NCAA Football Team Performance and Revenue

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1. Introduction

College football serves as a significant revenue driver for colleges across the United States. Schools generate income from football through ticket sales, television contracts, sponsorships, and various other sources. But does a team's on-field performance directly influence its athletic department's revenue? For instance, is there a correlation between a college football team's win-loss record and the total athletic revenue generated by its university? Could factors like average attendance at home games play a role in driving revenue? Additionally, do teams that qualify for bowl games consistently bring in more revenue than those that don't?

This project will try to analyze these questions and uncover patterns in the relationship between college football performance and athletic department revenue. Using data on win-loss records, attendance, and bowl game participation, we aim to explore whether success on the field translates to financial success off the field.

2. Data

This project uses two primary sources of data: College Football Data API[1] about team stats and Knight-Newhouse College Athletics Database[2] data about team total revenues and expenses

2.1 Team Stats

We collected data from College Football Data API, which contains about any stat you could think of for college football teams.

We used the API to scrape for the data we wanted to use. We wrote a web scrapping script to collect *team*, *year*, *wins*, *losses*, *conference*, and *bowl_game* from 2005-2023. We created a data frame that is contained in the *college_football_data_raw.csv* file in the project folder. The scrapping script is found in the notebooks folder.

We eventually cleaned the data to only have public division 1 schools that we had revenue information about. There are a total of 113 unique teams in our data. This cleaning can be found in *cfb_data_clean.csv*.

2.2 Team Revenue

The website Knight-Newhouse provided the revenue and the expense data for all the public division 1 teams that we needed. We were able to download a csv file from the website with the information we needed. This can be found in the *Revenues_Expenses_Data.csv*. The csv contained *team*, *year*, *total_revenue*, and *total_expense* for the necessary teams.

[1] https://collegefootballdata.com/exporter
[2] https://knightnewhousedata.org/fbs

2.3 Combining Team Stats and Revenue

Since both datasets included the team name and the season year, we merged them using these two fields as keys. We performed an outer join to horizontally combine the data frames, and the resulting dataset is saved as cbf_join_raw.csv.

The raw CSV file contained 6,194 rows and 9 columns. However, many rows had NaN values in the total_revenue and total_expense columns due to missing financial records for some college football teams. After cleaning the data to include only teams with complete financial records, the dataset was reduced to 2,147 rows and 9 columns. A description of each variable is contained in Table 1.

Table 1 Data Dictionary

Column	Type	Source	Description
team	Text	both	Name of the college football team
year	Numeric	both	Year of the football season
wins	Numeric	CFB Data API	Total number of games won in the season
losses	Numeric	CFB Data API	Total number of games lost in the season
conference	Text	CFB Data API	Conference to which the team belongs
average_attendance	Numeric	CFB Data API	Average attendance at home games
bowl_game	Text	CFB Data API	Name of bowl game if the team played in one
total_revenue	Numeric	Knight-Newhouse	Football program revenue for the season
total_expenses	Numeric	Knight-Newhouse	Football program expenses for the season

3. Analysis

3.1 Win-Loss Ratio and Revenue

We wanted to investigate whether a college football team's on-field performance influences the total revenue generated. To explore this, we calculated the correlation coefficient between a team's win-loss ratio and its total revenue. The correlation coefficient was 0.2698, showing a weak positive correlation. This means that as a team's win-loss ratio improves, there is a slight increase in revenue. However, the relationship is not very strong.

To determine the significance of this relationship, we analyzed the p-value, which was 3.92e-35. This extremely small p-value shows that the correlation is statistically significant, far below the commonly used threshold of 0.05. This shows a weak, but real, positive relationship between win-loss ratio and total revenue.

