



A generalized model of partial resale

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ABSTRACT

Partial resale refers to the business scenario where some resale activities, yet not all, are feasible. A paper by Geng, Wu and Whinston [12] finds that a time-restricted resale market may benefit a ticket seller more than both unrestricted resale and no resale. This paper extends the study on profitable partial resale model in two directions with both theoretical and practical importance. First, we show that the existence of arbitrage, including scalping activities by scalpers, does not reduce the benefit of partial resale to the seller. Moreover, arbitrage may increase the benefit of partial resale to the seller. Second, we propose two structures of partial resale that differ from the one with time-restricted resale market. These two new structures lead to different firm pricing strategies and consumer behaviors, yet the eventual seller profits are the same across all three alternatives. This finding implies that the seller can have flexibility in choosing how to conduct partial resale without affecting its profitability.

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1. Introduction

The advancements of Internet-based marketplaces in recent years, such as StubHub and Craigslist, have enabled consumers to trade event tickets directly with each other with unprecedented ease. As a result, ticket resale has exploded in recent years (Kelsey Group [18], Happel and Jennings [15,16]). This in turn leads to great interest among marketers and academia to study how resale affects a ticket seller's profit.

Most of past research has focused on two polar cases regarding resale activities: one polar case is *no resale*, where resale among buyers is strictly banned; the other polar case is *complete resale*, where all tickets are exchangeable among consumers without any restriction (Deserpa [10], Williams [27], Swofford [24], Rudi, Kapur and Pyke [21], Courty [7], Karp and Perloff [17]). Geng, Wu and Whinston [12] (hereafter GWW07) argue that a third option may benefit a ticket seller more than the above two polar cases. They term this third option *partial resale*, which stipulates that *some resale activities, yet not all, are feasible*. In a stylized model consisting of two periods (*advance* and *spot*), partial resale (resale only in advance period but not spot period) may lead to a higher seller profit than both complete resale and no resale.¹

The idea of partial resale enables marketing practitioners and policy makers to study resale markets and resale policies with a significantly widened viewpoint. Nevertheless, several additional issues need to be addressed before marketing practitioners can adopt partial resale for their business practices. One such issue is *arbitrage*. Ticket arbitrage is often associated with professional scalpers who usually do not have interest in consuming any ticket. Moreover, an ordinary consumer who intends to consume a ticket may also take part in arbitrage by purchasing multiple tickets and flipping all but one of them. GWW07 does not consider professional scalpers, and limits each consumer's purchase quantity to at most one. *Will partial resale still be valuable for the seller when arbitrage is unconstrained?* The answer to this question is important for marketing practitioners, especially when online consumer-to-consumer markets have led to explosive growth of arbitrage activities (Kelsey Group [18]).

Another issue is related to how partial resale is structured. GWW07 considers one specific structure of partial resale: resale in the advance period is feasible, while resale in the spot period is infeasible (hereafter referred to as *advance-period-only resale* for ease of exposition). In practice, nevertheless, many other structures of partial resale may exist as well. *Are there alternative structures of partial resale (besides advance-period-only resale) that benefit the seller as well?* The answer to this question will not only benefit a seller in practice in terms of choosing a structure of partial resale which fits its needs and market environment, but will also expand our understanding of how broadly the idea of partial resale applies in various market environments.

This paper studies the above two issues using a two-period game-theoretical model, which has been widely adopted in the literature on

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¹ Courty [8] also considers partial resale in a different setup, yet does not find it to be superior to no resale in terms of seller profitability.

tickets and advance selling (Shugan and Xie [23], Xie and Shugan [28], Lee and Whang [19], Geng et al. [12]). Different to previous literature, we introduce arbitrage in the two-period model, and consider resale markets with different restrictions.

Our analysis provides affirmative and interesting findings on these two issues. With respect to arbitrage, we show that its existence does not reduce the benefit of partial resale to the seller. Furthermore and strikingly, arbitrage can actually increase the benefit of partial resale to the seller when the number of early arrivers is less than the number of high-valuation buyers. Intuitively, partial resale enables the seller to price-discriminate high-valuation buyers regardless of their arrival times. Without arbitrage, the sale of the high-priced tickets is constrained by both the number of the early arrivers and the number of the high-valuation buyers; with arbitrage, the seller is able to price-discriminate all high-valuation buyers. The latter case thus leads to a higher profit for the seller when the number of early arrivers is less than the number of high-valuation buyers.

With respect to the structure of partial resale, we study two alternatives to advance-period-only resale. Under the first alternative, tickets sold in the advance period are resalable while the ones sold in the spot period are not. We call this alternative *advance-ticket-only resale*. Advance-ticket-only resale differs from advance-period-only resale in that the former allows the resale of advance tickets even in the spot period while the latter does not. This difference changes buyers' beliefs and their purchase and resale decisions. Consequently, the ticket seller's optimal pricing strategy under advance-ticket-only resale is significantly different from that under advance-period-only resale. Nevertheless and strikingly, we show that the seller's profits are the same under the two partial resale structures. We then consider the second alternative of partial resale, *high-price-only resale*, where the seller offers two (instead of one as before) posted prices concurrently in the advance period. Tickets with the higher price are resalable, while ones with the lower price are not. Although the seller's pricing strategy and induced consumer behavior under the high-price-only resale are distinctive to those under the aforementioned two partial resale structures, the seller profit is the same. These findings show that the seller has a much larger flexibility in choosing how to conduct partial resale without affecting its profitability.

