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FACTORS ASSOCIATED WITH FINANCIAL SUCCESS IN THE MIDWESTERN SKIING INDUSTRY

by
William Albert Leuschner

A dissertation submitted in partial fulfillment
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Doctoral Committee:

Professor G. Robinson Gregory, Chairman
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ABSTRACT

FACTORS ASSOCIATED WITH FINANCIAL SUCCESS
IN THE MIDWESTERN SKIING INDUSTRY

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The objectives of this study are twofold; to identify factors associated with the financial success of individual ski areas and to assess the industry's economic climate with respect to investment. Factors associated with the financial success of ski areas are examined using least squares, stepwise, multiple linear regressions. The climate of the industry is examined using the framework of the economic field of industrial organization.

The dependent variable for the regressions is rate of return on total investment (ROR) calculated from ski area income statements and balance sheets. Nineteen independent variables are initially hypothesized. A regression on all observations indicates vertical transport feet provide the best explanation of variations in ROR. Ignoring vertical transport feet, average price becomes the best explanation. The R^2's of these equations are 0.21 and 0.36 respectively. There are no other variables significantly related to ROR at or above the 0.05 level.

All observations are then classified by several series of empirical and a priori categories. Only the price and urban/rural category results are significantly different from

the above uncategorized results. Vertical transport feet, average price, and, in one case, a variable measuring snow on the ground are the only significant variables. R^2's range from 0.67 to 0.92.

Subject to several warnings attached to the use of the results of the regressions, it can be said: (1) ROR is maximized when ski areas have about one and two thirds million vertical transport feet of tow and lift capacity, an average price of about $3.67 per skier visit, and are located where snow on the ground, in the study area, is greatest and within fifty miles of an urban place with 50,000 or more population; and (2) areas not located within this distance of an urban place should have slightly more capacity and should charge a slightly higher price.

At least two, if not three, different markets exist in the industry--the single-day, weekend, and vacation markets. The following market structure is seen: (1) atomistic buyer concentration in all markets; (2) very low seller concentration industry-wide but moderate to high concentration in the individual markets; (3) moderate to high product differentiation; and (4) low barriers to entry and moderate barriers to exit. Industry performance does not contradict these hypotheses. The evidence suggests this may be an oligopolistic industry in the process of change rather than a case of destructive competition.

The industry investment climate is considered poor due to historically low profits, the constant threat of overcapacity, and recorded returns to successful areas which

are only moderate in light of the risks. The single-day ski area in the urban setting is seen as the best investment possibility due to its product being differentiated by location, higher seller concentration, and the possibility of using overcapacity by special promotional activities.

The author concludes public sector investment, whether in capital funds or land, must be made carefully so as not to create overcapacity. Assistance to existing areas to make them large enough to be profitable may be the highest priority for public investment.

PREFACE

During this study the author was employed by the North Central Forest Experiment Station, Forest Service-U.S.D.A. The study was part of a larger one made with the financial cooperation of the Upper Great Lakes Regional Commission. The author acknowledges his debt to these organizations, and to Hugh C. Davis and James T. Morgan in particular, for making this dissertation possible.

The doctoral committee, and particularly G. Robinson Gregory, the chairman, are thanked for their contributions.

The author expresses his sincere appreciation to his wife Margery for her support throughout the whole process which culminates in this dissertation and expresses his hope that Erik will enjoy a full share of benefits from it.

And thanks to Hans for listening.

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CHAPTER I

INTRODUCTION

Downhill skiing began in the United States during the 1849 California gold rush.[1] Many prospectors were of Scandinavian descent and they used skiing as an efficient mode of winter travel in the Sierras. The other prospectors soon adopted skiing as a recreational pastime and competitive sport during their celebrations.

From this beginning skiing survived primarily in ski clubs until the Third Olympic Winter Games at Lake Placid, New York in 1932. These games are generally credited with giving the industry its initial start by stirring the interest of the American public via radio and motion picture newsreel coverage. During the Depression years of the 1930's ski trails and lodges were built on public lands by the Civilian Conservation Corps and the Works Project Administration. These projects and the development of tows and lifts for transporting skiers uphill helped to further establish the budding industry during the 1930's.

In 1936 the Union Pacific Railroad opened Sun

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[1]The section on the historical development of skiing is adapted from Kenneth C. Chilman, "Skiing as a Forest Industry," Ann Arbor, Mich., 1967. (Dittographed.)

Valley in Idaho to publicize the railroad and increase its use. This marked the first large scale private investment in a United States ski area. The publicity attendant to its opening not only benefited Sun Valley, but the entire industry as well. Mount Hood in Oregon, Alta in Utah, and the Lake Placid Club in New York were also being developed during this period.

During World War II further expansion of the skiing industry was suppressed. However, there were several benefits from the war. First, advances in technology helped develop such items as the all-metal ski, the plastic running surface for ski bottoms, and artificial snowmaking. Second, the United States Army trained many men to ski, as, for example, in the Tenth Mountain Division. After the war these men became both customers and managerial personnel for the skiing industry. Finally, the sale of war surplus skis and boots provided the public low cost equipment with which to begin their participation in skiing.

The decade of the 1950's saw a large increase in the number of ski areas from about forty in 1950 to over 200 in 1960. However, it was probably the Eighth Olympic Winter Games at Squaw Valley, California in 1960 which gave the skiing industry its next significant boost. The development of Squaw Valley was well publicized in advance of the games and wide television coverage of the games themselves brought skiing into many an American home. Once again, the Olympic Winter Games served as a catalyst to

increase the public's interest in skiing.

The interest of investors was also apparently piqued for construction of several multi-million dollar skiing complexes was begun in the early 1960's. These included Alpine Meadow in California, Sierra Blanca in New Mexico, Stratton Meadow in Vermont, and the Vail complex in Colorado. The most recent of these (1965) was Mineral King in California currently being developed by Walt Disney Enterprises. This project had an estimated capital cost of $35 million.

Not all ski areas are of the multi-million dollar class. Many areas operate on a much smaller scale. It is shown later that, in the midwest at least, the barriers to entry into the industry are low and that many ski areas operate with total assets of less than $60,000.

Public interest in skiing during these years is reflected by an estimated annual compound increase in the number of northeastern skiers of 15.4 percent from 1953 to 1964.[1] The annual compound increase in skier attendance from 1955 to 1964 in twelve western states was estimated at 15.4 percent also.[2]

One can only conjecture about the cause of recent

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[1]Sno-Engineering, Inc., The Skier Market in Northeast North America, 1965 Edition (Washington, D.C.: Government Printing Office, 1965), "Synopsis."

[2]Roscoe B. Herrington, Skiing Trends and Opportunities in the Western States, U.S. Forest Service Research Paper INT-34 (Ogden, Utah: Inter-Mountain Forest and Range Experiment Station, 1967), Table 13, p. 65.

investment in the skiing industry. Part of the interest probably stems from the aforementioned publicity and growth rates of skiers and attendance. Certainly government agency projections of growth of participation in outdoor recreation activities has added to the aura of growth. Another attractive force may have been those ski areas which apparently made large profits during the short skiing season.

The private sector may also have been attracted by the romance of skiing. The operation of a service facility wherein one is surrounded by attractive young people and physically fit oldsters, all spending their money freely, certainly has appeal. In addition, some investors were probably skiing enthusiasts anxious to make a living by running their own ski areas while others may have been anxious to increase nationwide participation in a sport they loved.

The reasons for public sector involvement are perhaps more clear. First, much of the land most suitable for skiing is owned by federal and state agencies. Large investors, therefore, involved these public agencies in their projects. Many smaller ski areas also had their beginnings as private ski clubs which wanted to develop their own slopes. These clubs sought to lease public land due to its availability and low cost. In addition, many public agencies have developed ski areas as part of the services they provide.

The second major reason for public sector investment is to aid economically depressed regions. Skiing appears attractive for several reasons. First, the resource base (primarily hilly terrain and snow) is present in many depressed regions. Second, the activity takes place in the winter months when other activity is usually at a low ebb. Finally, the service nature of the industry seems to indicate it could employ relatively unskilled labor. Therefore, federal agencies charged with the responsibility of alleviating depressed regional economies began making loans for developing ski areas, either for initial development or for expansion of existing facilities.

Investment has been taking place but information for its evaluation has been scarce. Few studies were made prior to the 1960's and since then there have only been two comprehensive studies giving information on both the skier and the industry and covering more than one state.[1,2] There has not been a study of the midwestern skiing industry. It is this gap in knowledge that the current study helps fill.

The Problem and the Procedure

The problem is twofold. The first part is to examine individual ski areas and attempt to identify those variables associated with successful investment. These variables

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[1]Herrington, Skiing in the Western States.

[2]Sno-Engineering, The Skier Market.

may pertain to the physical management of the ski area, the efficiency with which the area's product is marketed and its overhead is utilized, or the location of the area as related to climate, population, and competing ski areas. The goal of this section is to isolate half a dozen or less of the variables closely associated with successful investment.

The results can be used in at least two ways. First, a potential investor may use them to evaluate a proposed project. The investor may be either an individual in the private sector who is called upon to supply debt or equity capital funds or a public agency requested to lend money or lease public land for ski area development. The particular investment may either be in a new ski area or in the expansion of existing skiing facilities.

The second use of the study's results is by the ski area developer. He can use the variables to plan those features which should be included in a ski area. Again, the developer may be either in the private or public sector and the planning may be for either a new or existing area.

The factors associated with successful investment are examined by using a least squares, stepwise, multiple linear regression. The dependent variable reflects the rate of return on investment at each of the ski areas.[1]

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[1]See p.20 for a summary of the dependent variable and p. 49 for a summary of the independent variables.

Initially, the dependent variable is regressed upon all the independent variables to determine which of them are most important. Importance is determined by the usual statistical tests--significance levels and partial coefficients of determination. After a working model is developed in this manner the regressions are run again by subclassifications of the ski areas to see if the significance of the independent variables changes. These subclassifications include capacity size class of the ski area and location of area relative to large population centers.

The second part of the problem is to assess the economic environment of the skiing industry to see if the industry is amenable to investment. It may be argued that this step should precede the analysis of the ski areas. However, it is felt prior analysis would provide useful insights for the examination of the industry.

The economic environment is examined using the framework of the economic field of industrial organization. First, the market structure is examined to see what type of market performance would be expected. Second, the performance is examined to see if it agrees with the predictions made from the examination of the structure. These two aspects are then integrated to assess the economic environment of the industry.

Definitions

The following general definitions are used in this

study:

1. Ski Area.--Any facility providing downhill skiing which (a) charges a positive price, (b) is open to the general public, (c) has at least one tow or lift for transporting skiers to the top of the hill, and (d) has an annual attendance of over 100 skiers.

This definition considers ski areas run by state, municipal, and non-profit organizations as part of the skiing industry since they are potential competitors in the skier market. Private clubs or non-profit corporations which are not open to the public are excluded since they do not compete directly in the market.

2. The Midwest.--The states of Illinois, Indiana, Michigan, Minnesota, and Wisconsin.

3. Skier-Day.--One person visiting a ski area for all or any part of a day for the purpose of skiing.

This is the unit of measurement of attendance and may be used synonymously with attendance. For example, a ski area with an attendance of 1,000 has 1,000 skier-days use.

Other terms are defined when first used.

The Data

A 100 percent survey of the midwestern ski areas was attempted. A list of ski areas was developed from commercial and state ski area directories covering the 1965-66 through the 1967-68 skiing seasons. The initial list

contained 192 ski areas. Thirty of these were not contacted; 21 because the operator either refused an interview or could not be located (see Table 1). The other 9 non-contacts were

TABLE 1

RESULTS OF SKI AREA OPERATOR INTERVIEW

	Total	Ill.	Ind.	Mich.	Minn.	Wisc.
Original Number of Areas	192	7	4	86	38	57
Non-Contacts						
Out of Business	9	0	0	6	2	1
Refused Interview	2	0	0	0	0	2
Could Not Locate Operator	19	0	0	13	0	8
Areas Contacted	162	7	4	67	36	48
Areas Not in Study[a]	15	0	0	7	2	6
Interviews Obtained	147	7	4	60	34	42

[a]Areas which did not conform to the definition of a ski area.

reported as being out of business by outside sources so no attempt at contact was made. The remaining 162 ski areas were contacted and 15 found not to fit the above definition of a ski area.

The fact that 147 operators were interviewed does not mean that all parts of the questionnaire were answered. Some questions were not answered because the information was unknown, others because it was considered confidential. In some cases the ski area was closed for the current season

while in others it was closed permanently.

This resulted in incomplete coverage of ski areas for some questions. In addition, there were the 21 ski areas about which no information was obtained. In the strictest sense, this makes generalization of findings to the whole industry impossible. However, in the practical sense some information was obtained for over 88 percent of the ski areas on the initial list. This information is by far the most detailed and the best available at this time.

Personal interviews of the area operators were administered by the author and six other Forest Service employees in late March, April, and May of 1967. A copy of the Ski Area Operator Questionnaire is found in Appendix A. The questionnaire contains some questions not needed for this study but needed for a Forest Service study of broader scope.

CHAPTER II

VARIABLES USED IN THE REGRESSION ANALYSES

The first goal of this study is to identify factors associated with successful investment in the midwestern skiing industry. This makes it necessary to define investment and a technique for measuring its success for use as a dependent variable and to hypothesize factors which seem likely to affect financial success for use as independent variables.

The Dependent Variable

In the economic sense "Investment refers to the production or acquisition of any such real capital asset. . . ." where "Capital, in sum, is any previously produced input or asset of a business firm or any other producer."[1] However, in the popular sense investment refers to the placement of funds with, or the retention of funds by, a firm or producer so that it may acquire capital as defined above.[2] Further, these funds are usually understood to be placed or retained

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[1]William J. Baumol, Economic Theory and Operations Analysis (2nd ed., Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1965), p. 408.

[2]Note that this definition allows current assets to be considered capital. For example, cash can be classified as a previously produced asset.

for an extended period of time, the accounting definition being for a year or more. In this study investment is defined as the placement with, or retention by, a firm or producer of funds for an implicit or explicit period of a year or more for the purpose of acquiring capital.[1]

There are several advantages to this definition. First, it makes practical sense. The decision to invest is really the decision to leave or place funds with a firm for it to obtain assets to conduct business. The dollars a firm has allows it to obtain capital (economic definition) to carry on production. Second, the definition allows quantification of investment in terms of dollars. Finally, as will be seen later in this chapter, it allows identification of investment by observation of a firm's balance sheet. Given the ability to identify investment and a unit to measure it we can establish the amount of investment and then measure its relative success.

Economic theory prescribes two techniques for measuring the success of investment: the marginal efficiency of investment (also called the internal rate of return) and the net discounted present value (also called the present net worth). Marginal efficiency of investment is defined as ". . . that rate of interest or return which would render

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[1]This definition ignores another popular definition of investment, namely the purchase of securities in a secondary market (such as one of the stock exchanges) for the purpose of receiving interest, dividends, and/or an increase in the market price of the security.

the discounted present value of its expected [underlining mine] future marginal yields exactly equal to the cost of the project."[1]

Investment in a new firm or expansion of an existing firm should be undertaken if the marginal efficiency of investment is greater than the "pure" interest rate.[2] This is so because the interest rate is considered the investor's minimum alternative investment and to place his funds in any project yielding less would incur an opportunity cost equal to the differential. Of course, it is assumed the investor will choose those projects with the highest marginal efficiency of investment (above the interest rate) first.

But what about the risk of the project? Keynes identifies two types of risk, borrower's and lender's, and states:

> For if a venture is a risky one, the borrower will require a wider margin between his expectation of yield and the rate of interest at which he will think it worth his while to borrow; whilst the very same reason will lead the lender to require a margin between what he charges and the pure rate of interest in order to induce

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[1]Baumol, Economic Theory, p. 439.

[2]The "pure" interest rate is the price of funds in a market completely free of risk and meeting the requirements for a purely competitive market. It is the price of funds which a person (or firm) would either pay or receive depending on whether he was a borrower or lender.

him to lend . . .[1,2]

The marginal efficiency of investment and the pure interest rate, then, are adjusted, respectively, for the borrower's and lender's risk before the investment decision is made.

The marginal efficiency of investment criterion has several disadvantages which makes the second criterion, net discounted present value, more favored in current economic thinking. These disadvantages are:

1. Solution in terms of the closest highest return (local maximum) instead of the overall highest return.

2. The possibility of making the wrong investment choice in the special case where investment funds are unlimited.

3. The assumption that positive and negative incomes are reinvested at the marginal efficiency of investment.

However, the marginal efficiency of investment is more useful, for purposes of this study at least, since it gives a solution in terms of a rate of return which is more directly comparable to other alternatives such as the interest rate which would be received if funds were lent. Further, the local maximum problem is more theoretical than

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[1]John Maynard Keynes, The General Theory of Employment Interest and Money (London: Macmillan & Co., Ltd., 1964), p. 145.

[2]See Baumol, Economic Theory, pp. 453-460 for a discussion of techniques to account for risk in actual investment calculations.

practical; investment funds are seldom unlimited; and calculation of present net worth requires knowing the interest rate or alternative rate of return, which is seldom known (at least, in the latter case, without first calculating the marginal efficiency of investment). In addition, Baumol says ". . . the two criteria are in agreement, and, in fact, we can normally expect them to be so."[1]

The marginal efficiency of investment would make a good criterion for judging the relative success of investment. Unfortunately, it cannot be calculated for the midwestern skiing industry if for no other reason than it is based on the expected returns and financial observations, by their nature, are based on past experience.

However, the historical nature of observations need not cause undue concern since expectations, in part, are based on past experience. One of the early questions an investor is likely to ask is the past history of a firm or industry. While recognizing past performance is not certain to be continued it is, nonetheless, instructive. The question then becomes one of finding a unit of measurement closely related to the marginal efficiency of investment which can be used with the historical data available.

To start, note the marginal efficiency of investment essentially calculates the net returns on an investment as a compound percent of the investment. "There are

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[1]Baumol, Economic Theory, p. 442.

two widely used natural measures of net profit, a comparison with tangible net worth of a business enterprise, and a comparison with net sales,"[1] where tangible net worth is the sum of the ownership (equity) investment in a firm less intangible assets. The first ratio mentioned leads toward a substitute for the marginal efficiency of investment. However, the tangible net worth only considers equity investment while this study's definition considers all investment funds, both debt and equity.

There are a series of ratios which analyze the returns on various classes of investment by determining returns as a percentage of total investment, equity investment, and common stock investment. Both the denominator and numerator of these ratios change depending on which class of investment is chosen.[2] A substitute for the marginal efficiency of investment should reflect the total investment, regardless of whether it is debt or equity.[3]

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[1]Roy A. Foulke, Practical Financial Statement Analysis, 2nd ed. (New York: McGraw-Hill Book Co., Inc., 1950), p. 555.

[2]For a fuller discussion see Merwin H. Waterman, "Trading on Equity," in Essays on Business Finance, Karl A. Boedecker, et al. (Ann Arbor, Mich.: Masterco Press, 1963), pp. 91-99.

[3]The choice of whether the funds for capital are obtained by debt or equity is the decision of the financial manager of the ski area and a function of the funds market at the time the decision is made. The debt-equity mix does have its effects on profitability due to leverage and the federal income tax structure. However, these factors are ignored since we are attempting to find a technique to determine the relative success of investment rather than prescribe the financial structure of a ski area.

Therefore, a ratio calculating the rate of return to total investment (ROR) is appropriate.

The next question which arises is, "What is total investment?" By the earlier definition it is all funds placed in or retained by a firm for a year or more to acquire capital. This translates, by accounting definition, to the sum of net worth (the various types of stocks, surpluses, and retained earnings) and long-term debt. This figure can be calculated by subtracting current liabilities from total liabilities. However, current liabilities can contain an account for that portion of long-term debt which is payable within the next year. Since this debt is long-term and since it is used in generating the current year's profit it must be added back to the total investment. In summary, total investment is defined and calculated by the formula:

Total Investment = Total Liabilities - Current Liabilities + Long-Term Debt Currently Payable

This formula causes a problem since some firms use loans due within a year or less (carried in current liabilities) which they renew year after year for many years. Although by definition these loans are not investment (since they are due within one year) they are in practice funds left in the firm for greater than a year.

A theoretical controversy arises in these cases since one school of thought feels the definition of

investment should be followed and investment calculated by the above formula while another school feels the actual practice should determine what is included in the investment calculation. A practical problem arises in determining whether or not the actual practice is to renew the loans in one year. This determination requires (1) a year by year examination of the notes payable account to see if its amount remained stable or increased and (2) a detailed list of the loans in that account to see if the lenders were changing.

The amount of time required for examining the notes payable account precluded doing so in this study. Further, a list of lenders was simply not available from the area operator and, even if available, could not have been obtained due to the amount of interviewer time required to copy it. Therefore, the notes payable were not included in total investment.

The numerator of ROR is the dollars entering the firm due to its operations. This is partially reflected by net profits before federal income tax. We are interested in returns to investment resulting from the usual operation of the firm, including monies received by operating the assets during the off-season. This may include room rentals, food and beverage sales, rental of the ski lodge for parties, and the like. To be excluded are net nonoperating incomes from such items as capital gains or insurance claims.

