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SERVICE QUALITY AND COMPETITION IN THE U.S. DOWN-HILL SKI INDUSTRY

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# Service Quality and Competition in the U.S. Down-hill Ski Industry

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## ABSTRACT

This paper illustrates the importance of the role of land constraints in a model explaining the effect of real income and transportation cost on long-run lift-ticket prices and lift capacity in a competitive two-sector ski industry. The model also explains large endogenous increases in lift capacity and real prices over time in response to an increase in real skier income despite a static number of skier-days per year. This approach, thus, has points in common with work by Shaked and Sutton (1986 and 1987), Sutton (1991 and 1998) on endogenous vertical differentiation and persistent market concentration.

## 1. Introduction

This paper provides empirical evidence of the importance of endogenous fixed costs (EFC) as determinants of the market structure and lift-ticket pricing for the U.S. down-hill ski industry. The distinctly different impacts of exogenously determined and endogenously determined fixed costs on market structure appear in the seminal work by Shaked and Sutton (1987) and earlier empirical work by Sutton (1991). Sutton's primary empirical examples were investments in endogenously determined fixed costs in quality due to advertising and/or research and development. In Sutton's EFC model, firms react to demand shocks by increasing quality resulting in sustained levels of market concentration despite relatively low exogenously determined fixed costs and an absence of economic profits and market power. By contrast in markets with horizontal differentiation when investment in quality comes from variable costs, the market shares of firms decrease as market demand increases leading to further market fragmentation and increased product variety at a range of prices. When quality comes from endogenous fixed costs and customers agree on the rank-order of quality, a higher quality firm can undercut the prices of competitors and capture the rival's business. The potential for undercutting a rival's price incites competition in quality that leads to increased costs of entry and a relatively stable number of increasingly high quality firms.

While Sutton's empirical work featured the quality of produced goods, this paper adds to a recent, growing literature that applies Shaked and Sutton's EFC approach to service industries. For example, Ellickson (2007) has recently contrasted the market structures of supermarkets with that of hair salons and barber shops. While the quality of hair salons and barber shops is largely due to investments in variable costs, Ellickson argues that service quality in supermarkets comes from

endogenous fixed investment in distribution systems. Supermarket companies increase their investments in quality as local market demand increases so that market concentration remains relatively unchanged, while both the number of hair salons and barber shops increases in proportion to the size of local markets which become increasingly fragmented over time. Based on the assumption that consumers are basically in agreement that greater variety represents higher quality, vertical differentiation in quality places rivals at a disadvantage and raises the costs of entry leading to relatively stable numbers of high quality supermarket chains in each local market. Since retail markets also have important spatial aspects, one should not necessarily expect the strong outcome associated with the pure EFC model. However, as shown by Shaked and Sutton, the non-fragmentation result does hold in a weaker form depending on the relative importance of vertical versus horizontal differentiation. When endogenous fixed costs are large relative to exogenous fixed costs, markets remain concentrated regardless of size.

Several other researchers have used variations of the EFC model. For example, Berry and Waldfogel (2003) find distinctly different market structures in restaurant and newspaper markets. Given the importance of variable costs in restaurant quality and fixed costs in newspaper quality, these markets have evolved in predictably different ways. More recently, Dick (2007) has found a static market structure among regional banks following increased investment in service quality over time. Following the same approach, Dick finds that despite large variation in market sizes, market concentration also remains relatively similar across regional banking markets. While there is variation in the number of firms according to the size of the market, the increase is due to an expansion in the number of smaller fringe firms. She suggests that her findings are consistent with banks using endogenous fixed costs investments to increase quality and “to capture the additional demand when market size grows, thereby

raising barriers to entry”. The largest banks appear to focus on retail customers with fringe banks focusing more on small business customers.

Dick notes that while anyone familiar with regional banking markets may be aware of the persistence of market concentration over time, “the empirical finding that markets with fewer banks tend to have lower deposit rates and higher loan rates has been historically taken to imply a less competitive conduct by banks and therefore have a negative effect on consumers ... However, once quality is introduced, there is no unambiguous implication one can make about consumer welfare from the empirical correlation between prices and the number of banks in a market. Some consumers might be happier paying a higher price to a bank in exchange for higher quality service.”

