21 Advance selling theory

Jinhong Xie and Steven M. Shugan

Abstract

The term 'advance selling' refers to a marketing practice in which the seller offers opportunities for buyers to make purchase commitments before the time of consumption. New developments in technology are overcoming many difficulties that have hindered the usefulness of advance selling in the past and are making it economically efficient for sellers in many industries. Traditional explanations for advance selling generally require some unique industry characteristics. Recent developments in advance selling theory illustrate that the profit advantage of advance selling is far more general than previously realized; it does not require specific industry structures, such as capacity constraints and the existence of early arrivals with low valuation and late arrivals with high valuation. This suggests that offering advance sales can improve profit simply because advance selling separates purchase from consumption, which creates buyer uncertainty about their future product/service valuation and removes the seller's information disadvantage. Since such buyer uncertainty occurs in almost all markets, the profit advantage of advance selling is generally applicable to sellers in many, if not all, industries. Moreover, this recent theory explains how various factors, such as seller credibility, marginal cost, capacity constraints, competition and refunds, affect the profit advantage of advance selling, and suggests specific selling strategies under different market/product conditions. Finally, this theory also demonstrates how advance selling can improve sellers' profit without necessarily reducing buyer surplus.

Overview

The term 'advance selling' refers to a marketing practice in which the seller offers opportunities for buyers to make purchase commitments before the time of consumption. For example, providers in different service industries can advance-sell services (e.g. concerts, sports, vacation packages, training courses, park passes) that are to be delivered at a specified future date or time period. Two recent changes have greatly increased the significance of advance selling as a general marketing strategy. First, new developments in technology are changing marketing activities (Shugan, 2004) and, specifically, are overcoming many difficulties that have hindered the usefulness of advance selling in the past. These developments are making advance selling economically efficient, less costly for sellers in many industries and inhibiting barriers to advance selling such as arbitrage. Second, recent developments in advance selling theory (e.g. Shugan and Xie, 2000, 2005; Xie and Shugan, 2001) have illustrated that the conditions necessary for a profit advantage from advance selling are far more general than previously thought. For example, consider traditional price discrimination explanations for advance selling that are often implemented with yield management systems. These systems hold capacity for late purchasers who are sometimes willing to pay more than those who buy in advance. However, these traditional explanations require specific relationships between price sensitivity and time of purchase (i.e. charging less to the price-sensitive leisure customers who often purchase early). This requirement is only met in a few industries, such as the travel industry (Desiraju and Shugan, 1999). New developments in advance selling theory, however, illustrate that the profit advantage

of advance selling does not require specific industry structures, such as capacity constraints and the existence of early arrivals with low valuation and late arrivals with high valuation that we often observe in travel-related industries. It suggests that offering advance sales can improve profit simply because advance selling separates purchase from consumption, which creates buyer uncertainty about their future product/service valuation and removes the seller's information disadvantage (caused by the buyer knowing more about their own valuation than the seller does). Since such buyer uncertainty occurs in almost all markets, the profit advantage of advance selling is generally applicable to sellers in many, if not all, industries. Moreover, this recent theory explains how various factors, such as seller credibility, marginal cost, capacity constraints, competition and refunds, affect the profit advantage of advance selling, and suggests specific selling strategies under different market/product conditions. Finally, this theory also demonstrates how advance selling can improve sellers' profit without necessarily reducing buyer surplus.

In Section 1 of this chapter, we discuss how and why advances in technology are creating new opportunities for implementing advance selling strategies. In Section 2, we review various reasons for offering advance sales. We devote the next three sections to the theory of advance selling driven by buyer uncertainty concerning future valuations or consumption states. We introduce the basic idea of the theory in Section 3 and discuss factors affecting the profit advantage of advance selling in Section 4. We focus on 'when' and 'how' to advance sell and discuss six specific selling strategies applicable to sellers facing different market/product conditions in Section 5. Finally, we provide a summary and state our conclusions in Section 6.

1. New technologies facilitate advance selling

1.1 Past impediments

Although some sellers have been practicing advance selling for some time, particularly those with access to institutional channels for the purpose, older technologies continue to limit the usefulness of advance selling for at least three important reasons. First, the seller has had difficulties in controlling/limiting arbitrage, which has often dramatically reduced the profitability of advance selling. For example, consider the case where an amusement park advance sells a park pass for future admission at a discounted price. An arbitrageur could buy the discounted park passes in advance and then make a profit by reselling them at a higher price to customers who otherwise would have been willing to buy directly from the seller at high prices at the gate. Consequently, the seller lowers profits by offering advance sales. Second, until recently, many sellers lacked efficient ways of implementing advance selling, which increased transaction costs of advance sales for both sellers and buyers. For example, in order to complete a transaction in the advance period, either the buyer had to make an extra visit to the seller or the seller had to use a complicated and costly central database system and/or specialized physical distribution channel (e.g. a travel agency). It was impractical for many services to establish such a centralized database and distribution networks. Finally, the high cost of content presentation and constrained buyer–seller interaction (e.g. without travel agents) have limited traditional advance selling to the simplest and most standardized transactions.

1.2 New technology

Many recent technological advances, such as Internet websites, electronic tickets and smart cards, are overcoming these limitations and making advance selling possible and indeed desirable for many service providers. These new technological developments facilitate advance selling by providing the following benefits:

1. *Limiting arbitrage* Electronic tickets and smart cards (i.e. credit card sized tickets with computer chips) can store and dynamically update relevant information such as the value, the quantity, the number and kind of pre-paid services, the valid duration of the pre-paid services, any restrictions on the pre-paid services and the quantity of services already consumed. Such encrypted information is making it difficult or impossible for arbitrageurs to resell the pre-purchased services (e.g. arbitrageurs are unable to certify to potential buyers that resold tickets provide the claimed services and have not expired). Smart cards provide more ample capacity for storing personal information (e.g. a digital picture of the user, biometric information) and are able to offer high-level encryption and sophisticated security protocols to identify users. These new technologies link a buyer's identity with specific purchases, which significantly increases a seller's ability to limit/control the degree of arbitrage. National Ticket Company, for example, prints personalized bar-coded redemption tickets (www.nationalticket.com). Amusement parks are beginning to place usage information on magnetic ticket strips that are updated electronically at the gate. Disney is using biometric palm readers and fingerprint scanners to identify season-pass holders (Rogers, 2002).
2. *Lowering transaction costs of advance sales* New technologies benefit advance selling by lower transaction costs for several reasons. First, widespread access to Internet websites allows sellers to make transactions and communicate with buyers remotely, without the need for physical presence. Second, new technologies are making it possible for sellers to avoid the use of a central database and the infrastructure necessary to allow real-time communication with that database. As ticketing technology becomes 'smarter', it is possible to record transaction records securely within a ticket. An electronic reader at any remote or decentralized location can obtain a customer's transaction records from the ticket itself. For example, a dry cleaning service could sell a $20 ticket good for $25 worth of future services and the ticket keeps track of the remaining balance. For a more complex example, consider a ticket for an under-hood automotive service that could contain credits for three oil changes, one tune-up and two brake inspections. As a customer consumes the services, a local device debits the ticket so that that ticket is kept current. When the customer advance-buys additional services, a credit is added to the ticket. The ticketing technology does the accounting and no communication with a central database is required.
3. *Allowing far more complex advance offerings* In addition to discouraging arbitrage and lowering transaction costs, new technologies allow far more complex transactions involving service packages with nonlinear pricing, bundling and variable consumption periods. For example, a hotel package can provide many different and complicated options, e.g. a bundle of a three-night stay with a dinner, a breakfast and, perhaps, tickets to local events; a two-night stay to be used during a specified time period that may include blackout dates; or a five-night stay that may not be

contiguous. Moreover, in addition to changes in package components, prices can continuously change over time as the service provider learns of demand and available capacity changes (e.g. due to cancellations). The service provider can now instantaneously adjust to changing conditions. In fact, it may be possible to make contingent sales, which allow buyers to make advance purchases for the right to use the service contingent on availability. Such sophisticated communications provide many benefits as well as satisfying the conditions that make advance selling profitable by creating more complex advance offerings. Complex advance offerings allow the seller to sufficiently differentiate advance offerings to avoid direct competition with other advance sellers. Moreover, complex advance offerings can focus on less constrained and more predictable dimensions of capacity. In sum, more sophisticated communication allows construction of very complex advance offerings that would be too costly to implement without the help of new technologies.

2. Why advance-sell?

Various factors can cause sellers to offer advance sales, some of which are simple and intuitive. For example, for many services, offering advance sales can prevent long lines at the gate or ticket counters on the day of service delivery, which is desirable for both buyers and service providers (e.g. amusement parks, theaters, studios, museums, auto shows, airlines and railroads). Offering advance sales may also be necessary for service providers who need time to make logistic arrangements. For instance, requiring advance registrations allows conference organizers sufficient time to arrange meeting rooms, transportation, beverages and meals, and to prepare printed materials for participants.

For example, Moe and Fader (2002) show that advance selling can provide sellers with important information that allows better forecasting of future demand. Gale and Holmes (1993) argue that advance selling allows sellers to divert demand from high-demand peak periods to off-peak periods with lesser demand. For a review of this literature, see Anderson and Dana (2005). Other causal factors, however, may be less straightforward. In this section, we focus on several important economic factors that motivate advance selling.

