

TICKET PRICING IN THE
ALPINE SKI INDUSTRY

by

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APPROVAL

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ABSTRACT

Alpine ski areas worldwide use daily lift-ticket pricing rather than individual ride-ticket pricing. Robert Barro and Paul Romer argue that the ski ride industry is a competitive market and that identical equilibriums and revenues are reached with either pricing method. They also argue that sticky lift ticket prices and lift-line queues are efficient. Lift-ticket pricing dominates because of lower monitoring costs. Tests of their model's predictions, however, do not support their model. A monopolistic ski-lift pricing model is developed. The monopoly model predicts that lift-ticket pricing would dominate the market due to its revenue generating advantages over ride-ticket pricing. Overall the monopoly model predicts the pricing policies that exist in the ski ride market better than the competitive model of Barro and Romer. It is argued that lift-ticket pricing is an indication of the market power most ski areas possess.

CHAPTER 1

INTRODUCTION TO SKI-LIFT PRICING

For the recreational pleasure of skiing down a mountain, skiers travel to ski resorts and purchase lift tickets which provide them a day's access to lift rides. Why do ski areas rely almost exclusively on lift-ticket pricing rather than ride-ticket pricing when each ski lift ride is actually a separate item? Is this simply the most efficient method of ride allocation in a competitive market, or rather an indication of market power? How can it be efficient to have lift lines, and if market power is present what are its implications? These are a few of the questions this thesis hopes to answer.

While skiing is now a recreational activity, it was initially developed as a utilitarian form of transportation during the stone-age and remained primarily as such until the later part of the 19th century (Flower, 1976, p. 22). To facilitate alpine skiing's recreational aspect, uphill transportation was developed. Such uphill transportation first appeared in the 1870s in the form of mountain trains, but was not commonplace until the late 1930s, after the invention of the drag-lift (Flower, 1976, p.114). In 1934 the first rope-tow in America was set up at Woodstoke, Vermont, and the

following year the first American resort specifically developed for skiers opened in Sun Valley, Idaho. Over the years the demand for uphill lift transportation has continued to grow. In America alone there are now more than 20 million skiers who account for over 53 million annual skier visits at the more than 600 American ski resorts (Ski Industries America, 1984; Symonds, 1988). In 1989 these ski resorts offered a combined lift capacity of over 19,600,000 rides per day at an average cost of \$21.00 for a day lift ticket (Enzel, 1989; Goeldner, 1989).

Lift-ticket pricing as opposed to ride-ticket pricing dominates the ski ride market worldwide. The former can be regarded as a two-part tariff with a lump sum fee (the lift ticket) required for the right to ski, and an explicit price per ride of zero. Ride-ticket pricing is a single-part tariff and requires a payment for each ride consumed.

Barro and Romer (1987) developed a model of a competitive ski industry (reviewed in Chapter 2) and explained the dominance of lift-ticket pricing and other aspects of the ski ride industry. While most economists, such as Yoram Barzel (1974), would label long and persistent queues for a commodity as an inefficient allocative mechanism that dissipates rents, Barro and Romer argue that this is not the case with ski ride lift lines. Instead they argue that lift lines are not due to inefficiency in the pricing mechanism, but are a necessary feature which allows lift-ticket pricing to be an efficient

ride allocation scheme. While most models of supply and demand assume that efficient pricing dictates that prices fluctuate with demand or supply, Barro and Romer argue that due to the lift line ride allocation mechanism and a unitary demand elasticity, lift ticket prices may remain fixed. In their competitive model, ride-ticket pricing and lift-ticket pricing results in identical total revenues and equilibrium conditions. Barro and Romer argue that due to lower monitoring and set-up costs, lift-ticket pricing schemes dominate the market. While their model has many interesting features, tests of its predictive capabilities, which are reported in Chapter 3, yield ambiguous results, at best. It will be argued that the model's predictive faults appear due to inaccurate assumptions about the underlying market structure.

To better explain ski ride pricing practices, a new model of the American alpine ski ride industry is developed in Chapter 4. For this model, it is assumed that each ski area possesses some degree of market power and can price as a monopolist. It is shown that under the assumption of monopolistic pricing, a ski area can generally generate greater revenues with lift-ticket pricing rather than with ride-ticket pricing, but not under all circumstances. The latter result contrasts with the outcome obtained by Oi (1974), whereby a two-part tariff (lift-ticket pricing) would always dominate. Nevertheless, this result is an anomaly, and as far as ski ride pricing studies are concerned, this aspect

is of minor importance since the conditions necessary for it to occur are uncommon.

When compared to actual ski ride pricing practices, the monopoly model's revenue maximization principle provides a stronger explanation for the dominance of lift-ticket pricing policies than does Barro and Romer's cost minimization contentions. Further analysis of the monopoly model and its predictive advantages over Barro and Romer's competitive model are presented in Chapter 5. It is shown that another economic anomaly may occur in the alpine ski ride industry. This anomaly is that local skiers rather than tourists may be the ones discriminated against in terms of higher (lift ticket) prices. Overall, the monopoly model's predictive and explanatory capabilities are shown to be superior to those of the competitive model. It is argued that the dominance of lift-ticket pricing schemes is due to the market power that most ski areas possess.

CHAPTER 2

SKI-LIFT PRICING, LITERATURE REVIEW

Contained in this chapter is a review of an article written by Barro and Romer (1987). Their article develops a competitive model of the alpine ski industry and challenges conventional wisdom by arguing that queues are not inefficient; lump-sum lift-ticket and per unit ride-ticket pricing policies result in identical revenues and equilibrium conditions; and fluctuations in demand need not require changes in lift-ticket pricing.

To demonstrate their arguments, ride-ticket pricing is considered first, followed by an analysis of lift-ticket pricing. A comparison of the two pricing schemes reveals that they yield identical revenues and equilibrium conditions. Lift-ticket pricing, however, is argued to be the pricing scheme of choice for ski areas due to lower monitoring and set-up costs. A deeper analysis of the Barro-Romer model shows how prices adjust to shifts in demand, differences across ski areas, transportation costs and skier preferences. The equations and notation offered in this chapter follows that employed by Barro and Romer.

Consider a ski industry where price is charged on a per ride basis. Each of n homogeneous skiers, who differ only in

their fixed costs of going skiing, face an industry comprised of J identical competitive ski areas. Each ski area operator has a fixed lift capacity, x , and charges the same common price per ride, P . The marginal cost of a ride is assumed to be zero for the ski area. The result is an industry whose total supply, Jx , is perfectly inelastic in the short run.

Each individual skier, i , seeks to maximize utility by consuming a combination of ski rides, q_i , and all other goods, z_i , subject to the budget constraint, Y_i . The budget constraint is assumed to be comprised of the cost of q_i ride tickets, the cost of all other goods, z_i , the price of which are set to \$1.00, and the lump sum costs of going skiing, c_i . The latter is comprised of the opportunity cost of going skiing and travel and boarding expenses and is independent of the number of ski rides taken per day. Hence, the budget constraint is

$$(2.1) \quad Y_i = Pq_i + z_i + c_i .$$

The demand for ski runs is described by a downward-sloping income compensated demand curve, $q_i = D_i(P)$, where P is the price per ride. The integral of the demand curve taken from zero to q_i provides a monetary measure of the willingness to pay for the q_i rides,

$$(2.2) \quad \phi(q) = \int_0^q D^{-1}(\tilde{q}) d\tilde{q} .$$

An individual will choose to ski as long as the total cost involved in consuming the q_i runs, is less than or equal

to the gain that the individual receives from skiing q_i runs,

$$(2.3) \quad Pq_i + c_i \leq \phi(q_i).$$

As long as the "net surplus" is greater than or equal to zero the individual will choose to ski.

While all individuals are assumed to have identical demand functions, they do differ in their respective lump sum costs, c_i . These fixed costs vary across individuals depending on their occupations and locations. Costs can also vary throughout the year. For example, during weekends and holidays when skiers are not working, the opportunity cost of time is often less. The distribution of the c_i 's across individuals is described by a cumulative distribution function F_s . The subscript s is a shift parameter which describes the changes in the lump sum costs at different times.

On a given day, only those individuals whose net surpluses are positive will ski. When the fixed costs are high, as during weekdays and non-vacation periods, relatively few individuals will have positive net surpluses and choose to ski. The actual number of skiers who choose to ski, N , therefore is a function of the price per ride and distribution of the lump sum costs,

$$(2.4) \quad N = N(P, s).$$

Equilibrium, in a ride-ticket pricing system, is determined by the number of rides provided by the ski industry, Jx , and the total number of rides demanded by the

ski community, $q_i N$. Therefore, the equilibrium conditions are

$$(2.5) \quad Jx = D(P) * N(P, s).$$

With lift capacity fixed in the short run, this condition will determine the equilibrium price per ride that each competitive firm takes as a given. For equilibrium to be reached the price per ride, P , must fluctuate in the same direction as demand, $D(P)$. Over the long run, when capacity is allowed to fluctuate, this equilibrium condition also determines the price per ride. As capacity increases, *ceteris paribus*, the price per ride will decrease. Competition in the industry requires that the firms take this equilibrium ride ticket price, P , as a given.

Barro and Romer demonstrate that these ride-ticket equilibrium conditions are identical, in terms of cost of skiing and allocation of rides, to that arrived at with a two-part pricing system. The two-part tariff consists of a lump sum entry fee, the lift ticket, and an explicit price per ride set equal to zero. The identical equilibria are reached due to unique properties intrinsic in the lift-ticket pricing scheme's allocation of rides. Under two-part pricing, as with ride-ticket pricing, each individual will choose to ski as long as the gain from skiing is not exceeded by the sum of the lift ticket price and the costs represented by c_i . While the explicit zero marginal price per ride appears to provide no constraint on the number of rides available per skier, an

area's lift capacity will constrain the number of rides that each skier will receive. Each skier, through the use of the lift line allocation mechanism, receives the same number of rides. In other words, though the skier faces an explicit zero marginal cost per ride he also faces a queue.

The number of rides per skier per day is determined by the speed at which he skis down a run, by the number of other skiers at the hill, the rate at which they ski, and the rate at which the lifts can transport skiers up the hill. If it is assumed that all skiers ski at the same pace, each skier will receive the same quantity of rides. Under this assumption the number of runs that any one individual skier can make is solely determined by the number of skiers at the hill, n , and the lift capacity of the hill, x (in rides per day). The quantity of rides that each skier receives, q_i , is simply the area's lift capacity, x , divided by the number of skiers at the lifts, n . It is assumed that facing a zero marginal price per ride each individual prefers a greater number of rides than is available. As a consequence, a lift line will arise and allocation by queuing will occur. It will be shown that this queuing form of ride allocation creates no inefficiencies due to an assumed zero opportunity cost of time for a skier at a hill.

The assumption that the opportunity cost of time for an individual waiting in a lift line is zero is not intuitive. Barro and Romer do not imply that the overall opportunity cost

of time for an individual is zero. They argue that when an individual is making a decision to go skiing, the individual's opportunity cost of time can be great. This opportunity cost of time is included in the fixed costs of going skiing, c_i , and is encompassed in the shift parameter, s . What Barro and Romer assume is that having made the decision to go skiing once the skier is at the ski resort he has a new approximately zero opportunity cost of time. They assume that the "time spent at a ski area or amusement park is inherently valuable so that the cost of time spent in the queue is approximately zero." (p. 876) Barro and Romer (pp. 877-878) state further that "people do not care directly about time spent waiting in lift lines They would prefer shorter lines because they would prefer more rides; but given a fixed number of rides, they are indifferent between spending time outdoors in line or indoors in the lodge." The individual is assumed not to be contemplating other possibilities for the use of his time but rather how many runs will be obtained. With a zero opportunity cost of time, the lift line efficiently allocates a fixed number of rides equally to all skiers. The efficiency of the lift line will be demonstrated later.