As has been the case in banking, market concentration has remained relatively static in local skiing markets and in the national market with little entry. This has occurred despite increased investment in endogenously determined fixed costs and higher real lift ticket prices across the industry over time. In this paper I adapt the EFC approach to explain both the static market structure of the U.S. ski industry along with persistent increases in both quality and real prices over time. However, recreational markets, such as skiing and golf, differ from the other service markets studied in the literature in one important way. While Ellickson, Dick, and Berry and Fogel focused on competition in local/regional service markets, golfers and skiers have access not only to a local/regional market but also to a relatively higher-quality national destination market. Thus, the evolution of market structure due to demand shocks must account for the relative qualities of the relevant local market and the national market. While many of the predictions of the model are in line with what most skiers would expect, the model shows that endogenous fixed cost investments and acreage constraints are important

determinants of both market structure and lift-ticket pricing. In addition, ski areas that use peak-load pricing in response to demand that varies considerably between on-peak and off-peak days of the week are actually less likely to increase lift capacity over time. In other words, the model departs from a typical peak-load pricing explanation for investments in lift capacity to one that focuses on increased quality of service throughout the season with those less constrained by acreage constraints and variations in peak/off-peak demand most likely to invest in lift capacity.

While service has been defined differently in this literature depending on the specific application, this paper focuses on two important indicators of the quality of a day of skiing: waiting time in lift lines and congestion on the slopes.<sup>1</sup> In light of the importance of the interaction of the national and local markets, I present a two-sector competitive model that accounts for both land and lift capacity constraints on service quality. In the model, rather than fragmenting completely into a larger number of specialized ski areas, both the local and national markets evolve in a manner predicted by the EFC approach of Shaked and Sutton with existing ski areas responding to increased local and national demand by increased investment in additional lift capacity with exit coming from relatively smaller, low-

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<sup>1</sup> For example, both Morey (1984) and Walsh, Miller, and Gilliam (1983) provide evidence from surveys of skiers' willingness to pay for less congestion in lift lines and on the slope. Morey provides empirical evidence that skiers are willing to pay for relatively more skiable acres at a ski area, while Walsh, Miller, and Gilliam document the separate effects of both waits in the lift line and congestion on the slope in skiers' willingness to pay for a day of skiing. Recent work by Mulligan and Llinares (2003) shows that the connection between capacity and service quality is especially important in explaining why time-saving technology embodied in new lift capacity follows a diffusion pattern in local markets that is distinctly different from that of innovations that lower production costs. See Davidson (1988) for an example of a short-run model of a retail market that accounts for consumers' opportunity cost of time and willingness to pay in order to avoid waiting in line. Davidson's queuing-theoretic model allows for differences in service speed and quality for two firms each with fixed capacity.

quality ski areas.<sup>2</sup> The model shows how an increase in lift capacity and real lift ticket prices can be a competitive response to increases in real income and decreases in transportation costs despite static market concentration. Increases in skier real income and decreases in transportation costs over time result in a shift in skier-days from local, land-constrained markets to national markets with increases in both lift capacity and *real* lift ticket prices at all ski resorts. Differences in skiable acreage constraints across sectors result in differences in lift capacity per skier in long-run equilibrium. Section 2 presents the EFC model, while Section 3 offers empirical support for the predictions of the EFC model using data from the U.S. downhill ski industry. Section 4 contains concluding remarks.

## **2. A Two-Sector Competitive Model of Service Quality**

This section presents a simple two-sector competitive model with two capacity constraints. Section 2a summarizes the earlier theoretical literature on ski-area pricing and capacity determination. For comparison purposes Section 2b presents a one-sector model with unlimited skiable acreage. Section 2c relaxes these two assumptions and presents the two-sector and two capacity-constraint model.

