

Big Mountain Resort is a premium ski resort in Montana with facilities that make it stand out within the state of Montana and within the United States. However, as there are doubts to whether Big Mountain is appropriately capitalizing on its facilities, and with an increase in operational costs due to the installation of a new chair lift, this investigation tries to answer two questions: which facilities best support an increase in ticket prices to help cover the increased operational costs and whether the current price of tickets is in the appropriate range within the market.

Initial exploration of the data highlighted that Montana ranked as the 12th highest state in terms of number of ski resorts, but the 9th cheapest state for skiing with no distinctive pricing between weekend and weekday ticket prices. This is interesting as other than South Dakota, most other states seem to have varied pricing depending on weekend and weekdays. 14.3% of the resorts in the dataset seemed to be missing both types of ticket prices, and 3.4% had only one ticket price missing. A decision was made at this point to drop any resorts that had missing Adult Weekend prices. For the resorts with both ticket types, of those with ticket prices less than \$100, the weekend prices tend to be higher than weekday prices, as shown in Figure 1; this contrasts with Big Mountain which charges \$81 for both types of tickets.

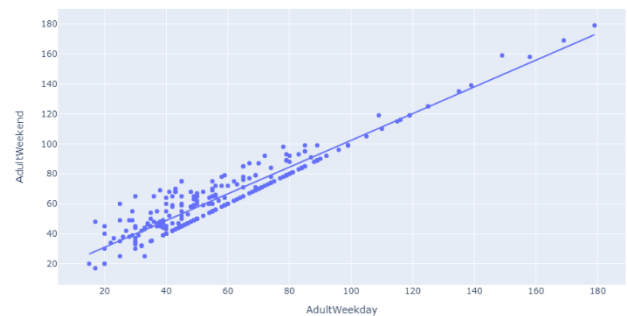


Figure 1 Scatter plot showing the relationship between the adult weekday and the adult weekend prices. This has an R squared value of 0.90(2 d.p).

Number of Resorts	Density of resorts by population	Total Ski-able area	Resort per 100 thousand square miles	Mean Ticket Prices
New York	Vermont	Colorado	New Hampshire	Utah
Michigan	Wyoming	Utah	Vermont	Colorado
Colorado	New Hampshire	California	Massachusetts	Vermont
California	Montana	Montana	Connecticut	Arizona
Pennsylvania	Idaho	Idaho	Rhode Island	California

In terms of the facilities at ski resorts, over 50% of the data was missing for the number of eight person lifts (fast Eights). This could mean that half of the recorded resorts don't have 8 person lifts, or it may be the data is not recorded, but it was decided this feature

will be dropped for the scope of this model.

The table above highlights the top 5 states for each category from an exploratory data analysis of states. This highlights how Montana, home to Big Mountain, has many resorts compared to the population, but not compared to its large skiable area. This could explain why Montana ranks very low in mean ticket prices. Further exploratory data analysis highlighted some key features that seem to be highly correlated to the ticket prices: number of fast four person lifts; number of runs/trails; area covered by snow makers (acres); ratio of total skiable area covered in lights for night skiing (in acres); total number of chairs; the length of the longest run (miles); vertical drop (miles).

To look at these features and their relationship with the ticket prices in more depth without overfitting our model, the data was split into a 70:30 ratio for training and testing the model respectively. For the training of the models, the initial challenge was determining the type of regression model that would be most suitable. Secondly, there were still missing values in the data set, even after the initial cleaning stages, so the median was used to fill in any missing data in the training set, and a linear regression model and a random forest model was created.

	Linear Regression Model	Random Forest Model
Features (Descending order in influencing ticket prices)	Vertical Drop (feet) Area Covered by Snow Makers (acres) Total Number of Chairs Number of fast 4 person chairs Number of Runs Longest Run (miles)	Number of fast 4 person chairs Number of Runs Area covered by Snow Makers (acres) Vertical Drop (feet) Total Skiable Terrain (acres) Total number of Chairs
Mean Cross Validation Scores (3 s.f)	0.632	0.698
Mean Standard Dev of Cross Validation Scores	0.095	0.071
Mean Absolute Error (Test set)	11.8	9.54
Standard Dev. in Mean Absolute error (Test Set)	1.62	1.35

As the cross-validation scores for the random forest model have a lower absolute error and a lower standard deviation than the linear regression, the random forest model was selected as optimal.

The four main features that supported increases in ticket prices are summarized below:

- Whilst Big Mountain Resort's ticket price of \$81 places it as one of the most expensive resorts in Montana, our model predicts this ticket price should be increased and be between \$85.48-\$106.26 with the current facilities at Big Mountain.
- Big Mountain ranks very highly in its size of vertical drop amongst its competitors, and investing in increasing the vertical drop will only really show an increase in revenue if the increase is of at least 100ft. This is predicted to support an increase in ticket prices of \$1.70, and therefore an increase in revenue of \$2.96 million.
- Whilst Big Mountain has the highest area covered by snow makers in Montana and ranks quite highly for this feature nationally, it would seem like a good idea to increase this area to further support ticket prices. However, as our data set didn't include operational costs of snow makers, it's important to note that only an increase of at least 30 acres is predicted to support an increase in ticket prices by \$1 (which should increase revenue by \$1.75 million)
- We were informed that the operational cost of the newly installed chair lift is \$1.54 million, but it would be useful to have the operational costs of the various other types of chair lifts as well. This is because our model predicts that increasing the number of four-person chair lifts by 1 will support an increase in ticket price of \$23.17, resulting in an increase in revenue of \$40.5 million. One increase in the total number of chairs lifts corresponds to \$0.29 increase in ticket prices whilst an increase of two is predicted to support an increase of \$1.28 resulting in \$2.2 million increase in revenue.

Although, it may now seem that investing in fast quads is the way to go, it's important to note this model wasn't trained with the operational costs of fast quads. Therefore, the conclusion that additional investment in fast quads might prove beneficial is supported using the current model, however further study is required to train our model with added operational costs. Whilst an increase in ticket prices will make Big Mountain the most expensive resort in Montana, this can be justified as its facilities rank highly in the USA but are not the highest in the state of Montana. Therefore, an important question to consider is whether its visitors are residents of Montana or if Big Mountain is competing with resorts nationally. A further study into the number of weekend and weekday visitors and a breakdown of the use of facilities during weekends and weekdays would also be useful if Big Mountain wishes to explore a different pricing model for the two types of tickets.