One more adjustment to the numerator must be made.

Investment is defined as including debt. Interest paid by the firm is deducted from profit but is a return on the lender's investment. Since the lender's investment is included in the denominator this return (i.e., interest) must be added back to the numerator.

All figures are on a before federal income tax basis. The primary reason is that the tax rate changes with the legal form of the firm. Deciding which legal form to adopt rests on many considerations, only one of which is profitability. To make the study as general as possible, before-tax figures are used. Interested investors can adjust the results to fit the legal form which best suits their needs.

A second reason for using before-tax figures is that some data come from non-profit corporations and state or local government-operated ski areas. These areas do not pay federal income tax so their data would have to be treated separately or adjusted for tax payments if after-tax figures are used. Finally, calculations on a before tax basis are simpler than on an after tax basis.

The formula for the return portion of the ratio is:

Profit B.T. - Capital Gains - Other Net Income, Nonoperating + Interest

This formula can overstate the returns if the firm has sizeable notes payable. These notes are not included in the denominator but the interest paid on them is included in the

interest account in the numerator. The amount of this interest should be subtracted but is not since this accounting detail was not available from the ski area operators. The numerator, then, may be overstated by the amount of this interest.

To summarize, the marginal efficiency of investment would be a good criterion for judging the relative success of investment but is impossible to calculate. Therefore, the rate of return on total investment (ROR) is used as a close substitute. ROR is defined and calculated by the formula:

$$ROR = \frac{PBT - CG - NOPY + INT}{TL - CL + LTDCP}$$

where

PBT = profits before federal income tax
CG = capital gains
NOPY = other nonoperating net income
INT = interest
TL = total liabilities
CL = current liabilities
LTDCP = long term debt currently payable

The time period of the dependent variable

The analysis uses regression techniques to examine the correlation between the dependent variable and certain physical, demographic and other attributes associated with the ski areas. The physical and other attributes are those existing in the 1967-68 skiing season. The demographic attributes can be calculated for almost any year chosen.

Strictly speaking, all independent variables and

the dependent variable should be for the same season since some attributes, such as the number of tows and lifts, can change from year to year and probably do change over a five or six year period. The ROR should be correlated with the assets in use when the return was made.

However, the use of only 1967-68 financial data presents a pragmatic problem. The data for many areas for this season are missing since interviewers visited the ski areas before the fiscal year closed. A compromise is made and a weighted average of 1967-68 and 1966-67 financial ratios used. For example, rate of return on total investment is calculated by summing 1966 and 1967 profit plus 1966 and 1967 interest, minus 1966 and 1967 capital gains, minus 1966 and 1967 other net non-operating income and dividing by the sum of 1966 and 1967 total investment. Where only 1966 or 1967 financial information is available the single year's financial ratio is used as the dependent variable.

This assumes the attributes of a ski area did not change significantly between the two seasons. While this is certainly not true in all cases it is hoped the error is not large enough to invalidate the results.

Calculating ROR by this procedure measures financial success by two, or even one, years operations. It is generally felt that financial success should be assessed, at least in part, by examining a firm's record over a series of years. The problem, assuming for the moment the data are available, becomes one of increasing the validity of the

dependent variable at the expense of decreasing the validity of the independent variables. The procedure adopted uses only one or two years to measure financial success because insistence on several years would substantially reduce the number of observations for analysis while also reducing the validity of the independent variables.[1]

A further difficulty suggests itself. The one or two years examined may have been "bad" years for the industry as a whole and therefore not truly reflect the financial positions. However, to the extent that the years were bad for the whole industry this is no problem since we are interested in the relative position of individual ski areas within the industry. On the other hand, if there were, say, adverse weather conditions in Minnesota but not in Michigan during one of the years the relative positions of the ski areas would be distorted. It must therefore be assumed that any exogenous adversities were either (1) randomly distributed, both geographically and temporally, or that (2) they occurred with equal force over all the ski areas in the analysis.

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[1]It was suggested that the number of years a ski area has been in operation be used as an independent variable to help account for this problem. This suggestion was rejected since it seemed quite likely that only the financially successful areas would remain in operation for several years so we would be correlating financial success with financial success.

Final selection of dependent variable

The values for the dependent variable were calculated using 1967-68 and 1966-67 data. The results of the calculation are summarized in Table 2. The last step in

TABLE 2

MISCELLANEOUS STATISTICS FOR DEPENDENT VARIABLE

Item	Value
Range of Ratio Values	
High	25.12
Low	-25.33
Number of Useable Ratios (number of observations)	27
Number of Ratios Based on Indicated Years	
1966 & 1967	9
1967 only	0
1966 only	18

choosing ski areas to be included was to rank the calculated values in descending order. The ranking was then visually examined and one ratio (with the value of -38.62) was eliminated since it appeared to be discontinuous.

The Independent Variables

In choosing the independent variables for regression analysis there are several statistical pitfalls, such as interaction, multicollinearity, and the loss of interval

scale measurement which must be avoided. These pitfalls were kept firmly in mind while formulating the independent variables.

Data for calculating the independent variables, unless otherwise mentioned, were based on answers to the Ski Area Operator Questionnaire and were for the 1967-68 skiing season.[1] However, when variables required an outside data source the year 1966 was used since two-thirds of the dependent variables were based solely on this year (Table 2).

Finally, the hypothesized effects of the independent variables were made ignoring their interactions with, and the effects of, other hypothesized variables. For example, it was hypothesized the greater the number of certified ski instructors the more successful the ski area. This ignores the possibility that the number of instructors must have a certain amount of slope variability to become important or that slope variability may far outweigh the effect of number of instructors.

The independent variables were divided into eight categories as an aid to thinking. Since the categories were formed as an aid they were not rigorously defined and the presence of a variable in one category does not mean it could not have been placed in another.

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[1]See Appendix A for a copy of the Ski Area Operator Questionnaire.

Physical management

This category deals with the physical skiing facilities provided to the skier. Many of the variables in this category can be changed, with varying degrees of flexibility, to meet changes in demand or competition.

Rope or combination area

Tows and lifts transporting skiers to the top of a hill are broadly classified by whether rope (synthetic or natural fiber) or metal cable transports the skier. Another distinction is made between tows and lifts. All tows transport the skier by towing him while his skis remain on the ground. To varying degrees, depending on the type of tow, the skier must use his leg muscles to support himself. Lifts, on the other hand, provide a seat for the skier and transport him without his skis touching the ground.

All rope facilities are tows requiring the skier to grasp the rope with his hands. Cable tows have evenly spaced metal bars (or secondary cables) suspended from them and provide some type of "seat" for the skier. All cable lifts in the midwest are chair lifts.

Rope tows are the least desirable facility from the skiers' point of view since they are the most strenuous to use and the skier is subject to rope burns. In addition, some area operators feel there is a "snob appeal" in using a chair lift or, at least, skiing at an area where one is present.

It is therefore hypothesized that an area with a combination of rope and cable facilities is more attractive to skiers than an area with only rope tows. If more skiers are attracted gross receipts will increase and so will financial success. A dummy variable with the value of one for rope only areas and the value of zero for combination rope and cable areas is used. This variable is named RORC (rope or combination).

Tows and lifts

RORC discriminates between areas having only rope facilities and those having both rope and cable facilities but skiers also consider the number of tows and lifts present. For example, the more tows and lifts the less time a skier must wait in line. In addition, skiers may prefer chair lifts to cable tows and either of these two to rope tows. The present variable, called TOLFT (tows and lifts) attempts to account for these differences.

The formula for TOLFT is:

$$TOLFT = \sum_{i} w_i \times N_i$$

where i = 1-3 respectively for rope tows, cable tows, and cable lifts.

w = an arbitrary weight from one to three corresponding to the i th. class.

N = the number of tows and lifts in the i th. class.

The assignment of the weight one, two, and three is arbitrary. However, there is no evidence that one weighting

scheme is better than another so the simplest is used.

Vertical transport
feet per hour

Vertical transport feet per hour (VTF) is a commonly used measure of ski area capacity.[1] The limiting factor in ski area capacity is assumed to be the tows and lifts. VTF for a ski area is calculated by multiplying the speed of each tow or lift in skiers per hour by the vertical drop of that tow or lift and summing these products for the ski area.[2] VTF is measured to the nearest 1,000 in this study.

There are at least two reasons for including VTF as an independent variable. First, a larger ski area may have a better public image and thereby attract more skiers. Second, the greater the capacity the less time a skier will have to wait in tow and lift lines.

There are several problems concerning the validity of VTF. First, the area operator is asked the skiers per hour and vertical drop for each of his tows and lifts. Some people feel the responses to vertical drop are intentionally biased upward by the operator to make his area more attractive. Perhaps more serious is the difficulty in estimating

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[1]For example, see Checchi and Company Skiing in West Virginia (Washington, D.C.: Checchi and Company, 1968), Herrington, Skiing in the Western States, and Sno-Engineering, The Skier Market.

[2]See Herrington, Skiing in the Western States, pp. 38-40, for a fuller discussion of VTF.

the skiers per hour for rope tows. Since the skier grasps the rope wherever he pleases there is no fixed interval between skiers and the number of skiers per hour becomes less certain. In addition, many rope tows are homemade making it difficult to judge rope speeds.

The second problem occurs when the operator refuses to estimate the skiers per hour for one or more of his tows or lifts. In this case the author estimates 1,000 skiers per hour for all cable facilities, 1,760 skiers per hour for fast (intermediate and expert) rope tows, and 634 skiers per hour for slow (beginner) rope tows. Table 3 shows the

TABLE 3

CABLE SPEED AND DISTANCE BETWEEN SKIERS FOR GIVEN SKIERS PER HOUR

Skiers per Hr.	Cable Speed in m.p.h.	Distance Btwn. Skiers in Feet
634	4	35
1,000	4	20
1,760	10	30

required cable or rope speeds in miles per hour and distance between skiers in feet to obtain these rates. Of course, different combinations of speed and distance will give the same results in skiers per hour.

Snowmaking

Snowmaking can affect financial success in at least three ways. First, it can increase the number of skiable days in the skiing season. Second, a ski area can offer more consistent and better snow conditions thereby gaining a competitive advantage over areas not using snowmaking equipment. Finally, snowmaking can have a negative effect because of the high capital and operating costs.[1]

These three influences, with the exception of capital costs, are related to the use rather than the capacity of snowmaking equipment. To measure use the cubic feet of compressed air generated per season per acre (CUFTA) is calculated to the nearest 1,000. The variable is placed on a per acre basis to allow meaningful comparisons between ski areas having different acres of slopes. The formula for CUFTA is:

CUFTA = (CMPCAP x SNOHR x 60) / ACRES x 1,000

where CMPCAP = the ski area's air compressor capacity in cubic feet per minute.

SNOHR = the reported hours of snowmaking equipment operation.

ACRES = the total acres of ski slopes.

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[1]For a discussion of snowmaking costs see William H. Wheeler, "It Pays to Purchase Air Compressors," Ski Area Management, Fall, 1967, pp. 42-44.

Slope grooming during skiing season

In-season slope grooming is reworking the snow to provide a better skiing surface. This may consist of packing the snow to form a better and longer lasting base, cutting down bumps (called "moguls") or building them up to suit skier preferences, mechanically breaking up icy or hard packed slopes to provide a better "bite" for skis, and the like.

Presumably, the more slope grooming performed, the more attractive an area is to a skier. However, a particular ski area may be forced to do excessive slope grooming to combat consistently bad weather conditions (such as icing) that are unique to its location. There is no apparent way to measure the existence of consistently bad conditions so it is assumed they either do not occur or that their occurrence is randomly distributed over all ski areas and therefore equally reflected in all measurements of slope grooming.

The reported man days of slope grooming during the 1967-68 season is divided by the acres of ski slopes for each area to measure this factor. A per acre figure is used to allow for differences in ski area size, as in CUFTA above, and calculations are carried to three decimal places. This variable is called SLPGRM.

Slope variability[1]

It is hypothesized that one of the more important items a skier seeks at a ski area is slope variability. During several hours of skiing a skier probably prefers a variety of slope conditions against which to test his expertise, upon which to practice and improve his skiing ability, and with which to maintain his interest.

There are several dimensions to slope variability. The first is the difficulty class of the slope. If the slopes are too easy the skier becomes bored. If the slopes are too difficult the skier is either unable to ski them or runs the risk of serious physical injury. A second dimension is a sufficient number of slopes within a skier's difficulty class so he can change from one to another to provide a more interesting and challenging day of skiing. Yet another dimension is slope width. The wider the slope the more ways a skier can traverse it on his downhill trip thereby increasing the variety of the skiing experience on one slope.

The length of the slope has two aspects. First, the longer the slope the less interruption in the skiing experience. Second, the proportion of the day's time spent waiting on tow and lift lines decreases as the length of the slope (and consequently the time spent skiing) increases.

A fifth dimension is the variability of the

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[1]There is some ambiguity in the usage of the terms slope, trail, and run. This study defines "slope" as any piece of land used for downhill skiing and uses the term generically to include trails and runs.

topography on the particular slope. Topography refers to the number of small hillocks or bumps, changes in the angle of the slope, and the like. Up to a certain point, the more variety, the more challenging the slope. Beyond that point the slope becomes less pleasurable to ski since the momentum of the downhill trip is interrupted.

A final dimension of slope variability is its maximum vertical drop. This dimension is interrelated with many of those already mentioned. For example, for a given vertical drop, the shorter the length of the slope the greater the difficulty class. Generally speaking, as vertical drop increases the land available for construction of slopes increases so more acres and/or numbers of slopes can be built. It follows, then, that skiers should tend to prefer areas with larger vertical drops.

Since slope variability is multi-dimensional, a compound variable to measure it seems reasonable. Aggregation by difficulty class is logical since most skiers want to ski within their class. Information from the Ski Area Operator Questionnaire details number, acres, and maximum length of slope by difficulty class but maximum vertical drop is available only for the whole ski area and by tow and lift. No measure of topographic variability is available. All three of the measurements available by difficulty class are included in the compound variable. Acres are used since they are essentially length times width and maximum length is sufficiently important for explicit inclusion.

For example, a ten-acre slope 870 feet wide and 500 feet long is probably less desirable than one 218 feet wide and 2,000 feet long.

The individual variables in a compound variable can be combined either additively or multiplicatively. Generally, within a difficulty class the number of slopes (N) ranged from one to ten, the number of acres (A) from ten to one hundred, and the maximum length (L) from hundreds to thousands. As a matter of judgement, the simple addition of these variables did not seem to adequately reflect differences which might occur. For example, if N = 5, A = 50, and L = 1,000 the value of the compound variable is 1,055. If N is increased to seven and the other values held constant the new compound value is 1,057. An increase in the scale of measurement by two units is judged insufficient to reflect the increase in the number of slopes, therefore the variables are multiplied together and divided by 1,000 (to keep the values manageable).

For the above example the values are 250 when N = 5 and 350 when N = 7. This result is judged more satisfactory. The slope variability variable (SLPVA) for a given difficulty class, then, is calculated by the formula:

$$SLPVA_i = \frac{N_i \times A_i \times L_i}{1{,}000}$$

where i = the i^{th} difficulty class

N = the number of slopes

A = the acres of slopes to the tenth of an acre

L = the maximum slope length in feet

A qualitative interpretation of SLPVA is difficult. Perhaps it is best visualized by thinking of a box where the width is equal to A, the length is equal to L, and the height equal to N. The greater the volume of this box the greater the slope variability and the chances of success. An increase of any one, or combination of, the variables (A, L, or N) increases the volume of the box in the same proportion.

It seems likely a larger share of the skier market is obtained by providing slopes for the range of skier expertise found in the market. An indication of the distribution of expertise is the number of years skiers have been skiing in the western and eastern states as shown in Table 4. These data are used to derive weights reflecting this distribution for use in summing $SLPVA_i$ for a ski area.

The author first assumes that all skiers skiing for one or two years desire beginner slopes, those skiing three to ten years intermediate slopes, and those skiing greater than ten years expert slopes. The eastern and western figures are then averaged and arbitrarily rounded to 33 percent, 50 percent, and 17 percent. The values .33, .50, and .17 are used to weight SLPVA for the beginner, intermediate, and expert classes, respectively.

TABLE 4

PERCENTAGE OF SKIERS SKIING INDICATED NUMBER OF YEARS

Region	Number of Years Skied		
	1-2	3-10	11 & More
Eastern	34	45	21
Western	31	41	28
Mean	32.5	43.0	24.5
Arbitrary Adjustment	33	50	17

Source: Herrington, Skiing in the Western States, Table 47, p. 84 and Sno-Engineering, The Skier Market, p. 8.

The formula for calculating SLPVA, then is:

$$SLPVA = \sum_i w_i \times SLPVA_i$$

where w = the weights .33, .50, and .17 for beginner, intermediate, and expert difficulty classes, respectively.

On area supporting facilities

This category refers to activities at or within walking distance of a ski area in which a skier may participate in addition to downhill skiing. Included in this category are the well-publicized apres ski activities of wine, women, and song as well as outdoor participation activities. The financial position can be improved by on site supporting facilities in two ways: they can make one ski area relatively more attractive than another thereby

improving attendance, and the facilities can provide an additional source of net revenue.

Variables to measure the beds of lodgings, auto parking capacity, and the presence of ice-skating and tobogganing were initially planned. These variables were not used because the small number of observations in the study limited the number of independent variables and the data indicated it was doubtful these variables added either uniqueness or net revenue.

An important, but unmeasured variable is the ski area's "image." Some areas have a reputation as "family" areas--a place where father, mother, and children can go together for a day of skiing. Others have the image of being a lively spot where the emphasis is on drinking, dancing, and other after-skiing activities. "Image" is not included because there is no readily available way to measure it.

Restaurant capacity

A large and attractive restaurant can make an area more attractive to skiers and be an additional source of net revenue. It is therefore hypothesized that financial success varies directly with the size of the restaurant. The number of restaurant seats is used as the measure of restaurant size. This variable is called RESCAP.

A deficiency of RESCAP is that it does not distinguish between the quality of restaurant facilities. Those

at ski areas range from cafeteria lines with picnic tables and limited menus to more elegant dining facilities with carpeted floors, uniformed waitresses and busboys, and extensive menus. However, there do tend to be more cafeteria-type restaurants.

Bar capacity

The emphasis on apres ski activity in popular writings leads to the conclusion that a large segment of the skiing population prefers a ski area with bar facilities. In addition, these facilities allow the area operator to promote special "party nights" during the skiing season and to cater to private parties during the non-skiing season. Following the logic of RESCAP a positive relationship between financial success and bar size is hypothesized and number of persons bar capacity is used to measure the variable (called BARCAP).

BARCAP shares some of RESCAP's deficiencies and also has a few of its own. BARCAP does not distinguish between the quality of the bar facilities nor does it distinguish between a beer and wine license as opposed to a liquor license. In addition, many bar facilities are physically located near the restaurant facilities making double counting of capacities possible. Further, preliminary analysis shows a partial correlation coefficient of 0.67 between RESCAP and BARCAP. It is likely in the final analysis one or the other of these will be deleted.

Ski instructors

Part of the enjoyment of skiing is learning to ski better. Most ski areas provide (at a price) schools for all classes of expertise. In fact, a few areas are oriented primarily toward teaching.[1] It is therefore hypothesized that the attractiveness of a ski area increases with the number of qualified ski instructors. The unit of measurement for this variable, called NOINS, is the number of certified ski instructors.[2]

This measurement does not reflect varying levels of teaching ability or, perhaps more important, the personality of the instructors or the director of the ski school. Many operators feel one or more handsome, well-tanned instructors, preferably with a German or other European accent, are a definite asset.

Marketing and overhead utilization

This category is concerned with how well a ski area sells itself and the additional steps it takes to utilize its assets in the face of the fixed costs involved. The latter is particularly important considering the relatively

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[1]For example, see John Hitchcock, "Little Hill, Big School," Ski Area Management, Spring, 1968, pp. 27-28 and Tony Lane, "A Mother Duck Area," Ski Area Management, Fall, 1968, p. 69.

[2]Certification is by the United States Ski Association and requires passing several real barriers. For more information see United States Ski Association, Central Division, Guide Book (Travers City, Mich.: United States Ski Association).

few days a year downhill skiing can be provided.

Advertising

Presumably, the more an area advertises, the better known it becomes and the more skiers it will attract. The dollar expenditure on advertising (DLRAD) is used to measure this factor.

There are some difficulties with DLRAD. First, skiers may be attracted more by "word of mouth" advertising than what they hear or see in the advertising media. Second, a large part of a small ski area's expenditure is for brochures. These are usually distributed at the area or at local motels, restaurants, chambers of commerce, etc. Although the expenditure is measured by DLRAD the quality of the distribution is not. Further, more than one year's supply of brochures is usually ordered therefore the current expenditure may not accurately reflect the current advertising.

Night skiing

Night skiing may be a very important factor contributing to financial success. The skiing season is seldom more than a third of a year but fixed costs, such as depreciation and interest, continue all year long. The provision of night skiing increases the number of <u>hours</u> in a skiing season during which income can be generated. If these hours are used by the skiing public, the area will be more successful financially. In addition, a ski area may gain an

advantage over a competitor who does not provide night skiing. There are enthusiasts who ski weekday nights after work. These skiers may become accustomed to the area with night skiing and continue to return for their day skiing.