Consider now, the pricing decision of each individual ski firm. As with ride-ticket pricing, each individual skier will only choose to ski at a particular area as long as the total gain from skiing exceeds the total costs. In a lift-ticket pricing ski industry, an individual facing the choice between

two areas, j and k , will choose the area from which he will have the greater consumer surplus. Each area is initially assumed to have identical lift capacities, x , and therefore able to offer a fixed quantity of rides per individual per day. Given each area's fixed lift capacity, the quantities, q_j and q_k , are determined solely by the number of individuals choosing to ski at each area. Homogeneous individuals will be indifferent between the two areas as long as the net surpluses are equal. Therefore,

$$(2.6) \quad \phi(q_j) - \pi_j - c_i = \phi(q_k) - \pi_k - c_i,$$

where, π is the lump sum lift ticket price.

Once a ski area chooses its lift ticket price, the number of skiers adjusts to keep the net surpluses at each area equal. In other words, a ski hill is a price taker with respect to the reservation value of net surplus. This reservation value of net surplus, which is the skier's gain from skiing minus the associated total costs, dictates a unique inverse relationship between the lift ticket price, π_j , and the number of skiers at area j . As ski area j increases its lift ticket price, the number of skiers will decline, and the number of rides per skier increases so as to maintain the equality of net surplus across the different ski areas.

Assuming that a ski area's marginal cost per ride is zero, a firm attempting to maximize profits given a fixed capacity will simply maximize total revenue (Hirshleifer,

1988, pp. 124-25). Total revenue is defined as the product of the lift ticket price and the number of skiers. To maximize revenue, a ski area will set its lift ticket price such that the elasticity, $(\partial n_j / \partial \pi_j) (\pi_j / n_j)$, equal to -1. Recalling that $q_j = x/n_j = D^{-1}(x/n_j)$, the elasticity of n_j with respect to π_j can be derived by implicit differentiation of the reservation value of net surplus (the left side of equation 2.6), that is,

$$(2.7) \quad \frac{\partial n_j}{\partial \pi_j} = \frac{-1}{D^{-1}\left(\frac{x}{n_j}\right) \left(\frac{x}{n_j^2}\right)}.$$

Multiplying both sides of this equation by $\frac{\pi_j}{n_j}$ yields the elasticity of the number of skiers with respect to the lift ticket price,

$$(2.8) \quad \frac{\partial n_j}{\partial \pi_j} \frac{\pi_j}{n_j} = \frac{-\pi_j}{D^{-1}\left(\frac{x}{n_j}\right) \left(\frac{x}{n_j}\right)}.$$

Maximization of revenue requires the ski area to operate such that the left hand side of (2.8) is equal to -1. Upon rearranging terms,

$$(2.9) \quad \pi_j = D^{-1}(q_j) (q_j).$$

Dividing (2.9) by q_j indicates that the average price per ride is equal to the marginal willingness to pay for the q_j^{th} ride,

$$(2.10) \quad \frac{\pi_j}{q_j} = D^{-1}(q_j).$$

Since $D^{-1}(q_j)$ is simply the inverse demand function, the

average price per ride in lift-ticket pricing is equal to the effective price per ride,

$$(2.11) \quad \hat{P}_j = \frac{\pi_j}{Q_j}.$$

It follows that the fixed number of rides available per skier at area j under a lift-ticket pricing policy is equal to the quantity that would be demanded at the "effective" price per ride $\hat{P}_j$, if each ride were sold individually, i.e.,

$$(2.12) \quad Q_j = D(\hat{P}_j).$$

Since each ski area is identical and since skiers have homogeneous demands, equilibrium dictates that each area offer the same lift ticket price, and serve the same quantity of skiers, each at the same effective price per ride. On any given day the number choosing to ski is a function of the effective price per ride and the fixed cost shift parameter,

$$(2.13) \quad N = N(\hat{P}, s).$$

Market equilibrium requires that the total number of rides offered, Jx , equal the total number of rides demanded, where the latter is the product of the number of rides demanded per individual, $D(\hat{P})$, and the number of individuals, $N(\hat{P}, s)$.

$$(2.14) \quad Jx = D(\hat{P}) * N(\hat{P}, s).$$

This lift-ticket market equilibrium is equivalent to the ride-ticket market equilibrium described in equation (2.5). However, the price per ride, P , has been replaced with the

effective price per ride, $\hat{P}$. Substitution of equation (2.12) into equation (2.11) dictates that the lift ticket price is determined by the effective price per ride.

$$(2.15) \quad \pi = \hat{P}q = \hat{P} \cdot D(\hat{P}).$$

The lift ticket price, as equation (2.15) shows, is determined by the product of the equilibrium effective price per ride and the number of rides each skier receives. This effective price per ride, $\hat{P}$, for q rides, would equal the equilibrium price per ride, P , reached with ride-ticket pricing. The identical effective price per ride with both ticketing schemes allows each skier to receive the same quantity of rides at the same total cost regardless of the pricing scheme used. With a lift ticket scheme, the individual rides are just packaged together.

The equality of ride ticket price and effective price per ride is what Barro and Romer (p. 875) refer to as the "package-deal effect." The package-deal effect refers to the situation wherein an individual is indifferent between purchasing a group of items in a pre-determined package or on a per-unit basis. It would occur if the individual is offered each item at a price, the sum of which would equal the price of the same items offered as a package with the transaction costs of the two purchases being equal. In the current context, an individual would be indifferent between purchasing twenty ride tickets at a price per ride of \$1.50, or a lift

ticket with a constraint of twenty rides for the price of \$30.00.

Since the same equilibrium is reached with a ride-ticket pricing system without queues and a lift-ticket pricing system with queues, the queues must result in no efficiency loss. Skiers and ski areas make their allocative decisions, not on the explicit zero marginal price per ride but rather on the implicit marginal effective price per ride, $\hat{P}=D^{-1}(q)$. Each competitive firm maximizes revenue with respect to the reservation value of net surplus, resulting in an identical allocation of rides and cost per ride as that of an equilibrium in the ride-ticket pricing scheme. The lift ticket is simply a package deal whereby the consumer is offered a group of q rides, each at an effective price per ride of $\hat{P}$. The total revenue received by the ski area and cost to the skier are the same with either pricing scheme. Since both ride-ticketing and lift-ticketing policies result in the same revenue, the method that minimizes monitoring and set-up costs is chosen.

It is argued that lift-ticket pricing is chosen because ride-ticket pricing would require greater costs to set and enforce contracts. Barro and Romer believe that only with ride-ticketing would ski areas be required to continually change prices and monitor skiers. With ride-ticketing, skiers would be required to purchase a ticket for every ride up the

hill or purchase a group of tickets ahead of time. The latter, however, would still require some physical action be taken upon a skier's ticket for every ride up the hill. Furthermore, Barro and Romer stress that a ride-ticketing system would require a larger menu of prices than a lift-ticketing system. In practice the demand for ski rides is not known with certainty at the beginning of the day. Throughout the day demand can change and ride-ticket pricing would need to be adjusted. For example, early in the day demand and price could be low, while later in the day demand could increase. To totally eliminate lift line queues, the ride-ticketing ski hill would have to constantly monitor the demand for ski rides and change the ride price accordingly. The lift-ticket pricing scheme with its lift line ride allocation mechanism, however, results in an automatic adjustment in the implicit price per ride through increases in the queue, thereby reducing adjustment costs. But, Barro and Romer also assume that the price elasticity of demand is approximately equal to unity. As is shown below, this automatic adjustment in the effective price per ride is such that lift ticket prices would seldom need adjustment.

To demonstrate how this automatic adjustment operates, assume, as Barro and Romer do, that an increase in aggregate demand results from a change in the shift parameter, s . The shift is caused by a decrease in the fixed costs of going skiing, which could be due to a decrease in the opportunity

cost of time associated with the weekend and holiday periods. Such a shift increases the number of people whose reservation value of net surplus exceeds the lift ticket price. As this occurs there will be more skiers per area. With a fixed capacity and an increase in demand, each skier will receive fewer rides. This results in an automatic increase in the effective price per ride. When the elasticity of demand with respect to the effective price per ride is unitary (absolute value), no lift ticket price change is necessary.

A very large portion of Barro and Romer's analysis deals with what they see as the presence of a stickiness in lift ticket prices over time and across areas. During the course of a season, such as over weekends and during Christmas, the demand for skiing varies, but lift ticket prices are seen by Barro or Romer to remain fixed. Analysis of equation (2.15) reveals the conditions whereby the effective price per ride under the lift-ticket pricing scheme can vary in the same direction as demand without any adjustments to the lift-ticket price. Taking the derivative of equation (2.15) with respect to the effective price per ride yields the incremental effect of a change in the lift ticket price due to a change in the effective price per ride,

$$(2.16) \quad \frac{d\pi}{d\hat{P}} = \hat{P}D'(\hat{P}) + D(\hat{P}).$$

Upon rearranging terms, it can be seen that the degree and direction of change in the equilibrium lift ticket price

depends on the elasticity of demand for rides with respect to the effective price per ride,

$$(2.17) \quad \frac{d\pi}{d\hat{P}} = D(\hat{P}) (1 + \eta_{D, \hat{P}}) \begin{matrix} > \\ < \end{matrix} 0 .$$

Since all individuals have the same demand function, $\eta_{D, \hat{P}}$ also defines the individual's elasticity of demand for rides with respect to the effective price per ride. Equation (2.17) shows the profit maximizing change in lift ticket price due to an incremental change in the effective price per ride. When aggregate demand increases the effective price per ride will automatically increase. But, depending on the elasticity of demand, the profit maximizing lift ticket price may increase, decrease or stay the same.

The pricing behavior due to an increase in demand can better be understood with the aid of Figure (1). In this figure ski areas have a total lift capacity, Jx , and face a market for ski rides which is comprised of individual demand curves such as d_i . The initial aggregate market demand is D_0 which later increases to D_1 as the number of skiers increases. The initial lift ticket price is, $\hat{P}_0 a q_0$, which is determined by the effective price per ride $\hat{P}_0$, and the quantity of rides per individual q_0 . An increase in demand from D_0 to D_1 , ceteris paribus, would not necessitate any change in the lift ticket price if a unitary elastic demand existed. With a unitary demand the effective price per ride increases, but this increase is exactly offset by a decrease in the number of

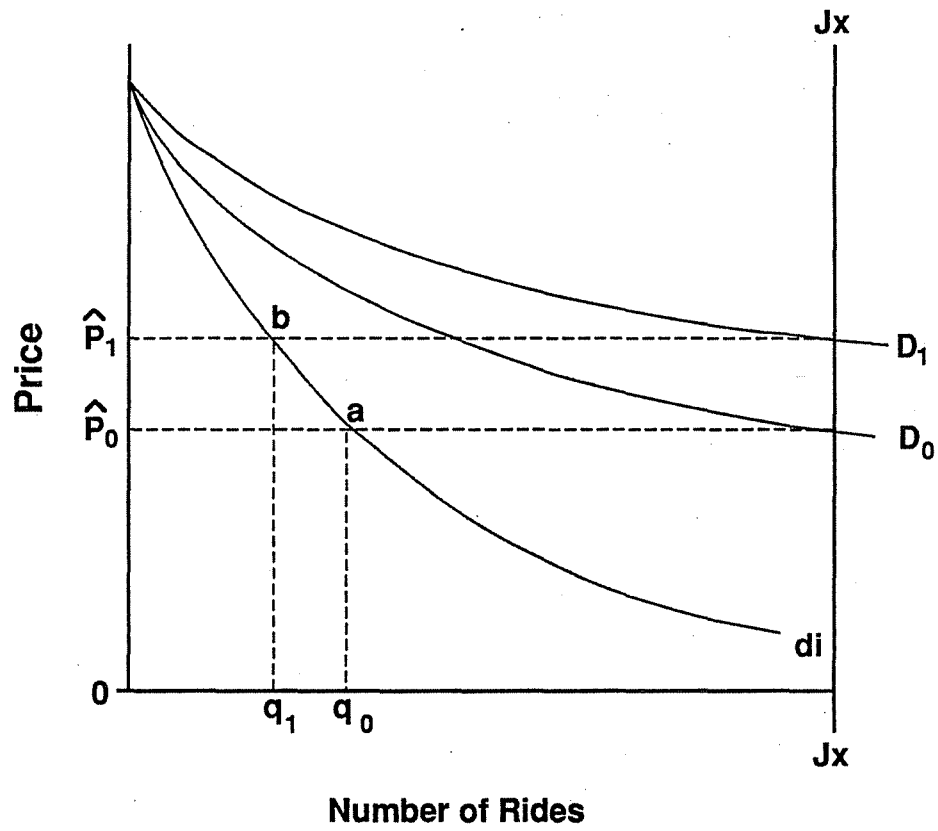


Figure 1. Price Response to Demand Increase

rides per individual, i.e., $\hat{P}_0 a q_0 = \hat{P}_1 b q_1$. If demand were elastic, the increase in demand would dictate a decrease in lift ticket prices because the decrease in rides would more than offset the increase in the effective price per ride. That is, $\hat{P}_1 b q_1 < \hat{P}_0 a q_0$. If there existed an inelastic demand for rides with respect to the effective price per ride, lift ticket prices would increase as demand increased, i.e., $\hat{P}_1 b q_1 > \hat{P}_0 a q_0$.