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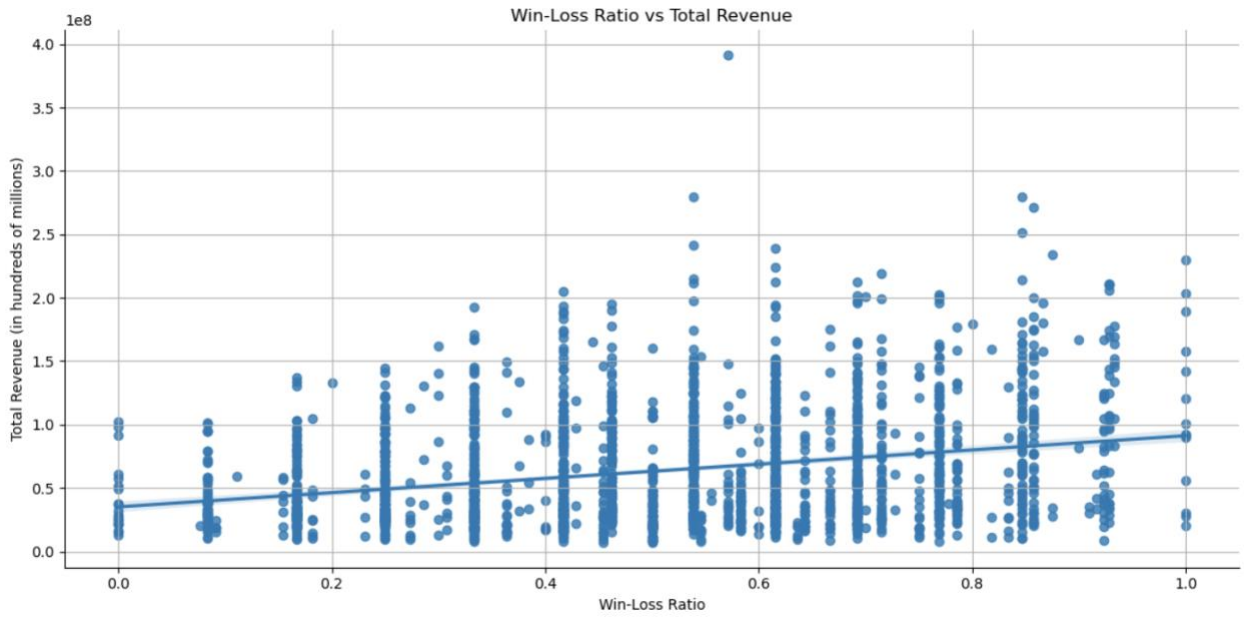

Figure 1 Scatterplot of Win-Loss ratio and Total Revenue

While this correlation is weak, it suggests that a team's performance has some influence on revenue. However, other factors like attendance, conference affiliation, and bowl game participation may also play significant roles.

3.2 Average Attendance and Revenue

We sought to understand whether higher average attendance correlates with increased revenue across various teams and conferences from 2005 to 2023. To explore this, we first calculated the average total revenue for each team and selected the top 10 teams based on this metric. We then visualized the relationship between attendance and revenue using bar charts and scatter plots and analyzed summary statistics for total revenue and attendance by conference. Our analysis suggests a clear trend where teams with higher average attendance generally report higher total revenue.

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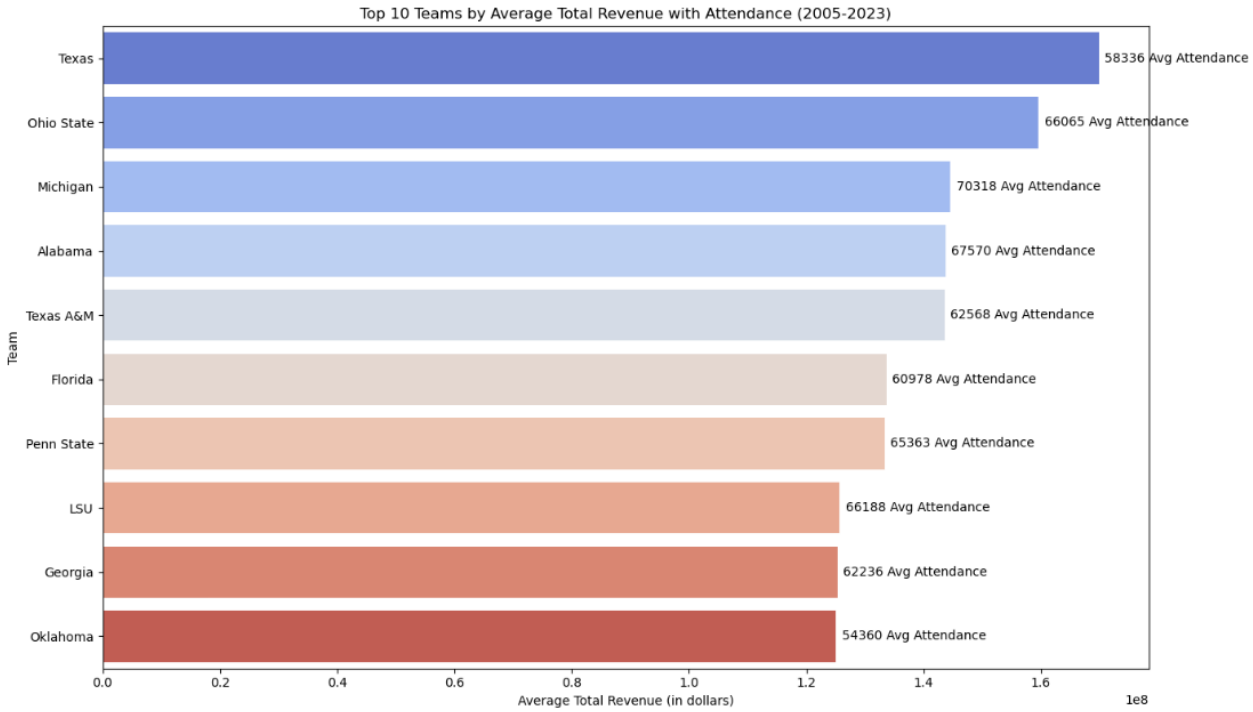