### **a. Theoretical literature on Ski-area pricing and Capacity Determination**

In the U.S. ski industry between 1980 and 2002 incumbents' lift capacity increased on average by nearly 100 percent while lift ticket prices increased approximately 45 percent in real terms. This

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<sup>2</sup> While making a distinction between quality in local markets and the national market, this paper incorporates an important feature of Ellickson's model concerning the role of land constraints in local markets. In his case land prices act as a constraint on the expansion of the number of stores as markets grow providing an incentive for increased vertical differentiation (that is, larger stores and more variety of products per store) as opposed to an increased number of more specialized stores. In my model local land constraints limit the growth in the number of specialized ski areas and encourage existing ski areas to increase lift capacity relative to available skiable acres in response to growing local demand.

occurred despite the fact that the number of skier-days fluctuated between approximately 50 to 55 million per year and there was limited entry into the market. Mulligan and Llinares offered a partial explanation by arguing that while there was little difference in the adoption decisions made by ski resorts in the national destination market in the Rocky Mountain states, a limited number of ski resorts in local/regional markets adopted faster detachable chairlifts to differentiate their service horizontally relative to that of their local competitors and to attract avid skiers who pay higher lift ticket prices and ski more runs per day. Despite the marked difference in the adoption decisions in the national and local markets and horizontal differentiation in local markets, nearly all surviving ski resorts increased lift capacity during this time period in response to an overall increased demand for quality. More importantly, there was little difference in the percent change in capacity between adopters of the faster technology and those adding the older, relatively slower technology. While entry was limited during this time period, there was a significant decrease in the number of small, relatively low quality ski areas in local markets that were unable to respond to the increased demand for quality. Although Mulligan and Llinares found empirical support for their hypotheses, they did not provide a complete theoretical model of capacity and price determination for the industry.

Two earlier theoretical papers concerned with congestion pricing that included lift-ticket pricing as the primary application, Barro and Romer (1987) and Scotchmer (1985), also did not provide complete models of the separate impacts of land and lift capacity constraints on quality and real lift ticket prices. Barro and Romer modeled a competitive skiing market with fixed lift capacity in order to explain the use of lift ticket prices as opposed to per-ride prices. Despite the maintained assumption of a competitive market, Barro and Romer's model does not address the issues raised in this paper,

because it is short-run in nature and does not account for skiable acreage constraints or differences between national and local ski markets.

Scotchmer used a two-part tariff model to explain the prevalence of lift-ticket pricing as opposed to a membership fee, such as an annual pass. Scotchmer modeled the ski area as a facility of unit size with congestion an increasing function of the number of people using the shared facility (that is, the slope). In her model exclusive use of annual membership fees would be evidence of monopoly power. She concluded that the prevalence of per-day lift ticket pricing was thus evidence of competitive pricing. Since she made no mention of lift capacity as a constraint, Scotchmer's model is also unable to account for endogenous changes in lift capacity and price over time in response to changes in the demand for less congestion. She also did not acknowledge that annual passes are purchased primarily by frequent skiers who ski during off-peak times. Besides, since the average number of skier days per skier, including those with annual passes, is only approximately five times per year and skiers do not generally ski at only one ski resort per year, an annual membership fee as a means of extracting consumer surplus is of limited practical relevance.

#### **b. A Model of Price and Capacity determination with No Acreage Constraints**

Assume that there are  $N_t$  skiers who ski at the same time on the same day in year  $t$ <sup>3</sup>. I assume that skiers allocate themselves equally across identical ski resorts and create lift lines that limit each skier to the same expected number of runs per day. Let  $q_{it}$  be the quantity of rides (that is, ski runs) per time period  $t$  desired by the  $i$ th person for  $t = 0, \dots, T$  and  $i = 1, \dots, N$ . The  $i$ th person chooses  $q_i$  in order

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<sup>3</sup> This assumption is made for expositional purposes. More generally, skiers could be assumed to ski at different times during the season and at different ski areas distributing themselves across the year and across ski areas in order to minimize the congestion costs imposed by other skiers.

to maximize  $U^{it} = U^{it}(q_{it}, z_{it})$  subject to  $Y_{it} = P_t q_{it} + z_{it} + v_{it}$ .  $Y_{it}$  is real income,  $z_{it}$  is a bundle of goods other than skiing with its price normalized to 1,  $P_t$  is the implicit price per ride, and  $v_{it}$  is an individual-specific, lump-sum cost of going skiing for a day, such as transportation costs, that is independent of the number of ski runs consumed and is not paid to the ski resort. Each skier has a downward-sloping, income-compensated demand curve for the number of runs per day,  $q_{it} = D^{it}(P_t)$ . Assume that this function does not vary across individuals, so that  $q_{it} = D^t(P_t)$ . A monetary equivalent measure of the gain from skiing is the area under the income-compensated demand curve,

$$F^t(q) = \int_0^q D^t(q) dq.$$

The  $i$ th individual chooses to ski if the fixed cost of a day of skiing,  $v_{it}$ , plus the lift ticket price,  $P_t D^t(P_t)$ , is less than the gain from skiing,  $F^t(q)$ . Assume further that  $\partial q / \partial Y > 0$ ,  $\partial Y_{it} / \partial t > 0$ ,  $\partial q / \partial v < 0$ , and  $\partial v_{it} / \partial t < 0$ .

