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MARKETING AND REVENUE ANALYTICS: MLB

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GitHub: https://github.com/mistmr7/MSDS457_MLB-Attendance

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1. Article Reviews

According to the *Associated Press*, MLB attendance fell during the 2018 season to its lowest rate since 2003. Major League Baseball attributes much of the issue to a historically bad Spring weather-wise, though many within the league have concerns. Attendance was down 9.4 percent across the league in April and included 54 postponements, with 35 games played in conditions under 40 degrees. A 2017 labor contract has been mentioned as one potential reason, as the new agreement limited spending on international amateurs, encouraging rebuilds due to having more cost-controlled players. The article notes that attendance peaked for many organizations competing, but rebuilding teams were among the prominent group that showed record low attendance figures. Not every team fit that trend, however, as Cleveland won their third straight AL Central title despite having plummeting attendance. Baltimore manager Buck Showalter blames the sport of baseball, saying people had too many different avenues to spend their money on entertainment and baseball wasn't meeting those standards currently. People change their habits with entertainment and weather, and baseball has to find a way to connect to their audience (Associated Press 2018).

Sporting News recently reported on a survey of almost 1600 adults, showing that 44 percent of respondents who claimed to be avid fans would be less interested in the 2022 season when it began. This survey was in response to the MLB lockout, which was threatening to push into Spring Training and the regular season. Even more troubling was that 54 percent of respondents said they did not have any interest in the MLB either way. For a sport that was already fighting declining attendance number, apathy in fans was a terrifying possibility. Attendance had hit a 37 year low in 2021, falling for the fifth straight non-pandemic season.

Couple this attendance drop with the average age of MLB fans climbing and baseball was headed for a financial disaster. Much like the Field of Dreams, the MLB has been playing under a "if we build it, they will come," ideology that seemingly is not matching public attitude. This can be seen in their positively celebrated Field of Dreams game played in 2021. Public sentiment seems to be changing, and while the Field of Dreams ideology worked in the past, the longer the lockout lasts the less likely that will be the case in the future (Foster 2022).

The New York Times reported in 2019 that MLB teams were trying new avenues to try to encourage young fans back into stadiums. The New York Mets started the Amazin' Mets ballpark pass, a $40 per month pass that allows entrance to all home games for standing room only. With total attendance down about 1 million fans for the 2019 season across the league and 14 percent lower than the 2007 peak, Major League clubs are scrambling to reverse this trend. Long games, an aging fan base, and poor parody across the league paint a picture of a dying sport, yet league revenues are at an all-time high and up 70 percent in the last decade. Ticket sales are no longer the golden standard for organizational success, and media rights has taken the throne. Eighteen MLB teams now have some type of subscription pass to games, and the early returns are promising for bringing young fans back to the stadium. Team executives note that it isn't a profitable strategy ticket-wise, but fan engagement continues to be an important measuring stick for current and future organizational success. The Oakland A's are a team who have seen success in using the subscription pass, selling nearly 10000 additional passes this year along with improving stadium experience with new bars and clubs within the stadium. With the addition of cheaper passes comes the removal of expensive suites, as teams are finding it difficult to sell the luxury boxes for 81 games a year. While teams are likely to remain profitable in the near term due to the media licenses, they know without the fan engagement that those media

rights will dry up as well, so Major League Baseball continues to search for ways to get fans interested in the sport again (Allentuck and Draper 2019).

2. Relevant Factors to Ticket Sales

In setting up the analysis of what factors were relevant to ticket sales, all home games were pulled from the 2018 New York Mets, the 2019 New York Mets, the 2019 New York Yankees and the 2018 Minnesota Twins. I wanted to get a picture of two different seasons for one ball club (Mets), both New York teams in a single season (Mets and Yankees 2019) and a team that was in the bottom half of the league for attendance (2018 Twins). Team schedules for each of the seasons were scraped from Baseball Reference, eliminating any away games. These schedules were converted to an excel file and columns were added for Promotion and Amount to map promotions and giveaways to the team schedule. Promotional Schedules for each of the teams were found via Google and the promotions were added to the excel file with a 0 for no promotion and a 1 for promotion (MetsPolice 2018; MLB 2018; MLB 2019; Warne 2018).