The variable NITES measures night skiing by simply counting the number of nights a week a particular area is open. While this does not quantitatively measure the amount of skiing available no difficulties are expected since most operators report running as many tows and lifts as attendance requires.

Children in organized ski schools

A slack attendance period occurs on weekdays. To fill this slack period many ski areas offer special package rates for tow tickets, equipment, and lessons to organized ski groups. These package plans are arranged through sponsoring organizations such as the Y.M.C.A. and local high schools. One area even interested a large local merchant in sponsoring a ski group. It is hypothesized that the more children in organized ski schools the more revenue is generated in off-peak hours and the more successful the ski area.

This variable, called NOKIDS, is measured by asking the area operator the number of children in organized ski schools. In addition to child's ski schools many areas have package rates for adult instruction. These are commonly sponsored by a local newspaper. Unfortunately, this factor was not measured at the time of interview.

A second criticism of NOKIDS is that most ski areas

do not keep very precise records. Therefore, in answering this question many operators estimated the answer without benefit of the actual figures. The values of NOKIDS, then, are subject to more respondent error than other variables in this study.

Off-season services

Another method of increasing financial success is to provide services to the public before and after the skiing season. These services may be renting the ski lodge for or catering to private parties, sponsoring teen dances, operating a chair lift as a summer tourist attraction, or keeping the restaurant open year round. All of these activities supplement the area's income in a season when its facilities would otherwise be unused.

This variable, called NOFSE, counts the number of off-season activities a ski area reported. It has the very definite disadvantage of not accounting for the volume of off-season business. This could have been measured by the dollar receipts of off-season revenues but many areas did not have this accounting detail available. While NOFSE is a poor measure the cyclical nature of the skiing industry indicates off-season incomes should be important. Rather than ignore this aspect completely NOFSE is included.

Managerial ability

Overall managerial ability can be one of the most important factors in determining financial success. This

category should assess both the business acumen of those owning and operating the ski area and the area's general financial position. Unfortunately, these are variables which are either difficult or impossible to measure.

Because of the scarcity of financial data and the limitation on the number of independent variables (caused by the relatively small number of observations) only a ratio of debt to equity is used to measure managerial ability. This ratio is not sufficient to measure the full range of managerial ability but it does provide an indication of the ski area's solvency and a chance to examine the often-heard complaint that ski areas contain too much debt and therefore get into financial difficulties.

Debt-equity ratio

Whenever possible the debt-equity ratio (called DETEQ) is calculated as a two-year average using balance sheet values for the beginning and end of each of the years. The formula, where two years' information is available, is:

$$DETEQ = \frac{TL_{67} + 2 \times TL_{66} + TL_{65} - EQ}{EQ}$$

where $EQ = PS_{67} + CS_{67} + CAS_{67} + RE_{67} + 2(PS_{66} + CS_{66} + CAS_{66} + RE_{66}) + PS_{65} + CS_{65} + CAS_{65} + RE_{65}$

and TL = total liabilities
PS = preferred stock
CS = common stock
CAS = capital surplus
RE = retained earnings

i = 67 = the 1967-68 season
66 = the 1966-67 season
65 = the 1965-66 season

Where only two consecutive years' information is available DETEQ is calculated by:

$$DETEQ = \frac{\sum_i TL_i - EQ_i}{\sum_i EQ_i}$$

where $EQ_i = \sum_i PS_i + CS_i + CAS_i + RE_i$

and the other notation is as above.

Where there is only one year's information the calculating formula is the same as that immediately above except there is no summation over the i^{th} seasons; that is, DETEQ is calculated only for the one season available.

The following four categories contain factors which the area operator controls primarily by his location decision. There is always a choice of locating at one site versus another (although costs may differ) but once the decision is made, control of the factors is usually lost short of abandoning the operation and beginning again elsewhere.

Climate

Financial success is affected by climate in at least two ways. First, there must be a certain minimum level of low temperatures and/or snow on the ground to provide snow

for skiing.[1] Second, many operators feel a lack of general snow cover decreases the desire to ski and/or makes skiers think there is no snow at the ski area. Therefore, it is hypothesized financial success will be greater the lower the temperatures and the greater the amount of snow on the ground.

Temperature

The temperature variable, called TEMP, is formed by simply adding the daily minimum and maximum temperatures for each ski area for the period of November 26, 1966 to April 12, 1967 (128 days). If TEMP is divided by two times 128 the answer is the daily mean of the maximum and minimum temperatures for the 128-day period. The lower the value of TEMP, the more successful the area is expected to be.

Snow

Snow is measured by the sum of the daily inches of snow on the ground during the same 128-day period. Snow on the ground, rather than snowfall, is relevant since it is what the skier skis upon and looks at. The higher the value of this variable, called SNO, the greater the expected success.

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[1]Snowmaking can begin at twenty eight degrees Fahrenheit but increases in efficiency as the temperature drops.

Comments on TEMP and SNO

Most operators had only a very vague idea of the correct answers to climatic questions when they answered them at all. Therefore, data published in Climatological Data were used.[1] Stations chosen were those which appeared to be nearest the ski area on the published maps.

The time period November 26, 1966 to April 2, 1967 was chosen since these were the dates of the first and last weekends in the respective months. This slightly extended season was used to reflect any advantage areas with early or late opening and closing dates might have.

Preliminary analysis showed a partial correlation coefficient of -0.65 between TEMP and SNO. The variables were left separate due to the importance of TEMP to areas with snowmaking equipment. However, it was considered likely that one of these variables would be eliminated or the two combined due to the likelihood of multicollinearity.

Terrain

Several of the factors already included in SLPVA might have been included in this category. One not included in either place (because it would require eight or more dummy variables) is aspect, or direction, of an area's slopes.

Vertical drop

The maximum vertical drop of a ski area is important

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[1]U.S. Department of Commerce, Climatological Data, Nov. & Dec., 1966, Jan., Feb., Mar., & April, 1967.

for several reasons. First, it is one determinant of slope variability.[1] Second, there may be a psychological effect on skiers making an area more attractive the larger its vertical drop. The latter seems particularly true if a skier has not previously visited an area. It is hypothesized, then, that the financial success of a ski area is positively correlated to its maximum vertical drop.

Vertical drop (called VERDRP) is measured by the number of feet reported by area operators. This is one variable which is particularly susceptible to an intentional upward response bias--even by admission of the respondents. Therefore the results of this variable must be interpreted with caution.

Market

The distance a skier travels from his residence to a ski area creates a barrier, or friction, to participation at that ski area. Presumably, the greater the distance, the greater the barrier. Therefore, a ski area should locate close enough to skier residences for serious consideration by the potential customers.

Interaction between population, distance, and a given activity has been long recognized and much is written about it under the title of "gravity models."[2] Gravity

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[1]See discussion on page 32.

[2]For a general discussion and bibliography see Walter Isard, Methods of Regional Analysis: an Introduction to

models have been applied to the problem of locating retail outlets and shopping centers and are now extended to predicting tourist and recreation travel.[1,2]

Population and Distance

Assuming a fairly stable proportion of the population at any given time skis, it follows the greater the population, the greater the number of skiers. If distance to a ski area is a barrier it can be hypothesized that the closer a ski area is to more people, the greater its potential market and chances for financial success. To measure this a variable called POPDIS (population-distance) is formed using the equation:

$$POPDIS = \sum_i \frac{POP_i}{DIS_i}$$

where i = the i^{th} county having its population centroid within 250 miles of the ski area centroid.

POP = the population of the i^{th} county to the nearest 100 people.

Regional Science (New York: The Technology Press of the Massachusetts Institute of Technology and John Wiley & Sons, 1960), pp. 493-568.

[1]For an early retail application see William John Reilly, The Law of Retail Gravitation (New York: Knickerbocker Press, 1931).

[2]For example, see L. J. Crampon, "A New Technique to Analyze Tourist Markets," Journal of Marketing, Vol. 30 (January, 1966), pp. 27-31 and Edward L. Ullman and Donald J. Volk, "An Operational Model for Predicting Reservoir Attendance and Benefits: Implications of a Location Approach to Water Recreation," Papers of the Michigan Academy of Science, Arts, and Letters, Vol. XLVII (1961 Meeting), 1962, pp. 473-484.

DIS = the straight line distance measured to the nearest five miles from the centroid of ski areas within a county to the centroid of population in the i^{th} county.

Appendix B contains a fuller discussion of the methods of calculation, assumptions, and possible imprecisions of POPDIS. This variable is used, despite some of these, since many authors feel it important and this author feels it should be tried in the skiing industry. Further, it is intuitively satisfying to theorize that attendance will decrease the farther away a ski area is from population centers.

Off-area supporting facilities

A likely hypothesis is that skiers seeking a variety of experiences are interested not only in the facilities at the ski area they visit but also those within moderate driving distance.[1] The general reputation, or "image," of a region is also important but is not included due to lack of knowledge of how to measure it.

Initially, seats restaurant capacity, persons bar capacity, and beds lodgings within a twenty-minute drive of the ski area were planned as measurements of off-area supporting facilities. These were not used because

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[1]This statement probably does not hold for the single day skier. This skier does not spend the night away from home implying most of his enjoyment comes from the skiing experience itself.

operators' responses were judged inaccurate and no comprehensive outside data source could be found.

Competing ski areas

A relatively accurate estimate is available of the number of ski areas within a twenty-minute drive. It is hypothesized that, particularly for areas with overnight clientele, the more surrounding ski areas the greater the likelihood of financial success since (1) more ski areas may imply a good regional skiing reputation, (2) the more ski areas, the greater the variety of skiing experiences available, and (3) smaller ski areas may obtain spillover attendance from larger areas. This is measured by the variable called COMPAR (competing areas) which is the number of areas reported within a twenty-minute drive.

Summary of independent variables

Nineteen independent variables are initially hypothesized. These are:

A - Physical Management

1-RORC	A dummy variable indicating rope only facilities versus combination rope and cable facilities.
2-TOLFT	A compound variable measuring the number and types of rope and cable facilities.
3-VTF	A commonly used measure of ski area capacity.
4-CUFTA	Cubic feet of compressed air per season per acre to measure the amount of snowmaking.

5-SLPGRM Man days of slope grooming per season per acre.

6-SLPVA A compound variable measuring slope variability.

B - On Area Supporting Facilities

1-RESCAP Seats of restaurant capacity.

2-BARCAP Persons bar capacity.

3-NOINS Number of certified ski instructors.

C - Marketing and Overhead Utilization

1-DLRAD Dollars advertising expenditure.

2-NITES Nights per week skiing is provided.

3-NOKIDS Number of children in an organized ski group.

4-NOFSE Number of off-season services provided.

D - Managerial Ability

1-DETEQ Ratio of debt to equity in ski area's balance sheet.

E - Climate

1-TEMP The sum of daily maximum and minimum temperatures during the skiing season.

2-SNO The sum of the daily inches of snow on the ground during the skiing season.

F - Terrain

1-VERDRP Feet of maximum vertical drop.

G - Market

1-POPDIS Population within 250 miles of ski area decayed over distance.

H - Off-Area Supporting Facilities

1-COMPAR Number of competing ski areas within twenty-minute drive.

These independent variables are merely candidates for inclusion in the final models. The next step is to calculate their values from the raw data which, as will be seen, eliminates some due to missing data. The final step is to formulate the models using stepwise linear regressions. A discussion of these steps and their results constitutes the next chapter.

CHAPTER III

FITTING AND EVALUATING THE REGRESSIONS

The wide geographical area and diversity of firms in this study make prediction of ROR with any great degree of accuracy difficult. However, we do seek to identify factors associated with financial success, indicate the direction of the association, make statements about which variables appear to have the greatest effects, and make predictions about the likelihood of success.

Models are formed by running a series of stepwise, linear, least squares, multiple regressions. It is the nature of the stepwise regression that it re-examines

> . . . at every stage of the regression . . . the variables incorporated into the model in the previous stages. A variable which may have been the best single variable to enter at an early stage may, at a later stage, be superfluous because of the relationships between it and other variables now in the regression. To check on this, the partial F criterion for each variable in the regression at any stage of the calculation is evaluated and compared with a preselected percentage point of the appropriate F distribution. . . . Any variable which provides a nonsignificant contribution is removed from the model.

where

> The stepwise procedure starts with the simple correlation matrix and enters into the regression the X variable most highly correlated with the response. . . . Using partial correlation coefficients as before, it now selects, as the next variable to enter the regression, that X variable whose partial correlation with

the response is highest.[1]

Statisticians believe stepwise regressions cause an overstatement of the significance level.[2] The extent of the overstatement is unknown and there is no known way to measure it. Therefore, future statements about significance are made following the traditional analysis but with the realization that the level of significance is being overstated by some unknown amount.

The argument in footnote two also means that a stepwise regression does not test a hypothesis. The regression uses the data to formulate the best possible hypothesis but since the significance test assumptions are violated a test is not performed. There are at least two remedies to this problem. The first is to randomly split the data in two and use one half to formulate the hypothesis and the

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[1]N. R. Draper and H. Smith, Applied Regression Analysis (New York: John Wiley & Sons, Inc., 1966), p. 171.

[2]This section is based on personal conversations with Dr. Frederick E. Smith and Dr. Charles F. Cooper, both of the School of Natural Resources, University of Michigan. The argument, in essence, is that the stepwise nature of the regression tries all of the specified variables and enters or retains only those meeting the specified significance level. The F distribution upon which the criterion of significance is based is calculated on the probability of obtaining a given decrease in variance on the first attempt at fitting a regression. Since the stepwise procedure makes many attempts at fitting the regression the probabilities of obtaining a spurious relationship are greater than those stated in the F distribution and the significance level is lower than that indicated by the ratio of the variances. A rule of thumb for maintaining some validity in the significance level is that the number of independent variables which are potentially able to enter the regression be equal to or less than the number of observations.

other half to test it. The second remedy is to simply gather more data. Unfortunately, this study can use neither remedy since the number of observations is too small to split and all possible information is gathered. The results of this chapter are hypotheses not yet tested. Their testing awaits ski areas releasing new data.

A first round of regressions is run on all observations and all variables to see which appear most important and to "get a feel" for the data. After changing some independent variables a second round of regressions is run and several equations chosen as final models for the "industry." All the observations are then classified by several series of empirical and a priori categories, for example, by a series of price categories. The significant variables from the second round equations are used to test the significance of the classifications and a third round of regressions is run on the significant categories. Final "category" models are then chosen, the equations analyzed for statistical validity, and the economic significance of the results discussed.

The First Round of Regressions

The first round of regressions was run using the MDC and REGRESSION programs of the Institute for Social Research, University of Michigan.[1] These programs allow the

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[1]For a fuller discussion of these programs see

use of observations containing missing data. The results of the regressions are summarized in Table 5. Each row

TABLE 5

RESULTS OF FIRST ROUND REGRESSIONS

STEP	Variable Entered	Significance Level		RSQD
		Variable	Equation	
1	VTF	.01	.01	.165
2	TEMP	.01	.01	.246
3	RESCAP	NS	.01	.260
4	BARCAP	NS	.01	.279
5	TOLFT	NS	.01	.306
6	NITES	NS	.05	.319
7	RORC	NS	.05	.332
8	SLPGRM	NS	.05	.347
9	COMPAR	NS	.05	.363
10	SNO	NS	.05	.374

Note: Significance levels calculated using F ratios. "NS" means non-significant at or above the .05 level.

of the table represents the indicated step of the regression (first row, first step; second row, second step, etc.) and contains information on that step. The first column shows the step and the second shows the independent variable

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The Institute for Social Research, Osiris/40 (1st ed., 3rd prntng.; Ann Arbor, Mich., Institute of Social Research, 1968), pp. 128-131 and 136-139.

which entered. The third and fourth columns show the significance level (using the F test) of the independent variable and entire regression. The fourth column contains the multiple coefficient of determination (R^2).

Observation of the step at which a variable enters shows which variable was most highly correlated at that point since the stepwise regression procedure selects the variable with the highest partial correlation coefficient at each step. Note that VTF entered first, was significant at the 0.01 level, and was associated with just over sixteen percent of the variation in the dependent variable.

The values of the multiple coefficients of determination (R^2) may appear low, particularly when compared to results in biological sciences. However, recalling the population's heterogeneity, the R^2's in Table 5 are judged quite satisfactory for a first attempt.

Succeeding Rounds of Regressions

At this point a different computer program was used. The primary reasons were the new program gave more information, had greater flexibility in adding and deleting variables, and had more rapid turn around time at less expense. Negatively, the new program did not handle missing data.[1]

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[1]The program was a least squares, stepwise, multiple linear regression, and was an adaptation of the BMDO2R Biomedical Computer Program developed at the Health Sciences Computing Facility, University of California at Los Angeles. For a more complete write-up of this program, see University

Added and deleted independent variables

The first independent variable added was the average price per skier visit. This was the price which would be obtained if the annual ticket receipts were divided by the annual attendance. It was the mean of all ticket prices weighted by their attendance.

A plot of ROR over price appeared to be a concave downward parabolic function. Consequently, this variable was specified as two--price(PRICE) and price squared (PRISQ). A positive sign was predicted for PRICE and a negative sign for PRISQ.

The apparent importance of VTF caused its re-examination and a concave downward hyperbola seemed a good fit. Accordingly, the variable 1/VTF (one divided by VTF) was added with the expectation that its sign would be negative. The sign of VTF could be either positive or negative if it entered the equation.

Since the regression program did not handle missing data a ski area missing any one independent variable either had to be dropped from the analysis or the independent variable had to be dropped from all twenty-seven observations. The second alternative was judged preferable due to the large number of observations which would have been lost. The following variables were deleted for this or the indicated

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of Michigan, "PSCC Stepwise Regression," Computing Center Memo #38, Ann Arbor, Mich., August, 1968. (Dittographed.)

reason:

1. DLRAD Missing data would have caused the loss of two observations.

2. NOKIDS Missing data would have caused the loss of an additional three observations.

3. CUFTA Missing data would have caused the loss of an additional two observations.

4. DETEQ The presence of negative retained earnings caused negative equity accounts giving negative ratios which have no real meaning.[1]

5. RESCAP This variable was moderately intercorrelated with four other variables having correlation coefficients from 0.55 to 0.68. BARCAP is quite similar and, not counting RESCAP, has only one correlation coefficient above 0.50.[2]

Results of the second round of regressions

This round was run with all independent variables, except the five mentioned above, free to enter. The F ratios to enter and leave were 2.000. Only those variables significant at the 0.05 level (using the F distribution) or better were retained in the final model. No nonsignificant variables were allowed.

This resulted in the equation:

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[1]For example, imagine firms A and B. Firm A has $500 of debt, $125 of common stock, and $125 of retained earnings. Its debt-equity ratio is $500/$250 or 2.00. That is, Firm A has twice as much debt as equity. Firm B has $500 debt and $125 of common stock. However, its retained earnings are a minus $375. This gives a debt-equity ratio of $500/-$250 or -2.00, which is not equivalent to twice as little debt as equity.

[2]See discussion of RESCAP and BARCAP on pp. 36-37 for additional reasons for deleting one of these variables.

(3.1) ROR = 14.5452 - 10,907.3711 1/VTF
(12.6201) (4,261.2422)

F Level 0.05 0.05

R^2: 0.2077 Residual d.f.: 25[1]

This equation was the best fit considering all the variables hypothesized and their interactions. Note that 1/VTF was the only significant variable. When this variable and VTF were deleted as possible variables, a second model was obtained:

(3.2) ROR = -58.4068 + 32.8073 PRICE - 3.9683 PRISQ
(11.5654) (9.7793) (1.3414)

F Level 0.01 0.01 0.01

R^2: 0.3612 Residual d.f.: 24

The reason PRICE and PRISQ did not enter Equation 3.1 was that a sufficient amount of their variation was coincident with the variation of 1/VTF to make them nonsignificant. By deleting 1/VTF this variation was not accounted for and they became significant. Equation 3.2 was the best fit when all hypothesized variables and their interactions, except VTF and 1/VTF, were considered. It was also the last equation for the "industry" since there were no significant variables when VTF, 1/VTF, PRICE, and PRISQ were deleted and the regression run again. Figure 1 contains the curves of Equations 3.1 and 3.2.

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[1]The figure in parentheses immediately beneath the dependent variable is the standard error of the estimate while those in parentheses beneath the independent variables are their respective standard errors. This convention will be followed hereafter.