Barro and Romer conclude that constant lift ticket prices result because the elasticity must remain very near unity throughout most of the year. Any potential increases in revenue from a lift ticket price change would be offset by the menu costs incurred from the price change. Barro and Romer infer that only in cases of very low demand, such as at the end of the season, does the elasticity of demand vary enough from unity to justify a change in lift ticket prices. Their model also predicts that there should be less variation in lift ticket prices across areas and seasons, than in the number of skiers or length of lift lines. While these predictions are relative statements, Barro and Romer leave the impression that elasticity of demand must be very close to unity.

The foundations of the Barro and Romer model described so far were derived upon the assumption that all ski areas are identical and that skiers differ only in their fixed cost

involved in going skiing. As these assumptions are relaxed to allow for differences in lift capacities, travel costs, and heterogenous individuals, the basic conclusions do not change.

Barro and Romer also allow lift capacities to vary considerably across areas, but lift ticket prices remain fixed. This can be explained with the use of what they refer to as the homogeneity effect. The homogeneity effect with lift-ticket pricing refers to the case where there are identical skiers who are free to choose from among J ski areas which differ only in their respective lift capacities. The skiers will sort themselves amongst the various areas such that, in equilibrium, the number of skiers at each area will vary one-for-one with their respective capacities and where each individual will pay an identical effective price per ride. If ski area B has twice the lift capacity as area A, area B will have twice as many skiers, and skiers at each area will receive the same number of rides. Skiers will adjust themselves between the areas until the net surplus at all the areas are equal. Thus, lift ticket prices will be identical across all ski areas.

This same homogeneity effect allows for one lift ticket being good across all the lifts at one area on a given day. The runs at a hill that have the greatest demand would also have the longest lines. In equilibrium a lift that provides a run that offers twice the distance as a neighboring run would be accompanied by a lift line that would allow for only

half the number of runs as the neighboring run. The net surplus in equilibrium must still be equal across every lift at a hill, as well as across all hills, otherwise an individual could gain surplus by choosing to ski at a different lift or area. Ski areas maximize revenue subject to the reservation value of net surplus, and skiers choose amongst the areas to keep the net surplus equal at all areas. Competition ensures that net surpluses are equated as equation (2.6) dictates.

To further expand on this point, assume two identical areas existed at different distances from a metropolitan area but charged the same lift ticket price. The hill at the closer proximity to the metropolitan area will have a larger amount of skiers. The equilibrium condition will be reached when the difference in travel costs associated with reaching the farther hill is made up for by the gain in extra rides available at the distant hill. This results in an equilibrium condition where the net surpluses once again are equal at both of the areas. As described previously, the elasticity of demand for rides with respect to the effective price per ride determines the effect of a demand change on the optimal lift ticket price. Over the range where the elasticity is unity there need be no difference in lift price associated with the difference in travel costs. The Barro and Romer model, however, would predict that in the presence of an elastic demand efficient pricing would dictate a lift ticket price

that is higher the more distant the hill. An inelastic demand would dictate a higher priced ticket the closer the hill. As always, the elasticity of demand with respect to the effective price per ride determines the change in the "gain from skiing" with a change in the number of rides available and therefore determines the equilibrium lift ticket prices.

As a final point, Barro and Romer consider the existence of two different types of skiers, avid skiers who demand a greater number of rides at every price than less avid skiers. The queuing mechanism intrinsic in the single lift-ticket pricing scheme allocates rides across ski slopes equally among each skier and cannot differentiate between the differences in demands of the various skiers. The solution posed by Barro and Romer is that two types of ski areas will develop such that each area will either cater to the avid or less avid skier. The avid hill will charge a higher lift ticket price such that fewer skiers will choose it. Thus, it will be able to offer a greater number of rides for each avid skier than the less expensive ski area.

To summarize, Barro and Romer argue that lift-ticket pricing leads to no inefficiencies even though the explicit marginal price per ride is zero and queues exist. The lift-ticket equilibrium in this competitive market is simply a package of the same quantity of rides and effective price per ride that would be demanded and offered under ride-ticket pricing. The lift-ticket pricing policy is used because it can

be implemented with lower monitoring and set-up costs as compared to a ride-ticket pricing system. Skiers adjust themselves across areas to keep the net surplus equal at all areas. The competitive ski areas must take the skiers reservation value of net surplus as a given, but are free to set their lift ticket price. Importantly, the Barro and Romer model predicts that if the elasticity of demand is unity, ski areas will not adjust their lift ticket prices even with predictable fluctuations in demand. Barro and Romer leave the clear impression that lift ticket prices are sticky and that queuing is a prime method for allocating rides. Furthermore, in their model ski areas are price takers with respect to the effective price per ride. Each competitive area has no market power. Thus, an area has no ability to price discriminate across demands.

CHAPTER 3

BARRO & ROMER TESTED AND QUESTIONED

Barro and Romer (1987) assert that lift ticket prices are "sticky" and that this stickiness is due to a unitary elasticity of demand. As described previously, with a unitary elasticity of demand with respect to the effective price per ride, ski areas would not need to adjust lift ticket price with changes in demand. Lift ticket prices would remain fixed over time and across areas because as demand changed skiers would simply adjust themselves until the net surpluses are once again equal. The assertion of a unitary elasticity and sticky prices can be tested in two ways. The assertion that the elasticity is unitary can be tested with statistical analysis, and the stickiness of lift ticket prices can be tested by comparing prices over time and across areas.

The pricing behavior of a competitive ski area in Barro and Romer's model and its implication for testing can better be understood with the aid of Figure (2). There, ski areas have an initial market lift capacity of Jx_0 which is later increased to Jx_1 . The ski areas face an aggregate market demand function, D_m , which is comprised of individual demand functions such as d_i . At the initial lift capacity the lift ticket price is, $\hat{P}_0 a q_0$, which is determined by the effective

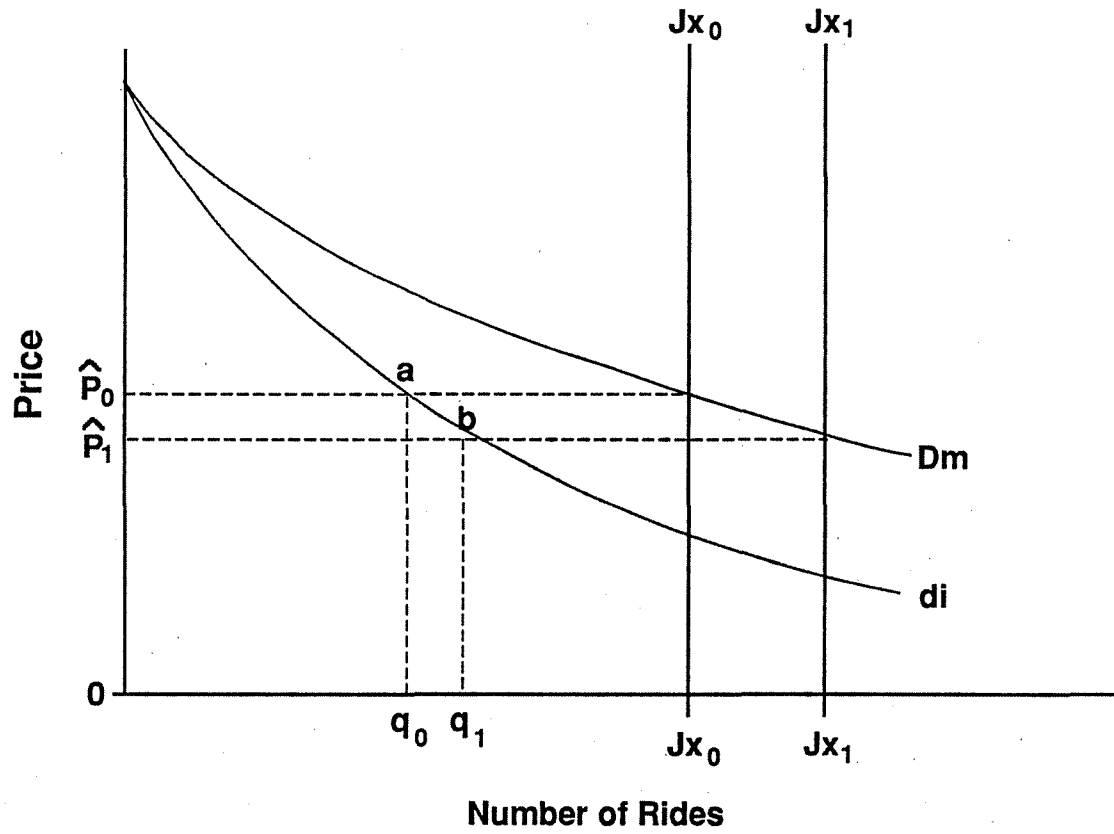


Figure 2. Price Response to Capacity Increase

price per ride $\hat{P}_0$, and the quantity of rides per individual, q_0 . As lift capacity increases to Jx_1 , the effective price per ride would decrease from $\hat{P}_0$ to $\hat{P}_1$ and the number of rides per individual would increase from q_0 to q_1 . An increase in capacity from Jx_0 to Jx_1 would not necessitate any change in lift ticket price if a unitary elastic demand with respect to the effective price per ride existed. With a unitary demand, the capacity increase would have no effect on lift ticket price because the decrease in the effective price per ride is exactly offset by an increase in the number of rides per individual; $\hat{P}_0 a q_0 = \hat{P}_1 b q_1$. If the capacity increase resulted in a lift ticket price increase it would suggest the presence of an elastic demand because the increase in rides would more than offset the decrease in the effective price per ride. That is $\hat{P}_1 b q_1 > \hat{P}_0 a q_0$. If the lift ticket price is inversely affected by an increase in capacity, an inelastic demand would be suggested. In such a case, $\hat{P}_1 b q_1 < \hat{P}_0 a q_0$.

Similarly if the number of skiers increase with a fixed capacity, the number of rides per individual decreases and therefore the effective price per ride increases. If the correlation between the number of skiers and the lift ticket price is zero, a unitary elasticity would be implied. Thus, skier visits should have a positive effect on lift price if the demand is inelastic or a negative effect if demand is elastic, holding capacity constant.

These relationships between lift ticket price, capacity

and skier visits suggests a simple empirical specification to test whether the effective price elasticity of demand is equal to unity as Barro and Romer contend. This specification can be described as

$$(3.1) \quad \pi = \alpha + b_1 V + b_2 C + \mu_t.$$

Here, π is the lift ticket price. The number of skier visits is represented by V , while C represents ski area lift capacity. Equation (3.1) can be estimated with a regression of lift ticket price on skier visits and capacity. This regression estimates the coefficients of visits and capacity and their significance on price. From these results Barro and Romer's assertion of a unitary elasticity can be tested as was described with Figures (1) and (2).

Estimation of (3.1) with ordinary least squares, however, would result in biased estimates due to the simultaneous interaction of the two endogenous variables, visits and price (Rao and Miller, 1971). Since price is dependent on visits, and visits is dependent on price, visits are correlated with the error term, u_t , thereby causing a violation of one of the basic assumptions of the classical linear regression model. Therefore, a two-stage least squares regression technique, which produces consistent unbiased estimates of equation (3.1), is used. The two-stage least squares technique replaces visits with a computed instrumental value that is intended to eliminate the stochastic elements that are correlated with the error term.