Each of these excel files was loaded back into a DataFrame via Python and Pandas, and Seaborn and Matplotlib were used to make plots to evaluate each of the DataFrames. The first analysis, shown in Figure 1, was to see if attendance was relatively stable over the length of the season. Each team had their average attendance for the month calculated, and the data was visualized using a bar chart. As can be seen from the figure, the Mets in 2018 had a slight drop in attendance in July that evened out to end the season. A cursory glance at the DataFrame suggests that this was due to dropping 10 games back in the standings in a single month. Besides this one-month dip, most of the teams saw a decently steady attendance across the season.

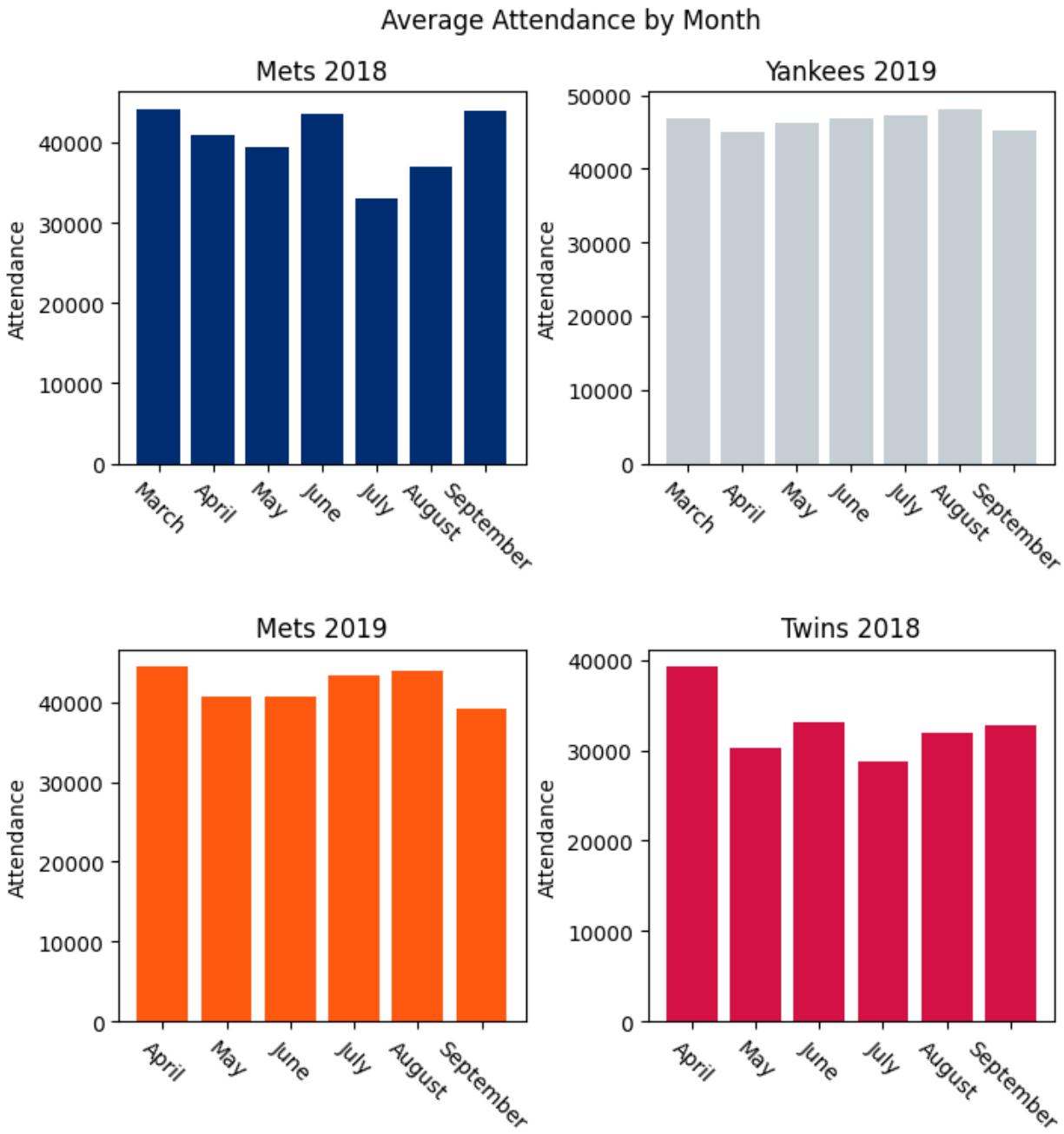

Figure 1: Bar chart of attendance by month for each of the four seasons of analysis.

The next analysis was to see if promotions had an effect on attendance for each of the four seasons. As can be boxplots of attendance versus promotion in Figure 2, it does seem like promotions have a positive effect on attendance, especially for the Mets. This was further analyzed by calculating Pearsons's coefficient and doing a statistical T-test, and the results of

those can be seen in Table 1. As can be seen from the table, with p values less than 0.05 for each of the Mets measurements and slightly above 0.05 for the Twins and Yankees, promotions do appear to have a statistically significant effect on attendance at least for the Mets.

