Decision Analysis Case Study Report

## 1. Risk Models (EOL & EMV):

   a. Opportunity Loss:

       i.   This model lowers the risk of losing an opportunity in the market.

       ii.   Adapting this model would have resulted in a series of decisions that does not match the actual actions taken over the period between 2013-2020.

   b. Based on the Monetary value:

       i.   Adapting this model would have resulted in a series of decisions that does not match the actual actions taken over the period between 2013-2020.

       ii.   The predicted payoffs were higher than the actual by, on average, **15%** of the actual payoffs.

       iii.   The actual payoffs over the years are plotted along with the payoffs that would have been achieved had the EMV prediction was opted for. The EMV payoffs are higher than the actual in all the years.

Payoffs Of EMV outcome actions vs actual actions taken
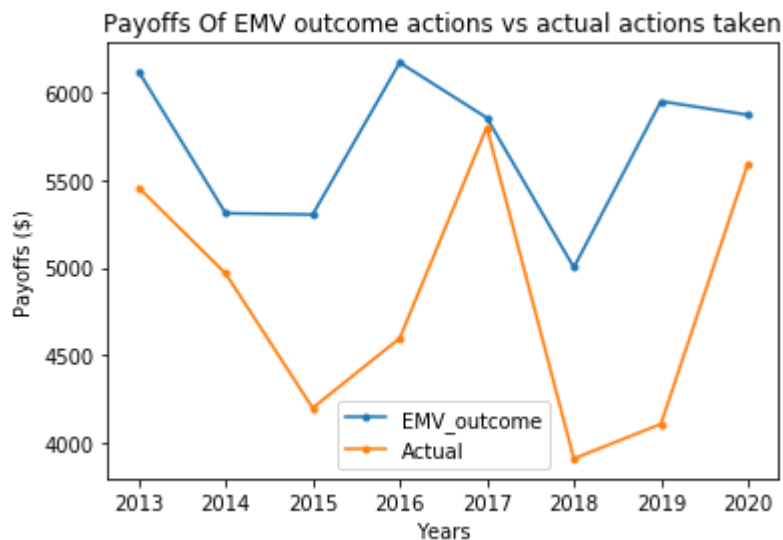
iv. The relative difference plot demonstrates this more with a positive difference (EMV outcome - Actual)/Actual over the whole years.
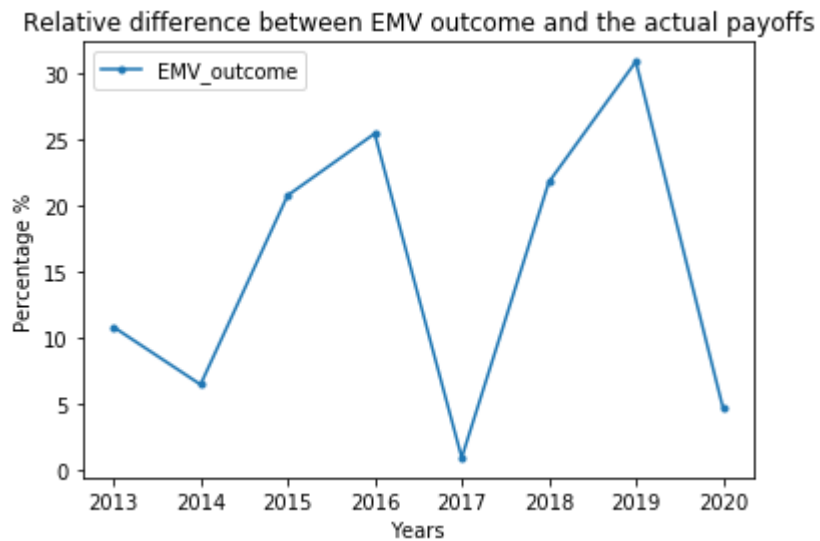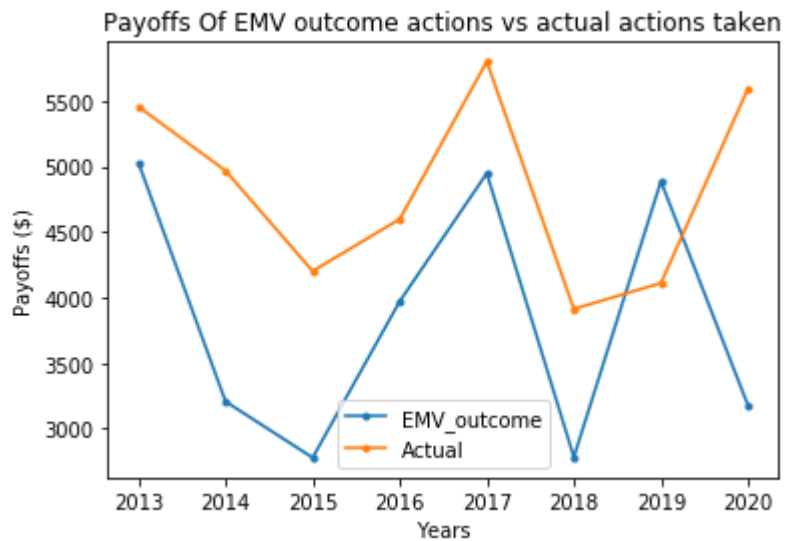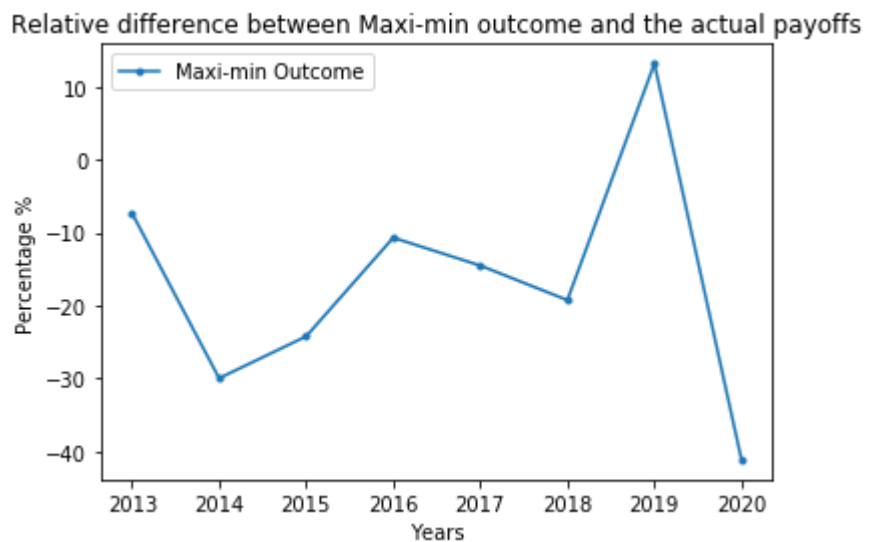
2. Pessimistic Manager Simulation:

a. Maxi-Min Outcomes:

i. This model chooses the best action given the worst case scenario.

ii. The model outcomes match the actual decisions in **3** years out of **8** (2015, 2017, and 2018), the actual decision was better than the predicted **4** times, and only **1** time the predicted would have yielded better results.

iii. The actual payoffs were higher than the predicted by, on average, **16%** of the actual payoffs.

The chart below compares the actual payoffs versus that of the Maxi-min model.

Payoffs Of EMV outcome actions vs actual actions taken

The relative difference is almost always below or equal to **0%:**

Relative difference between Maxi-min outcome and the actual payoffs

3. Optimistic Manager Simulation:

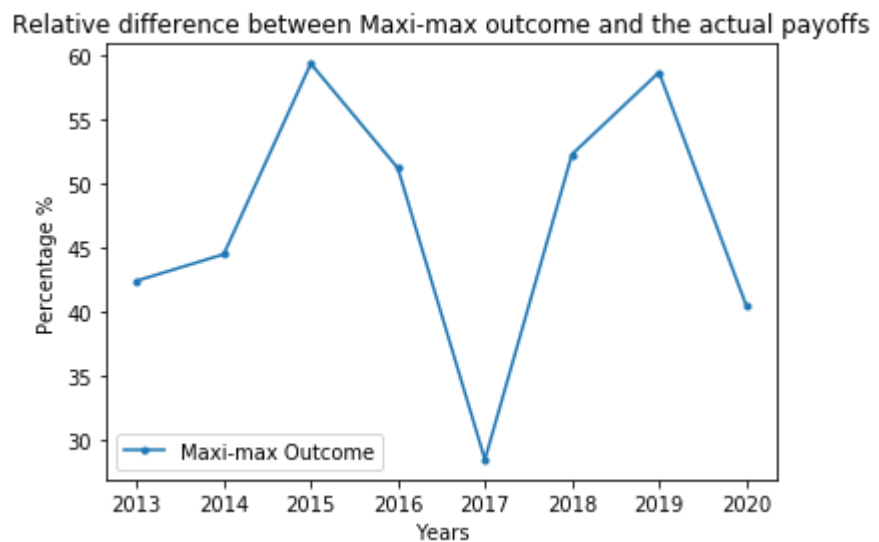## a. Maxi-Max Outcomes:

i. This model chooses the best action given the best case scenario.

ii. The model outcomes match the actual decisions in **50%** of the time, however, the predicted decision was better the whole other time.

iii. The actual payoffs were higher than the predicted by, on average, **47%** of the actual payoffs.

iv.   The chart below compares the actual payoffs versus that of the Maxi-max model.

Payoffs Of Maxi-max outcome actions vs actual actions taken
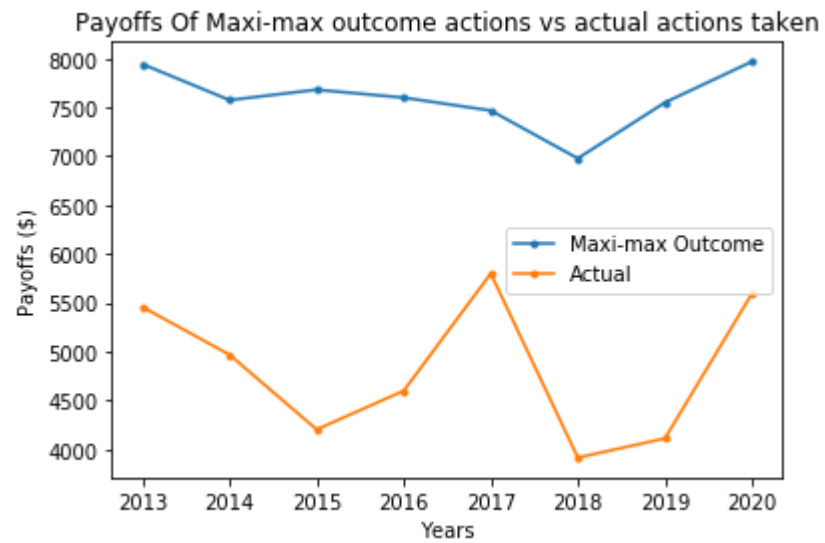
v.   The relative difference is always positive:

Relative difference between Maxi-max outcome and the actual payoffs

4. Distribution Of Actions:

   a. The chart below shows the distribution of actions and how many times they were chosen by the 4 techniques above.