The effectiveness of this technique is dependent on the ability to develop an instrumental variable which is highly correlated to visits but not correlated with price. The variables other than lift ticket price which can have a significant impact on the yearly number of skier visits are: weather, population, personal income, and the skiing region. Weather was included to capture effects on skier visits that are due to weather conditions. The population variable was included to capture any fluctuations in skier visits due to demographic changes. Since personal income can affect the opportunity cost of going skiing it also was included. Eastern ski areas have many lifts with small vertical displacement while western ski areas have fewer lifts with large vertical displacement. Since the capacity data (VTF) used in this analysis is the product of the vertical displacement and number of rides, regional dummy variables were included to capture effects due to these regional variations.

Data on lift ticket prices were obtained for the skiing seasons 1978-79 thru 1988-89 (Goeldner, 1978-88). These figures were only available as yearly average regional lift ticket prices including all discounts offered. The five regions covered are: the Northwest, East, Midwest, Rockies and the West. The nominal lift ticket prices were deflated by the Consumer Price Index using 1972 as the base year. Data on total yearly alpine area skier visits were obtained which correspond to the regions and time series lift ticket price

data (Kottke, 1978-88). The capacity data were available from the magazine Ski Area Management (1978-88). These figures are tabulated by the magazine as total vertical transfer feet per hour, VTF, and compiled to coincide with the above regions. Vertical Transfer Feet per Hour, or VTF, is the product of a chairlift's rated capacity in skiers per hour, and the vertical displacement of the lift ride.

The data used to estimate the instrumental variable were gathered from a number of sources. The average number of operating days per season, which was used as the proxy for weather conditions, was available from the annual Economic Analysis of North American Ski Areas (Goeldner, 1978-88). Regional population figures in the 14-44 year old age group were taken from the Statistical Abstracts of the U.S. (U.S. Department of Commerce, 1978-88). This population dataset was chosen because according to a pair of studies approximately 80 percent of all skiers are in the 14-44 year old age group and 76.8 % of all skiers ski within 500 miles of their home (Ski Industries America, 1984). The regional average yearly per capita Personal Income was developed from the Statistical Abstracts of the U.S. (U.S. Department of Commerce, 1978-88). It was deflated with the Consumer Price Index with 1972 as the base year.

Annual data for 11 seasons beginning in 1978-79 and five regions yielded a time series database of 55 usable data points per variable. Table (1) presents the means and standard

deviations for all the variables.

Table 1. Variables; Means and Standard Deviations.

VARIABLE	MEAN	STANDARD DEVIATION
Price (1972 dollars)	4.40	0.66
Visits (Millions)	16.685	15.563
Capacity (Thousand VTF)	5.283	5.077
Weather (Days of operation)	121.24	18.502
Population (Millions)	33.499	35.041
Personal Income (1972 Dollars)	4354.9	484.00

The results of the two-stage least square regression of equation (3.1) with the data just described are reported in table (2). The coefficient on the capacity variable is significant and positive at the 5 % level, while the coefficient on skier visits is insignificant, providing inconclusive results. As described with Figure (2) the insignificance of visits on price supports the assertion of unitary elasticity of demand. On the other hand, the positive and significant coefficient on capacity suggests an underlining elastic demand for rides. These results do not provide consistent support for the assertion of a unitary elasticity of demand.

Table 2. 2SLS Regression Results.

Variables	Coefficient	t-ratio
Visits	0.26E-3	0.728
Capacity	0.44E-7	7.112
Dummy 1	0.40E-2	2.813
Dummy 2	0.19E-2	1.022
Dummy 3	-0.25E-2	-1.456
Dummy 4	0.27E-2	-3.105

* R-Squared Adjusted = 0.8782

In addition to the above test, there are a number of instances where Barro and Romer's assertion of unitary demand elasticity resulting are at odds with real world lift-ticket pricing practices. For example, Barro and Romer (p. 881) argue that a substantial interval of time should exist "where lift ticket prices would show little or no variation with demand." While their statement is in relative terms many ski areas have multiple prices and change lift ticket prices frequently. For example, Breckenridge ski area in Colorado had 78 different lift ticket prices during the 1988-89 season (Russell, 1989). Breckenridge is not the only hill with such pricing policies. The American Ski Association, an organization that offers lift ticket discounts to club members, offers lift tickets from many areas which change 10 times or more during the season (American Ski Association, 1990). These price fluctuations exist at every ski area. Most areas at least lower the face value of their lift tickets or offer discounts off the face value for weekday periods (Berry, 1990).

Barro and Romer (p. 884) also assert that there is a "cross-sectional stickiness" in lift ticket prices. However, the 1987-88 Economic Analysis of North American Ski Areas shows lift ticket prices that are anything but cross-sectionally sticky (Goeldner, 1988). The face value weekend ski lift ticket prices vary from \$10.00 to over \$35.00 and the average revenue per lift ticket ranged from \$11.41 in the midwest to \$20.91 in California and Nevada. Lift-ticket revenue per skier visit also varies greatly with respect to area capacity. Areas of small capacity receive an average revenue per lift ticket of \$10.83 whereas areas with the largest capacities receive revenues of over \$23.00 per lift ticket. These pricing differences would not be observed if the homogeneity effect suggested by Barro and Romer were prevalent.

The cross-sectional variation in lift ticket prices is especially evident in the Wasatch Mountains east of Salt Lake City, Utah where 7 major ski resorts are within a few miles of one another (Ski Utah, 1989). Snowbird, the area closest to Salt Lake City, charges \$32.00 per lift ticket. A mile further up Little Cottonwood Canyon at Alta, a day's lift ticket sells for \$19.00. In the neighboring Big Cottonwood Canyon, Brighton sells weekday lift tickets for \$14.00 and weekend or holiday tickets for \$18.00. Across the canyon from Brighton at Solitude, weekday lift tickets are \$17.00 and holiday and weekend tickets are \$21.00. A single day's lift ticket good

for both Solitude and Brighton can be purchased for \$28.00. The ski resorts of Park City, Deer Valley and Park West, which operate on the other side of the ridge from Brighton, have substantially different lift ticket prices. These three areas have lift tickets selling for \$40.00, \$35.00 and \$24.00 dollars, respectively. The pricing practices observed in the Wasatch Range are clearly not cross-sectionally sticky. Further, the higher prices for the interconnect lift-tickets good for both Brighton and Solitude would not exist under Barro and Romer's assumptions.

There are a number of additional assumptions in the Barro and Romer model which seem at odds with actual behavior. For example, Barro and Romer assume that the willingness to pay per ski ride is independent of the number of skiers at a hill. Given this assumption, the only determining factor in the willingness to pay for a lift ticket is the number of rides available per individual. There may, however, be an additional congestion effect which is not accounted for in the Barro and Romer model. This congestion effect is caused by a disutility that each additional skier's presence imposes on every other skier's overall skiing experience. As more people ski, the queues are assumed to absorb each additional skier, while the number of skiers on each run remains the same. A more realistic assumption, borne out by observation, is that more skiers create more crowded runs. Assuming that skiers prefer to ski on uncrowded slopes, the value of each ride would be

inversely related to the number of skiers at an area. The inclusion of a congestion effect could negate Barro and Romer's homogeneity effect.

Furthermore, this congestion effect can explain why ski areas often limit the number of skiers during peak periods. As Uel Gardner, manager of Wintergreen ski resort in Virginia, puts it, "Another policy is to limit the number of skiers to minimize overcrowding on the trails and to reduce the lift line wait." (Ayers, 1989) Ski area operators, of course, limit the number of skiers by raising price.

Another problem with the Barro and Romer model is that lift lines may not always fluctuate with demand so as to automatically adjust the effective price per ride. If the number of skiers is restrained or if lift lines do not exist, the automatic adjustment cannot take place. Only during the holiday periods do most ski areas approach 100% utilization. Utilization often drops to as low as 25% for destination resorts and 50% for day areas during non-holiday periods (McKinsey and Co., 1989). During the 1989-90 ski season, Bridger Bowl near Bozeman, Montana, averaged 1208 skiers per day (Travel Montana, 1989). With a capacity of 45,600 rides per day, the average skier could have 38 rides per day and face no lift lines. In the Barro and Romer model a requirement for equilibrium is that the total number of rides demanded always equal the number supplied. A lift line must always exist and be allowed to fluctuate with demand to automatically

adjust the effective price per ride with demand changes. They argue that lift-tickets are chosen over ride tickets because the automatic price adjustment lessens monitoring and set-up costs. Since this automatic adjustment often cannot operate, the cost advantages of lift-ticketing over ride-ticketing are reduced or even negated.

There is another assumption that raises doubt that lift-ticketing is simply chosen over ride-ticket pricing because of lower monitoring costs. This assumption is that the opportunity cost of time is negligible. Barro and Romer (p. 880) state that "if the typical skier's fixed cost, c , for getting to the ski area is large, and if waiting in line is preferred to spending time on other available activities" then a positive opportunity cost of time would be relatively unimportant. Furthermore, they state that "skiers receive the same number of rides at the same cost in each case. The same people end up participating, and each ski area receives the same revenue." (Barro and Romer, p. 879) What the Barro and Romer model does not explain is, if the same number of people are participating and receiving the same number of rides with either pricing scheme, where will the people who stand in the lift lines go under a ride-ticket pricing scheme? There are, for example, restaurants at most ski areas. Thus with the alternative activities to standing in lift lines that are available at a ski resort, then the greater the opportunity cost of time the less efficient the lift-line ride allocation

system would be. A positive opportunity cost of time decreases any advantage of lift-ticketing over ride-ticketing policy because people would be willing to pay a price to avoid waiting in line.

Consider now, that Barro and Romer's formulation of the function assumes only the possibility of a rotating market demand curve. Barro and Romer state (p. 877) "Overall, we can write the number of persons N who choose to ski as a function, of $N = N(P, s)$." Here, (s) defines the shift parameter which describes the changes in the distribution of the fixed costs, c_i , involved in going skiing. When the c_i 's are low, as during weekends and holidays, many people will choose to ski. When the fixed costs are higher, as during weekdays and non-holiday periods, fewer people will choose to ski. The market demand curve rotates outward (as shown in Figure (1)) as the fixed costs decrease, and rotates inward as the fixed costs increase. An alternative assumption would be to allow rotating as well as shifting demands. Early in the season when people have not skied in a long time, their demand curves may be relatively high. At the end of the season, after skiing all winter, demands may shift inward. Such behavior could explain the large discounts on lift tickets at the end of the season (Russell, 1990). But, if individual demands are shifting over time, then Barro and Romer's simple relationship between the elasticity of demand and the lift-ticket price no longer holds, and the empirical test offered in Table (2) does not

provide a test of whether the underlying elasticity of demand is equal to unity.

Perhaps the most important assumption that shapes the foundation of the Barro and Romer model is that individual ski operators are price takers. Competition, which forces ski areas to be price takers with respect to the effective price per ride, is essential to the Barro and Romer model. There is evidence that this assumption may not accurately describe the alpine ski industry.

In the Barro and Romer model (p. 877), each consumer faces a market comprised of J firms, each of which "have a negligible impact on aggregate quantities." While over 600 ski areas exist in the U.S., they are scattered and the travel costs required to reach each can vary substantially (Enzel, 1989). The market that each skier faces is limited to those areas where the total costs, including travel costs, are similar, and exceeded by the consumer surplus received from skiing at the hill. With scattered ski areas and positive travel costs, there are likely to be many instances where a skier's net surplus is negative, except at a few nearby areas. This suggests that each ski area will possess some degree of market power, and the price taking behavior that Barro and Romer model is unlikely.

Furthermore, the presence of more than one ski area operating in the same location is not enough to guarantee a competitive marketplace, at least according to the Supreme

Court. It was ruled that Aspen Skiing Co. monopolized the market for downhill skiing services in Aspen, Colorado (Aspen Ski Co. v. Aspen Highlands Skiing Corp., 1985). While there were two firms operating ski areas in the same general location, the Court nevertheless found that Aspen Skiing Co. possessed monopoly power.