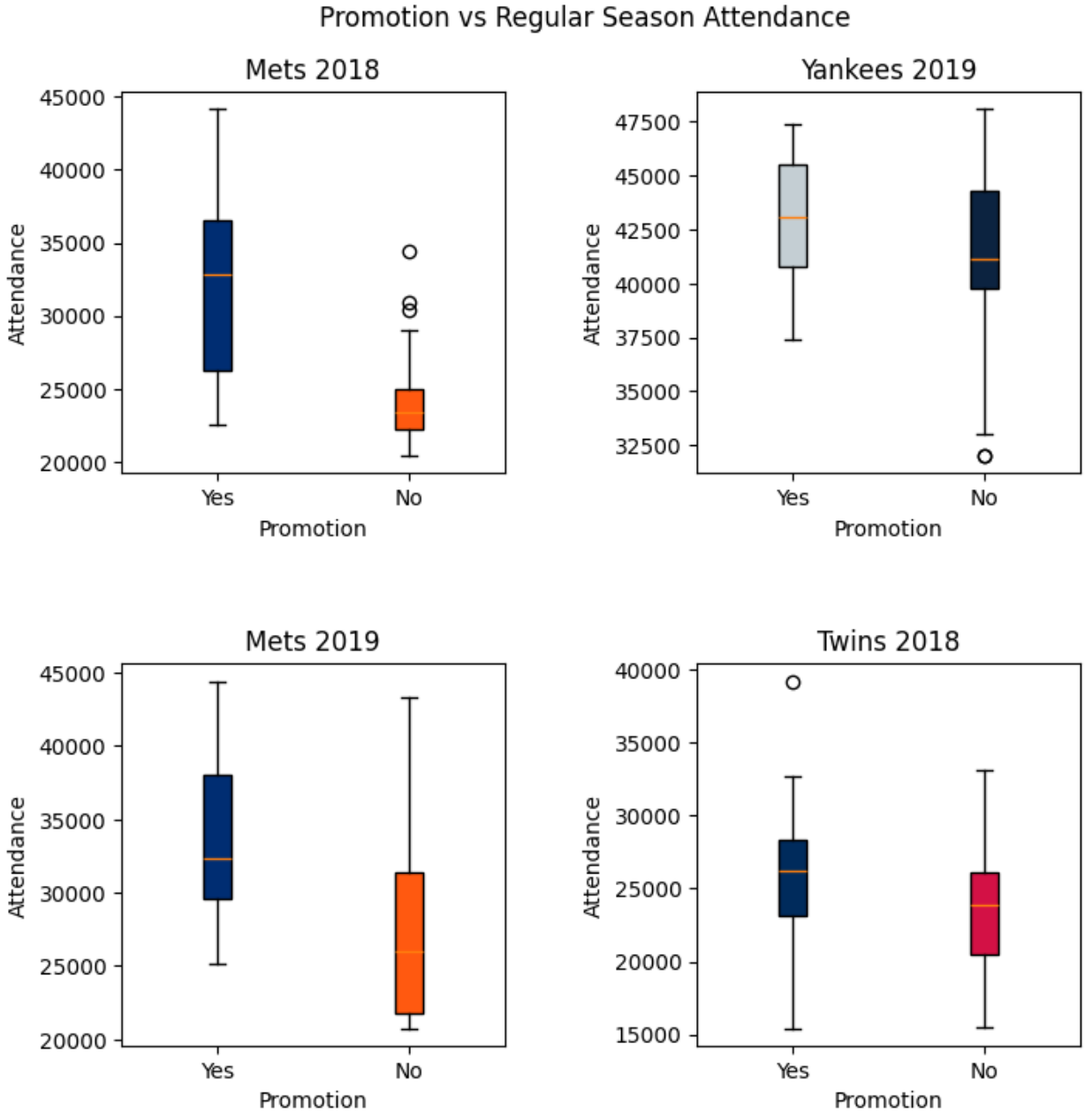

Figure 2: Attendance versus Promotion boxplots for each of the four seasons in the analysis

Team	Year	Correlation	T-statistic	p-value
Mets	2018	0.616796	6.964854	8.722718e-10
Mets	2019	0.480520	4.870048	5.623782e-06
Yankees	2019	0.205669	1.867959	6.547581e-02
Twins	2018	0.197583	1.791476	7.704658e-02

Table 1: Correlation statistics from Promotions versus attendance for the four seasons in the analysis

Digging into the analysis a little more, a bar chart was created in Figure 3 showing how many promotions each team ran on each day of the week. As can be seen in the visual, the Mets overwhelmingly run their promotions on the weekends, with a total of three promotions running on weekdays during the two years of analysis. The Yankees and Twins also ran more promotions on the weekends than weekdays, but the Yankees had 7 promotions on weekdays compared to 16 on weekends in their single season of analysis and the Twins had 12 on weekdays and 23 on weekends. So, were promotions really bringing more people to the ballpark or were more people coming to the weekend games?