2.1 Advance selling driven by price discrimination

Until recently, advance selling theory has largely focused on the benefits of price discrimination and has been applied mostly in travel-related industries (Borenstein and Rose, 1994; Stavins, 2001). Although price discrimination usually requires monopoly power, Dana (1998) argues that, despite a lack of market power, firms might still use advance purchase sales to sell to low-valuation customers at lower prices as predicted by traditional models of second-degree price discrimination. Hence, when potential buyers differ in their willingness to pay and the certainty with which they will need the service, advance selling allows sellers to charge a lower price to buyers with lower valuations and a larger probability of needing the service.

Second-degree price discrimination can be an important factor motivating advance selling in these industries because these industries possess some specific characteristics, such as capacity constraints and the existence of two unique segments, 'leisure travelers' and 'business travelers', of which the former are typically more price sensitive and buy

earlier and the latter are typically less price sensitive but buy later. Hence, by offering customers the options of purchasing in advance at a low price or waiting to buy when close to the time of service delivery at a high price, the seller creates opportunities to segment the market based on buyer heterogeneity.

As noted earlier, Dana (1998) shows that advance selling can allow the seller to segment the market based on heterogeneity in buyer demand certainty when the transaction costs of using spot prices to clear markets are excessively high (i.e. firms may employ some alternative rationing rules to clear the market). Specifically, Dana (1998) considers the situation where customers differ in certainty about their future need for the service and, consequently, their valuation. Dana (1998) considers potential buyers who differ in their willingness to pay and the certainty with which they will need the service. Advance selling allows sellers to charge a lower price to buyers with lower valuations and a larger probability of needing the service. Hence, when there is a negative correlation between demand certainty and valuation (i.e. buyers with more certain demands have a low valuation, but buyers with a less certain demand value the service more highly), customers with more certain demands and low valuation prefer to buy in advance to avoid the chance of being rationed in the spot market, especially when rationing of the item (e.g. airline seats) favors customers with low demand certainty and high valuation.

Gale and Homes (1992) provide another potential application of price discrimination when proposing that advance selling can both segment the market based on buyer heterogeneity in the strength of their preference and allow diversion of some buyers to off-peak services. Specifically, they consider the case where an airline operates two flights with departures at different times. In the advance period, all customers are uncertain about which flights they prefer, although some customers have a strong preference and others a weak one. Customers with a weak preference (e.g. with more time flexibility) prefer to buy in advance at a lower price, even though this leads to a higher risk of being ticketed on their less preferred flight (because they have bought their tickets before knowing which flight they prefer). Customers with a strong preference, on the other hand, choose to delay their purchase decision until the date of departure (i.e. after they have learned which flight fits their schedule best), even though they have to pay a higher price. Advance selling induces customers with weak preferences to buy in advance, which offers those with strong preferences a higher chance to get their preferred flight and increase their willingness to pay. Gale and Holmes (1993) further show that such discrimination provides an efficient allocation of capacity because it shifts buyers from peak to off-peak flights.

2.2 Advance selling driven by efficient capacity utilization

While advance selling at discount prices allows the seller to price-discriminate against high-valuation customers who arrive late, efficiently allocating capacity between different fare classes is extremely challenging for industries where the sellers face both capacity constraints and demand uncertainty (i.e. travel-related industries). In these industries, advance selling is often associated with yield management (also called revenue management), which utilizes heuristics and tools for capacity allocation (Weatherford and Bodily, 1992; Chatwin, 2000; Subramanian et al., 1999). As pointed out by Desiraju and Shugan (1999), yield management systems can assist advance selling only in industries with binding capacity and those that exhibit some special buyers characteristics (e.g. the inverse relationship between consumers' price sensitivity and their arrival time). Desiraju

and Shugan (1999) explain that, despite popular belief that yield management lowers prices, the actual intent of yield management is to save capacity for the late buyer who will pay lower prices. Otherwise, without capacity constraints, the seller could simply sell to meet demand.

One important yield management tool is overbooking – advance selling tickets for more seats than are actually available (Biyalogorsky et al., 1999; Chatwin, 2000; Subramanian et al., 1999). Overbooking maximizes capacity utilization and avoids revenue loss from 'no shows', but can suffer from the cost of compensating customers with confirmed seats who are bumped from an overbooked service.

Biyalogorsky and Gerstner (2004) show that in markets where low-valuation buyers arrive early and high-valuation buyers arrive late, advance selling under contingent pricing can enhance capacity utilization in the presence of both capacity constraints and demand uncertainty. In such markets, spot selling leads to low capacity utilization and decreased profits. Specifically, if capacity is reserved for spot sales at high prices, the reserved capacity will remain unsold if the high-valuation buyer fails to appear. If capacity is reserved for spot sales at low prices, the high-valuation buyer may not obtain the capacity even if she shows up, and the seller loses the opportunity to receive a high price for the purchase. However, if the seller advance sells under a contingent pricing contract, i.e. offering a low price in advance, but canceling the sales to low-paying advance buyers if high-valuation customers show up later, the seller can maximize capacity utilization and increase profit. Biyalogorsky et al. (2005) illustrate that providers with multi-class services (e.g. airlines offering first-class and coach-class seats) can increase capacity utilization by advance selling 'upgradeable tickets' to low-valuation buyers. The advance buyers of such tickets will be upgraded to a higher class of service (e.g. a hotel room with an ocean view) at the time of service delivery only if the reserved higher-class capacity remains unsold.

2.3 Advance selling driven by multiple selling limited capacities

Xie and Gerstner (2007) show that in the presence of capacity constraints, advance selling can not only be used to minimize unused capacity, as discussed earlier, but can also be used to sell a limited capacity multiple times. Advance buyers may find other alternatives after they have made advance purchases. If the alternative is sufficiently attractive, they are willing to pay a cancellation fee to terminate their pre-paid contracts. This implies that the seller has the opportunity to sell the same capacity twice, i.e. collecting fees from advance buyers who cancel and then reselling the freed slots. Multiple selling can be profitable even if the canceled unit was originally sold to high-valuation customers at a premium price and has to be resold to low-valuation customers at a low price as long as the refund offered for cancellation is lower than the resell price. Note that some consumer-added surplus is created when customers find new alternatives, which is why the advance buyers would be willing to pay a cancellation fee to get out of their paid-in-advance contract. Advance selling allows the seller to capture such consumer-added surplus – a profit potential that is not possible under a spot-selling strategy.

2.4 Advance selling driven by buyer uncertainty

All of the economic motivation factors previously discussed require either buyer heterogeneity or capacity constraints (or both), because the profit advantages from advance

selling in these cases are fundamentally driven by enhanced price discrimination or increased capacity utilization. Shugan and Xie (2000) proposed a theory of advance selling driven by buyer uncertainty, which suggests that conditions for a profit advantage are more general than previously thought and do not require the benefit of price discrimination and improved capacity utilization. Unlike research exploiting differences between consumers on their uncertainty for merely implementing price discrimination (e.g. Courty and Hau, 2000), Shugan and Xie (2000) proved that advance selling can increase profits simply because consumers have uncertainty about their future consumption states (whether consumers differ on uncertainty or not). Their proof requires conditions satisfied in almost all markets. Xie and Shugan (2001) further develop this theory by analyzing the impact of various factors affecting the profit potential of advance selling, such as seller credibility, buyer risk aversion, capacity constraints and refunds, and they offer specific guidelines for advance selling in different market/product conditions. Shugan and Xie (2005) extend the theory to competitive markets and examine how competition affects the profit advantage of advance selling. We now use a simple example to illustrate the core idea of this theory of advance selling. We then devote the next three sections to examine this theory in more detail and discuss its implications.

Consider a local river cruise line offering a 'Friday Moonlight Dance Cruise' that departs at 9:00 p.m. and returns at 1:00 a.m. The value of the dance cruise to a given customer on a given Friday may depend on many personal factors, including whether she is in a good mood for such a late-night entertainment or has an unexpected schedule conflict. When the Friday arrives, the customer knows these factors and forms a valuation (willingness to pay). Several weeks before the Friday, however, this future valuation is uncertain.

We first consider the case where the cruise line sells the ticket on the day of the cruise departure (i.e. when consumers have resolved their valuation uncertainty). We call this case 'spot selling'. Suppose, on a given Friday evening, 100 potential customers are equally likely to be in a favorable consumption state for the cruise (e.g. in good health and/or mood for enjoying a late-night dance party on the river) or an unfavorable consumption state (e.g. feeling tired, facing a deadline at work, or interested in some other activities, such as a late comedy show performed on the same Friday night). Suppose customers are willing to pay \$60 when in a favorable state, but only \$30 in the unfavorable state (of course, any number of states is possible). Also suppose that the cruise line has enough capacity to service 100 people on any given night and the average variable cost of serving a customer is \$10. With spot selling, the cruise line has two possible optimal strategies: (1) charge the higher price of \$60 and sell to only 50 customers who are in the favorable state, which leads to a profit of \$(60–10) $\times$ 50 = \$2500; or (2) charge the low price of \$30 and sell to all 100 customers, which leads to a profit of \$(30–10) $\times$ 1000 = \$2000. Clearly, under spot selling, the optimal price is \$60 and the maximum profit is \$2500. Notice that, under the optimal spot price of \$60, total consumer surplus is zero because all buyers pay a price equal to their valuation (i.e. \$60).

