

Salary dispersion and team success: The impact of positional spending on win percentage in the National Football League

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Abstract

As the NFL's salary cap has surged from \$34 million in 1994 to \$255 million in 2024, effective cap management has become crucial. However, relatively little focus has been paid to how spending on specific positions affects team success. The purpose of this study was to examine the relationship between salary cap allocation and team success in the NFL, specifically focusing on how spending in different positions affects win percentage. We utilized a quantitative design, analyzing 384 NFL team observations from the 2013–2024 seasons, with linear regression models applied to assess how salary cap allocations across key positions impacted team success, using win percentage as the primary outcome variable and the number of wins as a robustness check. Our findings show that higher spending on quarterbacks, wide receivers, and offensive linemen is strongly linked to improved team performance, while expenditures on running backs and tight ends have little to no significant impact. These results suggest that teams could benefit from reallocating resources to more critical positions, particularly quarterbacks and wide receivers, to maximize on-field performance. This study also offers practical insights for NFL teams seeking to refine their salary cap strategies.

Keywords: salary dispersion, positional spending, team success, National Football League

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1. Introduction

The salary cap is a tool used by professional sports leagues to limit player salaries and promote competitive balance. By capping total team payrolls, the idea is to prevent wealthier teams from monopolizing talent and, in theory, create a more level playing field (Luo, 2023). The salary cap is recalculated every year as a percentage of total league revenue, imposing financial constraints that all teams must follow (Dietl et al., 2009; McIntyre, 2017; Zimmer, 2016). While salary caps have been adopted by some leagues globally (e.g., Davies, 2021; Ferguson & Pinnuck, 2022; Zhou et al., 2023), the National Football League (NFL)'s hard cap operates under particularly stringent constraints. These unique financial parameters, as opposed to more flexible models used in other sports, underscore the importance of understanding how resource allocation in key positions influences team performance in the NFL.

Despite the cap's intended goal of promoting parity, some NFL teams continue to outperform others through strategic contract management and smart acquisitions (Robinson, 2024). However, spending more money doesn't always guarantee success, especially when financial resources are mismanaged. For example, teams like the Jacksonville Jaguars and New York Jets have consistently ranked among the highest free-agency spenders, yet their on-field success has been limited (Adhia, 2023). This highlights an important question of how NFL teams can optimize their salary cap allocation to maximize on-field success.

Quarterbacks, often considered the most important position in football, are generally the highest-paid players on championship teams. Since 2011, only three Super Bowl-winning teams had quarterbacks on rookie contracts, and none of these quarterbacks accounted for more than 13.1% of their team's salary cap hit until recent seasons (Thompson, 2023). While investing in a top-tier quarterback is crucial, teams must balance that expense with building a well-rounded, competitive roster, as the success of these strategies depends on the effective allocation of salary cap resources across positions. Misallocation of resources, such as overspending on underperforming players or neglecting critical positions, can lead to inefficiencies that ultimately undermine competitive balance.

An analysis of the 2023/24 NFL season highlights how difficult this balancing act can be. While some high-paid quarterbacks led their teams to the playoffs, reflecting the potential payoff of investing in elite talent, others struggled despite significant investments, demonstrating the complexity of optimizing salary cap allocation. Additionally, the contrasting strategies of the Kansas City Chiefs, who won Super Bowl LVII, and San Francisco 49ers demonstrate different approaches to cap allocation. The Chiefs allocated 16.5% of their cap to their quarterback, while the 49ers spent just 0.4% on theirs (Clawson, 2024).

Beyond quarterbacks, other key positions also influence success. In the 2023/24 NFL season, all eight of the non-quarterback players with the highest cap hits among the top 14 led their teams to the playoffs, showing how important it is to invest in various positions. This further illustrates the importance of understanding how spending on different positions impacts overall team performance. Despite its significance, few researchers have focused on how salary allocation by position correlates with team success (Thompson, 2023), leaving a gap in knowledge about the best ways to distribute cap resources across a roster.