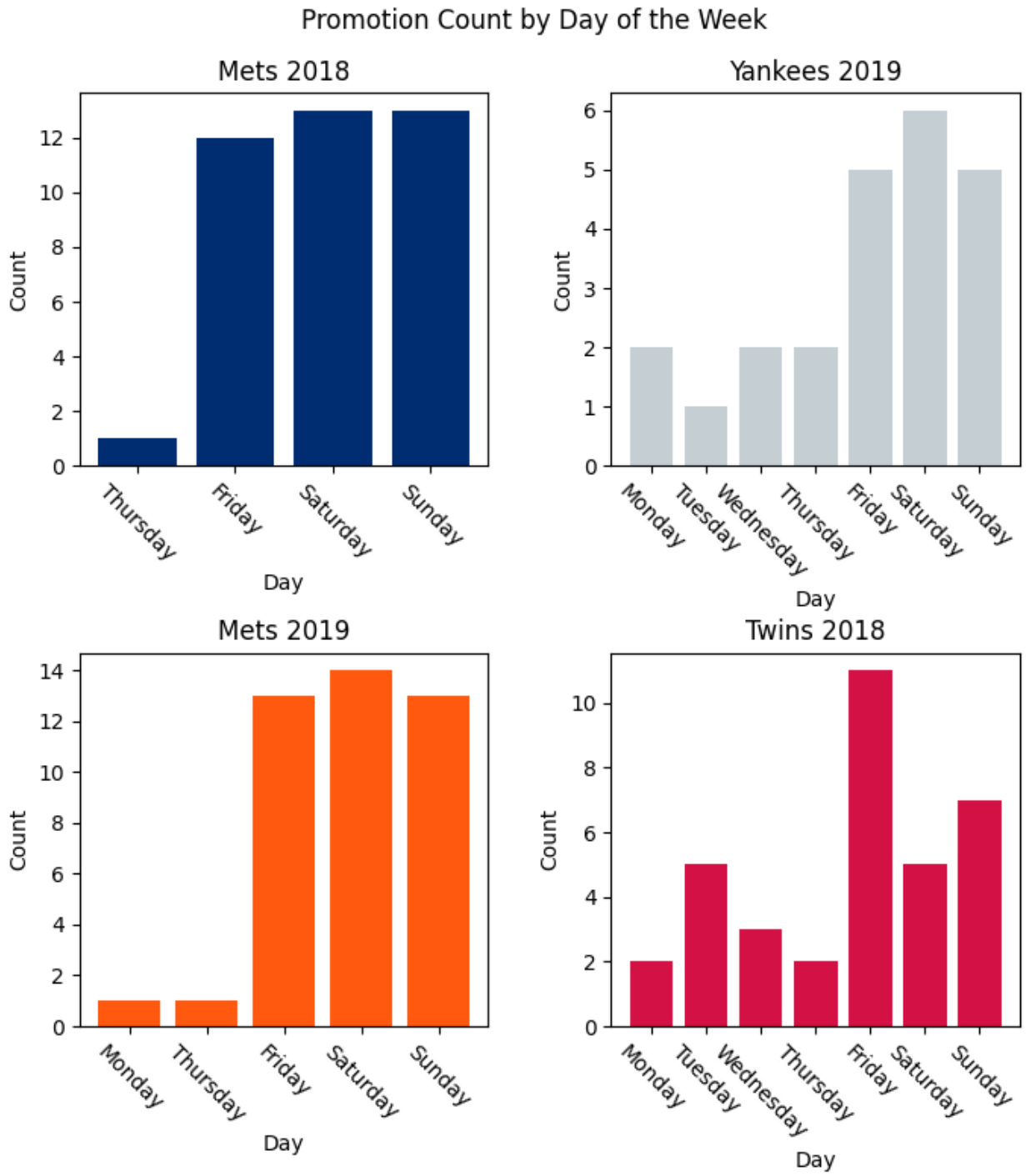

Figure 4: Number of promotions run on each day of the week for the four seasons of analysis

In analyzing whether attendance was boosted by promotions or if it really was just due to the day of the week a boxplot was created to show attendance by day of the week with and without a promotion available to fans, as can be seen in Figure 3. The Mets ran a promotion for

every weekend game for both seasons, so their results should be analyzed with that in mind. A Pearsons's coefficient and t-test were run for each day of the week for each season, and the results of the analysis can be seen in Table 2. From the table, we can see that the only statistically significant day for the Yankees and Twins were Mondays for Twins and Fridays for Yankees. Each of these days for the Yankees and Twins was further analyzed to see if a promotion had a statistically significant effect on attendance for each day of the week. The results of that can be seen in Table 3. None of the results are statistically significant, though this could be due to a low number of data points without promotions on the weekends and with promotions on the weekday games. Due to this, no conclusions should be drawn about day of the week and promotion, though visual data shows that promotions hold promise.

Day	Yankees Correlation	Yankees p-value	Twins Correlation	Twins p-value
0	-0.573587	0.137131	0.025400	0.934355
1	0.139705	0.648962	0.281519	0.375380
2	-0.207116	0.518351	0.444628	0.269682
3	0.534691	0.111300	0.244490	0.443771
4	0.433030	0.139392	-0.118959	0.685443
5	0.263363	0.384635	-0.266014	0.379689
6	0.087823	0.786080	0.278221	0.468513

Table 3: Correlation and statistical values for day of the week and promotion on attendance for the Twins and Yankees