Next, we shall see what happens if the cruise line offers the cruise tickets three weeks before the Friday evening (i.e. when customers have some uncertainty about their valuation). We call this case 'advance selling'. Given an equal chance to be in the favorable and unfavorable states, all customers expect to have a valuation of \$60 $\times$ 0.5 + \$30 $\times$ 0.5 =

$45 for the dance cruise. Hence, by charging a discounted price of $45, the seller will be able to advance-sell to all 100 potential customers and earn a profit of $(45 − 10) × 100 = $3500. Hence, with advance selling, the seller achieves a profit improvement over spot selling of ($3500 − $2500)/($2000) = 40%. Furthermore, as in the case of spot selling, the total consumer surplus under advance selling is zero (i.e. 50 buyers in favorable state receive a total positive surplus of $(60 − 45) × 50 = $750, and 50 buyers in unfavorable state receive a total negative surplus of $(30 − 45) × 50 = −$750).

Finally, we consider the ideal case where the seller is able to implement first-degree price discrimination, such that each customer pays their respective true willingness to pay (i.e. the customers who are in a favorable state pay $60, and the customers who are in an unfavorable state pay $30). With such perfect price discrimination, the seller is able to earn a profit of $(60 − 10) × 50 + $(30 − 10) × 50 = $3500, which is exactly the same profit that she achieves under advance selling!

The above example reveals the following intriguing facts:

1. Under both advance- and spot-selling strategies, a single price is charged to all customers (i.e. $60 under spot selling and $45 under advance selling), suggesting that the 40 percent profit advantage of advance selling is *not* achieved by enhanced price discrimination or price discrimination of any kind (all consumers pay the same price).
2. Under both advance- and spot-selling strategies, the seller has enough capacity to serve all potential customers, suggesting that the 40 percent profit advantage of advance selling is *not* due to the benefit of yield management.
3. Advance selling increases the cruise line's profit by 40 percent but has no impact on total consumer surplus, suggesting that advance selling can help the seller without hurting buyers.
4. Advance selling allows the cruise line to achieve the amount of profit only possible under first-degree price discrimination (i.e. $3500), suggesting that the profit advantage of advance selling can be enormous.
5. This example is not dependent on these particular numbers. In fact, Xie and Shugan (2001) show that increased profits of 100 percent are possible. Moreover, advance selling can increase profits with or without positive variable costs.

These facts are intriguing because they cannot be explained by the previous theory of advance selling and raise many important questions. For example, without the benefit of price discrimination and yield management, what is the fundamental source for the 40 percent profit improvement? How can advance selling benefit the seller without harming the buyer? How can the seller achieve the profit of first-degree price discrimination without either knowing the individual consumers' consumption states or charging them different prices? Furthermore, do these intriguing facts only hold for this specific example, or are they generally applicable to many more realistic settings (e.g. when consumers have more than two discrete consumption states, differ in their arrival times, or are risk averse, when the seller has capacity constraints or faces competition, or when refunds have to be offered to consumers who want to cancel advance purchases)? Finally, it is important to understand how sellers facing different market/product conditions should advance-sell. For example, when should we offer advance sales? How do we decide the price of advance

and spot sales? When should we limit the capacity for advance sales? We answer these questions in the next three sections.

3. A theory of advance selling driven by buyer uncertainty

3.1 Buyer state-dependent utility

The consumption utility of a given product or service for a given consumer may not be fixed, but may vary from time to time even if the quality of the product or service is constant (Hauser and Wernerfelt, 1990). The reason is that individual consumers can have multiple consumption states, and the level of realized utility from consuming a product or enjoying a service depends on the state of the consumer at the time of consumption or service delivery. Buyer consumption states are often affected by many personal factors, including health, mood, finances, work schedule and family situation. For example, the value of a dinner buffet at a Chinese restaurant to a given customer on a given Saturday evening could be affected by how much the customer craves Chinese food and the magnitude of the customer's hunger. The value of a summer holiday vacation package to a given family will be higher if the family is in a more favorable consumption state (e.g. healthy, in the mood for a vacation, and with no significant conflict) and lower in a less favorable state (e.g. a child has a cold, the roof of the house is leaking after major rainfall, a close friend is coming to town, or the family is facing some financial difficulty). The factors determining the true state of the customer for the specific consumption (e.g. a Chinese buffet dinner on a specific night or the vacation package for specified days and location) are often known to the customer only when close to the time of consumption. This is known as state-dependent consumption utility.

For example, consider the valuation of a soft drink. States might be not thirsty, somewhat thirsty, thirsty and very thirsty. As we move from the first state to the last, the buyer is willing to pay more for the soft drink. Close to the time of consumption, the buyer knows their own state (i.e. how thirsty they are). However, when buying in advance for future consumption, say a day in advance, the buyer has beliefs only about their future states, which we capture with state probabilities.

3.2 Spot selling: seller information disadvantage

State-dependent consumption utility can have significant implications for the seller, especially when the buyer has limited control over the time of consumption. These situations occur in many service markets (e.g. concerts, sports, cruises, group tours, educational programs, flights and trains, conferences, trade shows) where the service delivery time is scheduled by service providers rather than by each individual buyer.[1] In these situations, the buyer's willingness to pay depends on unobserved factors known only to the buyer with certainty at the time of consumption. From a seller's perspective, this implies that the seller faces an information disadvantage when close to the time of consumption (i.e. the spot period) because, at that point, the buyers know their

[1] The value of a bottle of water to a customer may vary depending on whether or not she is thirsty; however, the realized utility of the bottle of water may not vary much if she can always decide when to drink it.

consumption states while sellers do not. Such an information disadvantage can potentially reduce seller profit.

3.3 Advance selling: creating buyer uncertainty

By offering sales in advance, sellers can separate purchase and consumption, usually creating buyer uncertainty at the point of purchase around future consumption states and future valuations. Consequently, sellers can sell in advance to buyers with only uncertain future valuations or spot-sell to buyers with known valuations or do both. For example, when consumers advance purchase services (e.g. a Broadway show ticket, a summer camp sign-up, a SAT (standardized aptitude test) preparation course registration, a skating rink pass, or a tour bus voucher), they may be uncertain about their future valuation associated with the consumption of the service. Such buyer uncertainty creates an opportunity for profit improvement because it removes the seller information disadvantage. We shall see that advance selling also usually allows increased market participation because some buyers will have higher future valuations while others will have lower future valuations.

3.4 Profit advantage of advance selling

We now use a simple model to illustrate how buyer uncertainty creates a profit advantage for advance selling. To rule out the possibility of price discrimination, we consider a homogeneous market where all consumers arrive at the same time and have exactly the same distribution for their future valuation of the service. Specifically, assume that all consumers arrive in advance and have a q probability to be in a favorable state associated with a high valuation of H and a $1 - q$ probability to be in an unfavorable state associated with a low valuation of L, where $H > L$. There are absolutely no restrictions on the number of possible states and we only assume two states to illustrate the general intuition. Suppose both buyers and sellers know the distribution of buyer valuations. Let c denote the marginal cost, where $c \leq L$, and M denote the number of total potential customers. To eliminate any confusion with yield management, suppose the seller has sufficient capacity to serve all M customers.

In the case of spot selling, the seller offers sales in the spot period, in which q fraction of customers are in a favorable state and are willing to pay H and $1 - q$ fraction of customers are in an unfavorable state and are willing to pay only L. Customers decide whether to buy based on the spot price and their realized valuation. Note that customers have different realized valuations in the spot period (i.e. H or L), which is their private information unknown to the seller. The seller considers two spot-selling strategies: charging a high spot price of H or a low spot price of L.[2] We call these two spot-selling strategies 'high-price spot selling' and 'low-price spot selling', respectively. The profits under the two spot-selling strategies are given in the first two columns of Table 21.1. In the case of advance selling, the seller offers sales in the advance period, in which customers, like the seller, do not know their future consumption state. Given such buyer uncertainty, customers make purchase decisions based on their expected valuation

[2] Spot selling at any price between L and H is dominated by spot selling at a price of H; spot selling at any price below L is dominated by spot selling at a price of L.

Table 21.1 Profit advantage of advance selling

	High-price spot selling	Low-price spot selling	Advance selling	First-degree price discrimination (FPD) in the spot period
Price	H	L	$EV = qH + (1-q)L$	H (to those in favorable state) L (to those in unfavorable state)
Sales	qM	M	M	M
Profit	$qM(H-c)$	$M(L-c)$	$M(qH + (1-q)L - c)$	$M(qH + (1-q)L - c)$
Lost profit compared to FPD	$M(1-q)(L-c)$	$Mq(H-L)$	0	N/A
Consumer surplus	0	$Mq(H-L)$	0	0

EV, where $EV = qH + (1-q)L$. The seller offers advance sales at a price of EV.[3] The profit under 'advance selling' is presented in the third column of Table 21.1.[4]

To understand the sources of the profit advantage of advance selling, we compare each of the selling strategies with the ideal situation where the seller is able to implement first-degree price discrimination (FPD), i.e. charging buyers in a favorable state a high price of H and buyers in an unfavorable state a low price of L. We present the case of first-degree price discrimination in the last column of Table 21.1. We show the price, sales and profit under each case in the first three rows and the lost profit of each selling strategy compared with the case of FPD in the fourth row of Table 21.1. We also presents consumer surplus under each case in the last row of Table 21.1.