The presence of market power can be further witnessed by the price discriminating practices used throughout the alpine ski ride industry. Philips (1983, p. 6) defines price discrimination as "two varieties of a commodity are sold to two buyers at different net prices." Bridger Bowl near Bozeman, Montana for example, offers coupons, for \$ 5.00 off of lift tickets, available only to skiers staying at local hotels (Lippke, 1989). They also offer lift tickets for \$13.00, a 35 % savings, but only if the skier is willing to purchase an item at Burger King. Most ski areas offer discounts which are only available to skiers who join a national ski club, such as the American Ski Association (1990). As mentioned earlier, Breckenridge ski area had 78 different lift tickets during one season (Russell, 1989). It is quite evident that lift tickets were commonly sold to different customers for different prices on the same day. On any given day, there are many different lift-ticket prices offered to different individuals, for entry onto the same hill.

This is just one more instance where it has been shown

that the alpine ski market envisioned and modeled by Barro and Romer differs substantially from the one that actually exists. Regression analysis does not confirm the presence of a unitary elasticity of demand, and analysis of pricing shows lift ticket prices that are not sticky. Furthermore, lift lines often do not exist so the automatic adjustment in the effective price per ride cannot take place. Importantly, the assumption of a competitive ski ride market appears tenuous.

CHAPTER 4

MONOPOLISTIC SKI-LIFT PRICING

In this chapter a model of a ski industry is developed in which each ski area is assumed to possess market power. Both simple monopolistic and price discriminatory pricing are considered for ride-ticket and lift-ticket pricing. Comparison of ride-ticket and lift-ticket pricing in the monopoly model reveals that revenues derived using lift-ticket pricing generally exceed those of ride-ticket pricing. The monopoly model predicts that lift-ticketing would be the dominant pricing scheme due to its revenue maximizing capabilities. In contrast, Barro and Romer's competitive model shows ride and lift-ticketing to result in identical equilibria and revenues and that ski areas choose lift-ticket pricing on purely a cost minimization basis.

Skiers face a market that is limited to those areas where the total costs, including travel costs, are exceeded by the consumer surplus received from skiing at the hill. Over 600 ski areas are scattered throughout the United States and the travel costs required to reach each varies substantially, depending upon a skier's location. With scattered ski areas, scattered skiers, and positive travel costs, there are likely many instances where a skier's choice set will be restricted

to only local areas. This suggests that each ski area will possess some degree of market power and be a price setter.

To capture this market structure, it will be assumed that each ski area faces a market comprised of various identifiable groups of skiers, comprised of N_i skiers. The skiers are assumed to have homogenous demand characteristics within a group, but these characteristics vary across groups. As in Barro and Romer, skiers can differ in their demand for ski runs across groups but not in the time it takes them to ski each ski run. This assumption allows every skier at a hill using a lift-ticket pricing scheme to receive the same quantity of rides. The queuing mechanism remains the method by which a ski area using lift-ticket pricing can distribute a fixed number of rides equally to all skiers.

Each monopolistic ski area has the option of using ride-ticket pricing, where each ride is sold individually at a single price, P , or lift-ticket pricing with a lump-sum entry fee and a zero price per ride. The lift-ticket pricing scheme is designed to capture the entire net consumer surplus and therefore cannot exceed the gain minus the fixed costs of skiing. For simplicity in this analysis, however, fixed costs are ignored. With a fixed capacity of K rides and a marginal cost per ride that is assumed to be zero, the ski area will choose the ride-ticket or lift-ticket pricing scheme that maximizes revenue.

This comparison of a single and two-part tariff differs

from that analyzed by Oi (1971) in his Disneyland ride pricing model. Ride allocation in Oi's model allows the number of rides allocated per individual to vary across individuals with either pricing scheme. With the per individual ride allocation mechanism of Oi's model, two-part tariff revenue always exceed single-part tariff revenue. Unlike Oi's Disneyland model, a ski area can differentiate the number of rides offered to each individual only with ride-ticket pricing. With lift-ticket pricing the ski lift line allocates rides equally across all skiers. This lift-ticket ride allocation mechanism constrains the revenue generating capabilities of a lift-ticketing policy as compared to Oi's model. This constraint suggests that conditions may exist where ride ticket revenue exceeds lift-ticket revenue.

To analyze these revenue generating differences, consider first a ski area that faces one group of N_1 homogeneous skiers. Assume that the inverse market demand function for this group is linear and defined by

$$(4.1) \quad P_1 = a_1 - \frac{b_1 Q}{N_1} .$$

P_1 is the individual price per ride, b_1 is each individual's demand slope, and Q is the number of rides available to the group. Under ride ticket pricing and a zero marginal cost of supplying a ride, the ski area will operate at full capacity as long as marginal revenue is greater than zero. Substituting

B_1 for b_1/N_1 and the ski area ride capacity, K for Q , yields the total ride-ticketing revenue

$$(4.2) \quad TR_{1rt} = a_1 K - B_1 K^2.$$

Under a lift-ticket pricing policy the ski area can generate revenue equal to the product of each individual lift ticket price, π_1 , and the number of skiers N_1 . Here, the revenue maximizing ski area would set the lift ticket price equal to each individual's total willingness to pay. If the ski area charges anything greater than this, the skier would choose not to ski. If anything less than this is charged, the ski area is not maximizing revenue. The total willingness to pay is equal to the area under the individual's demand curve from zero to the rides available per individual, q_1 ; that is

$$(4.3) \quad \phi(q) = \int_0^{q_1} D^{-1}(q) dq.$$

Equating willingness to pay with lift ticket price and assuming linear demands, we obtain

$$(4.4) \quad \pi_1 = a_1 q_1 - \frac{b_1 q_1^2}{2}.$$

The number of rides available per individual, q_1 , is equal to K/N_1 . The product of the lift ticket price π_1 , and the number of skiers, N_1 , as well as substitution of K/N_1 for q_1 , and B_1 for b_1/N_1 , results in a total lift ticket revenue,

$$(4.5) \quad TR_{1LT} = a_1 K - \frac{B_1 K^2}{2}.$$

Comparison of equations (4.2) and (4.5),

$$(4.6) \quad a_1 K - B_1 K^2 \leq a_1 K - \frac{B_1 K^2}{2} ,$$

indicates that a ski area serving just one group of homogeneous skiers would maximize revenue by using a lift-ticket pricing scheme because its revenue exceeds ride ticket revenue by $B_1 K^2/2$. Notice that if the demand function is perfectly elastic, B_1 is equal to zero and both ride and lift ticketing revenues would be equal. Hence the Barro and Romer assumption of competitive pricing is a special case.

The revenue generating capabilities of ride-ticketing and lift-ticketing for a ski area serving a single homogeneous group are shown diagrammatically in Figure (3). If the lift capacity is K_0 the total revenue under a ride ticket policy is equal to OP_0bq_b , since q_b ride tickets would be purchased at price per ticket of P_0 . With lift-ticketing, revenue equals $Oabq_b$. Since, at a capacity of K_0 the ski area would be operating at full capacity with either pricing method, each skier would receive the same K_0/N rides with either ride-ticketing or lift-ticketing. The effective price per ride, however, is larger with lift-ticketing because each individual is forced to pay a greater amount for the same number of rides. Clearly lift-ticketing revenue exceeds ride-ticketing revenue by P_0ab .

The figure illustrates another revenue generating advantage that lift-ticketing has over ride-ticketing. If the

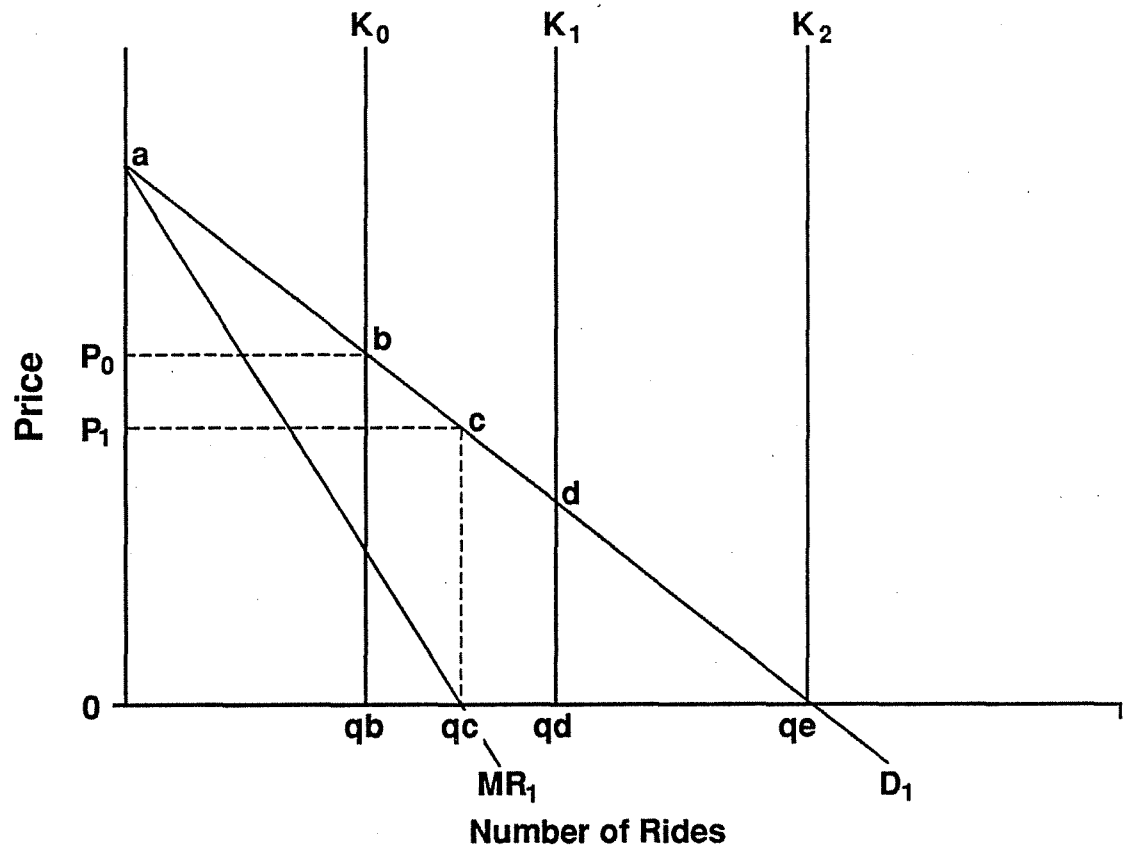


Figure 3. Ride-Ticket versus Lift-Ticket Revenue

capacity is increased to K_1 , ride ticket revenue would only rise to OP_1cq_c . The ski area would sell only q_c rides because marginal revenue would be negative at full capacity. With a capacity of K_1 , however, a lift-ticketing scheme would still generate positive marginal revenue at full capacity with total lift ticket revenue equal to $0adq_d$. At this capacity the number of rides sold with lift-ticketing would exceed those sold with ride-ticketing. Only if the ski area has a capacity greater than K_2 will it operate below full capacity with either scheme. At capacities greater than K_2 , note that q_c rides would be taken. This is exactly twice the q_c rides and twice the revenue which would maximize revenue under ride ticketing. Accordingly, lift-ticketing provides an incentive for a ski area to operate at a greater capacity.

Now consider the pricing options for a ski area facing not only the N_1 skiers in group 1 but also a second different group of N_2 skiers and assume that these two separable groups have different demand elasticities. The demand equation for group 1 remains as previously described in equation (4.1), while the demand equation for group 2 is

$$(4.7) \quad P_2 = a_2 - B_2Q_2$$

There are two possible relationships for the two demand functions. If the two groups are classified as either "avid" or "less avid" skiers, as described by Barro and Romer, individuals in group 1, avid skiers, demand a greater number of rides at all prices than skiers in group 2. Such non-

intersecting group demand functions are not very interesting because under such cases the ski area would maximize revenue by serving just the avid group.

The demand relationship which create a more complex pricing option is the case where the demand curves are intersecting, a possibility not considered by Barro and Romer. One group may have a higher willingness to pay for the first few rides but a smaller, marginal, willingness to pay for a large number of rides. What makes this case important is that with intersecting demand functions ride-ticketing may be the preferred option. Since lift-ticketing operates subject to the constraint that all skiers receive the same number of rides, while ride ticketing allows maximization with adjustments in ride allocation and price, ride-ticketing revenue may be greater than lift-ticketing revenue.