Figure 2 Bar Chart of Top 10 Teams by Average Total Revenue with Attendance

The bar chart highlights the top 10 teams with the highest average total revenues and their corresponding average attendance. Teams with larger fan bases, such as Michigan and Ohio State, show a clear correlation with higher revenue. Notably, Texas, despite having the second smallest average attendance among the top 10 teams, leads in revenue. This suggests that factors beyond attendance, such as media rights and alumni support, also play a significant role in financial performance.

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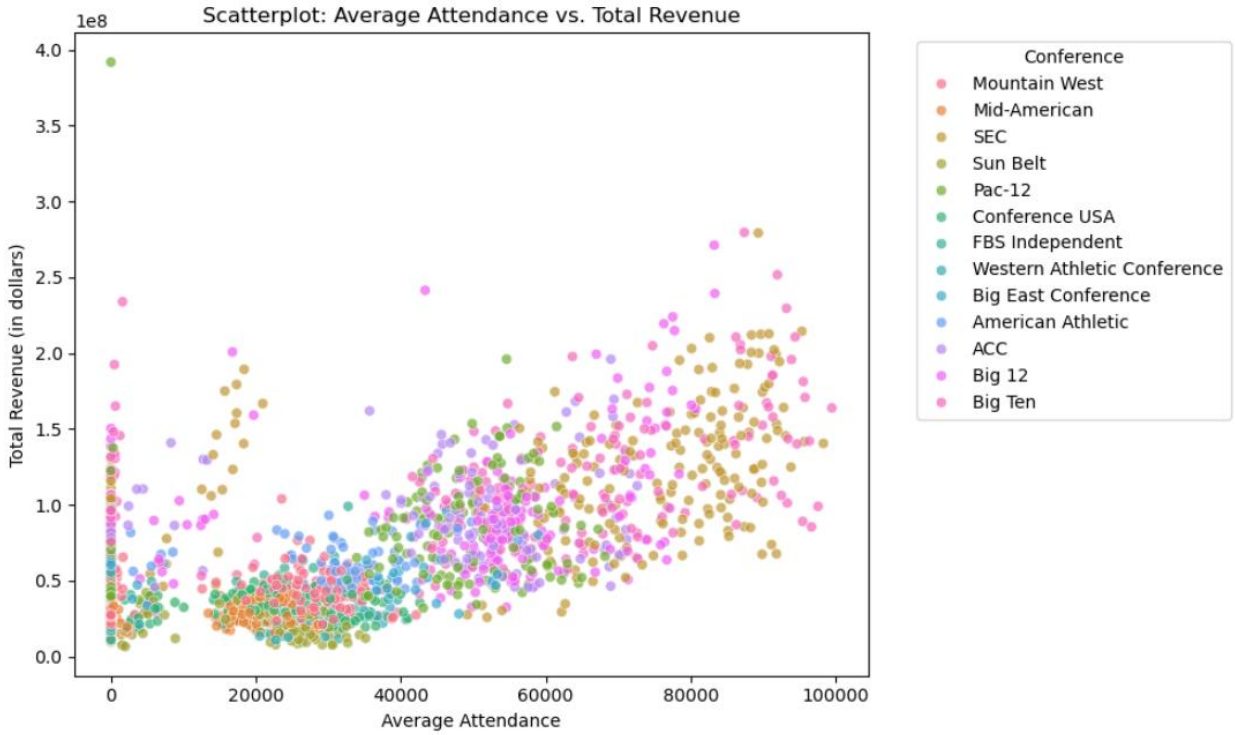

Figure 3 Scatterplot of Average Attendance and Total Revenue by Conference

The scatterplot reveals a positive relationship between average attendance and total revenue, confirming that teams with larger fan bases tend to generate higher revenue. This strengthens the argument that attendance is a critical factor in the financial success of athletic teams. However, the presence of outliers indicates that other variables, such as team performance or market size, may also contribute to revenue generation. While attendance remains a key driver, it is not the only determinant of financial success.