Table 21.1 reveals that, compared with the case of first-degree price discrimination, the two spot-selling strategies lead to lower profits. Specifically, the profit lost under high-price spot selling strategy is $M(1-q)(L-c)$. This profit decrease occurs because under high-price spot selling, the seller fails to capture demand from customers in an unfavorable state although their valuation is higher than the cost, $L > c$. This profit decline is greater when the profit margin from selling to these consumers increases (i.e. $L - c$ is higher) or when more customers will be in an unfavorable state (i.e. q is smaller). The profit decrease under low-price spot selling is $Mq(H-L)$. This profit decrease occurs because, under low-price spot selling, the seller charges the same price to all consumers

[3] Advance selling at any price above EV generates zero sales; and advance selling at any price below EV leads to the same sales but a lower profit margin compared with advance selling at a price of EV.

[4] Note that the seller can also consider offering sales both in advance and spot periods such as advance selling at a price of EV and spot selling at a price of H, or advance selling at a price of EV and spot selling at a price of L. However, the former is equivalent to advance selling only at EV because all consumers will buy in advance, and the latter is equivalent to spot selling only at L because all consumers will wait.

although those in a favorable state have a higher valuation than those in an unfavorable state, $H > L$. This profit decline is greater when the difference between valuations associated with favorable and unfavorable states increases (i.e. $H - L$ is larger) or when more consumers will be in a favorable state (i.e. q is higher).

The profit decreases under spot selling shown in Table 21.1 are not surprising given that the seller has neither the knowledge of individual consumers' consumption states nor the market power to charge different prices to consumers in different consumption states. However, it is surprising to see in Table 21.1 that, with the same seller knowledge and market power, the advance selling strategy allows the seller to achieve the profit that would be possible only under first-degree price discrimination (i.e. the lost profit under advance selling is zero), regardless of the specific values of H, L, q and c. (Notice that our early example of the local river cruise line is a special case of Table 21.1, where $H = 60$, $L = 30$, $q = 0.5$, $c = 10$.)

The advantages of advance selling over spot selling illustrated in Table 21.1 are fundamentally driven by buyer uncertainty that only occurs in the advance period but not in the spot period. The seller has an information disadvantage in the spot period given that the buyer's consumption state is known to the buyer but not to the seller. As a result of such an information disadvantage, the seller has to either give up the potential demand from consumers in an unfavorable state (as in the case of high-price spot selling) or give up the high profit margin from consumers in a favorable state (as in the case of low-price spot selling). However, as shown in Table 21.1, moving the transaction time from the spot period (i.e. when buyers have no uncertainty) to the advance period (i.e. when buyers have uncertainty) allows the seller to achieve both the benefits of a larger demand and a higher margin. This is because buyer uncertainty motivates consumers to change their decision criterion, i.e. rather than making purchase decisions based on realized utility in the spot period, they make those decisions based on expected utility in the advance period. Note that customers' realized utility is an individual consumer's private information unavailable to the seller; however, their expected utility can be constructed based on the seller's knowledge about the distribution of consumer valuation using the aggregate sales data. Without an informational disadvantage in the advance period, the seller is capable of reaching full market coverage (i.e. selling to all M customers) at a price higher than the valuation associated with an unfavorable state, $EV > L$. Note that if the same price of $EV = qH + (1 - q)L$ is offered in the spot period, the seller can only generate a demand of qM and is unable to reach full market coverage.

Finally, Table 21.1 shows that consumer surplus under advance selling is the same as that under high-price spot selling but lower than that under low-price spot selling. This implies that advance selling improves profit without reducing buyer surplus as long as the seller prefers high-price spot selling over low-price spot selling, which is the case when the favorable-state probability (q) is sufficiently high, the valuation difference between favorable and unfavorable states ($H - L$) is sufficiently high, or the profit margin from selling to customers in an unfavorable state ($L - c$) is sufficiently low. In sum, advance selling increases market participation, which increases profits without affecting consumer surplus.

It is important to note that although the simple model presented here has only two possible consumption states (i.e. a favorable state and an unfavorable state), the profit advantage of advance selling driven by buyer uncertainty applies for any distribution

of consumer valuations provided that expected valuations are above cost (see Shugan and Xie, 2004 for a formal analysis of a general distribution of consumer valuation). Furthermore, although the profit advantage of advance selling does not require buyer heterogeneity in the advance period (e.g. our simple model assumes the same distribution of valuation for all potential buyers), buyer heterogeneity can make advance selling even more profitable. For example, Shugan and Xie (2004) show that when buyers differ in their distribution of valuation, advance selling can future-improve profits by price discrimination between different segments with a combination strategy: advance selling at a discounted price and spot selling at a high price (see also Xie and Shugan, 2001 for a formal analysis of the case where consumers arrive at different times).[5]

4. Important factors affecting advance selling

We have shown in the previous section that the profit advantage of advance selling does not require price discrimination nor yield management and can be driven simply by buyer uncertainty. In this section, we discuss some important factors affecting the profit potential of advance selling.

4.1 Seller credibility

The first important factor is the seller's ability to credibly offer a discounted advance price. To motivate an advance purchase, the seller must often offer a discounted advance price. Unless consumers believe that a higher price will be charged in the future, they may decide to wait rather than make an advance purchase. This situation can create problems for sellers, especially when buyers expect that sellers will offer both advance and spot sales – a likely outcome when some customers fail to plan ahead for various reasons and enter the market only in the spot period (see Xie and Shugan, 2001 for a formal analysis of this case). In general, the seller's ability to credibly commit to a high spot price is a crucial condition for inducing advance sales. At least three types of sellers can establish such credibility:

1. *Sellers with high marginal costs* When it is very costly to serve each customer, it is in the seller's best interest to charge a higher rather than a lower spot price because the benefit of serving customers in low valuation may not be sufficient to compensate for its cost. If customers were aware of a high service cost, they would expect a higher spot price. As a result, a high cost can help the seller to establish endogenous

---

[5] Table 21.1 assumes that all customers arrive in the advance period. In the case where customers arrive in both the advance and spot period, the advance purchase decision by the early arrivals will be affected by their expected future spot price, $\tilde{p}_S$. When buyer valuations are H and L with probabilities q and $1–q$, respectively, the maximum price inducing an advance purchase is $p_A^{\max} = q\tilde{p}_S + (1 - q)L$ for $\tilde{p}_S \leq H$ and $p_A^{\max} = EV$, otherwise. Furthermore, consider a general density function $f(r)$ for buyer valuations where $L < r < H$. Let p_A denote the price in the advance period. The maximum advance price (buyers will pay) can be derived by equating the early arrivals' expected surplus from advance purchase, $ESA = \int_L^H rf(r)dr - p_A$, with their expected surplus from waiting, $ESW = \int_{\tilde{p}_S}^H (r - \tilde{p}_S)f(r)dr$. Solving for p_A, we obtain $p_A^{\max} = \tilde{p}_S - \int_L^{\tilde{p}_S} (\tilde{p}_S - r)f(r)dr$ for a general distribution. Readers interested in models of advance selling strategy should consult Xie and Shugan (2001) and Shugan and Xie (2005).

credibility. This reasoning is a consequence of imposing the rationality condition on consumers.

2. *Sellers with limited capacity* The optimal spot price is determined based on both the demand and the available capacity in the spot period. Sellers with limited capacity benefit little from offering low spot prices because the capacity is insufficient to satisfy the large demand. Consequently, when consumers know capacity is limited, they will expect high spot prices. Limited capacity also implies that, if the early arrivals wait, they may not be able to purchase in the spot period. A 'no capacity' situation is equivalent to one in which the spot price is infinite. Hence use of capacity constraints is another way for the seller to gaining endogenous credibility. By selling sufficient capacity in advance, the seller credibly commits to a high spot price.
3. *Sellers with established exogenous credibility* Even when sellers have very low costs and sufficient capacity, it is still possible to establish exogenous credibility. For example, many sellers, such as Disneyland, The Lake Erie Speedway and The Delaware Valley Bluegrass Festival, offer both a discounted 'Advance Price' and a regular 'Gate Price' simultaneously and routinely. A potential buyer has the option to pay a low 'Advance Price' for a future ticket or pay a high 'Gate Price' for a ticket good for the day of purchase. The fact that the future spot price is observable at the time when customers are making advance purchases allows the seller to establish exogenous credibility. Finally, persistently maintaining a reputation for a high spot price might also be sufficient for exogenous credibility when buyers expect sellers to guard zealously their reputations or face future loses.

4.2 Marginal cost

The second important factor is the marginal cost. On the one hand, a sufficiently low marginal cost is necessary to make advance selling at a discounted price profitable. As discussed earlier, advance selling allows sales to buyers who would be in unfavorable states later and would not purchase under a high spot price. Selling to those buyers, however, is unprofitable when the value of the product/service is less to them than its cost. When costs are too high (e.g. when $c > L$ in Table 21.1), advance selling fails to improve profits (see 'Strategy III: same low advance and spot prices' in the next section). We call the requirement of a sufficiently low cost the 'profitability condition' of advance selling. On the other hand, for sellers without capacity constraints, too low a cost may destroy the 'credibility' condition of advance selling, under which the customers believe the advance price is discounted from the spot price. A marginal cost that is too low may also motivate customers to wait rather than to purchase in the advance period because, under such conditions, they will expect a low spot price.

4.3 Capacity constraints

Capacity constraints affect advance selling strategies in several ways. First, they can facilitate advance selling. As mentioned earlier, without capacity constraints, a sufficiently high marginal cost is necessary to make a high spot price credible. Without that high spot price, buyers would not purchase in advance. However, in the presence of capacity constraints, the seller can credibly commit to a high spot price despite a zero marginal cost, because lack of availability implies an infinite spot price.