With the NFL's salary cap growing from \$34 million in 1994 to \$255 million in 2024-a staggering 650% increase-managing the cap effectively has become more important than ever (Robinson, 2024). Given this unprecedented growth, teams should adopt strategic cap management that not only balances payroll but also aligns positional investments with evolving offensive and defensive trends. Suboptimal allocation of these expanded resources can undermine long-term competitiveness by constraining a team's ability to address injuries, capitalize on free-agency opportunities, and adapt through the draft. While much research has examined the role of coaching and team strategies in relation to salary cap spending, little is known about how spending on specific positions influences team success (Roach, 2023). This study, therefore, aims to fill this gap by answering the following research question (RQ):

RQ: How can NFL teams optimize salary cap allocation across key positions to maximize team success and win games?

2. Literature Review

Previous research on salary cap systems in sports has highlighted various strategies that teams can use to gain a competitive edge. One key takeaway is the growing role of legal and financial experts who help navigate the complex restrictions imposed by the cap. Teams that are skilled at negotiating contracts, signing bonuses, and freeagent deals often gain an advantage, making these financial skills as crucial as coaching itself (McIntyre, 2017). Before the NFL implemented its salary cap, player salaries were more evenly distributed across positions. However, since its introduction, the pay for starting players—especially quarterbacks—has soared, sometimes at the expense of rookies and role players (Leeds & Kowalewski, 2001).

Theoretical Foundations

Two primary theoretical perspectives inform prior research on salary allocation and team success: tournament theory and team cohesiveness theory. These frameworks offer contrasting explanations for how financial resources should be distributed within a team to maximize performance. Tournament theory (Lazear & Rosen, 1981) posits that allocating higher salaries to top performers, such as quarterbacks and elite wide receivers, incentivizes competition and effort, ultimately improving overall team performance. This perspective aligns with the NFL's practice of prioritizing significant financial investments in star players at key positions. However, concentrating a disproportionate share of the salary cap on a few individuals can lead to roster depth issues, potentially creating weaknesses in other areas of the team.

Conversely, team cohesiveness theory (Levine, 1991) argues that a more balanced salary distribution fosters team harmony, enhances cooperation, and improves collective performance. Research on other sports (e.g., Tao et al., 2016) suggests that minimizing wage disparities within a roster strengthens team synergy and reduces internal conflicts. Applied to the NFL, this theory implies that teams should allocate resources more evenly across multiple key positions rather than over-investing in a single player. These opposing perspectives highlight the fundamental trade-offs in salary cap management, whether teams should concentrate spending on a few elite players or distribute funds more equitably across the roster. This study examines how these theories apply to the contemporary NFL salary landscape, assessing which approach is more effective in maximizing team success.

Salary Cap Strategies in the NFL

The relationship between salary cap spending and team success in the NFL has produced mixed results. Quinn et al. (2007) found that between 2000 and 2005, winning teams tended to allocate more of their salary cap to mid-tier players (those ranked 15th to 30th in salary), rather than concentrating spending on top earners. This balanced approach was linked to an increase in wins. Similarly, Mondello and Maxcy (2009) found that teams with more evenly distributed pay structures performed better on the field, while those that concentrated spending on a few star players often saw stronger financial results but not necessarily better on-field performance.

However, some argue that investing heavily in a few elite players can still lead to success, particularly in large markets where star power is important. Zimmer (2016) pointed out that underutilizing available cap space can hurt a team's performance, especially for those that depend on superstar players. Some researchers recommend that teams should allocate as much as 15% of their salary cap to quarterbacks (Mulholland & Jensen, 2019). On the other hand, Winsberg (2015) analyzed how salary cap distribution affects team success in the NFL, using data across multiple seasons. The study found that teams with moderate quarterback cap hits (10-15%) performed better than those that allocated a significantly higher portion of their salary cap to a single player. Additionally, Winsberg highlighted that teams that devoted more than 45% of their cap space to defense generally exhibited stronger overall performance, suggesting that maintaining defensive stability is critical to winning. The study also pointed out that teams heavily reliant on free agency often faced inefficiencies, whereas those that built through the draft and retained homegrown talent tended to sustain success over time.

Gosavi (2022) similarly examined the relationship between quarterback salary cap efficiency and team success from 2013 to 2021. The study reinforced the idea that high quarterback salaries do not always translate to more wins, with findings indicating that quarterbacks earning between 10-15% of the cap provided the best return on investment in terms of win percentage and playoff appearances. In contrast, teams that allocated more than 20% of their salary cap to a single quarterback often struggled to field a competitive roster in other key areas, particularly offensive line and secondary defense, which are crucial to long-term success.