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Summary Statistics: Revenue and Attendance by Conference		
conference	total_revenue	average_attendance
SEC	$115,452,253.00	58,421
Big Ten	$111,332,206.47	51,026
Big 12	$93,212,803.79	42,386
ACC	$87,094,495.61	40,742
Pac-12	$81,803,042.33	38,211
American Athletic	$62,291,939.67	31,042
Big East Conference	$52,779,262.98	23,974
Mountain West	$41,928,147.46	22,114
FBS Independent	$40,643,312.68	25,193
Conference USA	$31,718,792.86	20,248
Mid-American	$26,752,084.98	15,850
Sun Belt	$24,456,503.36	19,212
Western Athletic Conference	$22,466,202.81	14,578

Table 3 of Summary Statistics of Revenue and Attendance by Conference

The summary statistics illustrate that the SEC and Big Ten conferences dominate both revenue and attendance, with SEC teams generating over $115 million in revenue on average and attracting more than 58,000 fans per game. In contrast, conferences like Conference USA and Mid-American report significantly lower revenue and attendance, highlighting the financial disparity between major and smaller conferences. These differences emphasize the importance of fan engagement in driving revenue but also suggest that additional factors, such as media deals and conference affiliation, contribute to overall financial outcomes.

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3.3 Bowl Game and Revenue

In college football, teams that qualify for bowl games often experience heightened attention, with increased media coverage, fan engagement, and sponsorship opportunities. Given these factors, it is expected that teams participating in bowl games may generate significantly more revenue than those that do not qualify. This analysis seeks to determine whether bowl game participation directly correlates with higher athletic revenues for college football teams. By examining the revenue statistics of teams that participate in bowl games and those that do not, we aim to assess the financial impact of postseason play on collegiate athletic programs.

Bowl Teams Revenue Statistics:

	count	mean	std	min	25%	50%	75%	max
Bowl Teams	1,144.00	74,207,594.72	49,448,493.42	6,693,070.00	34,481,518.25	62,224,993.00	103,193,049.75	391,769,609.00

Non-Bowl Teams Revenue Statistics:

	count	mean	std	min	25%	50%	75%	max
Non-Bowl Teams	898.00	50,264,081.21	37,031,920.55	6,652,372.00	24,431,534.50	36,975,747.50	66,081,566.75	204,831,356.00

T-statistic: 12.0906
P-value: 0.0000

There is a significant difference in athletic revenue between teams that participate in bowl games and those that do not.

Figure 1: Summary Statistics of Bowl Teams Revenue vs Non-Bowl Teams Revenue

Our analysis of revenue differences between teams that participate in bowl games and those that do not reveals a statistically significant disparity, as indicated by a t-statistic of 12.0906 and a p-value of 0.0000. Teams that qualify for bowl games generate substantially higher athletic revenues, with a mean revenue of $74,207,594.72 compared to $50,264,081.21 for non-bowl teams. Additionally, bowl teams exhibit a wider revenue range, with a maximum revenue of $391,769,609.00, nearly double the $204,831,356.00 observed for non-bowl teams. The higher revenues among bowl teams may be attributed to increased media coverage, sponsorship deals, and heightened fan engagement associated with postseason play. These findings underscore the financial significance of bowl game participation in collegiate athletics.

