Bluberi Gaming Report

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1 INTRODUCTION

In order to effectively optimize the performance of Bluberi, a small-market gaming supplier,

we look to the data to bring relationships to light that we would not otherwise notice. For

the most part, there is no shortage of data to analyze. Finding data to reconcile the business

interests of the casino and the supplier, however, is where the difficulty lies. A supplier needs

to ensure that the games it provides are profitable enough for the casino to give it a spot on

their floor, but also engaging enough to make the players forget that they are losing money.

Many of the key insights that were found using Python, the matplotlib and seaborn package

for data visualization, the pandas package for data manipulation, the numpy package for

arrays and mathematical functions, the scipy package for statistical calculations, and the scikit-learn package for machine learning and clustering. In the rest of the doucment, there will be snippets of code and visualizations of data, all of which were created with Python.

2 CREEK CASINOS

By far the most interesting dataset to observe were the Poarch Creek casinos. Located in Alabama, the Creek Casinos—Atmore, Montgomery, and Wetumpka—are the largest dataset out of any of the properties in Bluberi's database. Given their size, they are also a key factor in the success of Bluberi. These casinos are the only casinos in Alabama, and none of its adjacent states have casinos. This ensures that the demographic of players at the Poarch Creeks are both diverse and unique. The games located at the Poarch Creek Casinos are what are known as Class 2 games—games whose usage statistics are sent straight to a server for Bluberi to access. This assures us of the accuracy, completeness, and relevancy of the data that we pull from these casinos.

To begin analyzing the data, the parameters of importance must first be identified. While there were many observations that play a role in the performance of a EGM (Electronic Gaming Machines, as they will be referred to in the rest of this report), the two that were considered of the highest importance were the average size of a bet (in dollars), and the number of games played. Average bet reflects the average amount that a player will wager on each play. This is an important metric for casinos, as the hold (the theoretical percentage of each bet that the casino takes as profit, determined through mathematical calculations of the long-run) multiplied by

the average bet gives the average profit that the casino makes off of each play. Games played is also important, as casinos have ultimate discretion as to what games they put out on the floor. Put simply, if a game is not being played, they will get rid of it. This statistic aligns the interests of the supplier (Bluberi) and the casino (Poarch Creeks) because the more plays a game has, the more money a customer loses to the casino, and the more secure the EGM is on the casino floor.
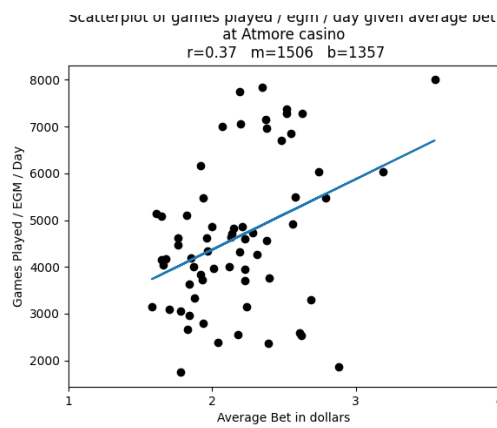

Figure 2.1: Atmore casino scatter plot

As shown by the regression lines in the three plots, there is a moderate positive correlation between average bet in dollars and games played. The *r* for Atmore (2.1), Montgomery (2.2), and Wetumpka (2.3) Wind Creek Casinos are .37, .47, and .58 respectively. This falls in line with expectations. Since these casinos are large and successful enough, we expect that the client base of these 3 properties will fall into the same fallacious thinking that plagues gamblers, and makes the casino industry profitable. They believe that they are invincible to the heavily
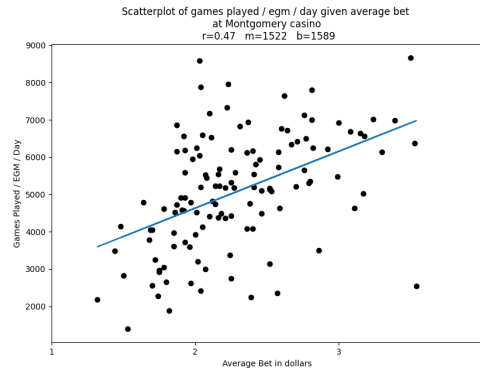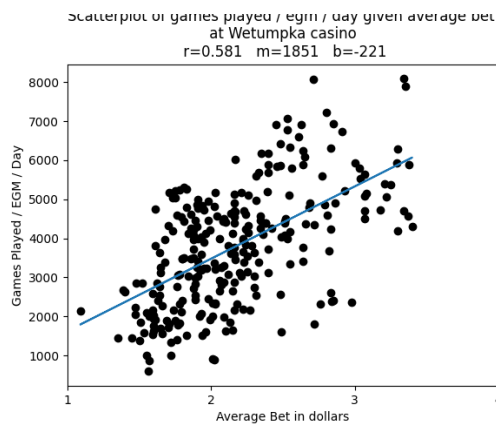
Figure 2.2: Montgomery casino scatter plot