This paper contributes to the small but growing literature on ticket. A significant number of papers in this literature (Thiel [25], Williams [27], Swofford [24], Courty [7], Karp and Perloff [17], Depken [9]) consider resale by professional scalpers, but not by ordinary consumers. These papers also assume that scalpers differ from ordinary consumers in term of market information, risk aversion, and the ability to get tickets. In contrast, our model allows both professional scalpers and ordinary consumers to buy and resell tickets. Indeed, the emergence of online consumer-to-consumer markets, such as eBay, has provided unprecedented opportunities for ordinary consumers to trade tickets as effectively as professional scalpers.

This paper also contributes broadly to the literature on price discrimination. Past research in related fields has considered pricing discrimination using purchase history (Acquisti and Varian [11]), bundling (Sankaranarayanan [22], Geng et al. [11]), advance selling (Shugan and Xie [23], Xie and Shugan [28], Cachon [4], Guo [14], Gopal et al. [13], Aron et al. [2]), and coupons and rebates (Chen et al. [5], Lu and Moorthy [20], Cheng and Dogan [6]). Resale among consumers is often deemed detrimental to seller profit and thus assumed away in prior research on price discrimination, as characterized by Tirole [26] (page 134): "if the transaction (arbitrage) costs between two consumers are low, any attempt to sell a given good to two consumers at different prices runs into the problem..." We contribute to the literature on price discrimination by showing that resale, if carefully controlled, can be an effective price discrimination tool even if the transaction costs for arbitrage is zero.

The rest of this paper is organized as follows: The model is described in the next section. We then study the impact of arbitrage on partial resale. Next, we introduce and study two alternative structures of partial resale. We then discuss the managerial implications and conclude the paper.

2. The model

Our model consists of one monopolistic ticket seller and a large number, $\hat{\Omega}$, of buyers. The ticket seller can produce up to T tickets at a constant marginal cost normalized to zero. Tickets are sold in two periods: *advance* and *spot*. In the advance period, the ticket seller releases S_1 tickets at price p_1 . The ticket seller then makes the rest of tickets available at price p_2 in the spot period.²

There are three types of buyers: *high-type buyers*, *low-type buyers*, and *professional scalpers*. A buyer of high-type (low-type) would like to consume at most one ticket at valuation $H(L)$. $H > L > 0$. However, he/she may buy multiple tickets if he/she expects a non-negative profit from arbitrage on the resale market. A professional scalper is a buyer that has no intention to consume any ticket, i.e. with a valuation of zero. Let the total number of high- and low-type buyers be Ω , whereas $\Omega \leq \hat{\Omega}$. Ω is then the upper bound of market demand. Let the number of high-type buyers be $q\Omega$ (so the number of low-type buyers is $(1 - q)\Omega$).

The ticket seller's spot selling is close to the consumption time. Moreover and as we discussed earlier, in practice the spot period (usually lasts days or only hours) is much shorter than the advance period (usually lasts months or weeks). Therefore, it is commonly assumed in the ticket literature that, by the time the ticket seller starts spot selling, buyers know their own valuations of a ticket. In contrast, by the time the ticket seller starts advance selling, buyers (except for scalpers) do not know their own valuations. As a consequence, there is an information revelation process for each buyer from advance period to the spot period. Our model follows such an information revelation process.

In this paper we consider strategic buyers – even if a buyer can catch the ticket seller's advance selling, she may strategically opt to wait for later purchase opportunities for a better deal. Moreover, a buyer may take advantage of resale opportunities (to either sell or buy) if doing so benefits her. To model this strategic waiting behavior, we consider buyers that are differentiated by their arrival time in the market. Some buyers, called *early arrivers*, arrive early enough to catch both the ticket seller's advance and spot selling (and they can be strategic in choosing between these two purchase opportunities); the rest buyers, called *late arrivers*, arrive after the ticket seller's advance selling. Among high- and low-type buyers, let $\alpha\Omega$ of them be early arrivers, and the rest be late arrivers. For clarity, hereafter we refer to $\alpha\Omega$ as *early demand*. Due to the existence of scalpers (who may arrive early or late), early demand is no larger than the number of early arrivers. For simplicity, let a buyer's arrival time and type be independent.

Resale activities happen after the ticket seller's advance selling. Resellers can be all three types of buyers (even a high-type buyer if he/she holds more than one ticket). We assume the ticket resale price is the market clearing price determined by the aggregate supply and demand in the resale market. Because the ticket seller's spot selling changes the supply and the demand in the resale market, ticket resale prices before the spot selling may be different to that after the spot selling. Thus, we split the resale market into two over time. The resale market before the ticket seller's spot selling, if it is open, is called *advance-resale market*. That after the spot selling, if it is

² If the firm cannot sell all S_1 tickets in the advance period, one issue is whether it will carry these unsold tickets to the spot period. This issue does not affect our analysis since, as we'll show later, in equilibrium where partial resale is beneficial to the firm, all S_1 tickets will be sold out in the advance period.

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