A ski area would choose to serve both groups only if it increased revenue. Assume, for now, that it does maximize ride ticket revenue by serving the two groups of demanders with a simple monopolistic pricing scheme and that the capacity constraint is binding. To analyze the revenue generation under a ride-ticketing scheme, serving both groups with a single ride ticket price, it is necessary to sum the two demand curves horizontally to derive the total market demand curve,

$$(4.8) \quad P = \frac{a_1 B_2 + a_2 B_1}{B_1 + B_2} - \frac{B_1 B_2}{B_1 + B_2} K .$$

The total ride ticket revenue received by serving both groups is the sum of the ride ticket price, P , and number of rides, K ,

$$(4.9) \quad TR = \frac{a_1 B_2 + a_2 B_1}{B_1 + B_2} K - \frac{B_1 B_2}{B_1 + B_2} K^2 .$$

To determine whether ride-ticket pricing can exceed lift-ticket pricing under these conditions, compare equations (4.5) and (4.9),

$$(4.10) \quad a_1 K - \frac{B_1 K^2}{2} \begin{matrix} < \\ > \\ = \end{matrix} \frac{a_1 B_2 + a_2 B_1}{B_1 + B_2} K - \frac{B_1 B_2}{B_1 + B_2} K^2 .$$

If the left side of equation (4.10) is always greater than the right side, the revenue derived from serving both groups with a single ride ticket price can never exceed the revenue received from serving just group 1 with lift-ticket pricing.

To see this, multiply equation (4.10) by $(B_1 + B_2)$;

$$(4.11) \quad a_1 B_1 K + a_1 B_2 K - \frac{B_1^2 K^2}{2} - \frac{B_1 B_2 K^2}{2} \begin{matrix} < \\ > \\ = \end{matrix} a_1 B_2 K + a_2 B_1 K - B_1 B_2 K^2 .$$

Subtracting $a_1 B_2 K$ from both sides and then dividing by B_1 yields,

$$(4.12) \quad a_1 K - \frac{B_1 K^2}{2} \begin{matrix} < \\ > \\ = \end{matrix} a_2 K - \frac{B_2 K^2}{2} .$$

Equation 4.12 indicates that the comparison between ride-ticket and lift-ticket pricing reduces to a simple comparison of lift-ticket pricing between the two groups. As long as the total lift-ticket revenue received from serving just group 1 exceeds the total lift-ticket revenue that would be generated from serving just group 2, lift-ticket pricing revenue exceeds ride ticket pricing revenue. Otherwise, the ski area would choose to serve just group 2 with lift tickets rather than just group 1. This reversal would still generate the result that lift-ticketing revenue is greater than ride-ticketing revenue with a single price per ride.

Of course, the ski area also has the option of serving both groups with singular priced lift tickets. A revenue maximizing ski area would choose to serve both groups with a singular priced lift ticket when such a policy would generate more revenue than a scheme of serving just one group. In this case, lift-ticketing would clearly beat simple monopolistic ride-ticketing. The analysis shows that when facing two groups with linear demands, simple lift-ticket pricing revenue exceeds simple monopolistic ride-ticket pricing.

The above result, however, holds only as long as the assumption of linear demands is valid. Once this assumption is relaxed to allow for non-linear demands, the results can change. The simple illustration in Figure (4) shows that a ski area with a capacity of 30 rides could generate revenues of \$60.00 by serving both skiers with a price per ride of \$2.00.

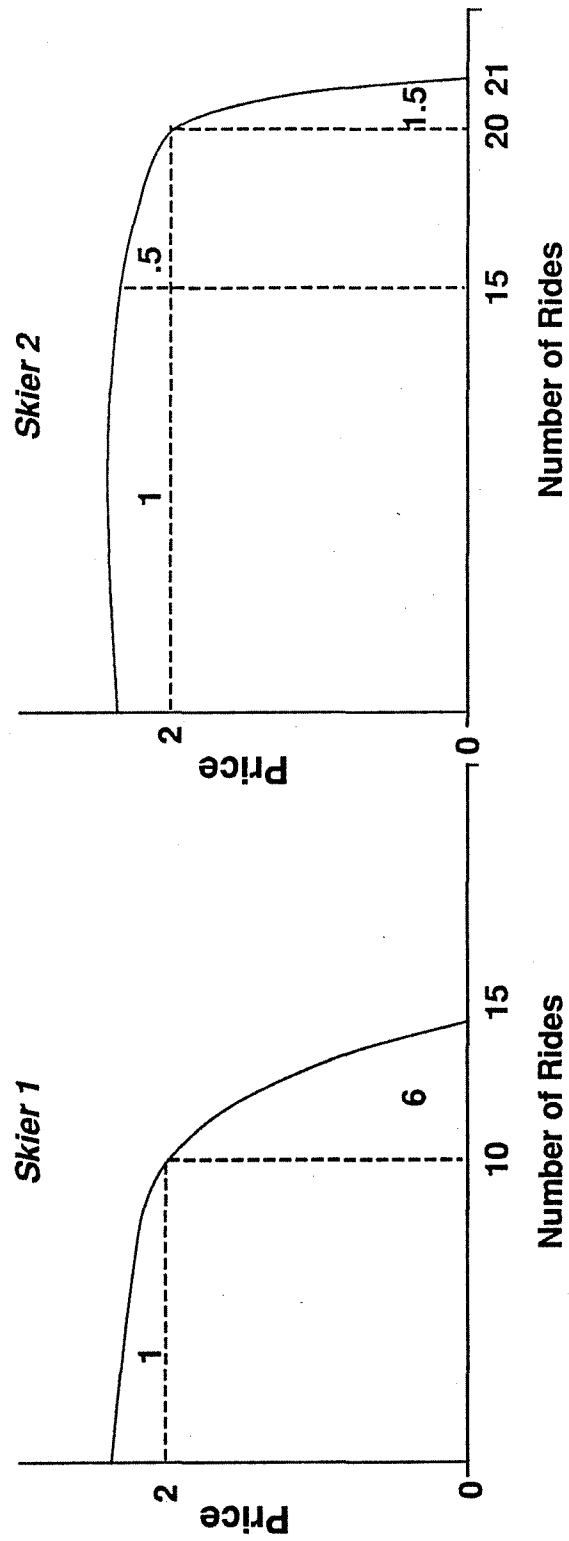


Figure 4. Non-Linear Demands

Under lift-ticketing pricing, the ski area has three options; serve just skier 1, just skier 2, or both at a single price. The best lift-ticket pricing policy would generate revenues of \$54.00 by serving both skiers with a single lift ticket price of \$27.00. When both skiers are served with a single lift ticket price, the maximum that the ski area could charge for the tickets is the lesser of the two consumer surpluses from the 15 rides that each skier would receive, which is \$27.00. When both skiers are served, each skier would receive 15 rides. Thus under these conditions ride-ticketing revenue exceeds lift-ticketing revenue.

Up to this point, the results obtained were derived under the assumption that a ski area offers all customers a single lift or ride ticket price. It was previously shown in chapter 3, that American ski areas have found it possible to practice lift ticket price discrimination. Therefore analysis of price discriminatory revenue generation is called for.

A mathematical comparison of price discriminating ride-ticketing and lift-ticketing revenues is very complicated and yields ambiguous results. To provide a clearer comparison of price discriminating ride and lift ticket revenues a fortran computer program was written. This computer program simulates the theoretical revenue maximizing ride and lift-ticketing policies for a hypothetical ski area with daily lift capacity K . The ski area faces two groups of skiers. Group size, demand slopes and intercepts vary. Once given these variables the

computer program derives the corresponding optimal revenues for the different pricing schemes.

To maximize ride ticket revenue, a ski area with a fixed capacity will set each group's price such that the marginal revenues are equated across all demanders. If the capacity constraint is not binding, the ski area will operate at a point at which the marginal revenues are equal to zero. Under lift-ticket pricing, the ski area facing two groups of demanders has three options available. They can cater to just group 1, just group 2, or serve both groups but charge a different price to each. If just the N_1 skiers in group 1 or the N_2 group 2 skiers are catered to, the ski area would set lift ticket price equal to the consumer surplus each skier in the group receives from the K/N_1 or K/N_2 rides, respectively. When both groups are sold tickets, skiers in each group will pay a different price equal to the consumer surplus from the $K/(N_1 + N_2)$ rides each is allocated. The revenue that the ski area receives with either of the pricing choices is the product of the lift ticket prices and tickets sold. With both groups skiing, the number of rides per skier and corresponding lift ticket price is less than if just one group skis. Thus, there will be occasions when serving both groups would result in a loss of revenue as compared to serving just one group. The revenue maximizing lift ticket policy will depend on each groups demand, the number in each group and the lift capacity of the area.

Using these theoretical foundations, the computer program (included in Appendix B) reveals that under the majority of conditions, as capacity, group size and demands are varied, lift-ticket pricing generates greater revenue than ride-ticket pricing. But, conditions do exist where price discriminatory ride-ticket pricing produces more revenue than price discriminatory lift- ticket pricing.

An example is provided in Table (3). In this example the ski area has a capacity of 10 rides, and faces just two skiers whose demand equations have intercepts of \$4 and \$3, and slopes of .5 and 0.01 respectively. Under these conditions, the ski area can maximize revenue with discriminatory ride-ticket pricing rather than lift-ticketing. The best ride-ticketing scheme offers skiers 1 and 2, 1.18 and 8.82 rides respectively, and generates revenues of \$29.70. Since it is impossible to offer fractions of rides, skier 1 would receive one ride and skier 2, nine rides with revenues of \$29.69. The best lift-ticket policy is to offer skier 2 all 10 rides, and exclude skier 1. This policy generates revenues of \$29.50. A lift-ticketing scheme of serving both groups can generate revenues of only \$28.63.

This simulation illustrates how lift-ticketing revenue maximization allows adjustment across groups in price only. If both skiers are served, they each receive the same number of rides. In comparison, ride-ticketing allows adjustment across groups in both ride allocation and price. This difference

allows ride-ticket pricing to make better use of the segmented demands.

Table 3. Price discriminatory ride and lift ticket revenue.

Ride Ticket Revenue	Rides Skier 1	Rides Skier 2	Lift Ticket Revenue	Rides Skier 1	Rides Skier 2
\$29.70	1.18	8.82	\$29.50	0.0	10.0
\$29.69	1.0	9.0	\$28.63	5.0	5.0
\$27.36	2.0	8.0	\$16.00	10.0	0.0

For academic studies it is of interest that discriminatory single-part tariff (ride-ticket) revenue may exceed discriminatory two-part (lift-ticket) revenue. In Oi's Disneyland monopoly paper (1971, p. 93) it is asserted that, "A discriminatory two-part, in which price is equated to marginal cost and all consumer surpluses are appropriated by lump sum taxes, is the best of all pricing strategies for a profit-maximizing monopoly." This assertion does not hold with lift-ticket ride allocation. It must be emphasized however that the cases where ride-ticketing revenue exceeds lift-ticketing revenue occur only with highly contrived capacities and demands.

Furthermore, the feasibility of ride-ticket price discrimination is limited because it is costly for a ski area to place enough impediments on the resale of ride tickets to limit arbitrage among skiers. For price discrimination to be effective, the firm must be able to segment the market and

price according to this segmentation. Discriminatory lift-ticket pricing is less costly to monitor because lift tickets, which are good for one or more days, can be sold at off-site locations where the clientele are more easily segmented. But ride-ticket pricing would most likely require a larger percentage of on-site ticket sales where the segmentation is much less likely. Therefore, even in the cases where ride-ticketing revenue could exceed lift-ticketing revenue, it may be too costly to segment the market.

To summarize, under most likely conditions, lift-ticket revenue will exceed ride-ticket revenue. Simulation shows that only under some limited contrived conditions can ride-ticket revenue exceed lift-ticket revenue and then, just slightly. Furthermore, market segmentation costs appear lower for lift-ticket pricing than for ride-ticketing. Under the conditions that generally exist in the ski industry, the monopoly model suggests that lift-ticket pricing would dominate due to its revenue generating advantages. Further analysis of the monopoly model, and its predictive advantages over the competitive model are developed in the next chapter.