There are  $R_t$  identical ski resorts each with capacity  $X_t$  rides per year  $t$  with aggregate capacity equal to  $X_t R_t$ . I assume that the full lift capacity of the ski resort is always in use, so that there are lift lines.<sup>4</sup> The ski resort can increase the quality of a day of skiing by increasing lift capacity and skiable acres up to the point where lift lines disappear and skiers are not impeded by congested slopes. Beyond this point any increase in lift capacity or skiable acres has no effect on quality. Ski resorts are assumed to be per-ride price takers, while rides are provided subject to a constant returns to scale cost function,  $C(X_t)$ , with  $\partial C(X_t) / \partial X_t = c_t = C(X_t) / X_t$ . Let  $p_{jt}$  equal the lift ticket price at area  $j$ . At each ski

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<sup>4</sup> As a result, I ignore the off-peak time in local markets, which is used primarily by season ticket holders.

area the number of rides per skier (that is, the quality of a day of skiing) is  $q_{jt}$  and equals  $X_t/n_{jt}$ , where  $n_{jt}$ , the number of skiers at ski area  $j$ , equals  $N_t/R_t$ . While the decision to go skiing is based on the lift ticket price and an expected number of rides, the marginal price per ride would be zero once the skier is at the ski area and has paid the lift ticket price. However, lift lines and congestion on the slope limit the number of runs.

Now assume further that when  $t$  equals 0, there are  $N$  identical skiers and the number of skiers is fixed over time. As a result, the model does not determine the number of skiers per year  $t$  but the level of quality provided per skier (that is,  $q_t$ ).<sup>5</sup> The model isolates the effect of increases in real income and decreases in transportation costs over time on the quality of a day of skiing for  $t > 0$ . Skiers continue to ski each year with ski resorts competing to provide the equilibrium quality demanded by the skiers at time  $t$ . Since  $c_t$  is constant in the long run and  $\partial q/\partial Y > 0$ , increases in real income over time increase a skier's demand for  $q_t$  (i.e., more rides per day and shorter waits in the lift line) and shift out the aggregate demand curve for ski runs per day even with no change in the aggregate number of skiers.

The constant-returns-to-scale assumption makes the number of ski resorts indeterminate in the long run. Without loss of generality, assume that the number of ski resorts remains fixed at  $R$ , so that in long-run equilibrium  $q_t = RX_t/N$ ,  $X_tR = D^t(P)N(P)$ , and  $P_t$  equals  $c_t$ . In other words,  $X_t$  adjusts so that no ski resort makes economic profits and all ski areas provide the same level of quality. In effect the  $N$  skiers are demanding and paying for a higher quality of service resulting from the shorter waits in the lift

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<sup>5</sup> The model thus incorporates the fact that the number of skier days per season has remained essentially unchanged since 1980 despite the large increase in lift capacity in the industry..

lines due to the increased lift capacity per skier. As a result, this basic model is a restatement of the standard competitive model with free entry and zero economic profits in long-run equilibrium with price being the implicit per ride price and revenue per skier equal to the lift ticket price. Increases in  $Y_t$  and decreases in  $v_t$  over time increase the aggregate demand for runs per day in the same way as an increase in  $N$ , the number of skiers, would in the standard competitive model with a constant-cost industry for a good that remains homogeneous over time.

### **c. The Two-Sector Competitive Model with a Binding Acreage Constraint for Local Ski Resorts**

I now extend the model by accounting for local and national sub-sectors and the skiable acreage constraint. Assume that the  $R$  resorts consist of  $L$  competitive local ski resorts and  $W$  competitive national/international resorts. Regardless of their preferences for skiing in the national versus the local market, skiers are not likely to have the same opportunity cost of a day of skiing at a national resort. To account for this difference, I follow Dana (1999), who in his model of airline ticket pricing, assumed a uniform distribution of a fixed number of customers according to their opportunity cost for flying at a preferred time of departure.