Figure 2.3: Wetumpka casino scatter plot

stacked house edge, and the trend between average bet and games played is attributed to this.

For small bet amounts, the downside and upside are both small, which leads to a boring round

of play. However, as you increase the bets to something more substantial, the expected profit

and loss functions begin to diverge. Both losses and wins are more pronounced, but due to

house edge, the losses dominate, and players quickly fall into a hole. If players are losing more

money at a higher rate with larger bet sizes, then why do we see higher game engagement at

the higher bet levels? The answer lies in human behavior. Behavioral economics asserts that humans tend to be risk averse in the domain of gains, and risk seeking in losses. Practically speaking, due to risk aversion, people would tend to favor a guaranteed win of $ 40 as opposed to a 50% chance of winning $100, even though the expected value for the gamble is greater than $40. The opposite is true when it comes to losses. If given the option of a sure loss of $50 or a 60% chance of losing $100, people tend to favor the gamble, even though the expected loss is greater. This idea is the driver of the correlation between average bet and number of games played: once people are in the red, they are willing to take a sub-optimal gamble to try and make it back. These graphs represent a way for Bluberi to increase game engagement, which, in the eyes of the casino, is indicative of a successful game.

3 SMALLER CASINOS

The next question to ask is if this trend is also observed at other casinos. Given that our justification for the positive correlation between bet size and game play at the Wind Creek casinos was dependent upon the psychology behind gambling, wouldn't it be safe to assume that the same trends could be observed at other casinos?

To answer the above question, we look to the Native Star and Iron Horse casinos; two casinos that are on the opposite side of the spectrum as the Wind Creeks. These two casinos are located in Winnebago and Emerson, Nebraska respectively. While subjective measures of quality and visual appeal highlight incongruities between these casinos and the Wind Creeks, there is an objective difference between the two: population. Both of these Nebraska casinos
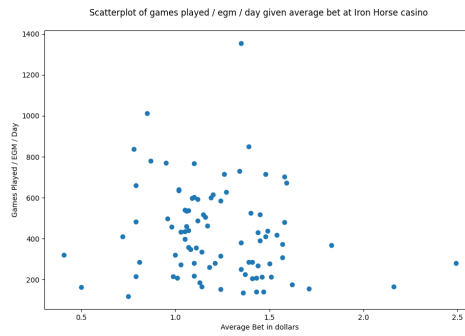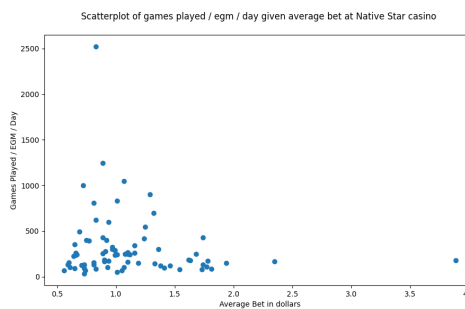
Figure 3.1: Iron Horse casino scatter plot

Figure 3.2: Native Star casino scatter plot

have populations of less than 1,000, putting them at $\frac{1}{10}$ of the population of Atmore (the least populous Wind Creek casino), and $\frac{1}{2000}$ of that of Montgomery (the most populous). The graphs of the two casinos also highlight stark differences in the relationship between average bet and games played. As seen in the scatter plot for Native Star (3.2), the number of games played appears to *decrease* with increases in average bet. This relationship looks nearly exponential, however, a single outlier is what gives the plot such shape, so no quadratic or linear regression was created for this graph.