CHAPTER 5

MARKET POWER and SKI LIFT PRICING PRACTICES

This chapter offers a comparison of Barro and Romer's (1987) model and the monopoly model and reveals the latter's predictive and explanatory advantages. While both models predict that lift-ticket pricing would dominate the market, the reasons and implications differ substantially. The competitive model yields lift-ticket and ride-ticket equilibria and revenues that are equal. There, the dominance of lift-ticket pricing is explained by cost minimization. The monopoly model predicts that lift-ticket pricing would dominate the market because under the majority of circumstances it generates greater revenue than ride-ticket pricing. It will be argued that the monopoly or market power model's revenue maximization principle provides a better explanation for the dominance of lift-ticket pricing than does Barro and Romer's cost minimization explanation. Furthermore, it will be shown that there are many pricing practices used in the alpine ski ride market that can be explained with the monopolistic model but not with Barro and Romer's model.

Extensive research by the author has found no ski areas which presently rely exclusively on ride-ticket pricing. Every major ski area in America and most ski areas worldwide use

lift-ticket pricing schemes (Enzel, 1989; Las Lenas ski resort personnel, telephone interview, 10 August 1990; Swiss tourism bureau personnel, telephone interview, 10 August 1990) Some areas in America such as Jackson Hole, Wyoming, and in Europe such as Lech in Austria, use lift-ticketing for the majority of rides but require ride tickets for specific lifts (Austrian Travel Bureau personnel, telephone interview, August 10, 1990). Jackson Hole relies on lift-ticket pricing for access to all their chairlifts but requires an additional \$2.00 for each ride on their tram (Jackson Hole, 1989). While such a pricing scheme, with positive allocation costs, would not be necessary in the Barro-Romer model as lift line ride allocation adjusts the effective price per ride across lifts automatically both model's predictions as to the dominance of lift-ticketing appear to hold.

To compare the two models, recall that Barro and Romer contend that a unitary elastic demand exists with respect to the effective price per ride. They assert that this, along with lift line ride allocation, allows for a constant lift ticket price over time and across areas. But neither a test of a unitary elasticity of demand or analysis of ski area pricing policies confirm their assertions. The empirical tests conducted in Chapter 3 used the Barro and Romer model to obtain estimates of the aggregate elasticity of demand. The results were inconclusive, thus they do not substantiate the contention of a unitary elasticity. Furthermore, most ski

areas have varying lift ticket prices throughout a season and not just at the end of the season. Ski areas offer single-day lift-ticket prices, multi-day ticket prices, and many off-site ticket discounts (Enzel, 1989; Hammel, 1990). Wholesale ticket prices are also available to travel groups and tour organizations (Vail Associates Inc., 1989). Crested Butte Colorado has had over 150 different priced skiing packages available (Lukens, 1990). Lift ticket prices are clearly not sticky.

Barro and Romer (p. 879) argue that lift-ticketing dominates due to lower "monitoring and set-up costs." But, the set-up cost argument stems out of the inaccurate belief that "lift-ticket prices apparently change relatively little." (p. 880) Moreover, the monitoring cost argument ignores available computerized ticketing technology which minimizes monitoring and allocation costs.

The set-up or menu costs are the costs necessary to have a complete range of prices for rides throughout a day as well as across a season. Barro and Romer contend that throughout a season few lift ticket price changes would be required while under ride-ticket pricing, changes would be required. On a daily basis, ride ticket pricing would require adjustments throughout a day while a single lift ticket price may be more efficient. When this is the case, the daily menu costs would be greater for ride-ticket pricing. But these menu costs may not be all that great and a single lift ticket price

throughout a day may not be optimal. Mt. Hood Ski area in Oregon now offers 7 lift ticket options every day. A skier can purchase lift tickets for one of four, three hour blocks, as well as the usual full and half day lift tickets (Enzel, 1989). In such a case the daily menu costs must be very similar between the two pricing schemes. With the similarity in the number of ticket prices required with both systems the set-up cost argument is questionable.

The Barro and Romer cost minimization explanation is questionable also because ski areas have computerized ticketing technology available to them which further minimizes the monitoring and set-up cost differences between the two ticketing systems (Myers, 1990). Once installed, these computerized ticketing systems can both sell tickets, adjust price, and police the buyers. A computerized ticket taker and turnstile can monitor each skier's entry onto a lift and limit entry to those skiers whose tickets are valid. Similarly, the available technology could feasibly bill skiers at the end of the day for rides taken. Such systems therefore require seemingly identical monitoring costs for both ride and lift ticket pricing. However, observation reveals that ski areas, such as Big Sky Montana, that have installed such technology do not offer ride-ticket pricing but continue to rely on lift-ticket pricing. Since Barro and Romer's cost minimization contention is questionable, so is their model's ability to explain the dominance of lift-ticket pricing.

Because Barro and Romer assume a competitive market, a single equilibrium lift ticket price would be reached for each day's lift ticket. This is not the case however, and most ski areas have found it possible to practice lift-ticket price discrimination. By selling lift tickets at various off-site locations, the ski areas are able to segment their demanders and charge different prices (Russell, 1989). In the Barro-Romer model, this type of pricing behavior is not considered.

Overall, the predictions offered by Barro and Romer's model are not substantiated. The dominance of lift-ticket pricing is based on their questionable assertion of cost minimization. Their contention of a unitary elasticity cannot be substantiated, and sticky lift ticket prices, which they predict, do not exist. Finally the competitive model predicts that a single daily lift ticket price would exist, but price discrimination is observed. This evidence is not consistent with a highly competitive marketplace, but is consistent with an industry wherein individual firms have market power.

Assuming ski areas possess market power, an implication of the monopoly model is that lift-ticket pricing would be chosen over ride-ticket pricing based on simple revenue maximization. The multiple seasonal prices that are observed are predicted with the monopoly model because a price setting ski area would have different lift ticket prices for each segmentable group of skiers. With the number and mix of skiers at an area changing daily, so should the lift ticket prices.

A further prediction of the monopoly model is that if two groups of demanders exist, that are easily separable and have different demand elasticities, the group with the more elastic demand would receive the lower price. Such pricing is suggested in a publication distributed by the National Ski Areas Association, which states that ski areas should "Strive to reduce the cost of skiing as much as possible to price-sensitive [elastic] consumer segments. . . . Bundled packages are a good way to do so without resorting to obvious discounting." (McKinsey and Co., 1989, Appendix A)

While much of the literature on price discrimination claims that tourists have the less elastic demands and are forced to pay more, in the ski ride market tourists appear to have the more elastic demands and pay less than some locals (Phlips, 1983; Nagle, 1987). The demand functions for tourist skier's demands can be more elastic than a local of a ski resort community because they have a larger number of close substitutes available. The tourist or destination skier deciding where to spend his or her vacation has a wide choice of ski areas available, at approximately the same price, than a local skier deciding where to go skiing for just one day. In 1989-90 a skier located in Chicago could, as shown in Table 4, purchase comparable packages for airfare and 3 nights lodging at very similar prices (Skiers Advocate, 1990).

A Chicago skier deciding where to ski has these options and more available at relatively similar prices, while a

resident of Jackson Hole, Wyoming faces substantially different relative prices. The local resident can ski at Jackson Hole and pay only the lift ticket expense or incur the relatively greater expense involved in the travel required to ski at the next closest comparable area over an hour away (Enzel, 1989). With many more options, the tourist skier can have the more elastic demand and therefore, be offered a lower priced lift ticket than the local resident.

Table 4. Airfare and lodging packages from Chicago.

Destination	Cost
Winter Park, Colorado	\$336.00
Crested Butte, Colorado	\$350.00
Steamboat Springs, Colorado	\$322.00
Lake Tahoe, California	\$300.00
Jackson Hole, Wyoming	\$320.00
Park City, Utah	\$321.00

Such pricing behavior is witnessed throughout the industry. During the winter of 1989-90 the resort of Jackson Hole made available a package of a lift ticket and a night's hotel lodging for \$39.00 (Bozeman Daily Chronicle, 1990). The package applied to a number of off peak periods throughout the winter. Although these packages make it difficult to determine the actual ticket price, the implicit lift-ticket price appears substantially reduced from the face value price of \$32.00. Since the local resident is unlikely to need the hotel accommodation, he or she does not receive the benefits of the

discount package. Another interesting feature of this offer was the statement in fine print that only residents of Wyoming, Idaho, Utah, Montana, and Colorado were eligible and that other restrictions apply. While the exact goal of these restrictions is unknown, they may be an attempt by the ski area to further segment even the tourist skiers by aiming these discounts at the skiers who reach the resort by automobile.

Similar pricing practices effectively barr local skiers from other discounted lift tickets that tourists receive. One such instance is the multi-day discounts that are offered by almost every ski resort (Enzel, 1989). If a skier is willing to purchase a ticket for three or more consecutive days, the resorts often offer these tickets at 15%-25% reductions. Ski areas can generally offer the multi-day discounts without the local skiers purchasing them. This occurs because two types of local skiers, the avid and less-avid generally exist (Smart, Inc., 1987). The local avid skiers ski multiple days per week and most often purchase season passes. The less avid local skiers, who rarely ski consecutive days would have less interest in multi-day tickets. Since the tourists generally ski consecutive days, the ski area is able to openly offer the multi-day discounted lift tickets to all skiers, while in actuality selling the discounted tickets only to tourists.

Reductions on these already discounted multi-day tickets, as well as single day tickets, are made available by ski

resorts to travel agents and tour groups. The Vail ski area in Vail, Colorado offers discounted lift tickets to travel agents and tour groups at up to 25% off face value (Vail Associates, Inc., 1989). Most ski areas offer similar sized discounts to tour operators and travel groups. According to Gerry Clyne, a tour operator (telephone interview, 9 January, 1990), the ski areas that are the most isolated from substitute areas offer the greatest discounts off single and multi-day tickets. These discounted lift tickets are then bundled with lodging, thus offering tourists discounted tickets that locals, with no lodging needs, are unlikely to purchase.

Analysis of the Colorado ski industry reveals price discrimination practices that would be expected if ski areas possess local market power. Skiers living in the Denver, Colorado metropolitan area are offered discounted lift tickets for resorts in the so called "front range" ski areas (Hammel, 1990). Denver skiers are analogous to tourists as each has a large number of ski areas available to him or her and total costs for skiing each area are relatively similar. But, a local at one of the resort communities faces relatively high costs if they drive to a surrounding area. Once again the relative costs involved in skiing the local hill are less than the costs required to reach and ski at a more distant hill. Therefore, the Denver skier faces more ski areas who's costs are relatively similar than a resident of one of the resort communities. The Denver skier can have a more elastic demand

and, if the monopoly model holds, should be charged a lower price than a resident of one of the resort communities. This, in fact, is what seems to occur. Most of the ski areas located closest to Denver sell tickets at a 25% reduction from face value at off-site locations in Denver (Russell, 1989). These discounted lift tickets are very prevalent throughout Denver. The above examples show that Colorado ski areas generally possess some degree of market power and are able to price discriminate. By maintaining higher prices for tickets purchased at the ski areas, firms are able to charge those skiers who have fewer substitutes higher prices.

The monopoly model also predicts that such discounted lift tickets should be less prevalent in regions where there are large urban areas like Denver, but fewer substitute ski areas. In Oregon, no ski areas are comparable to Mt. Bachelor in size and skiing services. Located 22 miles outside of Bend Oregon, Mt. Bachelor is situated in the center of the state. Despite Mt. Bachelor's isolation from other areas, it accounts for over 45% of Oregon's annual skier visits (Lawrence et al., 1988). With few substitutes, Oregon residents are likely to have less elastic demands than the out of state destination skiers considering traveling to Mt. Bachelor. The monopolistic model predicts that Oregon skiers would not be offered the discounted lift ticket prices that most out-of-state tourists are offered. Jeff Lotking, the Director of Marketing for Mt. Bachelor, emphasized this point when referring to the off-

site ticket sales throughout Oregon. He said "We don't offer the tickets at a discount." (Hammel, 1990) But according to Mt. Bachelors' 1988 annual report the average total lift ticket revenue for that season was \$ 9,842,100 from 624,000 skier visits. This amounts to an average revenue per lift ticket of \$15.77, which is a great reduction from the face value lift ticket cost of \$23.00. If the residents of Oregon, as Mr. Lotking states, are not receiving these reductions, perhaps the out-of-state tourists are.