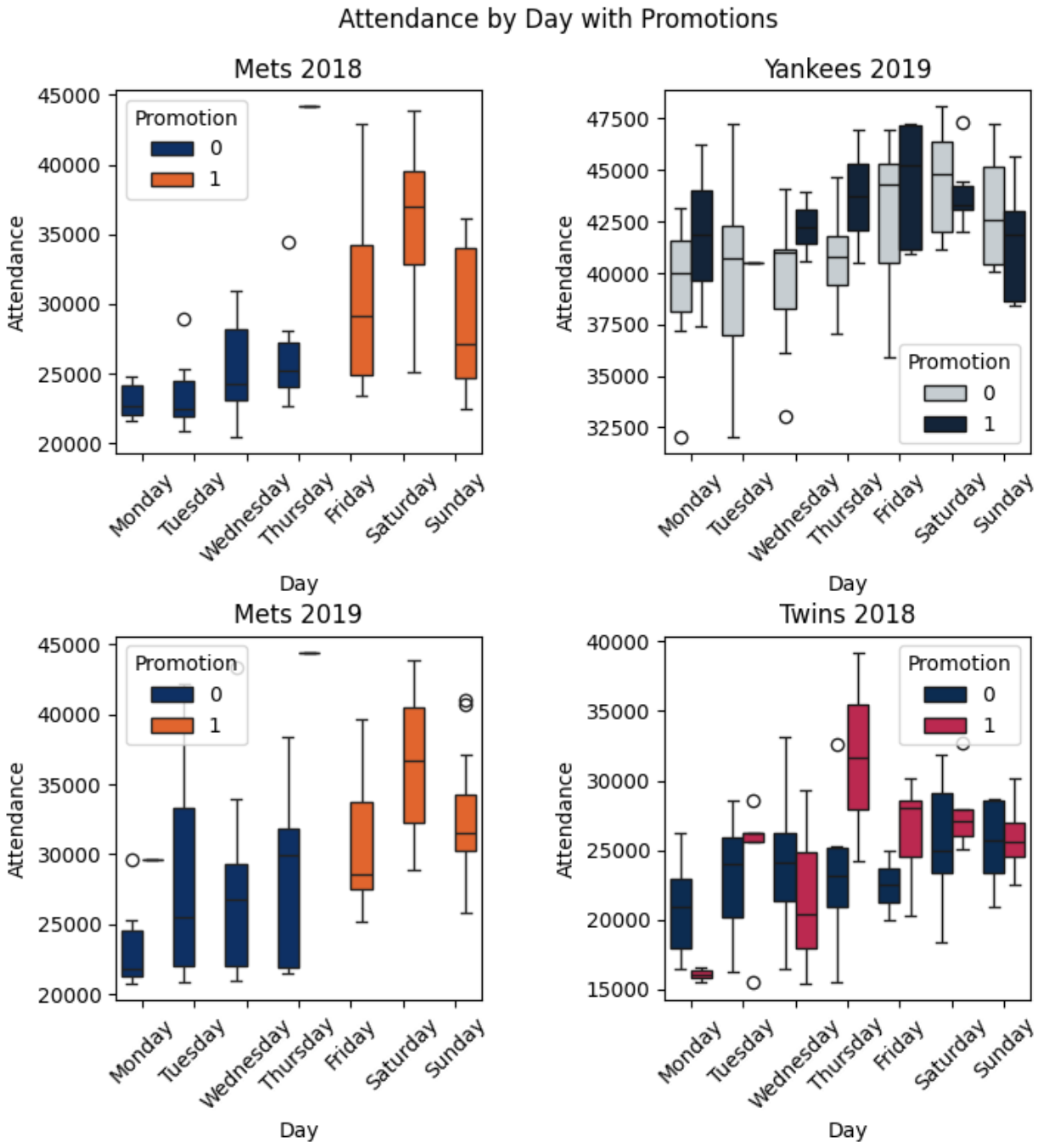

Figure 5: Attendance by day of the week with and without promotions for each of the analyses.

Team	Year	Correlation	Monday p value	Tuesday p value	Wednesday p value	Thursday p value	Friday p value	Saturday p value	Sunday p value
Mets	2018	0.549544	0.016451	0.002268	0.059361	0.936418	0.193016	0.000000	0.582002
Mets	2019	0.616796	0.099914	0.072775	0.912692	0.855220	0.000288	0.149881	0.007621
Yankees	2019	0.480520	0.069923	0.111741	0.792151	0.109961	0.006149	0.481741	0.085584
Twins	2018	0.205669	0.001593	0.488041	0.407532	0.796617	0.238485	0.093627	0.344262

Table 2: Statistical tests for attendance by day of the week for each of the four seasons of analysis, highlighting statistically significant days.