All skiers are located in the same place as the local ski resorts with  $v_t^L$  being the identical lump-sum cost of a day of skiing at a local ski resort and  $v_{it}^W$  the lump-sum cost of a day of skiing at a national resort for the  $i$ th skier with  $v_{it}^W > v_t^L$ . Otherwise identical skiers differ according to the distribution of their opportunity cost per day of skiing at a national resort,  $v_{it}^W$ , relative to  $v_t^L$ . Skiers with the lowest opportunity cost of a day of skiing at a national resort ski there and, except for the skier on the margin, earn additional consumer surplus that the competitive national ski areas are unable to

extract due the assumption of a competitive national submarket.

Assume further that at  $t$  equal to 0,  $p^W_0 > p^L_0$ . Although as specified, the model does not determine the relative magnitudes of the lift ticket prices in the national and local markets at  $t$  equal to 0, my objective is explaining how lift ticket prices changed over time due to increases in demand for the number of runs per day per skier regardless of an initial perception of relative quality. Additional differences between  $p^W_t$  and  $p^L_t$  for  $t > 0$  are thus due to exogenous changes in  $Y_t$  and  $v^W_{it}$ .<sup>6</sup>

Now assume that ski resorts in the national market can increase lift capacity in fixed proportion with skiable acreage at constant returns to scale, but that local ski resorts are constrained by available acreage. As a result, at local ski resorts the increase in demand for the number of runs per day per skier increases the overall demand for lift capacity and shorter lift lines at each ski area, but the number of runs does not increase in the same proportion as lift capacity when skiable acreage is a binding constraint. The additional congestion on the slope mitigates some of the advantages of the increased lift capacity. As a result,  $\partial C^W_t / \partial X_t = P^W_t < P^L_t = \partial C^L_t / \partial X_t$ . In other words, limits on aggregate skiable terrain result in an increasing cost industry for ski runs per day locally with a relatively higher implicit per-ride price in long-run equilibrium in response to increases in demand. Since  $\partial C^L_t / \partial X_t > C^L_t / X_t$ , local ski areas either earn economic profits or as in the Ellickson model pay higher Ricardian rents for the use

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<sup>6</sup> As specified the model assumes that at  $t$  equal to 0,  $F(q^W) > F(q^L)$  and  $q^W > q^L$ . In other words, at time period  $t$  equal to 0 national ski areas already provide higher quality due a greater number of runs per skier per day. One could assume further that skiers value a length-adjusted run (that is, VTFH) at a national ski area by more than the equivalent run at the local ski area due to more interesting runs and scenery or amounts of natural snow, so that  $F^W(q) > F^L(q)$  at all values of  $q$  at any time  $t$  and that the cost of providing an equivalent number of rides per skier is greater in the national market due to the increased cost of creating the more interesting ski runs and/or payment of Ricardian rents for use of land with more attractive characteristics, such as relatively greater annual natural snowfall (that is,  $c^W(X_t) > c^L(X_t)$ ).

of the land.

While capacity and the level of quality increase at both local and national ski resorts, the increased congestion at local ski resorts increases the proportion of skiers who shift from local to national ski resorts making the increase in lift capacity disproportionately greater at national ski resorts. In long-run equilibrium, competition within each submarket drives profits to zero while the skier on the margin is indifferent between skiing in either the local or national sub-sector. As a result,  $F^t(q^W) - p_t^W - v_t^W = F^t(q^L) - p_t^L - v_t^L$  for this skier. In other words, the skier on the margin pays a net transportation cost that equals this skier's perceived valuation of the difference in quality in the two sub-sectors net of the difference in lift ticket prices. Any decrease in relative transportation cost also increases the number of skiers going to the national market and results in an additional increase in aggregate capacity at national resorts.

