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Effect of online personalization services on complementary firms

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ABSTRACT

Should complementary firms offer online personalization services to their customers, and how does the differentiated quality of personalization services affect product prices and profits? To answer these questions, we investigate a two-dimensional model of both vertically differentiated product preferences and horizontally differentiated personalization services. The asymmetric quality of basic and complementary personalization services offered by firms is examined in three cases. The quality asymmetry of basic and complementary personalization services, and the complementarity of products lead to several interesting findings regarding firms' prices and profits. We find that when differentiated personalization services are offered by firms, the profits for both firms increase in complementarity. Given the presence of complementary personalization services offered by firm 1, both firms are worse off with the quality of complementary personalization services. When quality asymmetry exists for both basic and complementary personalization services, there are win-lose, win-win, and lose-win scenarios, which depend on the level of quality differentiation in the basic personalization services offered by firm 2. Furthermore, by comparing the profits in three cases, we find that firms' profits rest in complementarity.

1. Introduction

Customers are often faced with complementary personalization services that are embedded in their basic services when they browse a firm's portal or official website. For example, Apple mobile users, after receiving configuration information for an iPhone (e.g., model, color, capacity, etc.), often must select a carrier (e.g., AT&T, Sprint, T-Mobile, and Verizon, etc.) that can activate the iPhone.[1] Alternatively, they might be required to search for an accessory (e.g., the manufacturer, what's new, cases and protection, headphones and speakers, etc).[2] Similarly, mobile subscribers are often bound to choose the manufacturer, color, storage capacity, operating system, etc., when they subscribe to network services.[3] This example illustrates that as service qualities are extended by personalization technologies, the uncertainties of complementary demand and customers' private knowledge of their preference and price point for online firms' status can deteriorate.

To obtain a competitive advantage between complementary firms, it is crucial for firms to strategically offer an online personalization service that competes with its complementary firm. However, because of technical confines, product characteristics, and service differences, there is an important difference in personalization service quality; thus, online firms can offer complementary personalization services. Therefore, we allow for the asymmetry in the quality of these complementary personalization services to determine whether there are inconsistent implications.

Online personalization services, as special goods, extend beyond information goods (Wattal et al., 2009) because personalization services are usually offered free of charge by online firms. From a customer perspective, personalization services offered to customers can effectively reduce information overload and quickly capture personalized demands, thus drastically increasing customer satisfaction. From the perspective of online complementary firms, personalization services can be used to acquire customer preference information to conduct targeted advertising and price discrimination (Chellappa and Shivendu 2007). Online personalization services, can typically be achieved through embedded browser toolbars, sidebars, digital assistants, and sub-links to a website (Chellappa and Shivendu 2010). Customers, according to their preference, choose and click these toolbars or sidebars through level-by-level processing. When all sections are browsed and completed, a mobile-phone or favorite accessories webpage can be created. There are numerous examples of firms using online

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[1] Source: http://www.apple.com/iphone/, accessed in April 2017.
[2] Source: http://www.apple.com/shop/accessories/all-accessories, accessed in April 2017.
[3] Source: https://www.att.com/shop/wireless/deviceconfigurator.html?prefetched=true&sku=sku8040300, accessed in April 2017.

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personalization services to interact with their customers. For example, customers use the embedded toolbars in Apple's portal to filter information related to their personalized demands. Similarly, Amazon, Taobao, and eBay, among others, offer personalization services based on customers' stated preferences.

In addition to the asymmetry of personalization service quality, this paper uniquely incorporates complementarity of product preferences. As in Murthi and Sarkar (2003), the impact of online personalization on a firm's strategy can affect its key partners, for example, complementary firms. However, each firm seeks to promote its own product while retaining the ability to recommend products from multiple complementary firms. It is interesting for us to examine how each key player personalizes to strengthen its bargaining power relative to a complementary firm.

It is well known that complementarity can be used to reveal the internal compliance relationship between complementary products. However, complementarity varies among customers. We use this variable to capture customers' product preferences. This complementary relationship frequently arises in practice, for example, in relation to smart phones and wireless networks, hardware and software, high-definition television sets and high-definition programming, and industrial products and accessories.

