



Optimal trade-in strategy of retailers with online and offline sales channels

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ABSTRACT

Due to consumers' online shopping habits, more and more traditional retailers are operating online sales channels for survival. Many retailers selling durable products offer trade-in service to keep regular customers. In practice, these retailers have three channel choices to offer trade-in service: only offline channel (OFC); only online channel (ONC); double channel (DBC). Thus, a retailer with double channel who plans to offer trade-in service needs to pick the optimal choice from OFC, ONC and DBC. To this end, our paper investigates the optimal product price and trade-in rebate under the three choices, respectively, and explores which choice is the best for the retailer. We find that the three channel choices have no effect on the optimal product price, and the retailer under each choice may set the largest trade-in rebate which depends on the magnitude of the consumers' waiting psychological cost of online shopping and the unit shipping cost. Interestingly, we find that the optimal trade-in demand under DBC is not always larger than those under OFC and ONC. Moreover, no choice always benefits to replacement consumers. Most importantly, we find that if the unit shipping cost is relatively small, OFC is the best choice for the retailer; and if the unit shipping cost is relatively medium, DBC is the best choice; otherwise, ONC is the best choice.

1. Introduction

With the advent and rapid advances of information technologies, online retailing has witnessed significant growth over the last few years. According to the report released by the U.S. Commerce Department, online sales in the U.S. grew from \$341.70 billion in 2015 to \$394.86 billion in 2016, and the ratio of online sales to total sales grew from 7.3% in 2015 to 8.15% in 2016 (U.S. Census Bureau, 2017). Traditional brick-and-mortar (B&M) retailers are increasingly allowing consumers to buy products through online sales channels in addition to their physical channels. In United States, almost all top department stores and electronic stores, e.g., Walmart, Costco and Best Buy, adopt both online and offline sales channels to sell products to consumers (Zhang, 2009; Chen & Chen, 2017). This retailing mode is a kind of dual channel sales mode. This retailing mode is also widely observed in retailing industry in other countries, e.g., Suning and Gome in China.

As a ubiquitous post-sale service, trade-in program is widely adopted by retailers with dual channels (DC retailers) to stimulate the repeat purchase of the existing consumers. For instance, Apple Inc. offers its trade-in service through both online and offline Apple stores (Apple Renew, 2017). Unlike Apple Inc., some DC retailers provide

their trade-in services only through offline or online channel. For example, GAME only operates its trade-in service through offline stores (GAME, 2017), while Navman only allows replacement consumers to trade in their old Navman GPS device through Navman online stores (Navman, 2017). According to these practice, DC retailers can offer trade-in services by adopting three channel choices: offline channel (OFC), online channel (ONC) and double channels (DBC) (i.e., both online and offline channels). Hence, these DC retailers may face an important challenge: which channel choice (OFC, ONC or DBC) is the best for offering trade-in service to consumers? Motivated by this challenge, the primary goal of this paper is to examine the optimal trade-in strategy of DC retailers.

Typical Trade-in service in offline channel operated as follows. Consumers travel to physical stores and turn in their used products. After checking and testing the returned products, retailers will offer consumers some special discounts, which can be used in their future purchases. Notably, this discount is referred to as trade-in rebate (Ray, Boyaci, & Aras, 2005). Then, these replacement consumers may decide whether to accept the rebates for purchasing new products. Unlike through offline channel, in online channel, replacement consumers firstly ship their used products to online stores. When receiving the

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returned products, retailers will check these products and offer some trade-in rebates by using gift cards. Then, consumers may decide whether to accept the gift cards to purchase new products. Note that, when consumers choose to trade in their used products in offline channel, they need to travel to physical stores to conduct trade-in transactions and buy new products, which incurs some hassle costs including travel costs and searching costs for particular new products (Cao, So, & Yin, 2016). However, when consumers choose to conduct trade-in transactions through online channel, they need to wait for a delivery time to complete the whole trade-in transactions, which may lead to some psychological costs for consumers. As Hsiao (2009) suggested, the value of delivery time to a consumer for purchasing book online is approximately \$0.53 per day. Consequently, this psychological cost would be much large if the delivery time is sufficiently long. These costs may directly affect consumer decisions on choosing which channel to conduct their trade-in transactions. In this regard, some DC retailers offer their trade-in services through both offline and online channels, e.g., Apple Inc, Best Buy, Suning, Gome and Dell.

Trade-in rebate typically specifies the conditions under which DC retailers can accept consumer used products for some rebates. These rebate are commonly redeemed toward repeat purchase of new products with respect to consumer returned products. Consequently, trade-in service can serve as an effective new product sales mechanism (Li, Fong, & Xu, 2011). Furthermore, trade-in products may have certain actual residual values, which can generally serve as a significant source of revenue for retailers (Ray et al., 2005). However, such trade-in service in turn significantly increase operational costs for retailers. In offline channel, in addition to extra storage cost for trade-in products, DC retailers need to establish some counters and even hire some highly qualified salespeople to conduct trade-in transactions. In online channel, retailers are increasingly offer free shipping services for both trade-in products and new products to consumers, e.g., Apple Inc., Dell, Bestbuy.com and Amazon.com. In such a context, DC retailers may incur shipping costs regarding both trade-in product and new product for each replacement consumer. In this regard, regardless of whether in offline or online channel, it is unclear that trade-in service can really benefit DC retailers due to these operational costs. Hence, by considering both the benefits and the incurred operational costs, how to determine a suitable trade-in rebate is an important decision-making issue for DC retailers.