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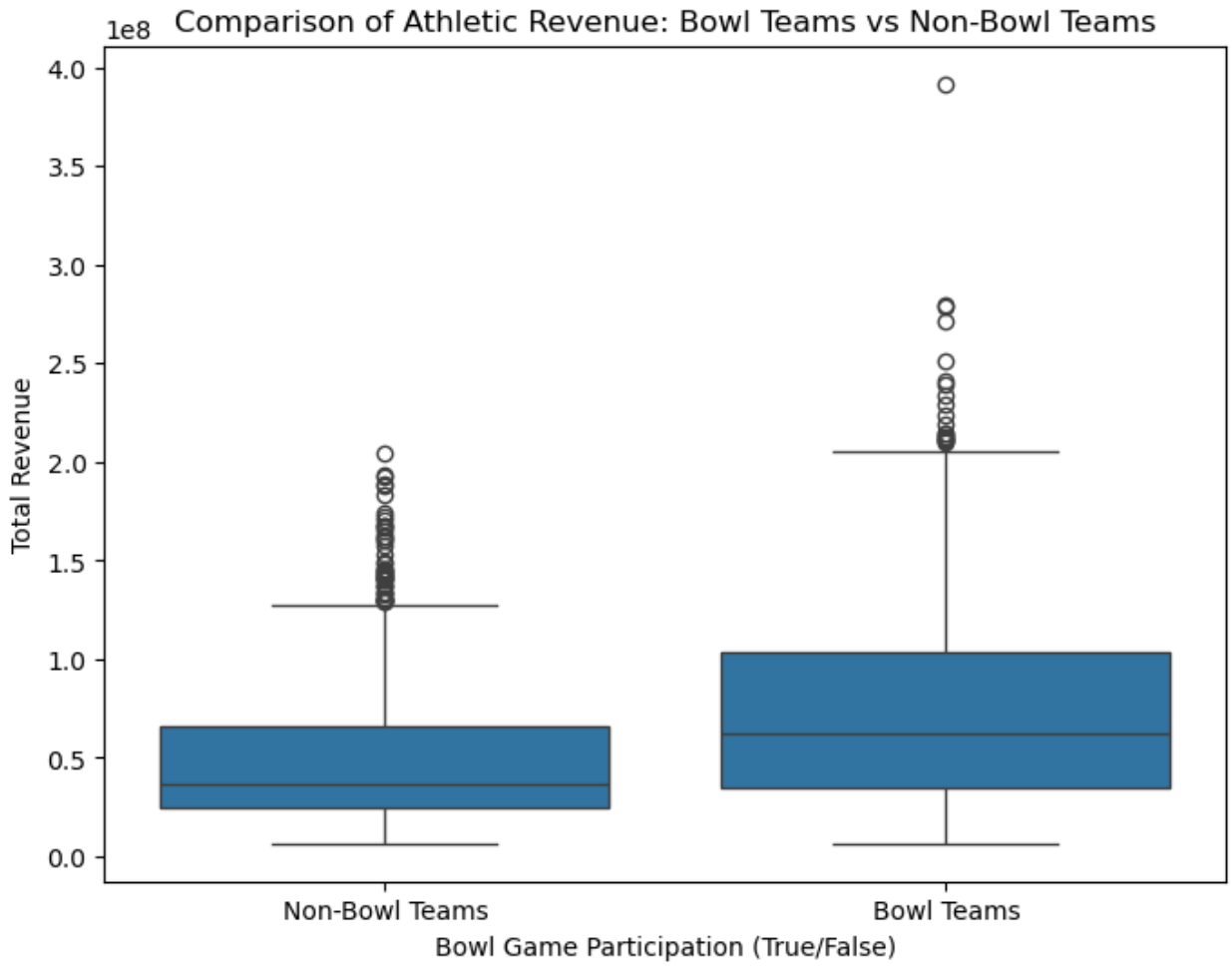

4. Conclusion

In this project, we analyzed three key aspects of college football team performance and their relationship with athletic department revenue: win-loss ratios, average attendance, and bowl game participation. The goal was to determine whether on-field success translates to financial success for NCAA Division I public institutions. Below are the summarized findings:

1. *Is there a correlation between a team's win-loss record and its athletic department's revenue?*

   There is a weak positive correlation (r = 0.2698) between a team's win-loss ratio and its total athletic revenue. While this indicates that better performance slightly increases revenue, the relationship is not very strong.

2. *Does higher average attendance at home games correlate with increased revenue?*

   Teams with higher average attendance tend to generate more revenue. This was evident from both scatterplots and bar charts, which showed a clear trend linking attendance and revenue. However, notable outliers like Texas highlight that factor beyond attendance, such as media rights and alumni support, also contribute significantly to revenue.

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3. *Do teams that qualify for bowl games consistently generate more revenue than those that don't?*

   Our analysis suggests that bowl game participation may be linked to higher revenue, as teams participating in these events benefit from increased media coverage, sponsorship opportunities, and fan engagement

This project has some limitations, such as missing financial data for certain teams, a lack of detailed variables like sponsorship deals or TV contracts, and unexamined external factors like conference affiliation or market size. Future work could include adding more data sources to cover broader revenue streams, analyzing the impact of media deals by conference, and studying year-over-year trends to better understand the link between team performance and revenue.

Despite these limitations, this project provides valuable insights into the connection between college football performance and financial outcomes, demonstrating that on-field success plays a role in driving revenue but is far from the only factor.

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