Second, capacity constraints allow sellers to charge a premium for advance purchase (see 'Strategy V: PREMIUM advance selling' in the next section). Without capacity constraints, buyers will pay no more in advance than the expected spot price. In the presence of capacity constraints, however, advance buyers must consider both the spot price and the likelihood of lack of availability in the spot period if they wait. They may be willing to pay a higher price in advance rather than compete with later arrivals in the spot period if the chance of obtaining capacity is sufficiently low. In general, premium advance selling is possible when the capacity is sufficiently large to make a low spot price optimal, but also sufficiently small to make the likelihood of availability in the spot period sufficiently low.

Third, although limited capacity can create the ability to advance-sell or even offer the opportunity for charging premium advance prices, it can also reduce the incentive for the seller to offer advance sales. For example, when capacity constraints are severe, the seller can easily sell out at a high spot price, implying that it is in the seller's best interest to offer only spot sales (see 'Strategy II: high spot prices without advance sales' in the next section). When capacity constraints are not too severe, the seller may benefit by offering limited advance sales at discount prices and reserve sufficient capacity for spot sales at high prices (see 'Strategy IV: discount advance selling, limit on advance sales' in the next section).[6]

4.4 Refunds for cancellations

Can the seller still benefit from advance selling if refunds are offered to advance buyers who wish to cancel their advance purchase at a later time because their state (ability to enjoy the service) becomes unfavorable? Surprisingly, as we show below, despite lower sales with refunds, advance selling with partial refunds can provide more profit than advance selling without refunds.

The benefit of offering refunds can be cost driven. To illustrate this we extend our basic model by allowing three possible consumption states that are associated with three different valuations, $\{H, L, V_0\}$, where $H > L > c > V_0$. We assume that the buyer is equally likely to be in any of the three states. Under a no-refund policy, in advance period, consumer expected valuation is $EV_{NR} = (H + L + V_0)/3$. By offering the advance sales at the price of EV_{NR}, all M potential consumers buy. The seller's maximum profit under advance selling without refunds is

$$\pi_{NR} = \left(\frac{H + L + V_0}{3} - c\right)M$$

Now consider advance selling with a partial refund, R, where $L > R > V_0$. Under such a partial refunds policy, advance buyers request refunds when in their worst state (i.e. a valuation of V_0), but otherwise enjoy the service. In the advance period, the consumer's expected valuation is $EV_R = (H + L + R)/3$. By offering advance sales at the price of EV_R, all M potential consumers will buy. Among them, two-thirds will enjoy the service,

---

[6] A formal analysis of capacity constraints on advance selling can be found in Xie and Shugan (2001).

but one-third will cancel the purchase later and will receive a refund of R. The seller's profit of advance selling with refunds is

$$\pi_R = \left\{\left(\frac{H + L + R}{3} - c\right)\frac{2}{3} + \left(\frac{H + L + R}{3} - R\right)\frac{1}{3}\right\}M = \left\{\frac{H + L}{3} - \frac{2c}{3}\right\}M$$

Now consider the difference in the profit from advance selling with (π_R) and without refunds (π_{NR}), i.e.

$$\pi_R - \pi_{NR} = \left(\frac{H + L}{3} - \frac{2c}{3}\right)M - \left(\frac{H + L + V_0}{3} - c\right)M = \left(\frac{V_0 - c}{3}\right)M$$

Profits with refunds are greater when $\pi_R > \pi_{NR}$ or $c > V_0$. This suggests that offering partial refunds increases the profitability of advance selling as long as the seller's marginal cost of offering the service is higher than the value of the service to the consumer who wants to cancel. Note that in this situation, offering partial refunds increases profits not by increasing revenues, but by cost savings from not serving customers in extremely low value states. Also note that offering refunds increases the buyer's expected utility, and thus their willingness to pay for advance sales. The seller can charge a higher advance price under the refund policy (i.e. $EV_R = (H + L + R)/3$ than that under the no-refund policy (i.e. $EV_{NR} = (H + L + V_0)/3$). This higher advance price under refunds compensates for the actual cost of the refunds. Recall our early example of the river cruise line. It is possible that some customers may be in states associated with very low or even zero value for the late-night dance cruise on a given Friday night (e.g. having severe back pain). The above discussion suggests that the cruise line can earn a higher profit by offering refunds to encourage advance buyers who value the cruise less than the cost of serving them (c = \$10). Such a refund policy also allows the cruise line to charge a higher advance price.

In addition to the benefit of refunds due to cost saving, refunds may also be used as a way of generating more revenue for sellers with capacity constraints. Xie and Gerstner (2007) show that allowing customers who find better alternatives to escape service contracts for a fee creates opportunities to sell the capacity-constrained service multiple times. The better the alternative that motivates a cancellation, the more profitable is a refund-for-cancellations policy compared with a no-refund policy that 'locks in' customers. The seller can benefit from offering refunds despite the willingness of advance buyers to abandon the service for no refund (i.e. they fail to arrive and claim the service). The role of the refund is to motivate these customers to notify the seller about their cancellations (instead of merely failing to arrive), which allows the seller to resell the service. For example, a buyer might purchase one of the best seats for a very popular concert at \$120 one month in advance. One week before the performance, however, a commitment might arise that prevents the buyer from attending the performance. In this situation, the capacity would go unused unless the buyer notified the seller of the situation. Without refunds, the highly desirable seat would be wasted. A partial refund (e.g. 50 percent of ticket value or \$60) could motivate the buyer to inform the seller of the cancellation, which allows the seller to resell the seat. It is important to note that the benefit of offering refunds for multiple selling requires capacity constraints. Sellers with sufficient capacity do not benefit from reselling returned capacity given that the seller has sufficient capacity to satisfy all potential demand.

4.5 Competition

Competition weakens or eliminates the effectiveness of many marketing strategies (e.g. bundling, quantity discounts, coupons and loyalty programs intended to exploit price discrimination). We might wonder whether the same negative effect of competition applies to advance selling. Recent work by Shugan and Xie (2005) shows that the profit advantage of advance selling driven by consumer uncertainty can not only survive competition, but also be greater in a competitive market than in a monopoly market, because, unlike many other marketing strategies, advance selling is not driven by price discrimination. Competition weakens other marketing strategies that exploit price discrimination because competitors target those being discriminated against. As a result, the profit advantages of marketing strategies based on price discrimination are often weaker for a seller facing competitors than for a monopoly seller. The profit advantage of an advance selling strategy, however, as shown in this chapter, does not require price discrimination. It can be driven simply by consumers' uncertainty about their future consumption states. Competition may not diminish the advantage of advance selling because consumer uncertainty applies to all consumers in the advance period; thus a competitor is unable to focus attention on only one group of consumers. It is possible, though, that the existence of a competitor can make it harder to satisfy the credibility condition of advance selling (i.e. consumers believe a high price will be charged in the spot period) because such competition may force the seller to lower spot prices. Shugan and Xie (2005) find that under some market conditions, advance selling can increase both the competitors' profits and the consumers' surplus because advance selling leads to greater market coverage. For example, suppose that buyer preferences for one competitor over another become apparent only in the spot period. Then, competition could raise spot prices as buyers only purchase from their preferred competitor (e.g. see Hauser and Shugan, 1983 for examples of how competition can raise prices). As noted earlier, higher spot prices can facilitate advance sales because advance prices are unable to exceed spot prices. Hence competition can create conditions profitable for advance selling.

4.6 Buyer risk aversion

Finally, will the profit advantage diminish or disappear when buyers are risk averse? Intuitively, buyer risk aversion could make advance purchasing less attractive because future valuations are uncertain. Sellers might need to take deeper discounts in the advance period, thereby making advance selling less profitable. Xie and Shugan (2001) examine the impact of buyer risk aversion on advance selling and find that the profit advantage of advance selling does not depend on risk neutrality. Buyer risk aversion can either increase or reduce the profitability of advance selling. Risk aversion increases the profitability from advance selling when buyers associate a greater loss with not enjoying discounted prices in favorable states than paying more than their valuations in unfavorable states.

5. When and how to advance-sell: six specific selling strategies

In the previous sections, we have explained why buyer uncertainty can turn advance selling into a profit advantage, and we have discussed some important factors affecting the profit potential of an advance-selling strategy. In this section, we focus on when and how to advance-sell. We discuss six specific selling strategies and provide guidelines for sellers who face different product/market conditions. Xie and Shugan (2001) develop a formal

model to derive these selling strategies, which states the explicit conditions under which each strategy is optimal. We illustrate these strategies here by providing several numerical examples in Table 21.2. As defined earlier, H and L denote consumer valuation in favorable and unfavorable states, respectively; q denotes the probability that a consumer will be in a favorable state, and c denotes the marginal cost. Furthermore, the model allows consumers to enter the market at different times. For example, some vacationers are 'early arrivals' who plan their vacation and thus have the opportunity to make advance purchases. There are also 'later arrivals', those who wait until the last minute to make a decision concerning their vacation and thus often miss opportunities for advance sales. Specifically, for the examples in Table 21.2 (except Example 1), consider the case where there are a total of M potential buyers, and $N = M/2$ buyers arrive in each of the two periods (i.e. the advance and spot periods). Finally, T denotes the level of capacity. To highlight the impact of the two important factors, capacity constraints and marginal cost, we set the same values for H and L in all of these examples ($H = 50$, $L = 30$, i.e. the consumer is willing to pay \$50 in a favorable state and \$30 in an unfavorable state) but vary N, T and c.