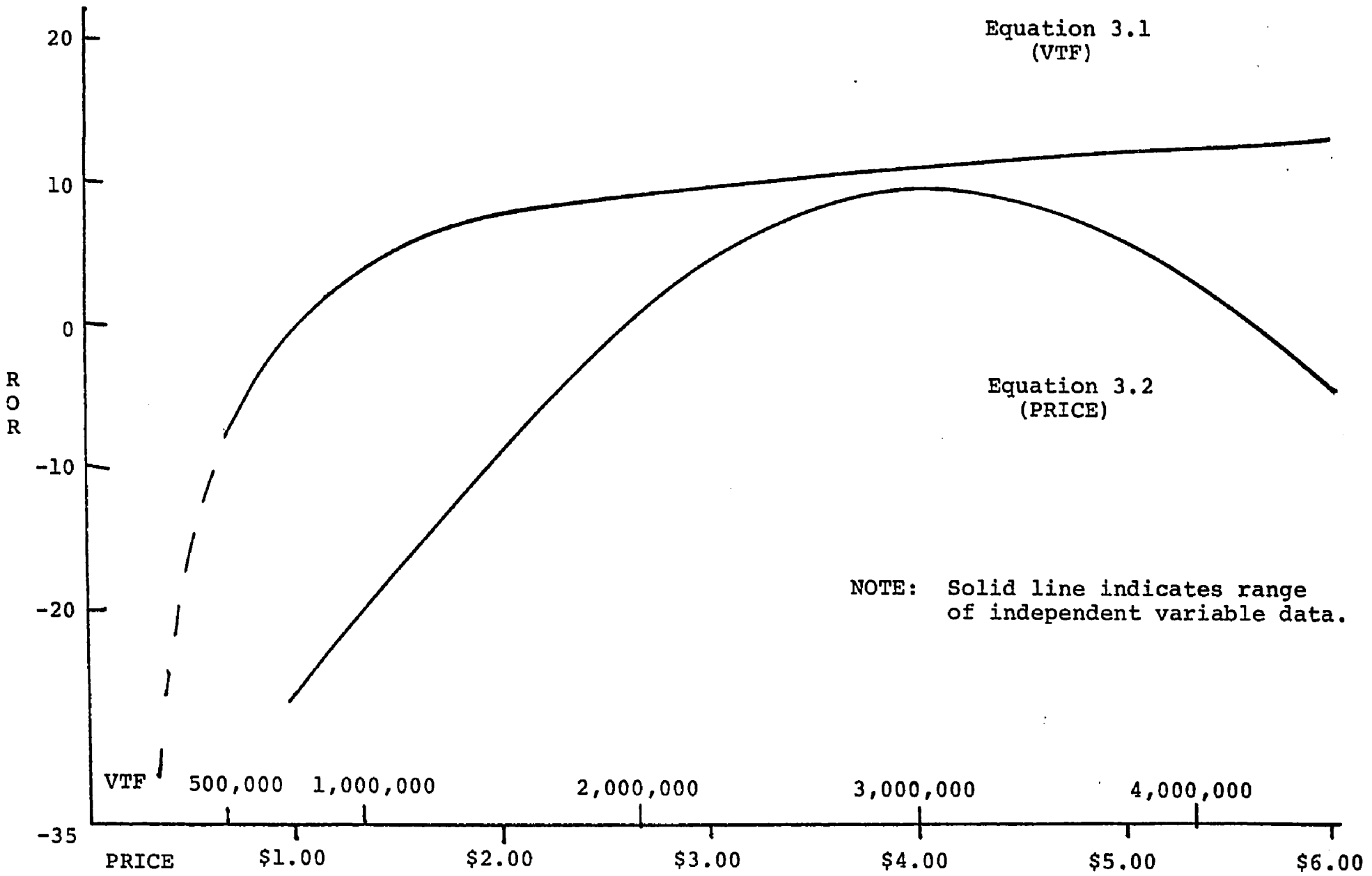


Figure 1.--Plot of Equations 3.1 and 3.2.

Classifying the dependent variable

Equations 3.1 and 3.2 showed the empirical importance of the vertical transport feet and price. The next step was classifying the dependent variable by these variables to control (hold constant) their effect. The twenty-seven observations were placed in a series of categories depending on an area's average price and vertical transport feet.

The categories chosen for vertical transport foot were:

Category 1 - 1,500,000 VTF or more
Category 2 - 700,000 to 1,499,999 VTF
Category 3 - Less than 700,000 VTF

These categories are arbitrary but follow Herrington's except (1) his two smallest categories have been combined into category 3, and (2) these categories included rope-only areas, whereas Herrington's did not.[1] A ranking of VTF for 157 midwestern ski areas disclosed no natural breaks in VTF's continuity until area values were well into the millions. The arbitrary classes were therefore judged reasonable.

The price categories were:

Category 1 (PRI1) - Less than $3.00
Category 2 (PRI2) - $3.00 to $4.00
Category 3 (PRI3) - Greater than $4.00

The limits of the categories were determined by occular examination of the curve of Equation 3.2 and set to place most positive ROR's in PRI2 and most negative ROR's in PRI1 and

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[1]Herrington, Skiing in the Western States, p. 64.

PRI3.

Two more classifications of ROR were made. First, ski areas were classified by whether they were Rural (RUROR) or Urban (URBROR). An Urban ski area was one located within fifty miles straight line distance of an urban place with 50,000 or more population. Rural areas were all others. This classification was made because it seemed likely that most Urban area customers would return home each day after skiing. The Rural area was likely to have both overnight and day skiers. It appeared likely that areas serving skiers who went to the expense of an overnight trip had different characteristics associated with their successful operation. It was this difference that the Urban/Rural classification sought to examine.

The final classification was by the ski area's geographical location. Lakes Michigan and Huron form a natural barrier around Michigan's Lower Peninsula. The Mackinac Bridge forms a pecuniary and psychological barrier to the north. It therefore seemed likely that customers of Lower Peninsula ski areas would come from the Lower Peninsula and parts of Indiana and Ohio including such large cities as Detroit, Toledo, and South Bend.

On the other hand, the ski areas in Michigan's Upper Peninsula, Wisconsin, and Minnesota seemed less isolated. Customers from Wisconsin, Minnesota and parts of Illinois, Iowa, and the Dakotas including the Chicago-Milwaukee megalopolis and the twin cities of Minneapolis-

St. Paul were likely. It was possible that different markets caused different characteristics to be associated with success. Accordingly, ski areas were assigned to two categories, Michigan's Lower Peninsula plus Indiana and Wisconsin-Minnesota (all other).

Testing the significance of the classifications

The following procedure was used to test for a significant difference between the "industry" equations and the classifications. First, two regressions were run on each category in each classification--the first using on 1/VTF as the independent variable and the second using PRICE and PRISQ as the independent variables. The sums of squares for the various classifications were supplied by the regressions and used to calculate an F ratio to determine significance.[1] Only the price classification was significant when

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[1] The formula for calculating the F ratio was:

$$F = \frac{(\text{Residual SS}_{\text{All Industry Regression}} - \sum_i \text{Residual SS}_i) \div \text{d.f.}_1}{\sum_i \text{Residual SS}_i \div \text{d.f.}_2}$$

where: i are the subsets of a particular reclassification, e.g., VTF or PRICE.

d.f._1 is the number of restrictions to whole industry model or (number of i-1)(number of parameters in whole industry equation).

d.f._2 is the number of data points in all i minus the total number of parameters in all the i, or, n - (number of i x number of parameters in model.

Essentially, this is the ratio of the decrease in variance

using 1/VTF as the model and only the Urban/Rural classification was significant when using PRICE and PRISQ as the model (Table 6).

These results were interpreted as meaning that the association of financial success to vertical transport feet was the same regardless of (1) the number of VTF a ski area had, (2) whether or not it was located near a large urban place, and (3) whether or not it was located in Michigan's lower peninsula or Indiana. However, the relationship changed depending on the average price charged at the ski area. Ignoring vertical transport feet, the relationship of price to financial success was the same regardless of (1) the number of VTF a ski area had, (2) the price it charged, and (3) whether or not it was located in Michigan's lower peninsula or Indiana. However, the relationship of price to financial success did change depending on whether or not a ski area was located near an urban place with 50,000 or more population.

The next step was to examine the categories of the significant classifications for relationships between ROR and all the specified independent variables. This was done with a third round of stepwise regressions with F ratios

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due to forming the reclassification and its subsets to the unexplained variance in the reclassification and its subsets. If this ratio is significant it means that formation of the reclassification and the subsets, as a totality, is significantly different from the whole industry equation. It has not been shown that any one subset is statistically different from another subset.

TABLE 6

STATISTICAL SIGNIFICANCE OF CLASSIFICATIONS

Classification Scheme	Independent Variables			
	1/VTF		PRICE & PRISQ	
	F Ratio	Signif. Level	F Ratio	Signif. Level
VTF	0.8441	N.S.	2.5213	N.S.
PRICE	7.4237	0.01	0.7288	N.S.
URBAN/RURAL	0.0387	N.S.	3.8873	0.05
LOCATION	1.1125	N.S.	1.2426	N.S.

Note: N.S. means nonsignificant results obtained.

of 2.0 to enter and leave and retention of only those variables significant at the 0.05 level and above. The division into categories decreased the number of observations for each regression making it necessary to reduce further the number of independent variables.[1]

More deleted independent variables

The following variables were deleted to meet mathematical requirements rather than to eliminate unwanted variables. Accordingly, the "weakest" variables were deleted first. The deleted variables and the reason for their deletion are listed below:

1. TEMP was eliminated because (a) it was the amount of snow

[1]See footnote 2, p. 63.

on the ground we were primarily interested in, (b) continued operation of more southerly ski areas gave reason to believe temperatures were low enough to make snow during most of the season, (c) the sum of the coefficients in the correlation matrix was higher for TEMP than for SNO, and (d) TEMP was moderately inter-correlated with SNO.

Originally, there were five independent variables all of which had values between zero and twenty two, and three of these had values restricted to the range of zero to seven. Intuitively there seemed an increased chance of spurious correlation with so many variables with such similar and limited values. These variables were examined and the following eliminated:

2. NOINS had all values between zero and seven. Further, this might have been one of the less important variables because most ski areas had at least one instructor and all instructors were certified. Therefore, a consistent minimum level of instruction was available and there might have been little comparative advantage in more instructors.
3. COMPAR had all values between zero and twelve. In addition, it was probably a relatively poor measure of the off-ski area supporting facilities and regional image.
4. NOFSE had values between zero and seven. In addition, the variable was a poor measure of off-season activity.[1]

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[1]See p. 41 for further discussion.

5. The variables PRICE and PRISQ were deleted from all price category regressions since these categories were formed to control for price.

Results of the third round of regressions

Significant results were obtained in all five categories (two classifications) on the first run of the third round of regressions. Only the Rural category had significant results when all previously significant variables were eliminated and the regressions run a second time. These equations are presented in Table 7 and summarized in Table 8.

The first line of Table 7 is the full equation, the second line the standard errors of the equation and independent variables, the third line the F ratio for the whole equation and the partial F ratios for each independent variable, and the fourth line the significance level of each of the F ratios. The last line contains several miscellaneous pieces of information; the multiple coefficient of determination (R^2), the number of observations (ski areas) in each category, the number of independent variables which could have entered the regression, and the residual degrees of freedom.

In Table 8 all variables appearing in any of the equations were listed in the first column. Following that are a series of three columns for each of the six significant equations.

TABLE 7

RESULTS OF THIRD ROUND REGRESSIONS

(3.3) PRI1 = -39.6718 + 0.6200 SLPGRM + 0.0638 POPDIS

	(2.0797)	(0.1153)	(0.0052)
	76.865	28.908	152.329
	0.05	0.05	0.01

F Ratio
Sig. Level

R^2: 0.987 Nmbr. of Obs.: 5 Potent. Var.: 11 Residual d.f.: 2

(3.4) PRI2 = 114.2692 - 0.0290 VTF - 80,338.5000 1/VTF

(7.5405)	(0.0114)	(21,732.7227)
9.959	6.4520	13.6653
0.01	0.05	0.01

F Ratio
Sig. Level

R^2: 0.666 Nmbr. of Obs.: 13 Potent. Var.: 11 Residual d.f.: 10

(3.5) PRI3 = 17.5820 - 11,894.5625 1/VTF

(5.1902)	(2,786.1799)
18.225	18.225
0.01	0.01

F Ratio
Sig. Level

R^2: 0.722 Nmbr. of Obs.: 9 Potent. Var.: 11 Residual d.f.: 7

(3.6) URBROR = -192.2948 + 0.0100 SNO - 0.0147 VTF - 37,512.0156 1/VTF

(5.1045)	(0.0025)	(0.0055)	(8,404.6289)
20.877	16.169	7.166	19.921
0.01	0.01	0.05	0.01

F Ratio
Sig. Level

+ 137.8656 PRICE - 18.8346 PRISQ

(17.8882)	(2.6966)
59.399	48.784
0.01	0.01

F Ratio
Sig. Level

R^2: 0.921 Nmbr. of Obs.: 15 Potent. Var.: 13 Residual d.f.: 9

TABLE 7--Continued

(3.70) RUROR = -7.2937 + 0.0057 VTF

	(11.0251)	(0.0025)
	5.050	5.050
F Ratio		
	0.05	0.05
Sig. Level		

R^2: 0.335 Nmbr. of Obs.: 12 Potent. Var.: 13 Residual d.f.: 10

(3.71) RUROR = -141.6776 - 0.0359 SLPVA + 0.0246 SNO - 127.7519 RORC

	(3.4719)	(0.0071)	(0.0044)	(19.7851)
	21.110	25.475	30.667	41.692
F Ratio				
	0.01	0.01	0.01	0.01
Sig. Level				

+ 5.9724 NITES + 0.0660 VERDRP + 0.3124 POPDIS + 14.6230 PRICE

	(1.2275)	(0.0176)	(0.0366)	(1.9342)
	23.673	14.004	73.044	57.156
F Ratio				
	0.01	0.05	0.01	0.01
Sig. Level				

R^2: 0.974 Nmbr. of Obs.: 12 Potent. Var.: 11 Residual d.f.: 4

TABLE 8

SUMMARY OF THIRD ROUND REGRESSIONS

Variable	Eq. 3.3 PRI1			Eq. 3.4 PRI2			Eq. 3.5 PRI3			Eq. 3.6 URBROR			Eq. 3.70 RUROR			Eq. 3.71 RUROR		
	Sign	F	r^2	Sign	F	r^2	Sign	F	r^2	Sign	F	r^2	Sign	F	r^2	Sign	F	r^2
VTF				-	6.4	.393				-	7.2	.043	+	5.0	.335			
1/VTF				-	13.7	.577	-	18.2	.72	-	19.9	.689						
PRICE										+	59.4	.868				+	57.2	.935
PRISQ										-	48.8	.844						
POPDIS	+	152.3	.986													+	73.0	.948
SLPGRM	+	28.9	.935															
SLPVA																-	25.5	.865
SNO										+	16.2	.640				+	30.7	.887
RORC																-	41.7	.912
NITES																+	23.7	.855
VERDRP																+	14.0	.778
Miscellaneous Data for Equations																		
R^2		.987			.666			.722			.921			.335			.974	
Sig. Level		.05			.01			.01			.01			.05			.01	
Nmbr. Obs.		5			13			9			15			12			12	
Pot. Var.		11			11			11			13			13			13	
Res. d.f.		2			10			7			9			10			4	
$\bar{R}^2$		.949			.599			.683			.877			.269			.928	

The first of these three columns shows the sign of the variable, the second the partial F ratio, and the third the partial coefficient of determination (r^2). Blank spaces indicate the variable did not enter that equation. The partial F ratios and partial coefficients of determination are shown so the relative importance and degree of significance of the independent variables can be judged. All variables in the table are significant at the 0.05 level or better.

At the bottom of Table 8 the first row contains the multiple coefficient of determination (R^2), the second row the significance level, the third row the number of observations (ski areas), the fourth row the number of independent variables which could have entered the equation, the fifth row the residual degrees of freedom, and the last row, the adjusted coefficient of determination ($\bar{R}^2$).[1]

Equation 3.3 had only five observations thereby casting doubt on the significance levels and increasing the likelihood of a spurious correlation. Therefore, the results were not analyzed further.

Equation 3.4 had two more observations than potential variables and so met the rule of thumb for validity of the significance statistics. 1/VTF was the stronger of the two

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[1]The adjusted coefficient of determination takes into account the number of observations in the regression. This statistic was calculated due to the diminished number of observations in the subset regressions. Further explanation of the statistic is available in most statistics textbooks, for example, Daniel B. Suits, Statistics: An Introduction to Quantitative Economic Research (Chicago: Rand McNally & Company, 1963), p. 175.

variables by both the r^2 and partial F ratio criteria. The two negative signs meant the curve of the equation would eventually turn down and cross the x axis.

Equation 3.5 had two fewer observations than potential variables. However, the F ratio was 18.22, compared to a required 12.25 for 0.01 and 5.59 for 0.05 significance levels. Further, the only variable entering was 1/VTF making Equation 3.5 precisely the same as the equation testing the category's significance. Therefore, this equation was treated as if the rule of thumb was not violated.

The R^2's show both Equations 3.4 and 3.5 were associated with about two thirds of the variation in ROR. While this was judged respectable, it did leave one third of the variation unexplained. Note also that the standard errors indicated great imprecision, particularly if it was desired to predict a specific ROR. As noted earlier, however, this imprecision was expected.

Equation 3.6 had five variables associated with over ninety percent of the variation in Urban ROR. Judged by r^2's PRICE and PRISQ were the most important variables. Both explained over eighty percent of the remaining variation when all other variables had explained as much as they could. They were also the most significant variables.

Equation 3.70 showed VTF the only significant variable. The results of this equation were disregarded since the number of observations was one less than the number of potential variables and it was barely significant at the

0.05 level (having an F ratio of 5.050 compared to 4.96 required for significance). When both VTF and 1/VTF were deleted from the potential variables Equation 3.71 resulted. Unfortunately, considerations of statistical validity led to the conclusion that the relations were spurious. Therefore, specific statements about the Rural category were impossible.

The curves for Equations 3.4 and 3.5 are plotted in Figure 2. Equation 3.6 is a multivariate function so a graphical presentation similar to Figures 1 and 2 is impossible. Instead, two of the three factors had their mean values assigned as a constant while the third factor's value was allowed to change. This traced the curve of the factor (Figure 3) although the height of the curve above (below) the x axis will change depending on the values of the other two factors.

The third round regressions indicated that (1) vertical transport feet was the only significant factor associated with ROR when ski areas were divided into price categories; (2) when average price is $3.00-$4.00 ROR increased with VTF to a certain point and then decreased; whereas (3) when average price was over $4.00 ROR increased until VTF was about 3,000,000 and then leveled; (4) that ROR for Urban areas increased, reached a maximum, and then decreased as both price and vertical transport feet increased, whereas it increased continuously as SNO increased; (5) VTF might be the best explanation of ROR in Rural ski areas; but

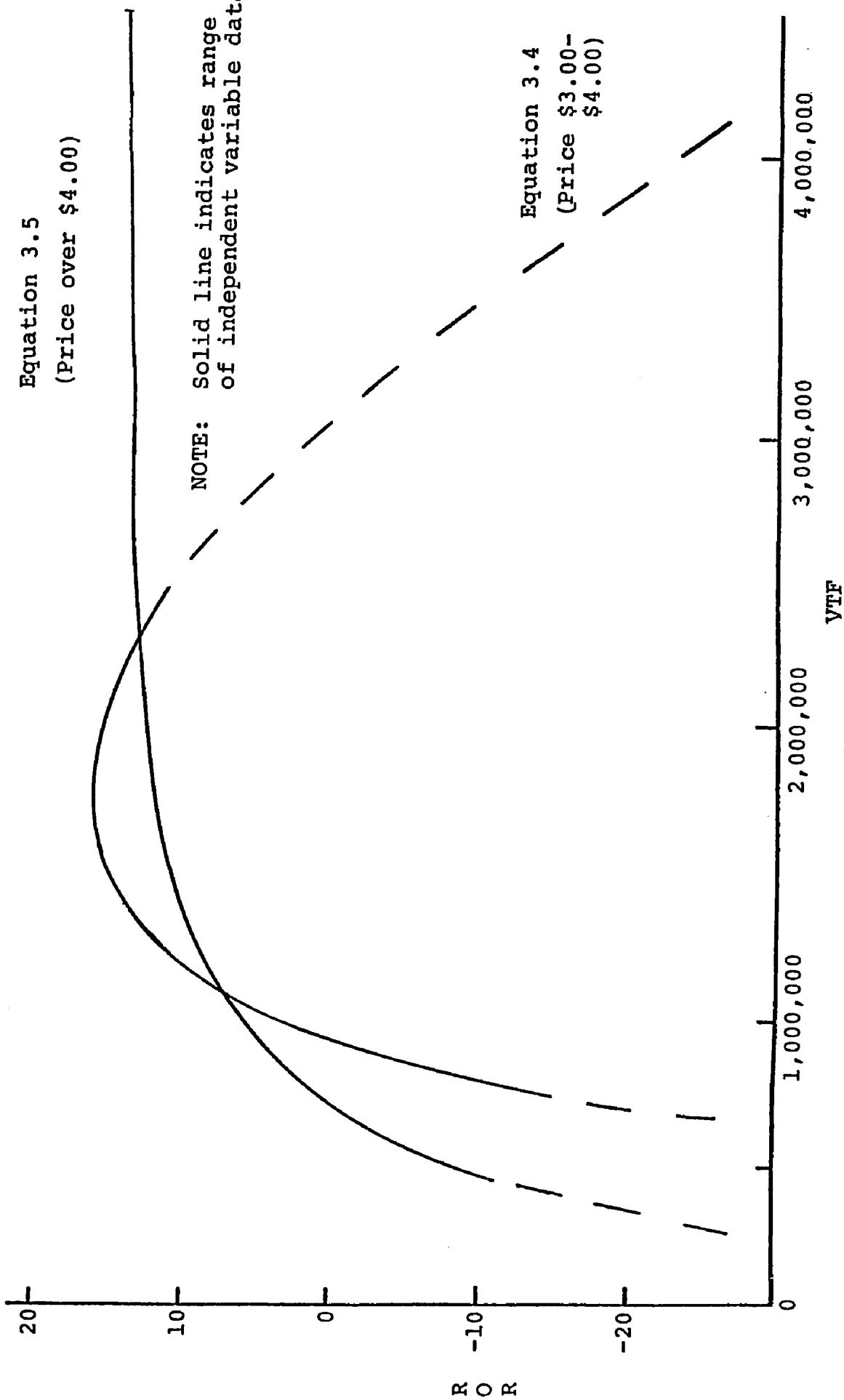


Figure 2.--Plot of Equations 3.4 and 3.5.

