more preferable for an information product when network externality does not exist in the market. When two versions are released in a market with network externality, the best sale channel strategy is that the high-quality version is distributed through the direct sale channel and the low-quality version is sold through the retailing channel.

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1. Introduction

Network externality is defined as the phenomenon that the increased value of a product is affected by the number of those who use similar or compatible products (Katz and Shapiro, 1985). A consumer can gain a greater utility from a product by sharing, accumulating, and communicating information, when more consumers are using it. This scenario is a typical characteristic of information products, such as social networking sites (*e.g.*, Facebook, Renren.com), software, and online games. For example, an online game has some inherent value for players, but the number of players is also an important factor that affects consumers' valuations for it. In general, more players can attract more new consumers (Meagher and Teo, 2005). The network externality, which exists for many information products (Tomak and Keskin, 2008), affects the decision of an information product producer on developing and selling new products. In this study, we explore the effects of the network externality on sale channel selection and versioning strategy.

Previous studies on information products generally assume that a consumer's willingness to pay depends on quality, and the utility gained from using a product is associated with its quality and price (Bhargava and Choudhary (2001); Chen and Sridhar, 2007). However, the number of consumers, *i.e.*, the network size, can create network externality (Jing, 2000). A large network size indicates a high market coverage that can bring potential revenue to a firm. The strategies for bundling or versioning information products can be affected by the network effect. For example, the mixed bundling strategy is the best choice for low-marginal-cost products without network externality (Schmalensee, 1984); however, the pure bundling strategy becomes the better choice in the presence of network externality (Prasad et al., 2010). With network externality, the piracy can be moderately tolerated, which was regarded as a serious threat to information products (Haruvy et al., 2004). Moreover, the piracy can increase a firm's profit under certain conditions (Conner and Rumelt, 1991), particularly when the low-quality version is illegally duplicated (Stephen and Lampe, 2003). As a second degree price discrimination strategy, versioning is widely used in selling information products,[1] and it has been

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[1] Versioning refers to the difference in content quality, not the product formats, such as CD, MP3, and DVD.

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proven to be more profitable when network externality exists in the market (Baake and Boom, 2001). Generally, a firm develops two versions of a product, in which the low-quality version is sold at a low price or given for free. The low-quality version attracts some consumers who are not able to purchase the high-quality product; thus, the network size is expanded. A firm gains a greater profit with the two-version strategy compared with the single-version strategy (Ernan and Prasad, 1998; Bhargava and Choudhary, 2004; Jing, 2003, 2007). In short, this stream of research indicates that a firm can benefit from the network effect because of an increasing number of consumers.

We focus primarily on the impact of the network effect on the supply chain configuration of information products. This paper investigates three modes of channels, *i.e.*, direct channel, retailing channel, and dual channel, and then examines their priorities for information product suppliers when the network externality is considered. Direct sale refers to selling and delivering products directly to consumers without any intermediaries such as retailers or distributors. Usually, direct sale is very effective in e-commerce because the transaction cost of the supplier is reduced. However, a supplier has to exert more effort to attract consumers, particularly retail-captive consumers (Khouja and Wang, 2010) in the absence of an intermediary. Therefore, the supplier needs to balance the trade-off between decreasing the transaction cost and attracting more consumers.

Many studies have examined the choice of sale channels for physical products. Chiang et al. (2003) analyzed the impact of a direct sale model on the profit of the supplier and retailer, and showed that the direct channel could induce the retailer to lower the price, resulting in a larger demand in the retailing channel. The supplier is more profitable even if no sales occur in the direct channel. Yan (2008) drew a similar conclusion that although the direct channel is in conflict with the retail channel, it can still drive the retailer to improve its service quality and at the same time induce the supplier to lower its wholesale price, thereby increasing sale and greater profit are obtained. In another paper, Yan (2010) developed a brand differentiation and revenue-sharing strategy to eliminate the channel conflict and coordinate the supply chain. Cai (2010) studied more complex channel structures and showed that the choice of channels depends on the product demand, channel operating cost, and channel substitutability. These studies indicate that the direct sale channel is usually combined with the traditional retail channel in selling physical products (Tsay and Agrawal, 2004; Yao and Liu, 2005). However, when information products are considered, some intrinsic issues still exist in the property analyses of channel modes and the appropriate choice of channels.