5.1 Strategy I: advance sales only

Under this strategy, the seller offers only advance sales. This strategy is best when there are no late arrivals, capacity is not a binding constraint, and the seller can credibly claim that spot sales are not available. That credibility occurs, for example, because the seller would probably suffer future losses in reputation from deceiving customers by making an advance announcement of no spot sales and later reneging on that statement. Our subsequent examples will explore the case without this form of exogenous credibility. Without exogenous credibility, consumers believe only seller announcements that are consistent with the seller's best strategy within the stated problem. For instance, consumers believe an announcement of no spot sales only when it is, in fact, more profitable for the seller to have no sales in the spot period than to spot-sell.

Let us consider a three-hour cruise at Clearwater Beach with a boat passenger capacity of $T = 200$ people. Assume that a potential customer is equally likely to be in a favorable state (e.g. a valued companion can also participate) or an unfavorable state (e.g. the companion is unable to participate), that is, $q = 0.5$. The customer will pay $H = \$50$ in a favorable state and $L = \$30$ in an unfavorable state. During the high season, many tourists may be interested in such a boat trip. Suppose that a total of $M = 200$ potential customers are interested in a given trip and all arrive in the advance period. In this case, the highest advance price the seller can charge is the customers' expected valuation, $\$50 \times 0.5 + \$30 \times 0.5 = \$40$. Hence, if costs are zero, $c = \$0$, then the seller would always prefer to sell all 200 tickets at the advance price of \$40, yielding a profit of $\$40 \times 200 = \$8000$. Spot selling at \$50 would yield a profit of only $\$50 \times 100 = \$5000$ and spot selling at \$30 would yield a profit of only $\$30 \times 200 = \$6000$. This case is Example 1 in Table 21.2.

5.2 Strategy II: high spot prices without advance sales

Under this strategy, the seller offers spot sales at a high price and does not offer advance sales. This strategy is best if either the capacity is sufficiently small or the cost is sufficiently high. A sufficiently small capacity occurs when all capacity can be sold at high spot prices. Sufficiently high costs occur when producing advance sales requires advance prices below marginal costs.

Table 21.2 Examples of six specific selling strategies

Example 1: $H = 50$, $L = 30$, $q = 0.5$, $M = 200$ (all arrive in the advance period), $T = 200$, $c = 0$ **→Strategy I (advance sales only) is optimal**	
Strategy	Profit
High spot price ($50) only	$\$50 \times 0.5 \times 200 = \$5000$
Low spot price ($30) only	$\$30 \times 200 = \$6000$
Advance price ($40) only	$\$40 \times 200 = \$8000$**←Optimal**
High advance price & low spot price	Same profit as low spot price because all buyers wait to buy spot
Example 2: $H = 50$, $L = 30$, $q = 0.5$, $N = 100$, $T = 85$, $c = 25$ **→Strategy II (high spot prices without advance sales) is optimal**	
Strategy	Profit
High spot price ($50) only	$\$(50–25) \times 85 = \$2125$**←Optimal**
Low spot price ($30) only	$\$(30–25) \times 85 = \$425$
Advance price ($40) only	$\$(40–25) \times 85 = \$1275$
Advance price ($40) & spot price ($50)	Same profit as advance selling only ($40)
Same low spot & advance price ($30)	Same profit as spot selling at $30
Same high spot & advance price ($50)	Same profit as spot selling at $50
Example 3: $H = 50$, $L = 30$, $q = 0.5$, $N = 100$, $T = 200$, $c = 0$ **→Strategy III (same low advance and spot prices) is optimal**	
Strategy	Profit
High spot price ($50) only	$\$50 \times 0.5 \times (100 + 100) = \$5000$
Low spot price ($30) only	$\$30 \times (100 + 100) = \$6000$**←Optimal**
Advance price ($40) only	Not credible – all consumers wait to buy spot at $30
Advance price ($40) & spot price ($50)	Not credible – $30 is the optimal spot price
Low advance price ($30) & spot price ($30)	$(\$30 \times 100) + (\$30 \times 100) = \$6000$**←Optimal**
Example 4: $H = 50$, $L = 30$, $q = 0.5$, $N = 80$, $T = 85$, $c = 0$ **→Strategy III (discount advance selling, limit on advance sales) is optimal**	
Strategy	Profit
High spot price ($50) only	$\$50 \times 0.5 \times (80 + 80) = \$4000$
Low spot price ($30) only	$\$30 \times 85 = \$2550$
Advance price ($40) only	$\$40 \times 80 = \$3200$
Advance price ($40) & spot price ($50)	$(\$40 \times 80) + \$50 \times (85–80) = \$3450$
Discounted advance price ($40) with limited advance sales of 10 units & high spot price ($50)	• Set advance limit to be S • Remaining spot capacity is $85–S$ • Spot sales are $(0.5)(80 + 80–S)$ • Solve for the optimal limit: $85–S = (0.5)(80 + 80–S)$, $S = 10$ • Profit$=(\$40 \times 10) + (\$50 \times 0.5 \times (80 + 80–10)) = \$4150$**←Optimal**

Table 21.2 (continued)

Example 5: $H = 50$, $L = 30$, $q = 0.5$, $N = 55$, $T = 85$, $c = 0$ **→Strategy IV (discount advance selling, no limit on advance sales) is optimal**	
Strategy	Profit
High spot price ($50) only	$\$50 \times 0.5 \times (55 + 55) = \$2750$
Low spot price ($30) only	$\$30 \times 85 = \$2550$
Advance price ($40) only	$\$40 \times 55 = \$2200$
Discounted advance price ($40) without limiting advance sales & high spot price ($50)	$\$40 \times 55 + \$50 \times 0.5 \times 55 = \$3575$←**Optimal**
Example 6: $H = 50$, $L = 30$, $q = 0.44$, $N = 55$, $T = 85$, $c = 0$ **→Strategy V (PREMIUM advance selling) is optimal**	
Strategy	Profit
High spot price ($50) only	$\$50 \times 0.44 \times (55 + 55) = \$2420.00$
Low spot price ($30) only	$\$30 \times 85 = \$2550$
Advance price ($0.44 \times 50 + 0.56 \times 30 = \$38.80$) & spot ($30)	Not credible – all consumers wait & try to buy at $30
Premium advance price ($32) advance sales & low spot price ($30)	• Probability of available spot capacity given everyone tries to spot-buy: 85/(55+55) = 17/22 • Spot probability of both a favorable state & no available spot capacity: $0.44 \times (1–(17/22)) = 0.10$ • Advance price inducing sales: $0.10 \times 50 + (1 - 0.10) \times 30 = \$32$ • $\$32 \times 55 + \$30 \times (85 - 55) = \$2660$←**Optimal**

Note: H, L = valuation in favorable and unfavorable states; q = the probability to be in favorable states; N = the number of arrivals in each period; T = capacity, c = the marginal cost.

Again, let us consider the same cruise, this time with a capacity of $T = 85$ people. For this and subsequent examples, assume half of the $M = 200$ customers arrive in the advance period ($N = M/2$) and the remainder arrive in the spot period. In this case, with $q = 0.5$, the highest advance price the seller can charge is the customers' expected valuation, $\$50 \times 0.5 + 30 \times 0.5 = \$40$. Note that a total of 100 customers will be in a favorable state in the spot period and are willing to pay $50, but the seller has only a total of 85 units for sale. Hence the seller would always prefer to sell all 85 tickets at the higher spot price of $50 and sell no tickets at the lower advance price of $40 given a constant marginal cost. Advance selling should also be avoided when the marginal cost is too high (i.e. failing to satisfy the profitability condition discussed earlier). For example, if it costs more than $40 to serve each customer on board (e.g. variable costs including refreshments), it is more profitable for the seller to charge a high spot price without offering advance sales at a discounted price, even if the capacity is sufficient to satisfy all demand. Example 2 in Table 21.2 provides numerical details for this example ($H = 50$, $L = 30$, $q = 0.5$, $N = 100$, $T = 85$, $c = 25$), in which selling only at a high spot price is best.

5.3 Strategy III: same low advance and spot prices

This strategy, which involves advance and spot selling at the same low price that induces purchases from all buyers and is equivalent to selling only at a low spot price, works best when the seller has both unlimited capacity and very low costs. With neither capacity constraints nor high marginal costs, a low spot price is often optimal because the large capacity and low cost make it more profitable to sell to all customers at a low price than to sell to customers in the favorable state only at a higher price. Early arrivals expect such a low price in the spot period and will only advance-buy at prices equal to the low spot price. Thus advance selling at that price generates no more profit than spot selling alone when we require endogenous credibility. Consider Example 3 in Table 21.2 ($H = 50$, $L = 30$, $q = 0.5$,$N = 100$, $T = 200$, $c = 0$), which differs from Example 2 in the value of two parameters: (1) the seller now has sufficient capacity to serve all 200 potential customers (i.e.$T = 200$) and (2) the boat offers neither beverages nor entertainment and thus bears a near zero marginal cost (e.g. $c = 0$). In this case, if the seller adopts Strategy II, i.e. spot selling at a high price without offering advance sales, the profit is $\$(50 \times 100) = \$5000$. However, by offering the same price of \$30 in both the advance and spot periods, the profit is $\$30 \times 100 + \$30 \times 100 = \$6000$. Note that an advance price higher than \$30 fails to induce advance sales because consumers wait to spot buy at the low spot price of \$30. Of course, if the seller had some other means to guarantee a spot price of \$50, similar to Example 1, then advance selling would again become more profitable than solely spot selling.