What may be less intuitive is the effect that an increase in demand for rides has on relative lift-ticket prices. Since local resorts are assumed to be per-ride price takers, the increase in demand increases the implicit price per ride in the local market,  $P_t^L$ , due to the increase in the marginal cost of a ride,  $c_t^L(X_t)$ . Since skiers are also receiving more rides per day due to the increase in capacity, lift ticket prices increase. The increased demand per skier in the national market also increases lift ticket prices, but the implicit price per ride remains unchanged due to the constant returns to scale assumption. Assuming that the demand for runs is elastic, lift ticket prices in the national market increase by more than they do in local markets due to the lower relative implicit price per ride and the relative increase in the quality of a day of skiing (that is, more rides per day).<sup>7</sup>

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<sup>7</sup> The assumption of an elastic demand for ski runs implies that  $\partial F(q)/\partial q > 0$  at the equilibrium number

### 3. The U.S. Ski Industry

This section provides data that support the predictions of the model in Section 2. There have been two important exogenous trends that have affected the market structure of the U.S. ski industry since 1980: sustained decreases in real transportation costs and increases in skier real income. As shown in Table 1, the domestic airfare price per transport mile has fallen steadily in real terms since 1980 providing an incentive for skiers to switch from local/regional markets to national ski resorts, which are found primarily in the Rocky Mountains. Skiers are among the wealthiest Americans. For example, according to a 1996 survey, average skier household income was more than \$80,000 with the share of skier households with income under \$50,000 only 27 percent (Cravatta, 1997). By comparison, median U.S. household income was only \$35,000 in 1996. Since 1980, the biggest increases in income were received by the upper fifth of the income distribution. In 1980 individuals in the top fifth of household income received 43.7 percent of aggregate income. By 2001 this figure had steadily increased to 50.1 percent, while each of the remaining quintiles experienced a decrease in their share during this time period (U.S. Census Bureau, 2005).

During this time period ski areas raised both real lift ticket prices and lift capacity at the national and local markets. Table 2 summarizes the changes based on data for lift capacity and skiable acreage for individual ski areas and data on skier days<sup>8</sup>. There are ski resorts in 39 of the states, but the number of skier days per year for specific ski resorts is available only in Colorado, Utah, Washington, New Mexico, Idaho, and Oregon and at the state level for Maine, Vermont, New Hampshire, and California.

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of runs per day.

<sup>8</sup> While most ski resorts collect data on skier days, many ski resort owners and state ski associations are reluctant to reveal this information.

Table 2 provides information for specific states and groups of states for changes in lift capacity between 1980 and 2002 along with the percentage of ski areas in the state using peak-load pricing on weekends and holidays, average skier days per skiable acre and lift capacity, the percentage change in real lift ticket prices between 1980 and 2002, and aggregate lift capacity per skiable acre. I follow Morey in defining lift capacity as Vertical Transport Feet per Hour (VTFH), which is the number of persons who can be transported 1,000 vertical feet per hour.<sup>9</sup> The most notable differences are between New England states, such as Vermont and New Hampshire, and those located in the national sub-market states of Colorado, Utah, Idaho, Montana and Wyoming. For example, among these ski resorts, the most lift capacity (VTFH) per skiable acre and skiers per acre are in Vermont. While Vermont ski resorts increased lift capacity on average by 79 percent between 1980 and 2002, lift ticket prices increased only by 43 percent in real terms. By contrast real lift ticket prices increased by 92 percent per ski resort in Utah with lift capacity increasing by 135 percent.<sup>10</sup>

Note that Table 2 makes no adjustment for the length of the season or the fact that the distribution of skier days is likely to be more uniform throughout the week at the national resorts due to the general absence of peak-load pricing. For example, only 4.2 percent of ski resorts in Colorado varied prices during the week, while 64.7 percent did so in Vermont and 82.4 percent did in New

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<sup>9</sup>VTFH equals vertical feet times lift capacity divided by 1,000. Lift capacity as reported by ski resorts is the number of persons who can be transported to the top of the hill per hour. This definition of capacity, however, does not account for the ski resort's vertical drop when making lift capacity comparisons among different ski resorts.

<sup>10</sup> Ski area specific data are from the 1980 and 2002 editions of Enzel's *The White Book of Ski Areas* on vertical drop, lift-capacity, skiable acres, and lift ticket prices for United States ski resorts and individual ski resort websites. Information on skier days for the year 2002-2003 came from each state's

Hampshire. As a result, a higher percentage of the skier days reported in Table 2 were concentrated during weekends and holidays at Eastern ski resorts, while spread out more evenly during the week at the ski resorts in the Rocky Mountain States. These adjustments make the crowding on the slope at peak times even greater at the ski resorts with the largest skier day per acre ratios shown in Table 2. For example, Colorado has a skier day per VTFH ratio comparable to that of Vermont (8.36 versus 8.81), while its average VTFH per acre is less than half that of Vermont (39.5 versus 86.3) and it is more likely to have its skier days spread out more evenly through the week. Its ski season is also generally much longer.