3. Dynamic Ticket Pricing Policy

Dynamic ticket pricing has become necessary to maximize revenue based on supply and demand. Sports were late to adopt dynamic pricing, as the San Francisco Giants were the first adopters of the pricing policy in 2009 (Rayer, Shapiro, and Lee 2012). Dynamic pricing helps organizations recoup value that has been taken by ticket resellers who had captured this lost revenue. Historically, static pricing was used to sell tickets at face value depending on the location of the seats. By utilizing dynamic pricing, teams can raise and lower prices to better reflect the demand for the product. Hypothetically speaking, if 40000 fans show up for a game at an average price of $50 a seat for a late-September pennant race, why would a team choose to keep the average price of $30? At the other end of the spectrum, if a middle of the week July game for a middling team brings 10000 fans to the park at an average ticket price of $50 but 20000 fans when you drop the ticket price to $25, shouldn't a team capitalize on the value of parking, merchandise, season tickets, concessions, etc. that come with getting more fans into the park?

Dynamic pricing is clearly a policy that can be used to increase revenue for sports teams, but implementing such a policy takes careful consideration and lots of data. Many different factors should be considered, both from a data analytics perspective and from a fan perception

perspective. According to a study in *The COSMA Journal* on dynamic pricing and fan perspectives, pricing transparency correlated highly with trust and satisfaction for the purchaser (Greer and Zoroya 2025). The study also found a positive correlation with promotions and pricing fairness as well as attendance with promotions.

A journal article published in *Managerial Finance* from interviews of 72 managers and executives from all four major North American professional sports found that most of the executives believed they were applying business analytics to dynamic pricing (Bouchet, Troilo, and Walkup 2016). However, only half of the organizations automate decision-making processes and thus do not automatically adjust prices for demand. The perception of dynamic pricing existed for most of these organizations, but in practice many of them were at best under-employing the technique.

4. Recommendations, Limitations, and Future Directions

Based on the data from section 2, what is the best way to implement dynamic pricing? Being transparent in pricing is important in building trust, so noting why some prices are higher than others should be a top priority. Reasons can be weekend games, promotions, important games for teams' postseason chances, special events, rivalry games, etc. The reason must be stated so the buyer understands why the price is higher and can justify spending more money. For each team, I would recommend flattening promotions across the day of the week to obtain better data for long-term pricing. Promotions by day was not well understood in the statistical testing, and that was due to not having enough data to work with. Creating a baseline to move forward is pertinent. After establishing a baseline, teams should look at historical data by day of the week and try to adjust pricing to better reflect the attendance numbers. For the Mets and Twins, these days showed a higher number of fans attending on weekends, so figuring out a

pricing strategy to get more weekday fans will help create stronger income streams from concessions, merchandise, parking, etc. Coupled with this recommendation is the creation of a subscription service for teams that do not consistently fill their stadiums. The additional revenue streams of increased attendance make up for the lost money on cheaper tickets for a segment of the fanbase that likely would not attend otherwise.

This study is limited to analyzing four teams across two years within Major League Baseball. Each team faces different challenges based on geography, weather, median income, population, team success, etc. Each team needs to do an in-depth study of their own data in order to most effectively implement dynamic pricing, and only the Mets were analyzed over two seasons. Gathering more data on promotional opportunities across each day of the week will help solidify the statistical relevance to promotion by day, and each team should take the opportunity to study this. Other factors need to be studied, from those in the previous sentence to games back in the standings, opponent, pitcher, win streak, and normalizing for other city activities such as concerts, festivals, and other attractions that could pull from the team's attendance. Gathering as much data as possible and normalizing promotions until promotion by day of the week is better understood will lead to implementing a data-driven policy.

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