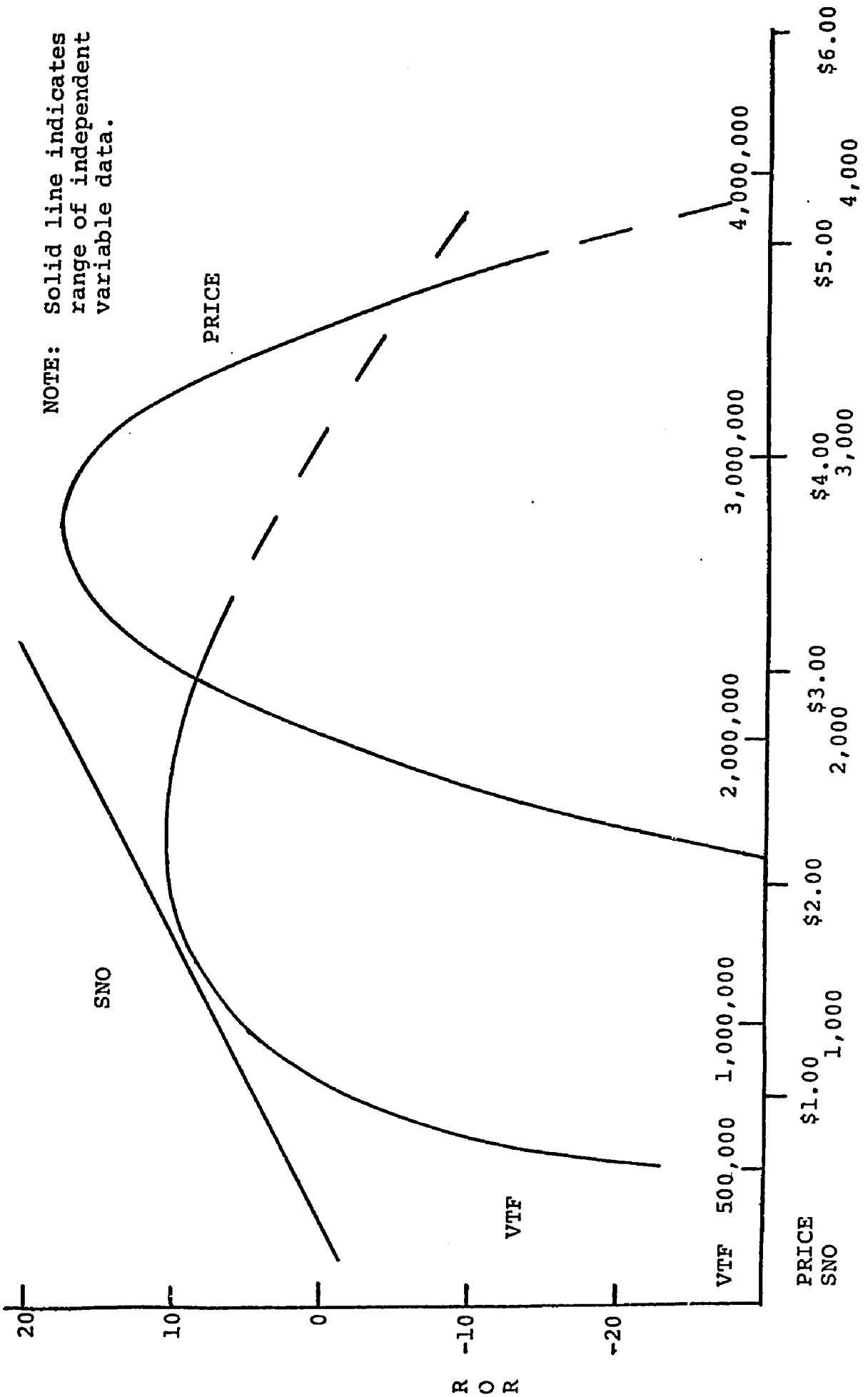


Figure 3.--Plot of Equation 3.6.

(6) the likelihood of nonsignificance and spurious correlation made specific statements about the Rural category impossible.

The regressions' statistical validity

There are several statistical pitfalls which must be avoided in choosing variables for use in a multiple linear regression. The first and most often mentioned is the maintenance of an interval scale of measurement. The second pitfall occurs when compound or ratio variables are used on either or both sides of the regression. Another pitfall is interaction which occurs when the dependent variable is not an additive function of the independent variables. The fourth pitfall, multicollinearity, occurs when one or more of the independent variables are so highly correlated that "we can form arbitrary linear combinations of the . . . simultaneous equations, making the regression coefficients indeterminate."[1]

All significant equations were checked for statistical validity using residual plots except Equation 3.5 which had too few observations to make plots meaningful.[2] In addition, the correlation matrices and standard errors were

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[1]Hubert M. Blalock, Jr., Causal Inferences in Nonexperimental Research (Chapel Hill: The University of North Carolina Press, 1964), p. 88.

[2]See Draper and Smith, Applied Regression Analysis for a discussion of checking statistical validity with residual plots.

examined as checks on multicollinearity. In all cases the author was satisfied that these checks did not show serious violations of the regression model assumptions except for Equation 3.71.

The correlation matrix for Equation 3.71 contained high coefficients for RORC-NITES (0.747) and RORC-POPDIS (0.975). No significant equation was obtained when RORC was deleted and the regression re-run. It was therefore concluded that the results of Equation 3.71 were spurious and had to be ignored.

The Economic Significance of the Regressions

There are several warnings about the results of the regressions and their use which must be made explicit before continuing. These are:

1. The use of stepwise regressions means the equations are hypotheses. The hypotheses have not been tested.

2. The skiing industry is highly heterogeneous. The regressions are an average. There can be large divergencies from the average.

3. Except for Equation 3.6 the R^2's range from 0.21 to 0.72. This leaves ample room for differences in ROR due to unexplained variations.

4. The results are based on twenty seven ski areas which happened to supply the financial data required. Strictly speaking, generalizations cannot be made about the industry. However, occular inspection of these areas shows

a good distribution of values over the dependent variable, states, VTF sizes, prices, and other independent variables.

The ROR and VTF relationships

It would indeed be gratifying to infer constant or increasing returns to scale from the curve of Equation 3.1 (Figure 1). However, this requires increases in ROR to be caused by decreases in average total cost. We do not know if this is the case since ROR contains costs, revenues, and investment. Further, VTF is not directly related to other cost items such as the size of the ski lodge or the bar and restaurant capacities.

The results of Equations 3.1, 3.4, and 3.5 (Figures 1 and 2) allow the formulation of the following hypotheses:

1. "Industry" ROR increases rapidly in the lower ranges of VTF leveling somewhere around 2,000,000 VTF.
    a. ROR for areas charging an average price of $3.00 to $4.00 rises much more rapidly than the industry average, attains a higher maximum, but decreases after about a million and three quarters VTF.
    b. ROR for areas charging an average price greater than $4.00 is lower than for areas charging $3.00-$4.00 in the 1,000,000 to 2,500,000 VTF range but does not decrease as VTF increases. This price class is very

similar to the "industry" average.

c. On the basis of VTF alone, the highest ROR is found at about 1,750,000 VTF and a price range of $3.00 to $4.00.

The implications of these hypotheses are that (1) the highest ROR is obtained at about 1,750,000 VTF and an average price in the $3.00-$4.00 range; (2) ski areas with lower VTF's may increase ROR by (a) raising price, or (b) increasing VTF; and (3) there may be an optimum sized ski area (in terms of VTF), beyond which ROR begins to decrease. This latter implication is perhaps seen in practice where the owners of the highly popular Boyne Mountain ski area in Michigan now operate three additional areas. There is at least one other case where the owners have increased investment by opening a second ski area, joining a partnership in a third, and are talking about building a fourth.

On the other hand, ski areas may add more tows and lifts as their ROR increases. If this is the case the VTF relationships may merely be showing that success is related to success.

The ROR and PRICE relationships

The results of Equation 3.2 lead to the second set of hypotheses:

2. Ignoring VTF, a parabolic average price function, concave to the x axis, best indicates changes in "industry" ROR and explains a larger percentage of its variance than VTF.

a. "Industry" ROR's are negative when average price is less than about $2.50, positive from about $2.50 to $5.50, and negative again beyond $5.50. A maximum is reached at about $4.13.

The significance of these hypotheses is that there may exist a price at which ROR is maximized and movement to either side of this price may decrease ROR. Further, the parabolic price function explains a greater percentage of ROR's variation, and is more significant than the hyperbolic VTF function.

The ROR and Urban relationships

The PRICE curve in Figure 3 contains several contrasting points when compared to the above "industry" curve. First, ROR is more sensitive to average price, rising and falling more rapidly from the maximum. Second, the maximum occurs at a lower average price. Finally, the price variables are the most important in the equation when judged by r^2's and partial F ratios.

The VTF curve in Figure 3 has several points of interest: (1) compared to Equation 3.1 (Figure 3) it decreases after reaching a maximum; and (2) compared to Equation 3.4 (a) the maximum point occurs at a slightly smaller VTF and (b) decreases less rapidly. SNO is a simple straight line relationship adding one-hundredth of one percent to ROR for each inch/day of snow on the ground.

Although the equations do not hope to predict ROR the differences in the maxima are of interest. As stated, Equation 3.6 is multivariate so its curves cannot be compared directly to those of the other equations. However, comparison at the maxima is possible by assigning Equation 3.6 the maximum values found within the Urban area data. This results in an estimate of 35.5 percent ROR compared to an "industry" high of 14.5 percent (Equation 3.1) and a $3.00-$4.00 price category high of about sixteen and a half percent. This, and the high R^2, leads to the conclusion that Urban ski areas are a better investment if ROR is the criterion.

This discussion is summarized by the hypotheses that:

3. The best explanation of Urban ROR considers price, vertical transport feet, and snow on the ground.
    a. The price function is a parabola concave to the x axis reaching its maximum about $3.67 average price.
    b. The vertical transport feet function is a negative hyperbola with an additional negative term (that is, $-b_1$ 1/VTF $-b_2$ VTF) reaching a maximum at about a million and two thirds VTF.
    c. ROR increases in a straight line function

with snow on the ground.

d. The Urban ROR global maximum is much higher than the "industry's" or the other price categories' examined.

The significance of the results is indicated by stating: from an investor's viewpoint the optimum ski area is located within fifty miles of an urban place of 50,000 or more population where there is a maximum amount of snow on the ground, and with a VTF capacity of about a million and two thirds, and an average price for tow and lift tickets of about $3.67. The investor should pay particular attention to his pricing since his ROR is more sensitive to it than the "industry" average ROR and it explains the most variation in ROR. Snow on the ground and vertical transport feet are only slightly less important than price in explaining ROR. Finally, the R^2 of this equation is 0.92 indicating less room for other variables to affect the results and allowing slightly more confidence in the preceding statements.

One last point can be made about all the regressions. The maximum ROR's on most of the curves are around fifteen or sixteen percent. The global maximum for the best investment opportunity is little more than twice this amount. Noting that these are before-tax figures serious doubt may be raised if, on the average, there is sufficient return considering the risks involved.

The nonsignificant variables

Nonsignificance means that differences in a particular variable did not correlate with differences in ROR. For example, the lack of significance of SNO in all but Equation 3.6 does not mean that snow on the ground is unimportant. What nonsignificance does mean is that the differences in the snow on the ground between the observed ski areas was not significantly correlated to the differences in ROR between the same ski areas. One would then tentatively conclude that, on the average and considering the intercorrelation between SNO and TEMP, there is sufficient snow on the ground and low temperatures throughout the region to support a ski area.

There are at least three additional reasons for nonsignificance. First, the variable may not be causally related to ROR. A second reason for nonsignificance is that there is a relationship but that the variable is misspecified and does not measure it. The compound variables, such as SLPVA, are particularly susceptible to this error. A final reason is that several variables may be determinants of one causal factor but substitution between the variables can take place. In this case it could be that no one variable has a causal effect but that a combination of them might. This is where a correctly specified compound variable is useful. For example, SLPVA allows a trade-off (or substitution) between number of slopes and the maximum length of the slopes.

Because of the number of nonsignificant variables involved no further interpretations are made. Caution is advised, however, in concluding that a variable is of no practical importance because it is statistically nonsignificant.

CHAPTER IV

THE ECONOMIC ORGANIZATION OF THE INDUSTRY

Although the investor is interested in the performance of an industry ". . . we look initially to the characteristics of market structure and market conduct as probable primary determinants of the performance of enterprises, . . ."[1] That is, by examining the market structure and conduct of the skiing industry we are able to obtain a better understanding of its performance and hence make better assessments of investment possibilities.

Market Structure

Bain defines market structure as ". . . those characteristics of the organization of a market which seem to influence strategically the nature of competition and pricing within the market."[2] The elements of market structure generally examined are buyer concentration, seller concentration, product differentiation, and barriers to entry. There are other elements, such as unique legal constraints, however, Bain cautions "It is thus expedient for scientific as well as for policy purposes to emphasize a very few

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[1]Joe S. Bain, Industrial Organization (New York: John Wiley & Sons, Inc., 1959), p. 3.

[2]Bain, Industrial Organization, p. 7.

apparently leading dimensions of market structure, . . ." since "the complete 'structure' of each industry, thus construed in its myriad dimensions, . . . would provide no useful explanation of differences among industries in conduct and performance, . . ."[1] Accordingly, the emphasis of this analysis is restricted to the above elements.

Buyer concentration

At present, there are no good estimates available of the number of skiers in the midwest. However, very rough estimates can be made by using data from other geographical regions. Herrington estimates that in 1963 an average of 1.3 percent of the population of twelve western states skied. The state averages ranged from 0.1 percent to 3.1 percent.[2] Using 1960 population figures and assuming 0.1 percent of Ohio and Indiana and 1.3 percent of the other states' residents skied, an estimate of about 350,000 skiers is obtained. Even if this estimate is high by several hundred percent, there are still enough skiers to assure an atomistic buyers' market provided no few skiers can buy a majority of the industry output. Now, the length of the ski season is seldom more than four months. Therefore, any one skier can only buy an absolute maximum of, say, 120 days skiing, an insufficient amount to make the buyer concentration anything but atomistic.

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[1]Bain, Industrial Organization, pp. 264-65.

[2]Herrington, Skiing in the Western States, Table 35, p. 78.

Seller concentration

Based on data collected, attendance and capacity concentration ratios are calculated as an aid to judging seller concentration (Table 9). Attendance data are for 117 ski

TABLE 9

CONCENTRATION RATIOS RANKED BY ATTENDANCE AND VTF
1967-68 SEASON

	Ranked by Attendance		Ranked by VTF	
	Attnd.	VTF	Attnd.	VTF
Top 4	13%	5%	5%	13%
Top 8	24%	11%	13%	22%
Top 20	46%	29%	33%	40%
Top 50	77%	58%	61%	68%
Number of Remaining Ski Areas	98		95[a]	

[a]The three missing areas are not in the Top 50.

areas for the 1967-68 season. The missing data for an additional thirty-one ski areas is estimated by various methods, depending on the information available for the individual areas. The VTF for each of 145 ski areas is calculated from responses or estimated from outside information.

The second and third columns of Table 9 rank midwestern ski areas by attendance and they show the percentage of total attendance and VTF which the four largest, eight largest, etc. ski areas contain. For example, attendance at

the four ski areas having the largest attendance is thirteen percent of total estimated attendance while the VTF at these four areas is only five percent of the estimated total. The second set of columns rank the ski areas by VTF and show the percentage of total estimated attendance and VTF these areas contain.

Bain suggests a tentative seven-way classification of industries using concentration ratios.[1] Adopting this classification the skiing industry falls into a Type V industry which may be verbally classified as a very "low-grade" oligopoly lying somewhere between very low and atomistic seller concentration.

However, there is one key difference between skiing and many other industries. In skiing the product cannot be distributed to the consumer. The consumer must, as it were, come to the place of manufacture to purchase the product. In this light there are at least three markets (or products). The first is the single-day market where the skier returns home each night. This skier probably frequents ski areas within about an hour's drive of his residence. The second market is the "weekend" market where the skier's trip lasts one to three nights. This skier probably travels greater distances (one would guess a maximum of 250-300 miles one way) allowing additional ski areas to enter the market. A final category is the vacation market where the trip lasts

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[1]See Bain, Industrial Organization, pp. 119-133.

four or more nights. These skiers probably travel even farther away for their skiing experience because the fixed costs of travel time and dollars are spread over many more days.

What does this say for market structure and seller concentration? There are relatively few areas within an hour's drive of the single-day skier's residence, particularly in an urban setting. For example, in the 1968-69 season there were seven areas (down from eleven a few years earlier) which might qualify as part of the Detroit single-day market. Defining the market thusly, there are surely oligopolistic, if not monopolistic, ski areas in the single-day markets.

The weekend market contains more ski areas. Casual observation of the map indicates most Michigan weekend skiers probably limit their travel to the Lower Peninsula while other midwestern weekend skiers probably stay north and west of Lake Michigan. The larger geographical area increases the number of ski areas in the market and decreases the concentration ratios. Competition is increased further since weekend areas must vie with single-day areas for the skiers' time and dollars. However, there are two mitigating factors.

First, there are small areas located away from the population centers (some of the Rural areas by the Chapter III definition) catering predominantly to local single-day skiers. These areas are not strong competitors in the

weekend market but do obtain the spill-over from weekend areas. Second, there are certain large ski areas which probably get a disproportionate amount of attendance. Judging from skier talk areas such as Boyne Mountain and Mount Telemark are in this category. The concentration of attendance in the top four or eight ski areas in a particular weekend market is probably as large as that in the single-day markets. However, the smaller weekend ski areas and the Rural single-day areas form a competitive fringe around these larger areas. With a little imagination, one can extend this competitive fringe to include the single-day areas near the skiers' residence. At any rate, the weekend market probably has oligopolistic tendencies but not as strong as those found in the single-day market.

The final category, the vacation market, probably has the world as its limit. The midwestern industry must compete with foreign airlines offering $300 package trips to the Swiss Alps and domestic airlines with similar tours to Aspen, Vail, and other continental ski meccas. The seller concentration on the world market must surely approach that shown in Table 9 and certainly those areas located in the midwest get a share but a very small one. However, considering only the midwestern ski areas, there are probably relatively few resort hotel-type ski areas which can compete. This is offset, in part, by the vacation skier who stays at a motel and skis several different areas during the trip. In sum, a seller concentration

similar to that in the weekend market is expected.

We find, then, that while on an industry-wide basis there appears little seller concentration, there is very high seller concentration in the single-day market. This concentration decreases in the weekend and vacation markets but still remains high enough to suspect oligopolistic tendencies.

Product differentiation

The more ski areas are able to differentiate themselves from each other the more control they can exercise over the prices they charge. For the polar case of complete product homogeneity, one expects a single price. As differentiation increases, one expects greater price differentials between ski areas. Secondly, when product differentiation occurs, it becomes worthwhile for a ski area to advertise or engage in other sales promotion tactics. Finally, a differentiated product allows a ski area to obtain a protected share of the market since it can direct its product toward a particular pattern of consumer preference. From the investor's viewpoint the greater the degree of product differentiation the better, since he can then increase his control of the market with the possibility of increasing profits and decreasing risk.[1]

In examining an industry for product differentiation

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[1]The case of product differentiation as a barrier to entry is discussed on pp. 98-99.

one must look at those product characteristics (1) which the consumer actually perceives as being different (regardless of whether or not they are in fact) and (2) those which the seller has some control over so he may actually differentiate his product. The first point requires the specification of the non-price variables of the consumers' demand function; a difficult if not impossible task. The second requirement is easier since knowledge of the product and production processes allows assessments of the extent to which the seller can affect differentiation.

Three broad sources of product differentiation are generally recognized. The first is differences in product quality or design, the second is lack of consumer knowledge about the essential qualities and characteristics of the product he is buying, and the third is consumer preferences for certain products. Seller attempts to change preference via branding, advertising, and other sales promotion techniques belong in the last category. Also included is the important area of special customer services including geographical location.