Overall, the data show that real lift ticket prices and lift capacity have increased over time at all ski areas despite relatively static aggregate skier days per season and little change in market concentration. These increases, however, have not been uniform throughout the industry. National ski areas in the Rockies and Western states, such as Colorado, California, Idaho, and Utah have experienced the largest increases in lift capacity over the past two decades while also increasing their lift ticket prices by more than those in the regional Eastern and Mid-western markets. As predicted by the model in Section 2, ski areas that have increased lift capacity and price relatively less are located in markets characterized by greater congestion on the slopes and longer lift lines despite the use of peak-load pricing at most of these ski resorts.

While the static concentration in the national and local ski markets and the increased capacity and higher quality across all ski areas may not be surprising to skiers, this result is consistent with the findings of Ellickson, Dick, and Berry and Waldfogel. All of these cases have in common an increase in

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trade association.

quality due to increased investment in endogenous fixed costs and increases in real prices despite a lack of evidence of sustainable economic profits over time. In addition, the increase in quality is not consistent across all markets with the relatively larger markets (the national market in this case) experiencing relatively larger increases in quality and prices despite little change in market structure over time.

#### 4. Conclusion

This paper has illustrated the importance of endogenous fixed cost in explaining the market structure and lift ticket pricing of the U.S. down-hill ski industry. While other authors have shown the importance of endogenous fixed costs for service industries, a model of the U.S. ski industry must account for both national and local markets and the impact of lift capacity and skiable acreage constraints on service quality. The EFC model presented in this paper shows that ski resorts with less binding skiable acreage constraints are more likely to increase lift capacity over time in response to increases in the demand for quality. The model implies that increases in lift capacity due to exogenous increases in demand for quality (the number of rides per day or, equivalently, a reduction in waiting time for each ride) result in higher real lift ticket prices and greater lift capacity even in the absence of an increase in the aggregate number of daily visits. While real lift ticket prices and lift capacity increase in both national and local markets, the largest increases take place in the relatively larger, higher-quality national market as implied by the EFC approach. More importantly, the increase in demand over time has had little effect on market structure in either the local markets or national markets. As predicted by the EFC approach, increased competition in endogenous fixed costs in lift capacity has increased quality by decreasing waiting time. Instead of fragmenting further over time quality has increased across the board with higher quality resulting in higher real lift ticket prices.

## REFERENCES

- Barro, R. and P. Romer, "Ski-Lift Pricing, with Applications to Labor and Other Markets," *American Economic Review*, 77 (1987), 875-890.
- Berry S., and Waldfogel, J. (2003). "Product Quality and Market Size," NBER Working Paper 9675, 2003.
- Dick, A., "Market Size, Service Quality and Competition in Banking," *Journal of Money, Credit, and Banking*, forthcoming 2007.
- Ellickson, P., "Does Sutton Apply to Supermarkets," *Rand Journal of Economics*, 2007.
- Carlson, L., "The Real Cost of Skiing," *Skiing*, 48 (1996), 58-60.
- Cravatta, M., "Slope and slide (decline in popularity of alpine skiing)," *American Demographics*, 19 (1997), 38.
- Davidson, C., "Equilibrium in Servicing Industries: An Economic Application of Queuing Theory," *Journal of Business*, 61 (1988), 347-67.
- Enzel, R., *White Book of Ski Areas*, Interski Services, 1980 and 2002.
- Morey, E., "The Choice of Ski Areas: Estimation of a Generalized CES Preference Ordering with Characteristics," *The Review of Economics and Statistics*, 66 (1984), 584-590.
- Mulligan, J. and E. Llinares, "Market Segmentation and the Diffusion of Quality-enhancing Innovations: the Case of Downhill Skiing," *The Review of Economics and Statistics*, 85 (2003), 493-501.
- Scotchmer, S., "Two-tier Pricing of Shared Facilities in a Free-Entry Equilibrium," *Rand Journal of Economics*, 16 (1985), 456-472.
- Shaked, A. and Sutton, J. "Natural Oligopolies", *Econometrica*, 51 (1983), 1469-1484.