As for Iron Horse Casino (3.1), the data appears to have no correlation between the two parameters. However, the scatter plot is bimodal, with the two modes at \$0.80 and \$1.50. This indicates that there is a "sweet spot" around \$0.80 and \$1.50 where games played is maximized as you approach those average bet values.

Both of these casinos show marked differences in how average bet affects the games played at a small casino vs. a large one. A lot of the gambling psychology that drove game play at Wind Creek is not relevant in these small-town casinos. Because the population is so small, most of the players will be recurrent customers. Such customers do not have the naivety of typical gamblers. They likely have a sufficient enough sample size to personally experience the loss associated with the house edge. As such, they are cautious with their bet size, not wanting to "spend it all in one place". Another likely explanation for the smaller bet size is the lack of production value in the smaller casinos. Typically, larger casinos will concern themselves more with the overall experience of the casino—bright flashing lights, cocktail waitresses bringing complimentary drinks, etc. Gamblers who sense this air of luxury may feel more inclined to gamble with higher stakes, as a way to fit in with this high-end ambiance. A lack of such amenities provides no incentive to bet more.

4 ACTIONABLE STEPS

While it is nice to know that there is a positive/negative correlation between game play and average bet, if average bet is a strictly exogenous factor, then this data is essentially worthless. Therefore, to have a chance of finding areas of improvement for Bluberi's business strategy, we

need to find a lever to change the average bet. Our hypothesis was that the default minimum

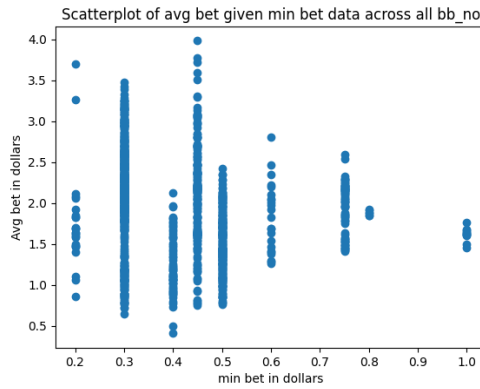bet would be something that impacts the average bet size.
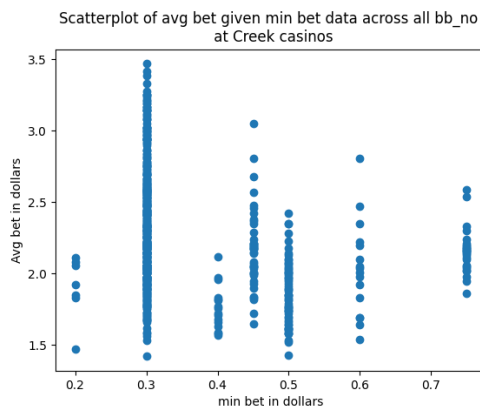

Figure 4.1: All casinos

Figure 4.2: Wind Creek Casinos

We plot the minimum bet size against the average bet size of each EGM for all casinos (4.1)

and specifically for the Wind Creek Casinos (4.2). Because the bet sizes are not continuous,

you see discrete collections of data points for each acceptable bet denomination. The first thing that is immediately clear is that, regardless of casino, EGMs with a minimum bet of $0.30 and $0.45 see a much larger range of average bets, and they also see the highest average bets compared to EGMs with other minimum bets. Across all casinos, EGMs with minimum bets of $0.40, $0.50, and $0.75 appear to have the most concentrated average bet sizes.

While instinct might lead you to believe that every EGM should employ a minimum bet of $0.30 and $0.45 because it leads to the highest average bet and therefore higher theoretical returns, it is not that simple. As observed in figures 3.1 and 3.2, higher average bets can have an adverse affect on game engagement, which is the metric that Bluberi is more concerned about. We recommend that the company tailor the minimum bets depending on how the casino's players react to changes in average bet, using the average bet vs. games played scatter plots in conjunction with the minimum bet vs. average bet plot to backsolve for the optimal minimum bet for the EGMs at each casino.

5 COMPETITION ANALYSIS

On the company side, Bluberi also faces competition from other game suppliers. One point of emphasis for the gaming industry as a whole is the Eilers report, put together by the research and consulting firm Eilers and Krejick Gaming. The annual report aggregates the performance of suppliers and their games, and releases it for casinos and other suppliers to access. The report is of great significance—casinos will occasionally use the Eilers report as a filter on

whose games they allow on their floor. This can often create a Catch-22, as the report considers any company with less than .5% of the floor share in a separate, "other" category. Legacy suppliers who already have a large floor share appear on the Eilers report, and the companies that appear on the Eilers report have a better chance at getting their units onto the casino floor. A big strategic focal point for the Bluberi executives is to command their own supplier report in Eilers.