The design aspect of the first source of product differentiation does not appear readily applicable to the skiing industry. Design is more relevant to a manufactured product than a service. However, there is room for difference in quality. A ski area basically sells a ride to the top of a hill and the experience of skiing down to its base. The quality of the skiing experience can be affected by the

amount and condition of the snow on the slopes, the facilities for transporting the skier to the top of the hill, the amount of time spent waiting in tow and lift lines, and the quality of the downhill skiing experience.

Several of the proposed independent variables are meant to at least partially measure factors affecting quality. These include CUFTA, SLPGRM, TEMP, SNO, TOLFT, RORC, SLPVA, and VERDRP. The range of values for these variables indicated that a moderate to high degree of quality difference, so defined, existed industry-wide.

However, the regressions do not show any of these variables (except SNO for Urban areas) significantly related to financial success. The implication is that these variables do not differentiate the product since differences in any <u>one</u> of them do not explain differences in financial success. On the other hand, although the reason for the importance of VTF is unknown it may be due to VTF reflecting certain qualitative aspects, such as vertical drop, number of tows and lifts, and the like, which taken together provide a higher quality experience. A <u>possible</u> hypothesis is that industry-wide no one qualitative variable is important enough, by itself, to differentiate a ski area's product but that trade-offs occur between qualitative variables and a compound variable, such as VTF, may measure them.

In summary, although a priori considerations indicate the possibility of moderate to high qualitative product

differentiation the results of the regressions imply none. Due to the contradictory a priori and empirical evidence nothing definite can be said about this source of product differentiation. However, the author still maintains an intuitive belief that quality is an important source of product differentiation and concludes this is an area requiring further research.

The second aspect of product differentiation is consumer knowledge of the product. The western study shows its skiers average just over ten days of skiing per season per skier while the eastern skier averages just under thirteen days.[1,2] To the extent these averages hold for today's midwestern skier he has over ten opportunities a season to evaluate different ski areas. It would seem that over a period of years, if not within one season, the individual skier could make a personal assessment of the single-day and weekend ski areas available to him.

There appears to be good verbal communication between skiers concerning the merits of one ski area over another, particularly about those close to the skier's residence. In addition, knowledge of snow conditions is probably good due to modern communications and the ability of the skier to evaluate an area's veracity by personal experience.

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[1]Herrington, Skiing in the Western States, inside front cover.

[2]Sno-Engineering, The Skier Market, p. ii.

These considerations lead to the conclusion that there is low or no product differentiation within the mid-western skiing industry due to lack of consumer knowledge of the product.

The final source of product differentiation, consumer preferences, is concerned with the ability of ski areas to influence skiers' preferences so they will visit one ski area instead of another. The most obvious source of differentiation in this category is sales promotion activities.

The Urban (single-day) areas advertise in local news media and local skiers do discuss their relative merits. However, casual observation indicates no one local area is able to successfully "brand" itself strictly by advertising.

There are a few Rural ski areas (those most likely to have weekend and vacation skiers) which advertise regionally. There are also attempts to establish regions as good geographic areas for skiing, for example, the "Boyne Country," Traverse City, and Gogebic County advertisements in Michigan.[1] The success of these attempts is impossible to acertain. However, casual observation indicates most skiers express a desire to ski these areas or regions at least once.

Perhaps a better measure of advertising is a very rough estimate of expenditures. In the 1967-68 season 112 areas reported a mean advertising expenditure of $3,093 per

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[1]For example, see Skiing, January, 1968, pp. 130M to 131M.

ski area. In the 1966-67 season fifty six areas reported mean total gross receipts (from all sources) of $101,389. If one figure is taken as a percentage of the other an average of 3.05 percent of gross receipts appears to be spent on advertising. It can be argued that this is too large an expenditure for unsuccessful results.

In summary, there are at least moderate attempts at product differentiation through sales promotion activities. These activities are probably not too successful for the single-day market but may well differentiate the product for certain weekend and vacation areas. This conclusion is further supported by the reasoning concerning consumer knowledge. To the extent the skier visits single-day areas more often he is better able to evaluate them personally and advertising becomes less important. To the extent relatively few weekend or vacation trips are made each year it is more difficult to evaluate areas, and advertising and ski area image become more important.

A second major area of product differentiation based on consumer preferences is that of additional services offered the consumer. Bain includes in this category ". . . the convenience of his (the seller's) location to the buyer. . . ."[1]

The locational aspect of services is quite important considering the time and difficulties involved in winter

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[1]Bain, Industrial Organization, p. 221.

travel. Herrington found that in 1964 about one-quarter of all the skiers who lived in the twelve western states traveled fifty miles or less to visit a ski area, that fifty-six percent traveled 100 miles or less, and that eighty-six percent traveled 250 miles or less.[1] This indicates a moderate to high degree of product differentiation on the basis of location.

In addition, the preceding regressions indicate that Urban areas, which are defined by their location relative to urban places, have higher ROR's than the industry average. This also implies that location is important.

There are other services which could differentiate one ski area from another. Most of these were discussed under the heading "On Area Supporting Facilities" in Chapter II. These variables lacked statistical significance in the regression analyses implying that no one of them was sufficient to differentiate a ski area.

In summary, then, there is high product differentiation on the basis of location and, although one would suspect that the other services are important, particularly for the weekend and vacation market, the data differ from the a priori considerations and the net result is unknown. The possible sources of product differentiation and an assessment of the degree of differentiation each provides is summarized in Table 10.

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[1]Herrington, Skiing in the Western States, Table 23, p. 72.

TABLE 10

ASSESSMENT OF PRODUCT DIFFERENTIATION

Source	Degree of Differentiation
Quality & Design	
Design	None
Quality	Unknown
Consumer Knowledge	Low
Consumer Preference	
Sales Promotion	Moderate
Location	High
Other Services	Unknown

Barriers to entry

Barriers to entry, and their height, indicate the potential competition an industry may expect. If the barriers are low or nonexistent, increases in demand are expected to bring new firms into the industry. If barriers are high, the existing industry members have an opportunity to raise price or limit production to earn profits in excess of those which would have been earned in a more competitive market.

Bain identifies three types of barriers: product differentiation, absolute cost, and economies of scale.[1] Three sources of product differentiation are identified: (1) favored distributive systems; (2) patent protection of product designs; and (3) consumer preferences for existing

[1]See Bain, Industrial Organization, pp. 239-242. This discussion uses Bain's outline as presented on these pages.

products and/or firms. Clearly, the first two sources of product differentiation are not relevant to the skiing industry. However, skier preferences for particular ski areas do exist.

The preceding discussion indicated that the strongest cause of differentiation was location, particularly in the case of single-day markets. This indicates the new entrant is not at a disadvantage if demand in the market he is entering is sufficient. The new entrant may be at a disadvantage in the weekend or vacation markets, however. In these markets there is some degree of "brand loyalty" to a particular region or ski area. Of course, if the entrant thinks demand is excessive in one of these regions he may enter planning to obtain his customers from the excess.

In summary, product differentiation can be moderate to high due to (a) the image or reputation of a ski area or region in the case of weekend and vacation markets, or (b) ski area location in the case of the single-day markets. These barriers may be ignored, however, to the extent that the entrant perceives excess demand in any one of the markets.

A second type of entry barrier is an absolute cost advantage of existing members which may arise from: (1) possession of superior productive techniques; (2) exclusive ownership or control of superior natural resources used in production; (3) the inability of the entrant to obtain the factors of production for comparable costs; and/or (4) the

higher cost or unavailability of new investment funds. The first factor, possession of superior production techniques, is more applicable to a manufacturing industry than a service industry such a skiing.

The ownership or control of natural resources is relevant if there is a shortage of skiable terrain. This may be the case if the hills with the highest elevations are considered but it is not probable that all acceptable locations in a five-state area are exhausted. However, there may be none available in a particular local market or additional costs might be needed for earth moving if an "acceptable" site is only available rather than a "superior" one. It is therefore concluded that at least low barriers to entry exist on this count.

In general, there is no disadvantage to the entrant in obtaining the factors of production. The machinery (tows, lifts, and snowmaking equipment), the labor (which needs no extraordinary skills), and the materials (primarily fuels for engines and water for snowmaking) are all readily available on the market. One possible disadvantage is the entrant's lack of either general managerial ability or specific knowledge (whatever it might be) necessary to run a ski area. However, management consultants are abundant and experienced ski area managers available as witnessed by "job wanted" classified advertisements--but this adds to cost.[1]

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[1]For example, see "Classified," Ski Area Management, Fall, 1968, p. 72 where two such advertisements appear.

It is concluded, then, that low absolute cost barriers may exist in this category.

The final absolute cost barrier is cost or availability of capital funds. Unfortunately, there are no specific data available on the cost of capital funds to either new or existing ski areas. The Small Business Administration and the Economic Development Administration have made low cost loans to ski areas, but private funds may be relatively expensive due to unfavorable financial writings.[1] However, the unfavorable reports date back at least eight years making it likely that today's entrant is at no more a disadvantage than his predecessor.

But, are funds available at all? If they are not, a barrier exists. Again, specific data are not available but there are some from which inferences can be made. For example, the Economic Development Administration, made ten loans totaling $2,717,000 for outdoor recreation projects in Minnesota and Michigan. Seven of these were for ski facilities.[2] Data gathered for this study contained balance

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[1]For example, see Peter C. DuBois, "Financial Stizmarks," Barrons, February 2, 1966, p. 3; Federal Reserve Bank of Minneapolis, Ski Resorts in the Ninth District, Business Report Series No. 1 (Minneapolis, Federal Reserve Bank of Minneapolis, 1964); and Jan W. Sissener, The Ski Lift Business in New England, Research Report No. 11 (Boston, Federal Reserve Bank of Boston, 1960).

[2]North Star Research and Development Institute, Developing and Financing Private Outdoor Recreation in the Upper Midwest (Minneapolis, North Star Research and Development Institute, 1966), p. 43

sheets for twenty-six ski areas from 1963-64 to 1966-67. During this period these areas increased their long-term debt by about $1,400,000 to a total of $3,200,000 on total liabilities of $6,600,000 while equity investment actually decreased about $100,000. Although these observations are on existing industry members it seems reasonable the new entrants could obtain debt if existing members could obtain $1,400,000 while decreasing their equity.

Another indicator of the difficulty of obtaining capital funds is the absolute amount needed to operate a ski area. Table 11 summarizes findings for forty-one ski areas as of the end of the 1966-1967 skiing season. As can be seen, it is possible to operate a ski area with about $60,000 of total assets although positive retained earnings are not achieved until the average reaches almost half a million dollars. However, if the mean accumulated depreciation is added back to retained earnings all asset classes have a positive cash flow.

It is concluded from this that the smaller ski areas need not necessarily be considered unprofitable on a long-range basis since the investors may be looking forward to a period of several years of unprofitable operation in order to build up assets to a more profitable level. If this is the case, the size of initial investment appears to be no barrier to entry since it would require only six investors with $10,000 apiece or, if 50 percent long-term debt is allowed, six investors with $5,000 apiece.

TABLE 11

MEAN TOTAL ASSETS AND RETAINED EARNINGS
PER SKI AREA--END OF 1966-67 SEASON

Total Assets Class of Ski Area	Number of Areas Observed	Mean Total Assets	Mean Retained Earnings	Mean Accumulated Depreciation	Mean Cash Flow ÷ Mean Total Assets
Less than $100.0M	16	$ 59,100	$-13,400	$ 21,800	$0.142
$100.0M to $249.9M	15	197,000	-56,400	76,700	0.103
$250.0M to $999.9M	4	468,400	58,000	288,200	0.739
$1,000.0M and over	6	1,767,100	173,800	581,200	0.427

In summary, then, there do not appear to be any absolute cost barriers to entry from capital funds nor do the capital funds appear to be absolutely unavailable.

The third and last major category of barriers to entry is economies of scale. In price theory, economies of scale exist as long as building the next larger sized plant reduces the long run average total cost. In industrial organization economies of scale become a barrier to entry if ". . . the proportion of the market which an entrant would have to supply in order to attain reasonable efficiency is large enough to provide at least a noticeable deterrant to entry."[1]

The results of Chapter III indicate there may be an optimum size ski area. If an area earns a lower ROR at a lower VTF there may be a deterrant to entry. However, Table 9 shows ninety five ski areas containing 32 percent of total VTF. These have an average of 583,000 VTF per ski area with extremes of 1,322,000 VTF and 14,000 VTF. Lower VTF capacity does not seem a noticeable deterrant to entry.

Total assets may be a better measure of scale since VTF is not in all cases directly related to size.[2] The last column of Table 11 shows a pattern similar to ROR over VTF--the smaller the assets, the smaller the returns. However, the presence of sixteen out of forty one areas

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[1]Bain, Industrial Organization, p. 249.

[2]See p. 78.

with mean total asset of $59,100 again seems to indicate size is not a noticeable deterrant to entry.

Although smaller ski areas have lower returns there are still many of them. It is judged, therefore, that any diseconomies of small scale are not sufficient to deter entry and that scale economies are low or non-existent barrier.

The types of barriers to entry and an assessment of their importance are summarized in Table 12. The conclusion is that on an industry-wide or market basis barriers to entry are low or nonexistent.

TABLE 12

ASSESSMENT OF BARRIERS TO ENTRY

Type	Importance
Product Differentiation	
Distributive Systems	None
Patent Protection	None
Consumer Preferences	Moderate-High
Absolute Cost	
Superior Productive Techniques	None
Natural Resources	Low
Factors of Production	Low
Investment Funds	None
Scale Economies	Low

Industry Performance

Several aspects of market structure have been discussed and certain hypotheses formed. The next step is to see if actual industry performance supports these hypotheses

or adds to our knowledge. Accordingly, prices, capacity utilization, entries and exits, and profits are examined. Note that some elements of performance have been discussed in conjunction with market structure. These are referred to at the appropriate times.[1]

Prices

Table 13 summarizes the prices for 105 ski areas during the 1967-68 skiing season. The price categories include all prices plus or minus twenty-five cents of the amount indicated. For example, the $1.00 category runs from $0.76 to $1.25 and the $1.50 category from $1.26 to $1.75. The second column indicates the number of ski areas charging these prices and the third column shows the percentage of the 105 areas falling into each category. Note these are average prices and are equivalent to the variable PRICE.

The average prices in Table 13 are widely divergent with no more than twenty percent of the ski areas in any one category. This evidence does not contradict the hypotheses of product differentiation or separate sub-markets in the midwestern skiing industry.

The variety of prices could be caused by each seller having a slightly different product thereby enabling him to charge a slightly different price than his competitors.

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[1]Market conduct, which deals with the industry's pricing and product policies and coercive conduct, is not discussed since data on conduct are virtually impossible to obtain.

TABLE 13

SUMMARY OF 1967-68 SEASON PRICES

Price Category	Number of Ski Areas	Percentage of All Areas Reporting
$0.50	2	2
1.00	10	10
1.50	9	8
2.00	12	11
2.50	15	14
3.00	21	20
3.50	7	7
4.00	15	14
4.50	8	8
5.00	4	4
5.50	1	1
6.00	1	1

In addition, or alternatively, the prices in Table 13 can be explained by the same or similar prices in several sub-markets where each sub-market is somewhat different from the other. Indeed, this may explain 66 percent of the areas falling in the $2.00 through $4.00 categories.

Capacity utilization

VTF capacity figures are comparable to actual attendance if certain assumptions are made.[1] Table 14

TABLE 14

PERCENTAGE USE OF TOW AND LIFT CAPACITY

Industry (Season)	Average All Days	Weekends & Holidays	Weekdays
Midwestern (1967-68)	46.7%	80.1%	26.7%
Western (1963-64)[a]	44.0	49.0	23.0
Eastern (1962-63)[b]	78.0	122.0	31.0

[a]Source: Herrington, Skiing in the Western States, Table 16, p. 67.

[b]Source: Sno-Engineering, The Skier Market, p. 61

contains capacity utilization estimates for the entire mid-western skiing industry as well as the eastern and western

[1]See Appendix B for a discussion of the derivation of the capacity estimates.

industries. There is little doubt that overcapacity exists industry-wide in both the midwest and west and, to some extent, in the east. The real culprit is lack of weekday use in all industries although weekend use is only moderate in the western industry. The good to heavy weekend and holiday use in the eastern and midwestern industries may explain any perceived excess demand on the part of entrants.

Time series data for the midwestern industry would be helpful but are not available. However, a history of continuing excess capacity would fit in well with several of the hypotheses. First, it would be consistent with low barriers to entry and could also indicate that once a firm enters the industry it is very difficult to leave it (that is, barriers to exit are high). Also, excess capacities are expected in imperfect market systems, a point supporting moderate and high seller concentration.

Entries and exits

Data tabulated from the Ski Area Operator Questionnaire show 92 ski areas open in the 1961-62 season and 140 areas open during the 1967-68 season. This net average of just under seven ski areas per season supports a hypothesis that barriers to entry are low industry-wide.

Information on exits is less precise. Over twenty five different ski areas were reported bankrupt in response to question twelve of the Ski Area Operator Questionnaire. However, several of those named are open during the 1968-69

season so it is not known whether the response is incorrect, the financial difficulties resolved, or the receiver operating the area (as happened in one case). However, while conducting area operator interviews the author was told on more than one occasion that the owner would gladly sell the ski area if only he could find a buyer.

Owner complaints about lack of buyers and reported bankrupt areas still open lead to the hypothesis that exit from the industry is at least moderately difficult. This is further supported by the fact that ski area equipment (with the exception of ropes, cables, and rental skis) depreciates rather slowly and does not have a good alternative use in another industry. This means it is difficult for a ski area owner to sell or wear out his equipment to leave the industry. In addition, the relatively rural setting of most ski areas and their hilly terrain make the land less suitable for alternative uses and less valuable.

However, exits from the industry do occur as witnessed by three Detroit area ski areas closing and a fourth burning and not being rebuilt. In addition, there are names on the bankrupt list and in early ski area directories that are not in later directories. However, it is difficult to tell how many of these areas reopened under a different name or sold their equipment to new entrants.

Profits

Time series data on profits are extremely difficult

to obtain. However, careful searching of the responses made it possible to find twenty-seven ski areas with income statements for four consecutive years, from the 1963-64 through the 1966-67 seasons.[1] All ski areas with income statements available for these years are used, consequently strict generalizations cannot be made.

Figure 4 shows the results of tabulating average profits before federal income tax per ski area. The solid line indicates the averages for the selected twenty-seven areas, the dot and dashed line the averages for any remaining observations in that season, and the dashed line the averages for all observations available for a given season. The numbers in parentheses next to each observation show the number of ski areas in that observation. The "All Available Observations" line is extended to the 1967-68 season even though the "27 Selected Areas" data are not available.

There is little doubt that abnormally low profits existed in the industry at least through 1966-67 where the time series data end.[2] The twenty-seven selected ski areas are in the red until 1966-67 when they go black by $5,000 per area, not an outstanding amount. The other ski areas are in even worse condition, never even averaging a positive profit. The "All Available Observations" line, of course,

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[1] These are not the same twenty-seven areas used for the regressions in Chapter III although some of the Chapter III areas are in this group.

[2] Note also the negative retained earnings in Table 11.

