Running the Numbers: Evaluating Team Rushing Success in Relation to Running Back and Offensive Line Spending

Devin A. Duran and Russ T. Steil

***Abstract*— Football is a dangerous sport that likely costs players several decades of their lives, and of the 22 positions on the field running back is by far the most dangerous (*Types of football injuries*, 2023). Despite this, running backs are one of the lower paid positions on the field. By the time their rookie contracts are up most running backs have sustained multiple career hindering injuries and it is not in an NFL team's best interest to give them a large contract. We examined whether or not spending more total cap space on the running backs lead to increased rushing yards per game and rushing touchdowns per game for NFL teams, we also examined the same for the offensive line. It was determined that there is no significant correlation between amount spent on running backs and rushing success, but that there is a significant correlation between amount spent on offensive linemen and rushing success.**

I. Introduction

The state of the National Football League is constantly shifting, and one of the most polarizing debates of the current NFL is the value of running backs. While teams like the Minnesota Vikings in the early to mid 2010s relied heavily on a bell-cow running back, the league today has shifted to more pass oriented. In the past offseason, many of the league's top running backs were due for new large contracts, but they were not given them. This is because many general managers believe that the running back position has and still is constantly losing value due to their replaceability. Although a great rushing attack is important to a team's success, who should truly deserve the credit and be invested in; an elite running back or an elite offensive line?

II. Related Works

While there have been several articles that delve into the topic of running backs being the lowest paid position in the NFL and the financial disadvantages that they face throughout their careers (Brandt, 2023), there have not been any highly cited studies that directly compare the total money a team spends running backs and the total money a team spendings on offensive linemen in relation to success in the actual rushing department. One notable study did investigate whether contracts with stat incentives, e.g. if a player runs for over 1,000 yards they receive a bonus, lead to better player performance metrics measured by Win Probability Added and Expected Points Added (Kim et al., 2018). The study determined that higher pay incentives did lead to increased NFL player performance.

III. Methods

A. Experimental Hypotheses

The main hypothesis of this study theorized that if an NFL team spends more total cap space on running backs, then they would have more rushing success measured by rushing yards per game. The null hypothesis for this test suggests that there is no significant correlation between money spent on running backs and rushing yards per game.

The secondary hypothesis theorized that if an NFL team spends more total cap space on running backs, then they would have more rushing success measured by total rushing touchdowns per game. The null hypothesis for this test suggests that there is no significant correlation between money spent on running backs and total rushing touchdowns per game.

The third hypothesis focused on the other position that plays a major factor in determining rushing success: the offensive line. It theorized that if an NFL team spends more total cap space on offensive linemen, then they would have more rushing success measured by rushing yards per game. The null hypothesis for this test suggests that there is no significant correlation between money spent on offensive linemen and rushing yards per game.

Finally, the fourth hypothesis theorized that if an NFL team spends more total cap space on offensive linemen, then they would have more rushing success measured by rushing touchdowns per game. The null hypothesis for this test suggests that there is no significant correlation between money spent on offensive linemen and rushing touchdowns per game.

B. Data Collection

The data for this research came in two forms: financial data and football statistical data from the 2020-2023 NFL seasons. The financial data was web scraped from sportstrac.com using the BeautifulSoup4 python package (cite). The football statistical data was web scraped from sportskeeda.com (cite). The final data included yards per game, touchdowns per game, total cap space spent on offensive lineman, and total cap space spent on running backs for all 32 NFL teams during the 2020-2023 NFL seasons.

C. Statistical Tests

In order to determine whether or not the data was normally distributed, a Shapiro-Wilk test was done on each of the four metrics. It was determined that all of the data was not normally distributed and therefore a Spearman-rank correlation test was used on each of the four hypotheses. Spearman-rank was chosen since it is robust against the non-parametric, continuous data collected for this research.

IV. Results

The main hypothesis of the research questioned whether or not the total cap dollars a team spends on running backs affects the rushing yards per game that that team achieves throughout the season. The Spearman rank correlation coefficient returned for this test was -0.036 and the p-value was 0.688, indicating that at a 0.05 significance threshold we fail to reject the null hypothesis.

The second hypothesis of the research questioned whether or not the total cap dollars a team spends on running backs affects the rushing touchdowns per game that that team achieves throughout the season. The Spearman rank correlation coefficient returned for this test was 0.018 and the p-value was 0.84, indicating that at a 0.05 significance threshold we fail to reject the null hypothesis.

The third hypothesis of the research questioned whether or not the total cap dollars a team spends on offensive linemen affects the rushing yards per game that that team achieves throughout the season. The Spearman rank correlation coefficient returned for this test was 0.781 and the p-value was $1.15x10^{-}27$, indicating that at a 0.05 significance threshold we reject the null hypothesis and that there is a significant positive correlation between cap dollars spent on offensive linemen and rushing yards per game.