5.4 Strategy IV: discount advance selling, limit on advance sales

Under this strategy, the seller advance-sells at a discount from the spot price, but limits the number of advance sales in order to reserve sufficient capacity for sales in the spot period. This strategy is best when (a) the cost is sufficiently low to satisfy the profitability condition of advance selling, and (b) the capacity is sufficient to serve all late arrivals who are in a favorable state but insufficient to satisfy all additional advance demand. Consider Example 4 in Table 21.2 ($H = 50$, $L = 30$, $q = 0.5$, $N = 80$, $T = 85$, $c = 0$), which differs from Example 2 only in the value of two parameters: (1) there is a total of 160 (i.e. $N = 80$) rather than 200 (i.e. $N = 100$) potential customers for a given boat trip; hence the seller faces a less severe capacity constraint compared with Example 2, and (2) the marginal cost is zero. In this case, if the seller should adopt Strategy II by spot selling at a price of \$50 without offering advance sales, 80 customers in the favorable state will buy and the seller earns a profit of $\$50 \times 80 = \$4000$. It is easy to see that this strategy is not optimal because there is still some unsold capacity and unfulfilled demand. Alternatively, all 85 tickets can be sold in the spot period under a low spot price of \$30; however, this strategy leads to a still lower profit of $\$30 \times 85 = \$2550$. Now suppose that the seller offers advance sales at a price of \$40 and spot sales at \$50. Under this strategy, 80 tickets will be sold in the advance period and five tickets will be sold in the spot period, earning a profit of $\$(40 \times 80 + 50 \times 5) = \$3450$. Although this profit represents a significant improvement over the two spot-selling strategies, the seller can further increase profit by limiting the number of tickets offered for sale in advance. Specifically, it is optimal to offer only ten tickets for sale in advance at a price of \$40.

We set this limit on advance sales, denoted S, by equating spot demand with available capacity. Selling S units in the advance period leaves $85 - S$ capacity in the spot period.

Spot demand will consist of 50 percent, i.e. the percentage in a favorable state, of the total number of consumers remaining in the spot period, which is $80 + 80 - S$, because we have already sold S in the advance period. Hence we solve $85 - S = 0.5 \times (80 + 80 - S)$ to find that $S = 10$ units.

With this limit, ten customers will purchase tickets in advance at a discounted price and the remaining 150 customers (i.e. 70 advance arrivals plus 80 later arrivals) will make purchase decisions in the spot period. Of these 150 consumers, 75 will be willing to pay the high spot price of \$50 given their favorable consumption state. Hence the seller earns a higher total profit of $(\$40 \times 10) + (\$50 \times 0.5 \times (80 + 80 - 10)) = \$4150$ by advance selling and limiting advance sales, in this case to ten units.

5.5 Strategy V: discount advance selling, no limit on advance sales

Under this strategy, the seller does not limit advance sales. This strategy is optimal if the cost is sufficiently low to satisfy the profitability condition and the capacity is sufficiently large to serve all early arrivals as well as all later arrivals who are in a favorable state. Consider Example 5 in Table 21.2 ($H = 50$, $L = 30$, $q = 0.5$,$N = 55$, $T = 85$, $c = 0$), which differs from Example 4 only in the number of potential customers, i.e. there is a total of $M = 110$ ($N = 55$) rather than $M = 160$ ($N = 80$) potential customers for a given trip. Hence the seller faces less severe capacity constraints in Example 5 than in Example 4. In this case, the capacity of 85 is sufficient to serve all 55 early arrivals plus 30 later arrivals in a favorable state and the cost is lower than the valuation of customers in an unfavorable state. Hence the optimal strategy is to sell tickets to all early arrivals at the discounted price of \$40 and to later arrivals at a higher spot price of \$50. The seller's profit under this strategy is $\$(40 \times 55 + 50 \times 0.5 \times 55) = \$3575$, which is higher than any strategy that excludes advance sales (i.e. without offering advance sales, the profit is $\$50 \times 0.5 \times (55 + 55) = \$2750$ under a high spot price and $\$30 \times 85 = \$2550$ under a low spot price). The higher spot profit for higher-price tickets makes the high spot price credible without the need for any form of exogenous credibility

5.6 Strategy VI: PREMIUM advance selling

This is a unique strategy under which advance sales are priced at a premium rather than discounted from the spot price. This strategy is best when the capacity is sufficiently large to make a low spot price optimal but also sufficiently small to make the likelihood of availability in the spot period sufficiently low. We might wonder why buyers would be willing to pay a premium in the advance period over the spot price when waiting is an option. As we show in the following analysis, charging a higher advance price is possible when early arrivals receive a greater benefit (surplus) by securing their capacity at a higher price, compared with competing for capacity with later arrivals in the spot period. Although this reasoning resembles risk aversion, it does not require risk aversion. We demonstrate that fact by providing an example with risk-neutral buyers. Consider Example 6, ($H = 50$, $L = 30$, $q = 0.44$,$N = 55$, $T = 85$, $c = 0$), which differs from Example 5 in only one way – the probability that a customer will be in a favorable state is 44 percent ($q = 0.44$) rather than 50 percent. In this case, in the advance period, a customer's expected valuation is $\$50 \times 0.44 + \$30 \times (1 - 0.44) = \$38.80$ for the boat trip.

In this case, however, the seller is unable to induce advance sales at an advance price of \$38.80 because early arrivals do not believe a high price of \$50 will be charged in the

spot period (i.e. the high spot price of \$50 is not credible). Specifically, the profits from only spot selling at a high price of \$50 are $\$50 \times 0.44 \times (55 + 55) = \$2420$ because only 44 percent of the 110 total arrivals will buy. Meanwhile, the profit from simply offering the low spot price of \$30 is $\$30 \times 85 = \$2550$, because there is insufficient capacity to sell to more than 85 customers. Since the low spot price provides greater profit (\$2550) for the seller than does a high spot price (\$2420), early arrivals expect that a low spot price of \$30 will be offered if they wait. In that case, they get a positive expected surplus because they receive $\$(50 - 30) = \$20$ if in a favorable state (and obtaining capacity), and zero surplus otherwise. Hence an advance price of \$38.80 fails to induce advance sales simply because early arrivals receive a positive expected surplus from waiting but an expected surplus of zero from purchasing in advance at a price of \$38.80.

However, early arrivals may be willing to purchase in advance at a price lower than \$38.80 but still higher than the low spot price of \$30 (i.e. advance purchase at a premium price) because, with limited availability, not all potential buyers will obtain spot capacity. Specifically, if all $55 + 55 = 110$ buyers attempt to spot buy, the probability of getting capacity is only 85/110 given capacity of 85. For this reason, early arrivals may be willing to pay a higher price in the advance period in order to guarantee capacity. Limited capacity is not a problem for the buyer when she is in an unfavorable state, because in that instance the buyer receives no surplus regardless of whether or not she buys at \$30 or fails to get capacity. In contrast, limited capacity is a problem for the buyer in a favorable state, because she would pay considerably more than \$30 (in fact up to \$50) to buy but may be unable to do so. In the advance period, the probability of this event (wanting to buy in a favorable state but not getting capacity) is $(1 - (85/110)) \times 0.44 = 0.1$. Given this probability, we can compute the amount the buyer would be willing to pay to avoid this event, which is the maximum advance price that the seller can charge to induce advance sales. Specifically, the buyer would be willing to advance buy at $0.1 \times \$50 + (1 - 0.1) \times \$30 = \$32$, which is lower than \$38.80 but still higher than \$30.[7]

We can also obtain the maximum advance price, denoted $P_A^{\max}$, by finding the advance price that makes the buyer's surplus from advance purchase, $0.44 \times (\$50 - P_A^{\max}) + (1 - 0.44) \times (\$30 - P_A^{\max})$, equal to the buyer's surplus from waiting, $0.44 \times (85/110) \times (\$50 - \$30) + (1 - 0.44) \times (\$30 - \$30)$. This leads to $P_A^{\max} = \$32$.

---

[7] There are three technical points here. The reader may skip these points, but completeness requires them. First, we used the probability 85/110 as that for obtaining capacity when we calculated the maximum advance price (i.e. \$32). At that price, early arrivals would advance buy to guarantee capacity. Now, if the probability of obtaining capacity is smaller than 85/110, then our conclusions survive and early arrivals will still advance-buy because the smaller probability increases the likelihood of the event of being in a favorable state with no available capacity. Second, when one or more consumers advance-buy, the probability of obtaining spot capacity is no longer $85/110 = 0.773$. For example, if one buyer advance-buys, the probability for obtaining spot capacity decreases to $(85 - 1)/(110 - 1) = 0.771$. If 55 buyers advance-buy, the probability of not obtaining spot capacity decreases further to $(85 - 55)/(110 - 55) = 0.55$. Hence, regardless of the way we compute the probability of obtaining capacity, an advance price of \$32 will induce advance sales. Third, if all 55 early arrivals advance-buy, the probability of wanting to buy in a favorable state but not getting capacity is $(1 - (85 - 55)/(110 - 55)) \times 0.44 = 0.2$ rather than $(1 - 85/110) \times 0.44 = 0.1$. The maximum advance price then becomes $0.2 \times \$50 + (1 - 0.2) \times \$30 = \$34$. Hence consumer expectations about other consumers' behavior influence optimal prices.