Overall, the monopoly model predicts the pricing policies that exist in the ski ride market better than the competitive model. Of course, it is recognized that the monopolistic model is an abstraction from reality, but so is Barro and Romer's model which employs perfect competition. Since all models abstract from reality to some degree, the choice of the model to use is generally based on predictive power (Friedman, 1953). Therefore, the monopoly model should be chosen to explain the pricing policies of the ski ride market.

According to the monopoly model, lift ticket prices are adjusted frequently across time and areas to meet each identifiable group of skiers consumer surplus. Ski areas are able to practice lift-ticket price discrimination and often offer the tourist skier the lower price. Lift-ticket pricing dominates the market because it maximizes lift-ticket revenue. The lift ticket is an uplifting tariff for a downhill monopoly.

REFERENCES

REFERENCES

- American Ski Association. Ski Directory. Denver, Colorado: American Ski Association, Inc., 1989.
- Aspen Skiing Co. v. Aspen Highlands Skiing Corp. 472 U.S. 585 (1985).
- Ayers, R. "Wintergreen Resort: Beating the Odds." Ski Patrol Magazine. 6 (Fall 1989):8-9.
- Barro, R. and P. Romer. "Ski-Lift Pricing, with Applications to Labor and Other Markets." The American Economic Review. 77 (December 1987):875-890.
- Barzel, Y. "A Theory of Rationing By Waiting." Journal of Law and Economics. 17(1974):73-96.
- Berry, W. "Peak Lift-Ticket Prices Will Increase \$1-\$2." The Insiders' Ski Letter. 1 (June 1990):1-8.
- Bozeman Daily Chronicle, Bozeman Montana, December 15, 1989.
- Enzel, R. The White Book of Ski Areas, United States and Canada. Washington D.C.: Interski Services, 1989.
- Flower, R. The History of Skiing. New York: Methuen Inc., 1976.
- Friedman, M. "The Methodology of Positive Economics." Essays in Positive Economics. University of Chicago. 1953.
- Goeldner, C. Economic Analysis of North American Ski Areas. Business Research Division, Graduate School of Business Administration, University of Colorado, Boulder, Colorado, 1978-1988.
- Greenhut, M. and H. Ohta. Theory of Spatial Pricing and Market Areas. Durham, North Carolina: Duke University Press, 1975.
- Hammel, F. "Area Promos." Ski Business. 30 (January 1990):40.
- Hirshleifer, J. Price Theory and Applications. Engelwood Cliffs New Jersey: Prentice-Hall, Inc., 1988.

- Jackson Hole. Travel Agents Ski Guide. Teton Village Wyoming: Jackson Hole Ski Corp., 1989.
- Kottke, M. End-of-Season National Business Survey Springfield, Massachusetts: National Ski Areas Association, 1978-1988.
- Lawrence, J., M. Malone, and R. Parker. Oregon Ski Economics 1986-1987 Season. University of Oregon, Dept. of Planning, Public Policy and Management, Community Planning Workshop Report, 1988.
- Lippke, H. Bridger Bowl Lift Ticket Prices. Bozeman, Montana: Bridger Bowl Marketing Department, 1989.
- Lukens, M. "Ah! Pre-Ski." Outside Magazine. 15 (October 1990): 97-100.
- McKinsey and Co. Building Ski Industry Demand. National Ski Areas Association, Ski Industries America, Executive Summary, January, 1989.
- Myers, C. "At Your Service." Ski. 54 (January 1990): 56.
- Nagle, T. The Strategy and Tactics of Pricing. Englewood, New Jersey: Prentice-Hall Inc., 1987.
- Phlips, L. The Economics of Price Discrimination. New York: Cambridge University Press, 1983.
- Oi, W. "A Disneyland Dilemma: Two-Part Tariffs for a Mickey Mouse Monopoly." Quarterly Journal of Economics. 82 (February 1974): 77-96.
- Russell, S. "Western Discounts Draw Pan from Prof." Skiing Trade News. (March 1989):33.
- Russell, S. "Where the Deals Are." Skiing. 42 (March 1990):80-84.
- Ski Area Management. Annual Lift Survey. (January, 1990).
- Ski Industries America. White Paper on Skiing. McLean, Virginia: Ski Industries America, 1984.
- Ski Utah, Inc. The Ski Utah Vacation Planner. Salt Lake City, Utah: Ski Utah, Inc., 1989.
- Skiers Advocate. Denver, Colorado: American Ski Association. 14 (March 1990)

- Smart, Inc. National Ski Opinion Survey. Wilton, Connecticut: Smart, Inc., July, 1987.
- Stigler, G. The Theory of Price, 4th ed. New York: Macmillan Publishing Company, 1987.
- Symonds, W. "A Punishing Run for Ski Resorts." Business Week. December 12, 1988.
- Travel Montana. Ski Industry Fact Sheet. Helena, Montana: Dept. of Commerce, 1989.
- U.S. Department of Commerce, Bureau of the Census. Statistical Abstract of the United States. Table 730 and 27. 1978-88.
- Vail Associates, Inc. Wholesale Program 1989-90 Season. Vail Colorado: Vail Associates, Inc., 1989.

APPENDICES

APPENDIX A

DATA SET

Table 5. Data, Regions 1-5.

Year	Region	Visits	VTF	Days	Price	Pop.	PI
1979	1	11.294	247119	88	9.04	21.822	8028
1980	1	8.655	254454	59	10.26	22.024	8958
1981	1	8.953	257160	81	11.52	22.151	10029
1982	1	11.467	259487	121	12.66	22.477	11204
1983	1	9.523	268346	76	12.89	22.656	12120
1984	1	12.087	282610	125	13.85	22.864	13541
1985	1	11.083	309381	109	14.42	23.07	14905
1986	1	12.836	329343	119	15.58	23.24	15952
1987	1	14.745	359042	135	16.4	23.431	17155
1988	1	14.421	399957	129	17.29	23.504	18631
1989	1	12.741	410095	121	19.09	23.488	20191
1979	2	3.763	194398	117	7.49	23.843	8248
1980	2	4.23	200515	99	7.57	15.846	9121
1981	2	4.172	202199	108	9.37	16.126	10129
1982	2	5.064	213490	123	10.75	17.665	11252
1983	2	4.256	222520	80	10.55	17.965	12051
1984	2	5.175	236780	125	12.26	18.267	13406
1985	2	4.394	254606	103	11.8	18.631	14555
1986	2	5.218	261949	113	13.71	18.987	15518
1987	2	5.816	274785	112	14.84	19.375	16436
1988	2	5.885	291121	123	16.61	19.716	17626
1989	2	5.424	301020	104	18.01	19.902	18959
1979	3	9.743	114080	149	6.05	26.711	8178
1980	3	8.682	121924	128	7.3	27.018	9053
1981	3	7.688	124197	110	9.34	27.079	9715
1982	3	7.846	127690	135	9.07	27.316	10612
1983	3	6.213	131891	99	8.71	27.381	10979
1984	3	6.961	134236	123	9.16	27.432	11877
1985	3	6.899	138110	117	9.99	27.598	12958
1986	3	7.201	141684	135	10.63	27.772	13687
1987	3	6.994	146055	124	10.28	27.953	14426
1988	3	6.783	151340	130	11.41	28.079	15227
1989	3	7.013	153910	139	12.16	28.109	16239

Table 5. (continued).

Year	Region	Visits	VTF	Days	Price	Pop.	PI
1979	4	15.837	340032	133	7.94	4.743	7427
1980	4	17.16	360495	123	9.41	4.936	8265
1981	4	10.486	393062	95	10.63	5.408	9146
1982	4	15.337	424803	126	12.57	5.677	10177
1983	4	14.808	455823	132	12.88	5.841	10673
1984	4	16.801	486475	141	13.8	5.971	11458
1985	4	17.624	516790	141	14.87	6.087	12162
1986	4	16.869	571603	127	16.24	6.208	12685
1987	4	16.68	622734	125	16.96	6.33	13099
1988	4	16.564	641506	116	17.55	6.404	13620
1989	4	16.601	666666	122	18.67	6.439	14363
1979	5	9.56	306341	155	8.42	14.169	8726
1980	5	9.473	324982	139	9.4	14.581	9777
1981	5	8.401	341191	103	10.63	15.504	10770
1982	5	11.004	355829	139	12.22	15.97	11802
1983	5	12.061	374944	154	13.83	16.308	12290
1984	5	9.606	398376	138	14.59	16.614	13526
1985	5	11.352	418370	145	15.36	16.928	14608
1986	5	9.797	446742	143	16.63	17.296	15482
1987	5	9.564	467742	122	15.64	17.69	16217
1988	5	10.255	486255	132	16.85	18.025	17168
1989	5	11.556	50099	136	19.81	18.319	18138

APPENDIX B

COMPUTER PROGRAM

The following outlines the computer program referred to in chapter 4.

Demand equations: $P_1 = a_1 - b_1 q_1$.
 $P_2 = a_2 - b_2 q_2$.

Enter variables: Capacity in rides per day, K.
 Number of skiers in group 1, n_1 .
 Number of skiers in group 2, n_2 .
 Y intercept for group 1, a_1 .
 Y intercept for group 2, a_2 .
 Slope for skier in group 1, b_1 .
 Slope for skier in group 2, b_2 .

A. Ride-ticket equilibrium and revenue.

Steps:

1) Determine how many rides to offer:

If $K < (a_1 - a_2) / (2b_1/n_1)$
 then it is best to serve just group 1,
 $q_1 = K/n_1$
 $q_2 = 0$

Else if; Serve both groups.

Set marginal revenues equal and
 allocate rides accordingly.

If $K < (a_1 n_1 / 2b_1 + a_2 n_2 / 2b_2)$
 $q_1 = (a_1 - a_2 + (2b_2 K / n_2)) / 2(b_1/n_1) + (b_2/n_2)$
 $q_2 = (a_2 - a_1 + (2b_1 K / n_1)) / 2(b_2/n_2) + (b_1/n_1)$

Else if;
 Allocate rides at zero marginal revenue.

$q_1 = a_1 / 2b_1$
 $q_2 = a_2 / 2b_2$

2) Set price per ride.

$P_1 = a_1 - b_1 q_1$
 $P_2 = a_2 - b_2 q_2$

3) Total ride-ticket revenue.

Revenue = $P_1 n_1 q_1 + P_2 n_2 q_2$

B. Lift-ticket equilibrium and revenue.

Steps:

1) Calculate revenue if serving just group 1.

If $K > a_1 n_1 / b_1$

Then

$$q_1 = a_1 / b_1$$

$$\text{Revenue, just group 1} = a_1 a_1 n_1 / 2 b_1$$

Else

$$q_1 = K / n_1$$

$$\text{Revenue, just group 1} = (b_1 / 2) (K / n_1) (K / n_1) + (a_1 - b_1 K / n_1) (K / n_1)$$

2) Calculate revenue if serving just group 2.

If $K > a_2 n_2 / b_2$

then

$$q_2 = a_2 / b_2$$

$$\text{Revenue, just group 2} = (a_2 a_2) n_2 / 2 b_2$$

Else

$$q_2 = K / n_2$$

$$\text{Revenue, just group 2} = (b_2 / 2) (K / n_2) (K / n_2) + (a_2 - b_2 K / n_2) (K / n_2)$$

3) Calculate revenue if serving both groups.

If $K > a_1 n_1 / b_1 + a_2 n_2 / b_2$

then

$$q_1 = a_1 / b_1$$

$$q_2 = a_2 / b_2$$

$$\text{Revenue, groups 1 and 2} = (q_1 a_1 n_1) / 2 + (q_2 a_2 n_2) / 2$$

Else

$$q_1 = K / (n_1 + n_2)$$

$$q_2 = K / (n_1 + n_2)$$

$$\begin{aligned} \text{Revenue, groups 1 and 2} = & (b_1 / 2) (q_1) (q_1) + (a_1 - b_1 q_1) (q_1) \\ & + (b_2 / 2) (q_2) (q_2) + (a_2 - b_2 q_2) (q_2) \end{aligned}$$

4) Determine revenue maximizing lift ticket choice.

C. Final Step: Compare A. and B.