The fourth hypothesis of the research questioned whether or not the total cap dollars a team spends on offensive linemen affects the touchdowns per game that that team achieves throughout the season. The Spearman rank correlation coefficient returned for this test was 0.502 and the p-value was $1.54x10^{-}9$, indicating that at a 0.05 significance threshold we reject the null hypothesis and that there is a significant positive correlation between cap dollars spent on offensive linemen and touchdowns per game.

V. Discussion

Overall, the hypotheses were the relationship between the amount of salary cap a team spends on its running backs and offensive lines and the production that was produced in the ground game in terms of the amount of yards and touchdowns each team gained per game.

The first two hypotheses observed the relationship between the amount of a team's salary given to a team's running backs and the amount of rushing yards and touchdowns per game a team generated. The p-values returned for these tests ended up being 0.688 and 0.84 respectively, which are both significantly larger than the 0.05 significance threshold. With such high p-values, we failed to reject the null hypothesis that there is no correlation between running backs and rushing yards and rushing touchdowns per game.

The other two hypotheses observed the relationships between the offensive line and rushing yards and touchdowns per game. The p-values generated here, however, were $1.15x10^{-}27$ and $1.54x10^{-}9$ respectively, both relatively below the 0.05 significance threshold. With this information we reject the null hypothesis and conclude that the salary of offensive linemen does in fact play a role in rushing production.

While the p-values generated in the tests for running backs' salary were very high, the p-values for the test for offensive linemen's salaries were minute. A misleading factor definitely comes to mind and that is that the NFL teams tend to have 10-12 total offensive lineman yet only 4-6 running backs. However, the differences of the p-value cannot be ignored and despite a team having more offensive linemen, the results do indeed emphasize that the salary given to offensive linemen affect a team's rushing attack.

One team in particular that is very good at running the football is the Philadelphia Eagles. The Eagles rushing attack propelled them to a Super Bowl appearance last year, and this year they currently have the best record in the NFL through 12 games sitting at 10-2. The Eagles for the last few years have had one of the best offensive lines in NFL history, led by future hall of famers such as Jason Kelce, Lane Johnson, and Jordan Mailata all of which are being paid massive contracts that are at least 10 million per year. However the Eagles for example, have given less than 2 million per year to each of their past two top running backs, Miles Sanders and D'Andre Swift, who replaced Sanders this past offseason.

What should also be taken into consideration is that more and more in today's NFL, quarterbacks and even wide receivers are accounting for a team's rushing stats. Players like Baltimore Ravens quarterback Lamar Jackson and San Francisco 49ers receiver Deebo Samuel account for a significant portion of their teams rushing yards despite not being running backs. These players, of course, are still blocked for by the offensive line, which shows that the offensive line, quite literally accounts for every single rushing yard and touchdown, but running backs do not.

VI. Conclusion

While running backs are the players that rush the ball the most and account for the majority of the NFL's rushing yards and touchdowns, they are often seen as replaceable by many General Managers around the league, who are hesitant to give large contracts to running backs, even some of the league's best. This was due to the belief among NFL teams and fans alike that running backs are expendable, but an elite offensive line is not. Our results showed that teams who invest more in offensive linemen tend to have more rushing production, while teams investing in running backs have multiple possibilities in the impact of their rushing, which we can conclude is the skill of its offensive line. With multiple positions accounting for team rushing stats it is safe to say that it is the offensive line creating openings for these players that allow for teams to succeed in the ground game.

References

[1] Brandt, A. (2023, June 21). *NFL running backs face financial disadvantages ... - Sports Illustrated.* Sports Illustrated. Retrieved from https://www.si.com/nfl/2023/06/21/nfl-running-backs-value-business-football

[2] Kim, S., Sarin, A., & Sarin, S. (2018). *Do players perform for pay? An empirical examination via NFL players' compensation contracts. Journal of Banking & Finance*, *88*, 330–346. DOI: 10.1016/j.jbankfin.2018.01.004

[3] NFL running back spending - cap. Spotrac.com. (n.d.). Retrieved from https://www.spotrac.com/nfl/positional/running-back/

[4] Sportskeeda. (n.d.). *2023 NFL team stat leaders - passing, rushing, scoring, defense and much more.* 2023 NFL Team Stat Leaders - Passing, Rushing, Scoring, Defense and much more. Retrieved from https://www.sportskeeda.com/nfl/team-stat/rushing-yards-leaders

[5] Types of football injuries. Jonathan Perkins Injury Lawyers. (2023, May 16). Retrieved from https://www.800perkins.com/practice-area/types-of-football-injuries/#:~:text=Players%20in%20the%20offensive%20line,to%20the%20majority%20of%20injuries.