Information products can be reproduced and distributed with negligible costs based on the information and communication technologies in e-commerce. For instance, information products can be transmitted from the supplier to the end-users through the Internet. Direct sale seems to be the more effective and efficient channel. For example, the advent of MP3s and online file sharing helped music artists provide digital music files over the internet directly to consumers, and thus artists are independent from the control of record companies (Lewis et al., 2005). However, Kulmala and Erkki (2005) showed that network firms intend to cooperate with partners (retailers or other intermediaries) in the software industry. Khouja et al. (2010) found that revenue sharing can result in the larger profit for both supplier and retailer in the rental supply chain of information products, such as movie DVDs and computer games. Khouja and Wang (2010) investigated the impact of a digital distribution channel on the information goods industry. It was indicated that both direct channel and retail channel had their respective pros and cons, but the dual distribution channel was the most profitable and suffered the least from piracy as well. Hua et al. (2011) established the conditions under which a publisher would sell only printed books (p-books) (via retailer), only e-books (via direct sale), or both. The choice of sale channels was determined by the reader acceptance of e-books, the wholesale price of p-books, and the publisher's power of negotiation with bookstores. Bonwoo et al. (2011) analyzed several factors that affected an airline company's decision to sell tickets through Online Travel Agency (OTA) platforms or solely through their own websites.[2] Airline companies were less likely to use OTA platforms if they had many loyal consumers and the OTA platforms were highly competitive.

Previous studies on sale channels did not consider the impact of network externality on the channel selection, and the versioning strategy was not examined as well. However, the inherent characteristic of information products that usually have strong network externalities affects the consumer's valuation of the product. Thus, what is the appropriate sale channel for a firm to sell information products with network externality? The consideration of network externality distinguishes this study from previous ones, and this paper intends to make a detailed investigation on this issue.

The rest of this paper is organized as follows. In Section 2, we define the network externality in information product markets. In Sections 3 and 4, we examine the optimal pricing and versioning strategy in the presence of the network externality when the product is sold via either a retail channel or a dual channel, and then we determine the best sale channel mode for the supplier. Finally, conclusions are presented in Section 5.

2. Problem specifications

When the network externality exists, a consumer purchases the product with a network size Q at a price p, and he/she can obtain the net utility $(v+\gamma Q)x-p$, where $v\times x$ is the product's inherent "network-independent" or standalone value, and γQx is the "network-generated" value derived from network externality. Previous studies consider the network effect to be linear with respect to the size of the user base (Jing, 2003, 2007; Prasad et al., 2010; Zhao et al., 2014).[3]

Considering the user utility function, x denotes the product quality, which can be explained as the number of features of an information product line (*e.g.* digital music album or modularized software) such that a higher value of this variable implies a higher quality (Chellappa and Shivendu, 2007). Taking the software as an example, a larger number of modules in a software package generally denotes a higher quality version.[4] v indicates the consumer's valuation (or marginal willingness to pay) for the product with respect to quality x, and it reflects a consumer's preference for the quality. In our study, v is an exogenous variable and assumed to be uniformly distributed on [0,1].

It is assumed that there are N potential consumers in the market. Q represents the quantity sold or the number of consumers who have purchased the product. Since we assume that

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[2] Presently, more tickets are offered in digital format than in paper format. However, in a strict sense, these products do not belong to the category of information products because they are not duplicable.

[3] However, many studies neglect the situation that a network-generated value is associated with quality.

[4] However, we should notice that the "quality" of an information product is multi-dimensional. These dimensions can be functions, user interface, performance speed, scalability, and after-sale support (Chen and Sridhar, 2007). As in some previous studies (*e.g.* Bhargava and Choudhary, 2001; Chellappa and Shivendu, 2007), we defined it as a quantitative parameter of the general quality $x>0$. In our model, x is endogenously decided by the retailer who contracts for a subset of features (quality) with the supplier based on consumers' demand.

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