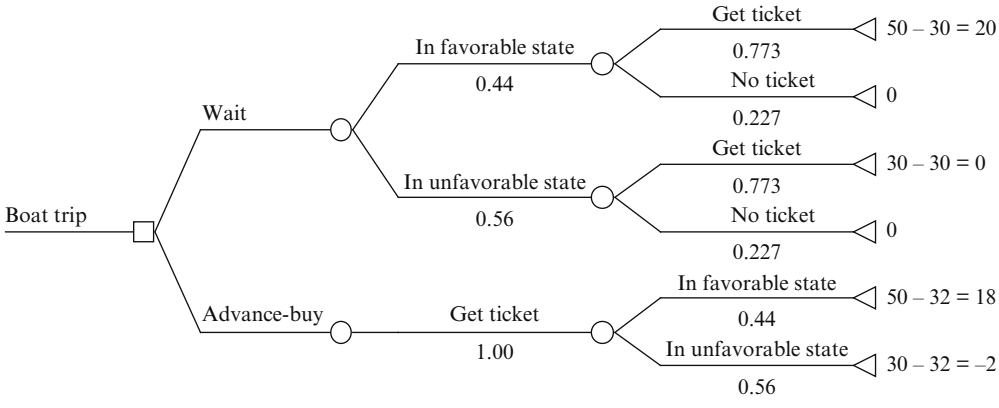

Figure 21.1 Early arrivals receive the same surplus from advance purchase at a price of $32 or from waiting to buy in the spot period at a price of $30

Figure 21.1 illustrates the buyer's decision. Specifically, it illustrates the consumer's surplus in different states under different conditions given different actions. We shall show that an advance price of $32 and a spot price of $30 make the consumer indifferent to either advance buying or spot buying, given a probability of 85/110 = 0.773 of obtaining capacity.

If early arrivals advance-buy, they pay $32. There is a 44 percent chance that their valuation will be $50 and they will enjoy a surplus of $50 − $32 = $18. There is a 1–44 percent = 56 percent chance that their valuation will be $30 and they will suffer a loss of $30 − $32 = −$2. The expected surplus from advance buying, therefore, is (0.44 × $18) − (0.56 × $2) = $6.80.

If early arrivals wait, there is a 1–44% = 56% chance of being in the unfavorable state which always results in zero surplus whether the consumer buys at $30 or does not buy at all (because the consumer valuation is $30). If early arrivals wait, there is a 44 percent chance of being in the favorable state and a probability of 85/110 = 0.773 of getting a ticket. Obtaining a ticket provides a surplus of $50 − $30 = $20 because the consumer would be willing to pay $50. The expected surplus of waiting, therefore, is 0.44 × (0.773) × ($50 − $30) = $6.80.

We see that the surplus from waiting exactly equals the surplus from advance buying. Hence, $32, or just slightly less, is the optimal advance price (to break the indifference), to induce advance buying. As shown in Example 6 in Table 21.2, premium advance selling at $32 and spot selling at $30 is superior to other strategies and produces a profit of $32 × 55 + $30 × (85 − 55) = $2660.

It is important to notice that, although 'discounted advance selling' fails to improve profit in this case, 'premium advance selling' is more profitable than any spot-selling strategy. In general, the optimality of premium advance selling depends upon the amount of available capacity, the distribution of consumer valuation, the marginal cost of the service and consumer expectation.

6. Conclusion

Advance selling is a powerful marketing tool worthy of considerable future research. We have shown that advance selling can be profitable with or without price discrimination, with or without capacity constraints, with or without competition, with or without refunds, with or without buyer uncertainty, and under other robust conditions. However, when buyer uncertainty concerning future consumption states is present, that condition alone can allow advance selling to increase profits by up to 100 percent over the profits from spot selling only at the optimal spot price. Buyer uncertainty in the advance period that would be resolved in the spot period would create private information in the spot period for the buyer. Hence the seller benefits from selling in the advance period when buyers often lack that specific private information. For the common case when buyer uncertainty about future consumption states motivates advance selling, we show that the profits from advance selling come from increased market participation rather than price discrimination. Hence advance selling for this reason, unlike price discrimination, does not necessarily reduce buyer surplus and might actually increase it. Given our enthusiasm for advance selling, we might wonder why firms are not already exploiting advance-selling tools. We argue that, for many industries, only recent technological advances have made advance selling profitable.

As noted earlier, research has just begun to explore many topics related to advance selling and many topics await future research. Geng et al. (2007) study situations of advance selling when sellers allow resales. The consequences and profitability of advance selling in many unexplored situations deserve further research. For example, we have discussed only future uncertain consumption states that influence buyer valuations for a service. It is possible that, in competitive markets, this future uncertainty is related to which competitor best matches buyer preferences. Hence buyers know which competitor best meets their needs only in the spot period. Another situation worth exploration is when sellers have a better estimate of buyer valuations in the advance period than the buyers do themselves. This situation is common when sellers have extensive experience while buyers are usually buying for the first time. Still another situation is when buyers realize that other buyers are also acting strategically and that their ability to obtain future capacity depends on the behavior of these other buyers. In this case, buyers must anticipate how other buyers will behave given particular advance-selling strategies and buyers might attempt to influence other buyers. Finally, but certainly not the only other avenue for research, we might consider the situation when sellers are offering different advance prices at different points in time before the spot period. In other words, we could consider situations with multiple advance periods.

References

Biyalogorsky, Eyal and Eitan Gerstner (2004), 'Contingent pricing to reduce price risks', *Marketing Science*, **23** (1), 146–55.

Biyalogorsky, Eyal, Eitan Gerstner, Dan Weiss and Jinhong Xie (2005), 'Economics of service upgrades', *Journal of Service Research*, **7** (3), 234–44.

Biyalogorsky, Eyal, Ziv Carmon, Gila Fruchter and Eitan Gerstner (1999), 'Overselling with opportunistic cancellations', *Marketing Science*, **18** (4), 605–10.

Borenstein, Severin and Nancy L. Rose (1994), 'Competition and price dispersion in the U.S. airline industry', *The Journal of Political Economy*, **102** (4), 653–83.

Chatwin, Richard E. (2000), 'Optimal dynamic pricing of perishable products with stochastic demand and a finite set of prices', *European Journal of Operational Research*, **125** (1), 149–74.

Courty, Pascal and Hau Li (2000), 'Sequential screening', *Review of Economic Studies*, **67**, 697–717.
Dana, J.D., Jr (1998), 'Advanced-purchase discounts and price discrimination in competitive markets', *Journal of Political Economy*, **106**, 395–422.
Dana, James, Jr and Eric Anderson (2005), 'When is price discrimination profitable?', Working Paper, Northwestern University.
Desiraju, Ramarao and Steven M. Shugan (1999), 'Strategic service pricing and yield management', *Journal of Marketing*, **63** (January), 44–56.
Gale, Ian L. and T. Holmes (1992), 'The efficiency of advance-purchase discounts in the presence of aggregate demand uncertainty', *International Journal of Industrial Organization*, **10** (September), 413–37.
Gale, Ian L. and Thomas J. Holmes (1993), 'Advance-purchase discounts and monopoly allocation of capacity', *American Economic Review*, **83** (1), 135–46.
Geng, Xianjun, Ruhai Wu and Andrew B. Whinston (2007), 'Profiting from partial allowance of ticket resale', *Journal of Marketing*, **71** (April), 184–95.
Hauser, John and Steven M. Shugan (1983), 'Defensive marketing strategy' *Marketing Science,* **2** (4), 319–60.
Hauser, John. R. and Birger Wernerfelt (1990), 'An evaluation cost model of consideration sets', *Journal of Consumer Research*, **16** (March), 393–408.
Moe, Wendy W. and Peter S. Fader (2002), 'Using advanced purchase orders to forecast new product sales', *Marketing Science*, **21** (3), 347–64.
Rogers, M. (2002), 'The practical futurist: halt! Who goes there?', *Newsweek*, 7 February.
Shugan, Steven M. (2004), 'The impact of advancing technology on marketing and academic research', *Marketing Science*, **23** (4), 469–75.
Shugan, Steven M. and Jinhong Xie (2000), 'Advance pricing of services and other implications of separating purchase and consumption', *Journal of Service Research*, **2** (February), 227–39.
Shugan, Steven M. and Jinhong Xie (2004), 'Advance selling for services', *California Management Review*, **46** (3), 37–55.
Shugan, Steven M. and Jinhong Xie (2005), 'Advance-selling as a competitive marketing tool', *International Journal of Research in Marketing*, **22**, 351–73.
Stavins, Joanna (2001), 'Price discrimination in the airline market: the effect of market concentration', *The Review of Economics and Statistics*, **83** (1), 200–202.
Subramanian, Janakiram, Shaler Shaler and Conrad J. Lautenbacher (1999), 'Airline yield management with overbooking, cancellations, and no-shows', *Transportation Science*, **33** (2), 147–67.
Weatherford, L.R. and S.E. Bodily (1992), 'A taxonomy and research overview of perishable-asset revenue management: yield management, overbooking, and pricing', *Operations Research*, **40**, 831–44.
Xie, Jinhong and Eitan Gerstner (2007), 'Service escape: profiting from customer cancellations', *Marketing Science*, **26** (Spring), 18–30.
Xie, Jinhong and Steven M. Shugan (2001), 'Electronic tickets, smart cards, and online prepayments: when and how to advance sell', *Marketing Science*, **20** (3), 219–43.