Synthesizing the factors illustrated above, this paper's central focus is to investigate the implications of complementary firms offering complementary personalization services separately. Considering the asymmetry quality of offering complementary personalization services, will complementary firms implement complementary personalization services strategies? To gain competitive advantage and motivate a customer's potential requirements, an intensely personalized service war is launched between complementary firms. A number of studies in marketing, management science, information systems, and electronic commerce have focused on the online personalization issue theoretically (Chung et al., 2009; Kwon and Kim, 2012; Mendelson and Parlaktürk, 2008; Murthi and Sarkar, 2003; Tam and Ho, 2005; Zhang, 2011). However, few theoretical works have considered how the asymmetric quality of complementary personalization services affects the pricing strategies and profits of firms in the context of E-commerce. Furthermore, there is a complementary relationship between two firms. In this paper, we address the following research questions.

Research Question 1: How does complementarity affect firms' investments in online personalization services?

Research Question 2: What happens to equilibrium prices and profits in the presence of complementary personalization services for two firms?

Research Question 3: Under what conditions do firms find it profitable to offer complementary personalization services?

Research Question 4: Who will gain from the presentation of both basic and complementary personalization services?

In answering these questions and filling this theoretical gap, we propose a two-dimensional differentiation model of both vertical product preferences and horizontal personalization services. In this model, there are two complementary firms that sell products that are complementary to each other on a vertical dimension and that simultaneously offer two related personalization services for product attributes (e.g., by toolbars and sidebars) in their websites or online portals to interact with their customers on a horizontal dimension. Because of the difference in the capacity to offer personalization services, the two firms can offer asymmetric quality of both basic and complementary personalization services.[4] We examine the following scenarios: 1) firm 1 offers only basic personalization services and firm 2 only offers complementary personalization services ("*differentiated personalization services*"); 2) firm 1 offers basic personalization services and low-quality complementary personalization services, and basic personalization services are infeasible for firm 2 ("*asymmetric complementary personalization services*"); 3) there is an asymmetric quality of basic and complementary personalization services offered by both firms (general case: "*asymmetric basic and complementary personalization services*").[5]

Through our analysis, several new insights and findings can be obtained. We summarize the key contributions of our paper as follows: 1) we provide a model of both the vertical differentiation of product preferences and the horizontal differentiation of personalization service preferences. To the best of our knowledge, our paper is the first to simultaneously consider the effects of complementarity and the effects of online personalization services on firms' prices and profits. 2) We introduce the concept of online personalization services and show how complementary personalization services change both firms' pricing strategies in important ways, where the levels of personalization services are a strategic variable. Both firms can adjust the quality of personalization services to maximize their profits. In summary, the insights and results gained from the two-dimensional model contribute to the theories of complementary product pricing and online personalization.

The rest of this paper is organized as follows. We first review the related literature in the areas of online personalization, complementary product pricing, and product and service differentiation. Next, we present a two-dimensional differentiated model and define online personalization services and complementarity. We then analyze the model and derive the effects of online personalization services regarding the firms' prices and profits in the presence of the asymmetric quality of complementary personalization services. Finally, we conclude our paper, discuss the implications for theory and practice, and present ideas for several future studies. All of the relevant proofs are provided in the appendixes.

2. Literature review

2.1. Online personalization

Our paper is related to the current stream of literature on online personalization (Kazienko and Adamski, 2007; Kumar et al., 2004; Lee and Lee, 2009; Miceli et al., 2007; Vesanen and Raulas, 2006; Wang and Li, 2013; Xu and Wang, 2006; Xu et al., 2011). These studies involve information management, information technology, interactive marketing, and electronic commerce and information systems. To identify the effects of key players in the personalization process, Murthi and Sarkar (2003) provide a framework for online personalization in the area of management science. Chellappa and Shivendu (2007) analyze the strategic interaction of an online personalization monopolist. In their model, they examine four optimal regulatory regimes for their welfare implications. Chellappa and Shivendu (2010) use an economic model to examine the economics of online personalization. Liu et al. (2010) study several deterministic resource policies in the context of online personalization on content delivery sites. Ho et al. (2011) investigate the effects of strategic interaction between timing issues and recommendations in the context of personalized services. Zhang (2011) discusses the two perils of behavior-based personalization between information damage differentiation and endogenous product design. Similar to our study, Ghoshal et al.

[4] To avoid ambiguity, we assume that the related personalization services of product attributes for firm 1 are called basic personalization services, e.g., model, color, capacity, etc. The related personalization services of product attributes for firm 2 are called complementary personalization services, e.g., AT&T, Sprint, T-Mobile, Verizon, etc.

[5] Criteria for the division and customer utility are shown in Table 2.