In order to find entry points to a greater floor share, we first need to find insight into what separates the top performers from the rest of the individually reported companies. In order to gain floor share without already having a spot in the Eilers report, Bluberi will need to convince the casinos that their machines perform just as well as the legacy players that appear on Eilers. One of the most important measurements of supplier success is Eilers "Fair Share", a comparison of a game's theoretical win percentage (theo) within its zone, and the percentage of total games the supplier has on the floor. Theo is a measure of how much a casino expects throughout a length of play. Across game paces and length of plays, the theo can be expressed as:

$$Theo = AmountBet \times HouseEdge$$

Since metrics like theo are not reported to external sources like Eilers, we do not have any way to directly measure how the top companies are achieving their results. However, we can use two metrics that are actively reported by Eilers: coin in vs. zone and net win vs. zone. As the name suggests coin in vs. zone is a measure of how much money is put into the machine as compared to the rest of the machines in their zone. Net win measures the amount of profit the

casino generates from a game compared to the other games in the same zone. While this does not directly measure theo, it does measure the things that a supplier can change about their game to improve their theo. If the supplier made the game more engaging and addictive, that would raise the theo by increasing the total amount of money wagered on the game, and a proportional increase in coin in would be measured. Likewise, if the company changed some of the math models to change the house edge, that would also improve the theo of the game, but such a change would only be observed on the Eilers report as an increased in net win. Hypothetically, given a large enough sample size, the law of large numbers asserts that:

$$NetWin = TotalCoinIn \times Theo$$

Therefore, comparing the coin in and net win of the highest performing games to specific suppliers should be an adequate measurement of whether or not these companies are doing anything revolutionary.
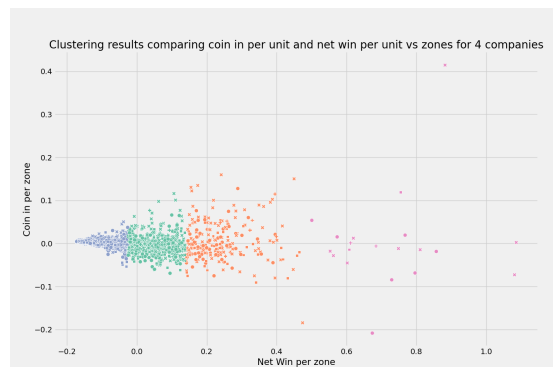

Figure 5.1: K means cluster based on Eilers data

To begin, a k-means clustering algorithm was written to determine if any of the game performance between suppliers had to do with company specific alterations to typical game performance. The algorithm was written to consider the top four performers in Fair Share as labels: Konami, Igt, Everi Holdings, and Scientific Games.

K-Means is a clustering algorithm that creates its clusters starting with k centroids, where a centroid is the central data point of a cluster. By definition, each cluster will have a centroid, so you will have k clusters and k centroids. The algorithm optimizes the clusters by iterating through two steps:

1. Assign each data point to a cluster based on its nearest centroid

2. Reassign centroids based on which data point is at the center of the new cluster

When an iteration of k-means is completed without any cluster reassignments, that indicates the optimal solution has been found.

Based on the silhouette score of .51, it can be determined that the clusters are reasonably separate from each other. However, the ARI (Adjusted Rand Index) is essentially 0, which means that when the created clusters of predicted suppliers are compared to the true supplier, the clustering was done at random with little relation to the true labels. This is both good and bad news. Unfortunately, there is no performance advantage that the top four companies use that Bluberi can also implement. By the same token, since the performance of games is

essentially random, it means that any quantifiable driver of success that Bluberi can employ would be a monumental improvement from the industry standard of seeing what sticks.

6 CONCLUSION

We believe that there is a great opportunity for Bluberi to optimize the performance of their machines, and some of the methods above are a place to start. This analysis of the data would put them in a great position over legacy players who are able to succeed with sub-optimal performance simply because of name recognition. It is our hope that through quantitatively superior strategy, Bluberi can disrupt the industry.