The distribution of number of times strategies are chosen by opt. algorithms over years
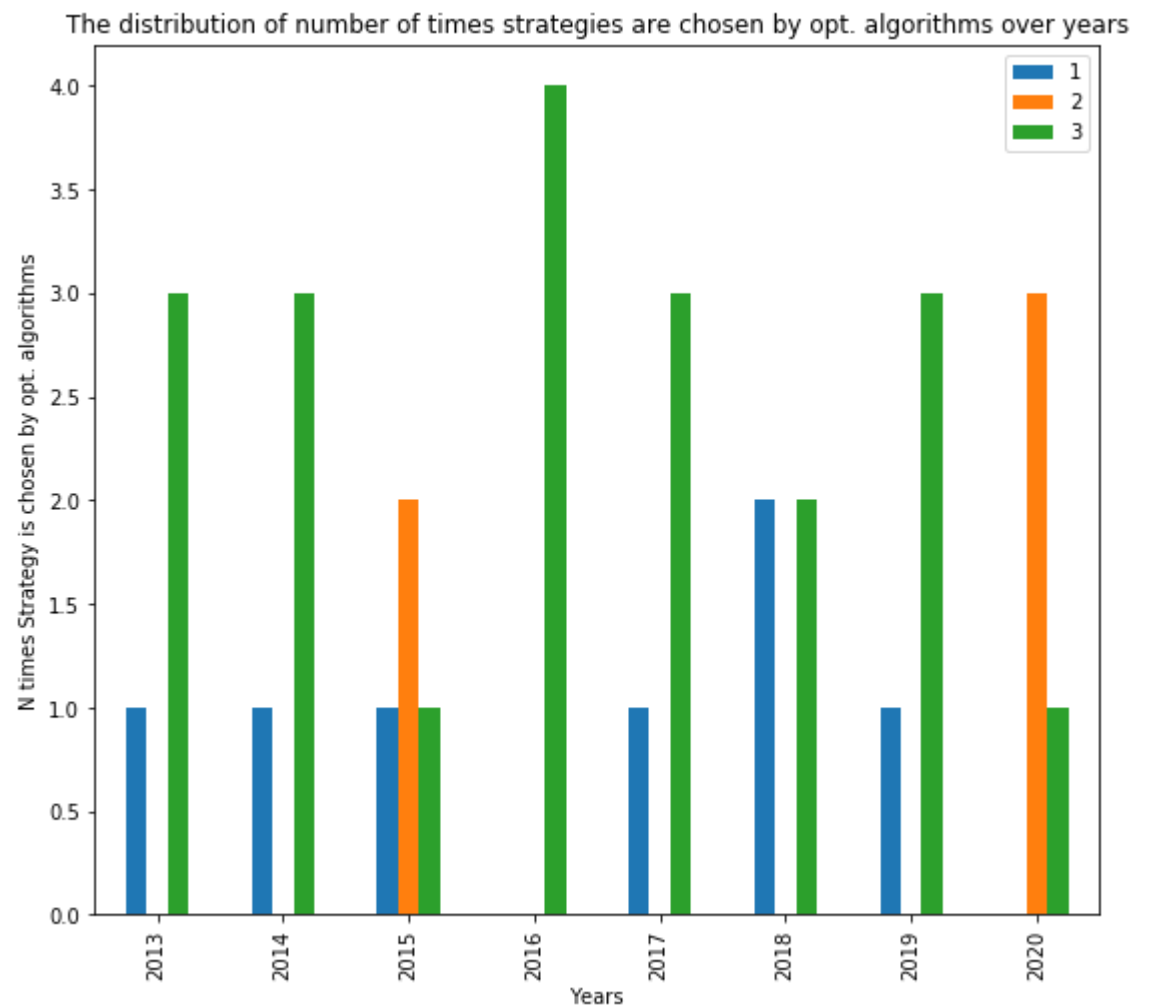
   b. It is clear that the action "3" was the best decision by the models' votes for **6** out of **8** years.

5. Sensitivity analysis:

    a. Working with the first two states of nature, each with probability of 0.5.

    b. It is clear that action 3 is inferior to both action 1 and action 2 for any probability value.

    c. As long as the probability of the state of nature "Level 1" is less than **63%** it is preferable to go with **"Action 2"** for **2021** payoffs data, however, **"Action 1"** is the best option in case the probability of "Level 1" event exceeds **63%.**

EMV payoffs for different actions with different probabilities of events