Shaked, A. and Sutton, J. "Product Differentiation and Industrial Structure," *Journal of Industrial Economics*, 60 (1987), 889-917.

Stehmann, O., 1992, "Entry Deterrence and Excess Capacity in a Stackelberg Game," *Economic Notes*, 21, 450-467.

Sutton, J., 1991, *Sunk Costs and Market Structure*, Cambridge, MA, MIT Press.

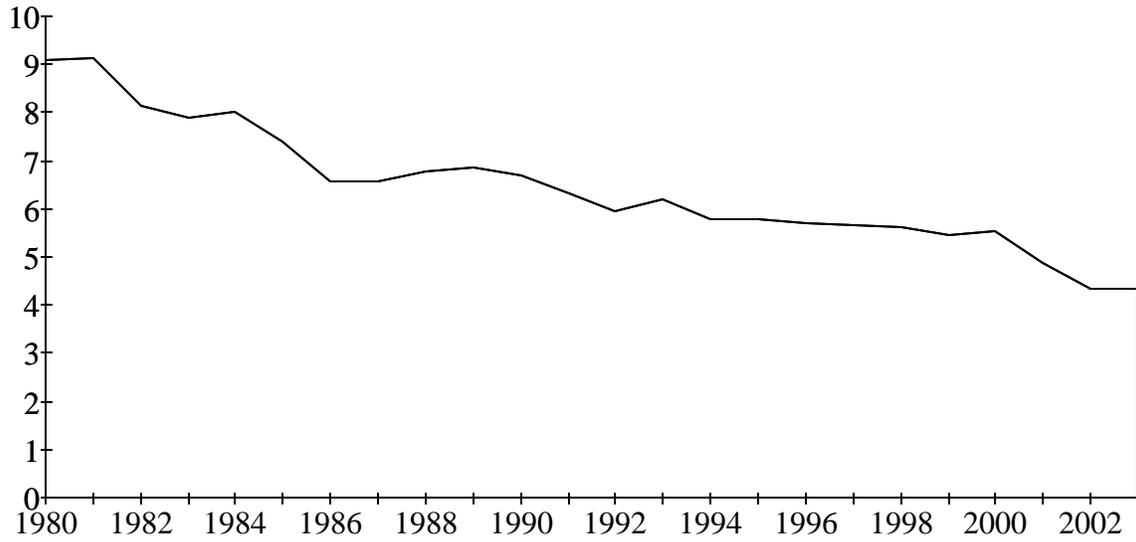
Sutton, J., 1998, *Technology and Market Structure*, Cambridge, MA, MIT Press.

U.S. Census Bureau, 2005, *Historical Income Inequality Tables*, Table IE-3,  
<http://www.census.gov/hhes/income/histinc/ineqtoc.html>.

Walsh, R., Miller, N., and L. Gilliam, 1983, "Congestion and Willingness to Pay for Expansion of Skiing Capacity," *Land Economics*, 59, 195-210.

**TABLE 1**

**DOMESTIC AIRFARES PER MILE FROM 1980 TO 2003 (IN 1978 CENTS)**



Source: The Air Transport Association of America, Inc.

TABLE 2

LIFT-TICKET PRICES, CAPACITY AND CONGESTION  
FROM 1980 TO 2002 FOR SELECTED STATES

States	Percent Change VTFH 1980-2002	Percentage of Ski resorts using Peak-load Pricing	Skier Days per VTFH 2002	Skier Days per Acre 2002	Percent Change Real lift-ticket Price 1980-2002	VTFH/Acre 2002
Colorado	202	4.2	8.36	331	72	39.54
California	145	41.0	5.87	54	49	9.17
Idaho	136	37.5	4.87	68	64	13.91
Utah	135	14.3	5.71	127	92	22.25
New Mexico	97	11.1	6.08	175	40	28.73
Maine	97	69.2	7.34	368	70	50.06
Montana Wyoming	96	16.7	8.84	117	60	13.26
Vermont	70	64.7	8.81	761	43	86.30
New Hampshire	68	82.4	10.76	707	43	65.69
Midwest	64	76.3	27.72	828	30	29.87
New York Rhode Island Massachusetts	26	72.7	18.77	826	32	44.02

<sup>1</sup> VTFH is vertical transport feet per hour: the number of skiers who can be transported 1000 feet per hour.