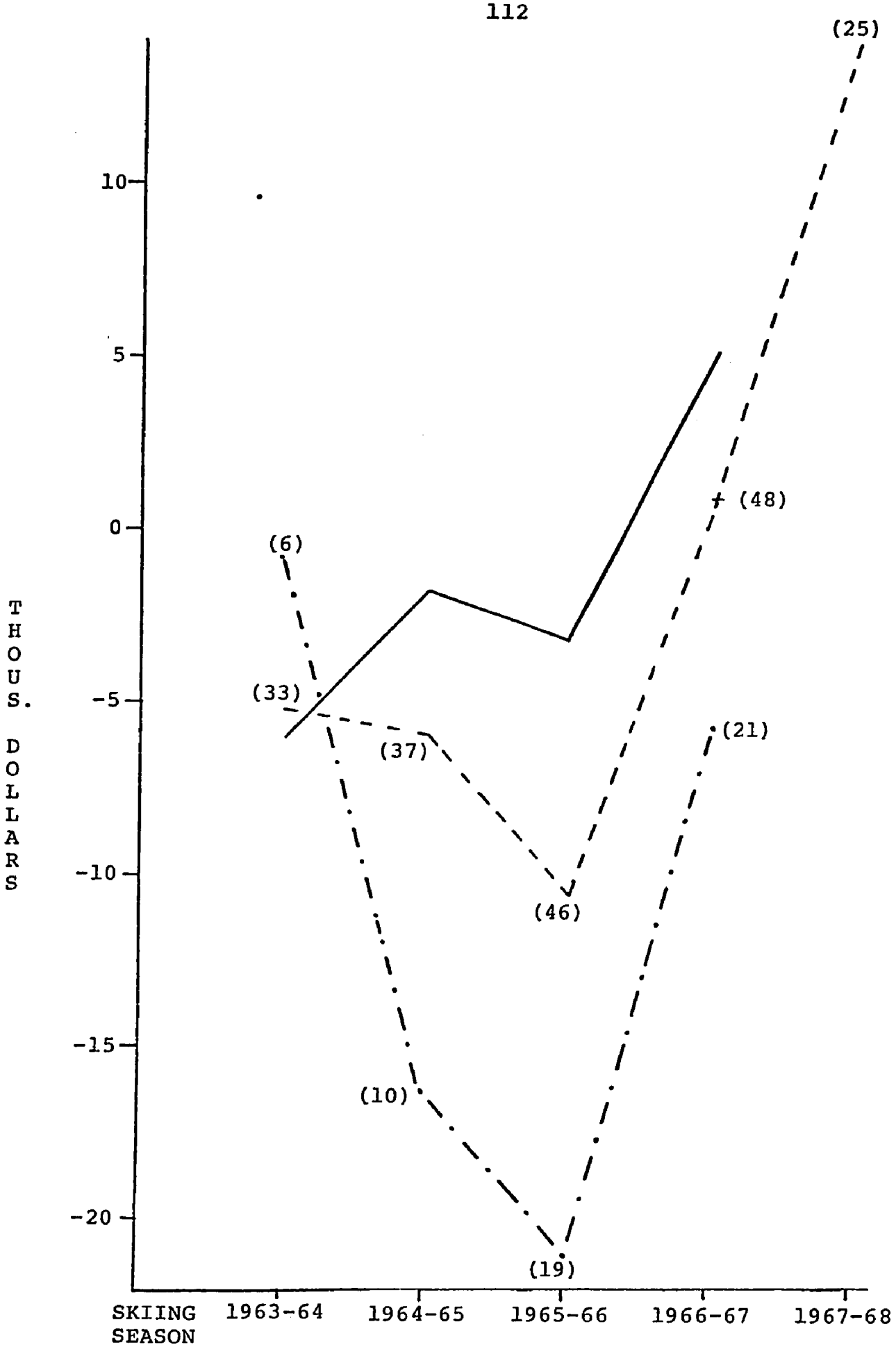


Figure 4.--Average profit before tax per ski area by skiing season.

falls between these two but barely reaches a positive profit in 1966-67 although it does turn strongly positive in 1967-68. The rather strong upward trend exhibited by the "27 Selected Areas" and the final burst of the "All Available Observations" are quite encouraging but it is an open question as to whether this trend will continue.[1]

Summary

At least two, if not three, different markets within the midwestern skiing industry are hypothesized. These are the single-day, weekend, and vacation markets although the latter two may be considered one market. Urban ski areas, as previously defined, serve the single-day market almost exclusively. Rural areas, as previously defined, can serve any of the markets although specific Rural ski areas probably specialize in one or the other.

The following market structure is seen as existing:

1. Atomistic buyer concentration in all markets.
2. Very low seller concentration industry-wide but moderate to high concentration in the vacation, weekend and single-day markets.
3. In general, moderate to high product differenti-

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[1]See Sno-Engineering, Inc., Economic and Financial Statistics (1st ed., Franconia, N.H.: Sno-Engineering, Inc., 1967) for the only other known published financial statements. Page seven shows six "Central U.S." areas with a 1966-67 average profit as a percent of equity of minus 18.9 percent while the same figure for forty-three ski areas throughout the United States is 3.0 percent.

ation from:

a. Moderate to high sales promotion activities and area or regional "images" in the vacation and weekend markets.

b. The moderate to high importance of location in all markets.

c. An intuitive and unsubstantiated feeling that quality of the skiing experience is quite important.

4. Barriers to entry can be moderate to high if the existing industry members possess an image or exhaust the single-day market. However, the entrant may perceive excess demand, either currently or in the near future, and enter the industry to supply it. Thus, actual barriers to entry are low.

An examination of industry performance shows:

1. A wide variety of prices which do not contradict the hypotheses of differentiated products and several sub-markets, each of which might have similar prices within the market but different prices between the markets.

2. The existence of average overcapacity in the industry in general even though weekend and holiday use is about eighty percent. Overcapacity could be caused by, and does not contradict hypotheses of low barriers to entry, moderate

or high barriers to exit, and/or imperfect market systems.

3. Examination of entries and exits shows:
   a. A net average of seven new ski areas a season for the last seven seasons thereby supporting a hypothesis of low barriers to entry.
   b. Owner complaints about lack of buyers, areas reported bankrupt but remaining open, and long-lived and non-transferable capital equipment, all of which lead to a hypothesis of moderate to high barriers to exit.
4. The existence of abnormally low profits for the last several years but with an improving trend. Whether the trend will continue is unknown.

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

The investment decision is now transposed and consideration first given to the investment climate in the industry. The next section draws conclusions about factors affecting the financial success of an individual ski area, and finally the implications for investment and recommendations for future research are discussed.

The Industry

The existence of heretofore low average industry profits, a generally poor financial reputation, and overcapacity on tows and lifts seems to indicate a case of "destructive competition" existing in the skiing industry.[1] The case is further strengthened when we observe easy entry requiring low capital investment; the ability to open a new ski area between seasons; barriers to exit which contribute to overcapacity; and the possibility of slow entreprenural exit since many ties may be other than financial.[2]

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[1] See Bain, Industrial Organization, Chapter 11, pp. 428 to 457, and particularly pp. 430 to 439, for a discussion of excessive competition.

[2] See pp. 3 and 4 for a discussion of investment psychology.

In addition, a reasonable hypothesis can be formed for the initial generation of overcapacity within the last decade, namely the impetus started by the 1960 Winter Olympic Games. New capacity, to a point, is also easily added at any existing ski area simply by adding a tow or lift (but this may be at the expense of the quality of the skiing experience).

Although overcapacity and immobility of factors of production are the causes of destructive competition, the basic difficulty is an atomistic seller market which precludes restriction of output or increase in price and yields a price which is depressed relative to average total costs. Unfortunately, price-cost data are not available for study. Destructive competition also requires chronically depressed profits but they are usually taken to be depressed for a much longer period than our data show. Our evidence covers only the last five years and shows improving profits at that. In addition, we cannot be certain the data speak for the industry as a whole although the earlier years certainly substantiate the poor financial image previously existing.

All of this makes it extremely difficult to tell whether we have a case of destructive competition or a basically oligopolistic industry caught along the path to what it hopes is a profitable equilibrium position. The picture is further muddied by an increase in attendance at reporting ski areas from an average of just over 5,000

skiers per area per season in 1960-61 to just over 14,000 skiers per area per season in 1967-68. In addition, some ski areas make good or at least acceptable ROR's so the destructiveness is not spread throughout the entire industry.[1]

The hypothesis of an oligopolistic industry can be supported by the following line of reasoning:

1. The 1960 Winter Olympic Games stimulated both public interest in becoming a skier and investment in the skiing industry.
2. Some ski areas or developments were profitable due to their oligopolistic position caused by one or a combination of an increased quantity of skiers in their market, a superior location or image, and/or a high quality skiing experience.
3. Numbers 1 and 2 above combined to attract new investment, yielding overcapacity and depressed profits.
4. Barriers to exit caused the retention of overcapacity for several years and continued to depress profits.
5. During this period some ski areas continued to make good or at least subsistence profits due to the combination of increasing absolute

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[1]For example, see Tables 2 and 11.

amounts of attendance and/or an oligopolistic position as discussed in 2 above.

6. Investment continued during this period due to a combination of entrants observing the successful areas and making overly optimistic assessments of their chances of success; the appearance of government publications all predicting increases in the "demand" for recreation in the coming decades; and the lack of even such basic data as attendance with which to evaluate investment decisions.

The fact that profits appear to be improving is no guarantee that they will improve, or that industry overcapacity problems have been resolved. The fact that entrance is relatively easy will always place the existing industry member in a vulnerable position unless he is able to develop barriers to entry into his market.

The following conclusions are therefore drawn about the general economic climate and possibilities for investment in the midwestern skiing industry.

1. In general, the midwestern skiing industry is a poor investment possibility due to:
   a. Historically low average industry profits.
   b. The constant threat of overcapacity due to the ease with which existing ski areas can add capacity, the low barriers to entry,

and the moderate barriers to exit.

c. Returns to successful ski areas which are only moderate in light of the high risks.

More specifically:

2. The vacation market is a particularly poor investment in both the present and the future considering the decreasing cost of travel and western and European ski areas' ability to differentiate their product by both their geographical image and their higher quality skiing experience.
3. The weekend market is only slightly better as an investment since the new entrant must compete with existing industry members which have established their names and contend with the under-utilization of tow and lift capacity on weekdays. Further, advances in transportation may well extend the geographical limits of the market in the future, forcing midwestern areas to compete with eastern or western areas.
4. An urban-oriented single-day ski area is the best investment possibility of the three markets since the major portion of product differentiation is accomplished by location, seller concentration is highest opening possibilities for at least tacit price agreements, and location near population centers increases the possibility

of utilizing overcapacity through nite skiing, ski schools, and other promotional activities.

These conclusions do not specifically take future growth of skier participation into account. An increase in the number of skiers may increase the investment possibilities in each market but it is still felt that the urban single-day market will be relatively the best investment.

The Ski Area

Recalling all the warnings about the results of Chapter III, it may seem improper to draw conclusions and make recommendations specifically about ski area investment. However, certain facts have been indicated, if not proved, and it is illogical not to take advantage of this information since no other is available. It is not unreasonable to ask: "Having studied the industry, and assuming I am going to invest in a ski area, what are your recommendations?" The answer to the question is: "Although these recommendations have not been proved, and are subject to several inaccuracies, they are the best information at this time. Subject to this and previous warnings, the following recommendations are made:

1. Consider seriously whether the best recorded ROR of just over twenty-five percent, before tax, is sufficient return for the risks involved in the industry structure and the dependency on the weather.

2. Build or buy within fifty miles of a town or city with greater than 50,000 population since ski areas so located make a greater return on their investment.
3. Set the average tow or lift ticket price at about $3.67 per skier visit. Since this is an average, weighted down by season passes, ski school packages, and the like, day ticket prices for the weekends can be slightly higher.
4. The ski area should have about a million and two-thirds vertical transport feet of tow and lift capacity.
   a. The rate of return on investment of areas smaller than this drops off rather rapidly.
   b. The rate of return on investment on areas larger than this also decreases although not as rapidly as on smaller areas.
   c. If increased investment is planned seriously consider doing it by opening a second ski area rather than enlarging the present one.
5. The presence of natural snow on the ground is quite important; therefore seek a geographical area where it is high.
6. If for some reason a ski area is not built in or around an urban setting it should:
   a. Have slightly more vertical transport feet

(about a million and three-quarters).

b. Charge a slightly higher average price (about $4.13).

7. Of those factors specified only the three mentioned above are significantly related to financial success. This does not mean that the other factors are unimportant. Lack of statistical significance should not be mistaken for lack of practical significance.

There are also a few points, not brought out by the results of the study, which may be fairly obvious but are important enough to mention. The length of the skiing season in the midwest is seldom more than 120 days, start to finish. During the 1967-68 season 127 ski areas had a mean season length of seventy-five days while 143 ski areas reported a mean of forty-eight skiable days. Taking one figure as a percent of the other the indication is that areas are open only two-thirds of the season.

Although this figure is an industry-wide average and does not segregate those ski areas which have snowmaking equipment from those which do not the point is clear. The ski area operating solely as a ski area has the potential of generating income during only one-third of the calendar year at best and usually for a lesser time than that. This means that the investment in land, lodge, and other assets lies dormant two thirds of the time. Activities which use these

assets on a year-round basis should be sought and adopted.[1]

Secondly, one extremely important variable is not measured. That variable is the managerial ability of the ski area operator. Casual observation indicates that in many ski areas, particularly those of moderate and small size, managerial talent is applied on a part-time basis throughout the skiing season, since business is part time throughout the calendar year. Many managers have regular, full-time jobs and show up at the area in the evenings and on weekends. One wonders whether under this arrangement enough thought and study is given to the problems of their second business.

What may be a lack of managerial ability is also reflected in the lack of records to guide decisions. Many ski areas have no balance sheets, have income statements only because the Internal Revenue Service requires them, and do not even know their annual attendance. Records by cost center, such as restaurant, bar, ski rental, and slopes, are almost nonexistent and apparently no effort is made to use management techniques. In discussing records of costs and revenues one operator of a moderate-sized area responded: "We just count the money in the cash drawer at the end of the day. If there is more than we started with we are happy."

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[1]The industry is not unfamiliar with this point, for example see Myles Jackson, "Summer Business: Key to Year-Round Success," Ski Area Management, Winter, 1969.

The analysis in Chapter III did not measure the level of managerial ability or the use of management tools. It certainly behooves a ski area operator to be familiar with these or to hire a good management consultant to assist him. It would probably also assist a ski area operator to become familiar with some of the knowledge existing in the field of hotel and restaurant administration.

Implications for Investment

The implications for private sector investment in a new ski area are fairly clear; the averages of past experience indicate investment is not particularly profitable although exceptions do exist. Profits have been low in the past but, although they now show improvement, the susceptibility of the industry to overcapacity and the basic dependency on the weather create enough uncertainty about future profitability to, in the author's judgment, require higher returns on investment than are currently being made.

The case for increased investment in existing ski areas is less clear-cut. To the extent barriers to exit exist it may be prudent for a ski area to expand its VTF in an attempt to increase the return on its investment. The same would apply, of course, to maintaining the current level of capacity. It may also be prudent to attempt to expand operations to include the off-season use of the ski area facilities.

The statements concerning private investment are, of course, generalities based on industry-wide averages. The industry is quite heterogeneous and differences in the rates of return on investment can be large. There are surely other areas making returns as high or higher than those included in this study. It may also be that a heretofore undiscovered or, more likely, developing markets, will allow profitable investment. Another alternative is the year-round resort complex. However, the spector of easy entry still exists so care must be taken in investing.

Finally, the reason for private investment may only partially be the monetary return upon it. Sissener lists four possible reasons why area operators remain in business in the face of poor profits.[1] Other may be supposed. For example, the owner may deduct a year-round salary from expenses while only working four months of the year. Reasons other than return on investment are in a large part unique to the individual investor and he must place his own priority on the nonmonetary aspects of income. This may well change the investment decision of the individual private investor.

Currently, there are at least two rationales for public investment: the relief of depressed regional economies and the supplying of recreational activities. Unfortunately, specific answers to both of these investment

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[1]Sissener, The Ski Lift Business, p. 55.

decisions are not included in this study. To make an informed decision on investment to relieve a depressed economy one would need to consider costs, the number of people employed, the length of employment, the hourly and total wages earned, skier and ski area expenditures, the multiplier effects on each of these, and so on. Decision on an investment to provide recreation hinges on estimates of skier demand and some judgment as to what part of this demand the public sector should supply. Information of these types is not supplied by this study.

However, the hypotheses of the study indicate some broad guidelines which can be followed <u>if</u> we assume the public sector chooses to invest in skiing. These are:

1. Before investing in either a new ski area or in increased capacity at an existing area the amount of overcapacity in the region should be examined. Care must be taken that government investment does not create so much overcapacity in a regional market that either existing ski areas are forced out of business or the new government facility or its leasee cannot make a sufficient profit, or both.
2. The considerations in "1" above also apply to applications for government-managed land for use as a ski area.
3. Serious consideration should be given to establishing a higher priority for existing ski areas'

applications for assistance, whether it be for investment funds or land use. The reason is, again, the possible existence of overcapacity. It is better to help an existing area become large enough to be profitable than to create excess capacity wherein no one area can make sufficient profits.

It is, of course, difficult to tell at what point the benefits accruing to a region from expanding capacity are offset by the decrease in ski area profits. Answers to questions of this type depend, in large part, on the situation in the local market. The main point is that it would be a misallocation of resources for the public sector to provide skiing which is being sufficiently supplied by the private sector, and self-defeating to finance one ski area to create local employment at the expense of unemployment at a ski area fifteen miles down the road.

Recommendations for the Future

Perhaps the overwhelming reason for increased investment in the industry, and one by and large ignored in this study, is increased demand. One reason the level of demand is ignored is that many areas did not know their attendance. Out of 140 ski areas open in the 1967-68 season only 117 were able or willing to give attendance estimates. Of the attendance estimates given less than twenty percent were from actual attendance records. The other eighty percent

either relied on memory estimates, or outright guesses. The missing data and the unreliability of that obtained precluded further analysis.

However, the average increase of 7,000 skiers per area per season in seven seasons is certainly impressive. It may well be that shifting demand will support investment, either in new or existing ski areas. Of high priority, then, should be a study of skier demand.

The first recommendation leads directly to the second. More and better records need to be kept by the industry so that informed decisions can be made. The aforementioned lack of attendance data is certainly a good starting point. The reporting of these figures and gross ticket receipts, say on a weekly basis, would provide the raw price-quantity data for further work. Other information in the way of financial statements, special cost studies, and the like would also be helpful.

A question can be raised as to who would provide this service. A starting point is the trade associations, most notably the Central Ski Areas Association located in Traverse City, Michigan. Of course, use of a trade organization would probably require an additional levy to offset the costs involved. As an alternative the state university extension services might be approached. These organizations might be persuaded to provide the service at a reduced cost or possibly free of charge. One can even envision the extension agency assisting the smaller area owners with a standardized accounting system which will not only help

aggregation of data but also assist the area owner in making his management decisions.

Reluctance may be encountered among the ski area operators to disclose certain, if not all, of the information. Assurances of confidentiality can be given (another advantage of an extension service) and data presented in aggregated form. A selling point to recalcitrant operators might be that knowledge of overcapacity, to the extent it exists, will discourage prospective investors rather than encourage them. This is, of course, not much of a selling point for the area in a market with undercapacity unless the ski area has its product differentiated on other than a locational basis.

A third recommendation is to obtain additional data to test the hypotheses formed in this study. This task is somewhat simplified if a duplication of the current study is desired since data will only have to be gathered on those variables in the hypotheses.

Finally, the failure of the current study to obtain a satisfactory hypothesis to explain the relationship of VTF to ROR detracts from the results. This most certainly is of future interest and should be explored fully. Perhaps a more useful study design would be to use matching techniques to examine, on a case study basis, ski areas with the same number of vertical transport feet and price but as widely different ROR's as possible. Controlling these factors in this manner may give a more penetrating picture of the causal factors of financial success.

APPENDIX A

SKI AREA OPERATOR QUESTIONNAIRE

BUDGET BUREAU NO. 40-S68029
APPROVAL EXPIRES JUNE 1968

PLEASE PRINT ALL ANSWERS

SKI AREA OPERATOR QUESTIONNAIRE

Name of Area _____

Mailing Address _____

_____

Area is located _____ on highway No. _____,
(Direction)
_____ miles from _____.
(City)

Name of Manager _____

Name & Title of respondent _____, _____
(Name) (Title)

Date of Interview _____. Interviewer _____

1. What month and year was this site first commercially operated for skiing? ____/____.
(Mo. / Yr.)

2. What were the opening and closing dates for:

   a. The 1967-68 season? Opening Date ____/____ (Mo. / Day) Closing Date ____/____ (Mo./ Day)

   b. A typical year? Opening Date ____/____ (Mo. / Day) Closing Date ____/____ (Mo./ Day)

3. a. What days of the week and hours, including night hours, do you plan to operate during next year's season? _____

   _____

   b. What were these for the 1967-68 season? _____

   c. How many days were you open during the 1967-68 season? _____ (days)

   d. How many days did you shut down for 1/2 day or more due to bad weather other than lack of snow? _____ (days)

4. What is the maximum vertical rise, in feet, of your skiable area?

_____
(Feet)

5. Which of the following best describes the general exposure of ski slopes? (Interviewer may circle more than one)

N NE E SE S SW W NW

6. a. Do you use snow making equipment?

Circle one. YES NO

If "NO", skip to question 7. If "YES", complete question 6.

b. How many guns or nozzles do you have? _____
(Number)

c. What is your total compressor capacity in cubic feet per minute?

_____
(CF.M.)

d. How many hours did you operate the snow making equipment during the 1967 - 68 ski season? _____
(hours)

e. Over what percent of your skiable area did you make one or more inches of artifical snow during the 1967 - 68 season? _____
(Percent)

f. What percent of all snow on these areas was this? _____
(Percent)

g. How many extra skiable days do you think snow making equipment gave you? _____
(Days)

7. For each of the following difficulty classes, how many runs do you have, and what is the maximum length and average width in feet? Here is a copy of the form I will be filling out. (Hand respondent copy of table below)

Difficulty Class	(1) Number of Runs	(2) Acres Feet Avgh Width	(3) Feet Maximum Length	(4) Skiable Acres
a. Beginner				
b. Intermediate				
c. Expert				
d. Sub-Total (Interviewer add)		XXX	XXX	
e. Ski Touring and/or Cross Country		XXX		XXX
f. GRAND TOTAL (Interviewer add)		XXX	XXX	XXX

(Note: Interviewer calculate "Skiable Acres" from Width and Length data. Be sure to get width and length for EACH run)

8. Next we would like a description of all tow and lift facilities that are now used, or have been used on the site since the 1960-61 season. Describe all facilities including rope tows even though they have been replaced or are inoperative. Here is a copy of the form I will be filling out. (Hand respondent a copy of the table below.)