As mentioned above, DC retailers in practice have three channel choices to offer trade-in service: the first is OFC (e.g. GAME); the second is ONC (e.g. Navman, Microsoft Inc); the third is DBC (e.g. Apple Inc, Best Buy). Moreover, each Channel choice has its advantages and disadvantages for trade-in consumers and DC retailers. In this context, DC retailers need to pick up optimal channel choice to offer trade-in service as well as determine optimal trade-in rebate. Despite the importance of trade-in strategy in terms of channel choice and rebate value to DC retailers, there is no previous studies investigating it. Thus, this paper fills this gap.

To investigate optimal trade-in rebate under each channel choice and explore which trade-in channel choice is more conducive to DC retailers, we consider a DC retailer that sell a new durable product to a group of consumers via both offline and online channels, and offer trade-in service through OFC, ONC or DBC to possible replacement consumers. Note that, both new and replacement consumers are considered in this study. According to the choice of trade-in service channels, we develop three theoretical models with respect to OFC, ONC and DBC to examine the optimal trade-in strategy for the DC retailer. The optimal decisions on trade-in channel choice, trade-in rebate and new product price are examined, and then the demand from new consumers, new and replacement consumer surplus, and the optimal profit under each model are further investigated. Our results provide insights for DC retailers to determine optimal trade-in rebate and trade-in channel choice among OFC, ONC and DBC.

Notably, to capture some key features of the operating environment,

we consider that both new and replacement consumers are heterogeneous with respect to the following two important dimensions. First, consumers are allowed to differ in the valuation for a new product. Second, we allow consumers to differ in shopping cost at the physical stores. This cost can be seen as a hassle cost that can include travel costs incurred by store visits and additional time required to search for a particular product and expected wait at the checkout counters. This hassle cost would depend on the monetary value of store visit and time for the individual consumer (Cao et al., 2016).

The rest of the paper is organized as follows. Section 2 reviews the most relevant literature. In Section 3, we present our theoretical models and the solution procedures. In Section 4, the optimal decisions on the channel choice of offering trade-in services are examined, and the optimal trade-in rebates, pricing strategies and the optimal profits of DC retailers are also investigated. Section 5 offers concluding remarks. All proofs are presented in the Appendices.

2. Literature review

Our work focuses on examining the optimal trade-in strategy of DC retailer with online and offline sales channels. Two main topics of prior research are primarily related to our study, i.e., dual channel management and trade-in strategy.

The first stream is related to dual channel management, which has received considerable attention in both marketing and operations literature. Most related studies focus on examining the impacts of introducing an online channel on optimal decisions and profits of manufacturers or suppliers who typically sell products through physical channels. Some work investigate the effect of online channel on pricing strategy and optimal profits of supply chain players (Cattani, Gilland, Heese, & Swaminathan, 2006; Batarfi, Jaber, & Aljazzar, 2017). In particular, Chiang, Chhajed, and Hess (2003) consider a manufacturer selling product to consumers through an independent retailer, and investigate whether a direct channel (e.g., online channel) is helpful to the manufacturer. They find that the introduction of a direct channel can benefit the manufacturer even if no sales occur in the direct channel. Note that, introducing an online channel leads to direct competition between online and physical channels. Some studies have examined channel competition between online and offline channels, e.g., Cattani et al. (2006), Lu and Liu (2013), Chen (2015b) and Li, Huang, Cheng, and Ji (2015). Specifically, Yao and Liu (2005) has explored price competition between a physical retailer and an online retailer. Some recent work has further examined related issues, e.g., consumer choice between online and offline channels (Balakrishnan, Sundaresan, & Zhang, 2014) and consumers online shopping habits (Jopson, 2013). Notably, these studies have a same feature that online (or direct) channel and offline channel belong to different firms, which is different with our study.

In recent years, however, many retailers have realized the need to integrate their physical and online channels together to enrich customer value proposition and improve operational efficiency (Gao & Su, 2016b). As a result, omnichannel management has received increasingly attention in academic research (Rigby, 2011; Brynjolfsson, Hu, & Rahman, 2013). Gao and Su (2016a) investigate retailers' strategies on three omnichannel information mechanisms, i.e., physical showrooms, virtual showrooms and availability information. They find that the three mechanisms may not exhibit complementarities when consumers are homogeneous. Gallino and Moreno (2014) empirically show that the implementation of the channel "buy online and pick up in store" (BOPS) can reduce online sales and increase offline sales and traffic. Gao and Su (2016b) further examine the impact of implementing BOPS channel on the profits of different types of products and consumer base for a retailer, and find that BOPS is not suitable for all products. Similarly, Cao et al. (2016) examine the impact of BOPS on the demand allocations and profitability of retailer, and find that retailers should carefully select products which are sold through the BOPS channel. This

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