USE ONE LINE FOR EACH TOW OR LIFT

	(1) Type of Tow or Lift (e.g. T-Bar)	(2) Length in Feet	(3) Vertical Rise in Feet	(4) Year Built	(5) Year Use Stopped	(6) Actual Maximum Capacity in Skiers/Hour	(7) Nights operated (e.g.w.) (Fri.Sat)
a.							
b.							
c.							
d.							
e.							
f.							
g.							
h.							
i.							
j.							

9. Do you DEFINITELY plan to install and operate more tows and/or lifts at your present site or on adjacent land within the next 5 years.

a. Circle one: YES NO

If "No" skip to question 10, if "YES", complete question 9.

b. Please tell me the type of lift you plan to install, the actual capacity in skiers per hour, feet of vertical rise, new skiable acres which will be added, and planned date of completion for each tow or lift you DEFINITELY plan to install.

	Lift Type	Planned Maximum Capacity in Skiers/Hour	Vertical Rise in Feet	New Skiable Acres	Planned Date of Completion
(1)					
(2)					
(3)					

10. Do you now operate ski touring and/or cross country trails?

    a. Circle One: YES NO

    b. IF YES - Do you think they are profitable? Circle one: YES NO

    c. IF NO - Do you think it would be profitable to build them? Circle one: YES NO

11. Describe any new ski areas that you know of which are under construction or definitely planned. Be sure to include the town where they will be located and date of completion. Information on the number, types, capacities, and vertical rises of lifts would be helpful.

    _____

    _____

    _____

12. Do you know of any ski areas which have gone into bankruptcy or closed completely for one or more seasons? If you do, can you tell me for EACH its name, the town where it was located and the date it closed. Information on the number, types, and capacities of tows would also be helpful.

    _____

    _____

    _____

13. Do you feel there are any factors which are limiting attendance at your ski area?

    Circle one: YES NO

    If "NO", skip to question 14. If "YES", complete question 13.

    Please rank in order of importance, by using numbers 1, 2, 3, etc., those factors which you feel are limiting skier attendance. Indicate as many factors as you feel are important. (Interviewer: Respondent may begin telling you factors in answer to the first part of this question. If this happens rank the first factor mentioned as 1, the second as 2, and so on. When respondent stops speaking DO NOT read the second part of the question but DO ask "Are there any other limiting factors?")

Limiting Factors	Rank
a. Inadequate lift or tow capacity.	
b. Inadequate skiable area.	
c. Inadequate base facilities. (specify)	
(1) _____	
(2) _____	
(3) _____	
d. Climate, lack of snow, etc.	
e. Poor roads.	
f. Other (Specify)	
(1) _____	
(2) _____	
(3) _____	

14. Please answer each of the following questions with information for the 1967-68 ski season.

a. How many inches of natural snow fall occurred on your area? _____ (Inches)

b. What was the average number of inches of packed snow at the base of your site in mid-February? _____ (Inches)

c. During the ski season how many days did the day time temperature range between 45 and 0 degrees Fahrenheit? _____ (Days)

d. During the ski season how many nights did the night time temperature range between 28 degrees and 0 degrees Fahrenheit? _____ (Nights)

15. We are trying to determine the availability to skiers of facilities other than those directly connected with skiing. ON-SITE facilities are those at your area and within walking distance of your tow area. OFF-SITE facilities are those with thirty minutes driving distance (about twenty miles) of your tows and lifts. Please estimate the following information with respect to your ski area. (Hand respondent copy of below table)

	a. ON-SITE	b. OFF-SITE
(1) Restaurant seating capacity.	_____	_____
(2) Number of beds.	_____	_____
(3) Bars, dance halls, nite clubs. (Number of persons legal capacity)	_____	_____
(4) Number of cars parking capacity.	_____	XXX
(5) Number of children in organized ski school. or ski group.	_____	X X X
(6) Number of certified ski instructors.	_____	X X X
(7) Non-skiing activities. (Check applicable line)		
(a) Ice skating	_____	_____
(b) Snowmobiling	_____	_____
(c) Tobagganing	_____	_____
(d) Swimming (heated or indoor pool)	_____	_____
(e) Other (Specify)		
(i) _____	_____	_____
(ii) _____	_____	_____
(iii) _____	_____	_____

(8) Names of ski areas within twenty miles radius.

(a) _____

(b) _____

(c) _____

16. Please estimate the total number of skier visits for each season, from 1958 - 59 to 1967 - 68, from your ticket or revenue records. Here is a copy of the form I will be filling out (Hand respondent copy). A skier visit is one person visiting a ski area for all or any part of a day for the purpose of skiing. DO NOT INCLUDE NONSKIERS. I would also like you to estimate the total percent of annual attendance occuring during weekends and holidays. By holidays I mean from December 25 to January 1 inclusive, and February 22. If attendance information is not readily available I have some worksheets which will help us in estimating it.

Season	Average Cost of Day Ticket	Total Number of Skier Visits	Percent Weekend and Holiday Attendance
a. 1967 - 68			
b. 1966 - 67			
c. 1965 - 66			
d. 1964 - 65			
e. 1963 - 64			
f. 1962 - 63			
g. 1961 - 62			
h. 1960 - 61			

Interviewer: Note source of information _____

17. a. Was your ski area open to the public between the 1963 - 37 and 1967 - 68 ski seasons?

Circle one: YES NO

If "NO", skip to question 18. If "YES", complete question 17.

b. Did you operate any of the following? (Check YES or NO in each case)

	YES	NO
(1) Ski lift (If "YES", how many tickets did you sell?_____, what was the price per ticket? $_____.)	___	___
(2) Restaurant?	___	___
(3) Bar, nite club, etc?	___	___
(4) Lodging facilities?	___	___
(5) Any other facilities? If "YES", specify._____ _____	___	___

We are interested in gathering expenditure information on ski areas to determine their impact on the local economy and to identify factors leading to their successful operation. The following questions will assist us in doing this. All information will be held in strictest confidence and will not be published so individual ski areas can be identified.

13. What was your total expenditure for the following items during your fiscal year which included the 1967 - 68 ski season?

Item	Total Dollar Expenditure
a. Advertising	$_____
b. The cost of merchandise, not counting wages, sold out:	
(1) Restaurants	$_____
(2) Bar, nite club, etc.	$_____
(3) Ski shop	$_____
c. Operating, maintenance, and repair expenses, not counting wages, for:	
(1) Tows and lifts	$_____
(2) Snow making equipment	$_____

19. We are trying to determine the number of man-hours employment and total wages by certain categories for each ski area. The categories are Yearlong, Seasonal - Skiing season, and Seasonal - Non-skiing season. We are also interested in the number of different employees and the percentage which were local residents. A local resident is anyone living permanently in the county in which your ski area is located or in a county which borders on the county in which your ski area is located. Be sure to include yourself but DO NOT INCLUDE people who were not paid cash wages.

Type of Employee	(1) Total Number Employed	(2) Percent Local Residents	(3) Total Wages	(4) Average Wage/Hr.	(5) Man-hours Employed
a. Yearlong	_____	_____ %	$ _____	$ _____	_____
b. Seasonal-Skiing season (Nov. to April)	_____	_____ %	$ _____	$ _____	_____
	_____	_____ %	$ _____	$ _____	_____
	_____	_____ %	$ _____	$ _____	_____
c. Seasonal - Non-skiing season (May to Oct.)	_____	_____ %	$ _____	$ _____	_____
	_____	_____ %	$ _____	$ _____	_____
	_____	_____ %	$ _____	$ _____	_____
d. Total (Interviewer Add)	_____		$ _____		_____

(Note: Total number employed is available from Social Security or Federal Witholding Tax records. Man-hours employed can be calculated by having the operator estimate the average hourly wage and dividing this into total wages, i.e. col 3 ÷ col. 4.

20. During your fiscal year which included the 1967-68 season, how many man-days of slope maintenance did you perform:

a. During the ski season when snow was on the slopes? For example packing and dragging. _____ (Man-Days)

b. During the off-season when no snow was on the slopes? For example seeding and rock removal. _____ (Man-Days)

21. We would like to obtain income statements and balance sheets for your operation covering the last five years. May I repeat, this information will be held in the STRICTEST CONFIDENCE. We would prefer to copy the accounts as they appear on your statements and are prepared to do this now. If this is not possible, the accounts on these forms (Interviewer show income and Balance sheet forms to respondent) will satisfy our needs. As an aid to their compilations the accounts on these forms were designed to closely follow the Federal Income Tax forms which you file.

INTERVIEWER COMPLETE THIS SECTION

1. Obtained financial statements during interview.

   Circle one: YES NO

2. If "NO",

   a. ( ) Respondent absolutely refused to give statements. Specify reason_____
   _____

   b. ( ) Respondent promised to mail statements at later date. (Tear out optional forms and leave with respondent)

   c. ( ) Respondent asked interviewer to call back on

   _____.
   (Set date for call-back)

   d. ( ) Other. Specify_____
   _____.

---

a. Before looking at your statements I have a few short questions.

   (1) What is the legal form of the business for example corporation or partnership?_____.

   (2) What type of depreciation do you use for example straight line or sum of the digits?_____.

   (3) Over how many years do you depreciate:

   (a) Buildings _____
   (Years)

   (b) Equipment _____
   (Years)

   (4). Is your accounting on a cash or accrual basis? _____
   (Basis)

21 b. Ski Area Income Statement

Account	Year Ending / / mo da yr	Year Ending / / mo da yr	Year Ending / / mo da yr	Year Ending / / mo da yr	Year Ending / / mo da yr
GROSS RECEIPTS					
a) Tows and Lifts					
b) Restaurants					
c) Bars and Nite Clubs					
d) Equipment Rentals					
e) Other (Specify)					

21. b. Optional Form for Ski Area Income Statement.

Account	Year Ending / / mo da yr	Year Ending / / mo da yr	Year Ending / / mo da yr	Year Ending / / mo da yr	Year Ending / / mo da yr
GROSS RECEIPTS FROM					
a. Tows and Lifts					
b. Restaurants					
c. Bars and Nite Clubs					
d. Rentals					
e. Other (Specify)					
f. TOTAL GROSS RECEIPTS FROM SKI AREA OPERATION					
COST OF GOODS SOLD					
g. Inventory Expense					
h. Labor					
i. Other					
j. TOTAL COST OF GOODS SOLD					
k. GROSS OPERATING PROFIT					
OTHER INCOME					
l. Net gain or loss from sale of capital assets					
m. Other net income and/or net gains or losses (Specify)					
n. TOTAL					

21. b. Ski Area Income Statement

Account	Year Ending / / mo da yr	Year Ending / / mo da yr	Year Ending / / mo da yr	Year Ending / / mo da yr	Year Ending / / mo da yr
OTHER EXPENSES					
o. Depreciation					
p. Interest payments					
q. Rent or lease payments for ski area or land on which it is located.					
r. City and county taxes					
s. All other expenses (Including salaries of proprietors, etc.)					
t. TOTAL OTHER EXPENSES					
u. NET PROFIT BEFORE TAX					
GROSS RECEIPTS					
a. Tows & Lifts					
b. Equipment Rental					
c. Restaurants					
d. Bars & Nite Clubs					
e. Ski School					
f. Other					
g. TOTAL GROSS RECEIPTS					

21. c. Ski Area Balance Sheet

Account	Year Ending / / mo da yr	Year Ending / / mo da yr	Year Ending / / mo da yr	Year Ending / / mo da yr	Year Ending / / mo da yr

21. c. Optional Form for Ski Area Balance Sheet

Account	Year Ending / / mo da yr	Year Ending / / mo da yr	Year Ending / / mo da yr	Year Ending / / mo da yr	Year Ending / / mo da yr
CURRENT ASSETS					
a. Cash					
b. Accounts Receivable and Trade Notes.					
c. Inventories.					
d. Other Current Assets.					
e. TOTAL CURRENT ASSETS (a+b+c+d)					
NON-CURRENT ASSETS					
f. Land					
g. Building and Equipment					
(1) Accrued Depreciation					
(2) Net Bldg. & Deprc.					
h. Goodwill & Other Intangible Assets.					
i. Other non-current assets.					
j. TOTAL ASSETS (e+f+g+h+i)					

21. c. Balance Sheet, Continued.

Account	Year Ending / / mo da yr	Year Ending / / mo da yr	Year Ending / / mo da yr	Year Ending / / mo da yr	Year Ending / / mo da yr
CURRENT LIABILITIES					
k. Accounts Payable.					
l. Notes Payable.					
m. Long Term Debt Currently Payable.					
n. Other Current Liabilities					
o. TOTAL CURRENT LIABILITIES (add k thru n)					
LONG TERM LIABILITIES					
p. Long Term Debt. (Mortgages, bonds, etc.) Specify, including interest rate.					
(1)_____					
(2)_____					
(3)_____					
q. Preferred Stock Specify					
(1)_____					
(2)_____					
r. Common Stock					
s. Capital Surplus					
t. Retained Earnings					
u. TOTAL LIABILITIES (add o through t)					

APPENDIX B

CALCULATING POPDIS

POPDIS is defined and calculated by the formula:

$$POPDIS = \sum_{i} \frac{POP_i}{DIS_i}$$

where: i = the i^{th} county having its population centroid within 250 miles of the ski area centroid.

POP = the population of the i^{th} county to the nearest 100 people.

DIS = the straight line distance measured to the nearest five miles from the centroid of ski areas within a county to the centroid of population in the i^{th} county.

The centroid of ski areas within a given county is ocularly determined. Where only one ski area is in a county its location is the centroid. The population centroid is the ocularly determined geographical center of a county unless there is one or more urban places with over 25,000 population.[1] In the latter case, the centroid is the urban place or ocularly determined average distance between urban places.

A maximum radius of 250 miles is used since the

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[1]All population data are obtained from Sales Management, Inc., "Survey of Buying Power," Sales Management, June, 1967.

western study showed 99 percent of single-day skiers and 86 percent of all skiers come from within this radius.[1] The count of counties is stopped within the 250-mile radius when a county of 1,000,000 or more population is encountered under the assumption that any additional population in that direction would be insignificant. If a ski area is located in a county of 1,000,000 or more only that county counted.

When land is contiguous all county population centroids just touching the radius are included. When land is not contiguous the following rules are used:

1. Measure the straight line distance across the nearest bridge, etc.
2. Subtract this distance from 250 to determine a new maximum radius.
3. Continue measurement from the farthest terminus of the bridge using the new maximum radius calculated in "2" above.

There are several assumptions in POPDIS (made to simplify calculations) which should be stated explicitly. The first is that the importance of population decreases directly with distance rather than with some exponential function of distance. Second, in a given direction, the number of people beyond the 1,000,000 population county are not a significant part of the market. Next, it is assumed the Great Lakes form a natural barrier excluding markets falling within the straight line 250-mile radius. Finally,

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[1]Herrington, Skiing in the Western States, Table 23, p. 72.

the use of ski area centroids within a county assumes that the county line is some meaningful barrier. This is true where there are no ski areas in the adjacent county located near the county being measured. However, in other instances this is not true and the assumption is invalid.

There are some calculating techniques which can cause imprecision in POPDIS. First, the scale of the maps is small (about one inch equal thirty miles) in order to encompass the 250-mile radius. This small scale makes precise measurement of distance impossible, consequently it is measured to the nearest five miles. Second, the ocular estimates of ski area and population centroids can be imprecise and/or not representative of the average distance from one centroid to the other.

Finally, some may object to using straight line distance versus travel time or road distance. However, Griffin states, "In the earlier correlation and regression program, the correlation between driving distance, line of sight distance, and driving time was so high that either of the other two could have been used in place of driving distance."[1] The more easily calculable straight line distance is therefore used.

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[1]John B. Griffin, "Skier Demand: An Application of the Gravity Model" (unpublished Master's thesis, University of Michigan, 1968), p. 32.

APPENDIX C

ESTIMATING TOW AND LIFT CAPACITY AND SKI AREA UTILIZATION

Much confusion and many differing practices are encountered in the measurement of the physical capacity of a going business concern, regardless of the industry it is in. The skiing industry is no exception.

Capacity is usually defined as the maximum physical output technically possible, regardless of the amount of that output which the market is willing to buy. It is based on the machinery and equipment present at the time the capacity is measured and is usually based on the capacity of the limiting, or "bottleneck," piece of equipment.

When capacity is stated on an annual basis widely divergent opinions of actual capacity occur. These divergencies are due to different answers to several questions, such as: How many shifts, or hours of daily operation should capacity be based upon? How many operating days in the year should be assumed and how large an allowance should be made for machinery breakdowns? To answer these questions one must look at the purpose for which the capacity figure is being calculated.

In the case of the skiing industry there are at

least two reasons for calculating capacity. The first is to see how fully the present investment is being utilized. The second is to determine how much new tow and lift capacity must be added to meet possible increases in demand. Each of these reasons entails a different set of assumptions.

Before proceeding further, it may be well to describe how ski area capacity was calculated in this study. As a matter of review, VTF is calculated by multiplying the vertical drop of each tow or lift by the number of skiers per hour which that tow or lift can transport to the top of the hill. This calculation is made for each tow and lift on a ski area and the results summed to obtain the VTF for that ski area. Industry capacity, measured in VTF, is simply the sum of all the ski areas' capacity. This implicitly assumes the tows and lifts are the limiting factor in a ski area's capacity.

The daily capacity of a specific ski area in number of skiers is found by multiplying VTF by the number of hours per day the ski area is open to obtain the vertical transport feet per day available to skiers. This result is then divided by the number of vertical transport feet per day a skier uses to obtain the area's daily capacity. The season capacity is calculated by multiplying the daily capacity by the number of days in the season. These calculations can be expressed in one formula as:

$$\frac{\text{Skier Days}}{\text{Season}} = \frac{\text{Vert. Trns. Ft.}}{\text{Hour}} \times \frac{\text{Hours}}{\text{Day}}$$

$$\cdot \times \frac{\text{Day}}{\frac{\text{Vert. Trns. Ft.}}{\text{Skier}}} \times \frac{\text{Days}}{\text{Season}}$$

Industry skier capacity is, again, the sum of each ski area's capacity. Following Herrington and Sno-Engineering, it is assumed a skier uses 8,000 vertical transport feet per day.[1,2,3] In the formula, this becomes 1/8,000. The reamining values to be estimated are "Days per Season" and "Hours per Day."

If the purpose of the calculation is to see how fully the present investment is being utilized it is appropriate to use total days in the skiing season as the estimate for "Days per Season" rather than skiable days in the skiing season as Herrington and Sno Engineering apparently did. This is so because the investment is made in the ski area throughout the entire season. Further, the capacity of the ski area stands ready to be used at any time during this period, pending favorable weather conditions, and at least certain costs are incurred to maintain this readiness. However, this calculation would make the comparison in Table 14

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[1]Herrington, Skiing in the Western States, p. 45.

[2]Sno-Engineering, The Skier Market, p. A-20.

[3]Intuitively, the Great Lakes skier would seem to require more vertical transport feet a day due to the lower vertical rises and shorter runs. However, the author knows of no studies on the subject and uses the figure for lack of better information.

impossible therefore calculations are made using the mean skiable days of reporting areas (48 days). The Herrington-Sno-Engineering estimate of five hours for "Hours per Day" was used due to lack of better information and to maintain comparability.[1,2,3] In summary, then, 8,000 vertical transport feet per skier per day, five hours per day of operation, and forty-eight days per season are assumed for each and every ski area. Only the vertical transport feet are calculated separately for each ski area.[4]

The utilization figures in Table 14 are calculated by taking the attendance of all reporting ski areas as a percentage of their capacity in Skier Days per Season (as calculated by the above formula). The division by weekend and holidays was made as follows. "Actual" attendance on weekends and holidays is obtained by multiplying annual attendance by the estimated amount occurring on weekends and holidays as reported in question sixteen of the Ski

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[1]Herrington, Skiing in the Western States, p. 45.

[2]Sno-Engineering, The Skier Market, p. A-20.

[3]A more precise method would have been to calculate the days and hours for each area from the answers to questions 2a, 3b, and 8(7) of the Ski Area Questionnaire. However, the lengthy calculations involved and the inconsistency of night operation of some tows and lifts precluded doing this.

[4]Note that the use of these constants by this and the previous authors is what allows the comparison of capacities by use of vertical transport feet. Note also that short-run supply is a function of demand since vertical transport feet per skier per day is demand and this determines the number of skiers per day (or season) a ski area can supply.

Area Operator Questionnaire. Capacity is calculated by allocating three-eighths of the annual capacity in Skier Days to weekends and holidays and five-eighths to weekdays. This allocation is based on a count of actual weekend and holiday days in an assumed eighty-day season with Christmas week, New Years Day, and George Washington's Birthday counted as holidays. The sum of the "actual" figures in each category is then taken as a percentage of the sum of the capacity figures in each category to find percentage utilization.

Note that the utilization figures in Table 14 are based on skiable days per season and five hours a day of operation. From the investor's point of view these estimates overstate utilization. That is, the figures do not allow for "down time" due to poor weather conditions nor for the increase in capacity to be gained by adding snow-making equipment or lights for night skiing. Changes of this type can make a significant difference. For example, changing "Days per Season" from forty-eight to seventy-five (the mean length of the skiing season) decreases total utilization from forty-seven to thirty percent with weekend and weekday utilization forty-eight and eighteen percent respectively.

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