Jeffords and Potts (2019) explored salary cap allocation trends between 2011 and 2018, identifying optimal spending strategies for maximizing team success. Their study found that teams allocating 50-55% of their cap to offense and 35-40% to defense consistently achieved higher win percentages. Additionally, allocating at least 12% of the cap to quarterbacks was a strong predictor of playoff appearances, aligning with tournament theory's argument that rewarding elite performers enhances team outcomes. However, the study also cautioned against over-investing in quarterbacks beyond 18% of the cap, as this often led to roster depth issues, particularly in defensive positions.

Thompson (2023) investigated how quarterback salary cap allocation impacts Super Bowlwinning teams, analyzing contract structures from 2011 to 2023. The study found that quarterbacks consuming 12-16% of the salary cap were most likely to lead their teams to a championship, whereas teams exceeding 17-18% in quarterback spending frequently encountered depth issues, particularly along the offensive line and defensive secondary. The study also highlighted that teams with quarterbacks on rookie-scale contracts benefited from increased financial flexibility, allowing them to invest in key supporting positions. These findings underscore the importance of balancing quarterback salaries with overall roster depth to sustain long-term success.

Roach (2023) recently found that teams led by offensive-minded coaches often spend more on offense, though this doesn't always translate into better performance than teams that allocate resources more evenly between offense and defense. Likewise, Ness (2010) discovered that while spending more on key defensive players correlates with success, overspending on defense can sometimes reduce a team's overall effectiveness. This demonstrates the need for a balanced salary cap strategy that prioritizes key players without spreading resources.

In terms of offensive spending, Calvetti Jr. (2023) provided valuable insights into wage distribution among NFL offensive positions from 2011 to 2021. He used "approximate value" to estimate player contributions and found that guards and right tackles should receive the highest cap allocations, with slightly less emphasis on wide receivers, left tackles, and centers. This suggests that teams can improve offensive performance, and ultimately team success, by refining how they allocate cap space across these positions.

Other Professional Leagues

The debate over salary distribution extends beyond the NFL. Extensive research in Major League Baseball (MLB), a league without a salary cap, has also examined how salary dispersion impacts team performance. Tao et al. (2016) analyzed MLB data from 1985 to 2013 through the lens of two theories: tournament theory, which argues that larger pay disparities motivate greater effort (Lazear & Rosen, 1981), and team-cohesiveness theory, which suggests that smaller wage gaps foster better outcomes through improved team cohesion (Levine, 1991). Tao et al. found that teams with more cohesive wage structures generally outperformed those with larger pay gaps, highlighting the risks of relying too much on a few superstar players. Frick et al. (2003), using four North America's major leagues in baseball, basketball, football, and hockey, analyzed over 1,100 team-year observations from 1985 to 2001 and found that salary distribution affects team success differently depending on the sport. For example, sports like football and hockey, which rely heavily on teamwork, benefit more from equal salary distribution. In contrast, individual talent plays a bigger role in baseball and basketball, where larger pay discrepancies can be beneficial.

Although salary caps are designed to promote competitive balance, their effects vary across leagues. In the NBA, for instance, certain exceptions allow teams to exceed the salary cap, which can worsen financial disparities between teams. Research by Totty and Owens (2011) and Keefer (2021) suggests that the NBA's salary cap doesn't always achieve its intended effect. For instance, Keefer's study of the 2015/2016 and 2016/2017 NBA seasons found that while player salaries increased significantly due to new broadcasting contracts, this didn't necessarily lead to improved player productivity. On the other side, Kim et al. (2020) found that higher salary dispersion, when combined with smaller wage gaps among key contributors, was linked to better team performance. Their 23-year analysis of NBA seasons (1995/1996 to 2017/2018) supports cap strategies that balance high salary dispersion with controlled wage gaps, leading to better overall win percentages.

Major League Soccer (MLS) also faces unique challenges in managing its salary cap due to roster restrictions. MLS teams are allowed up to eight international players, known as Designated Players, which places a premium on developing homegrown talent. Fotopoulos and Opatkiewicz (2012) examined MLS salary structures and found that while Designated Players were often the highestpaid, they didn't consistently outperform domestic players. Their study introduced the concept of "productive minutes" to measure a player's contribution and concluded that prioritizing college talent—providing higher productivity at a lower cost—could free up cap space for more strategic acquisitions.

In contrast to North American leagues, many elite European soccer leagues, such as Germany's Bundesliga, operate without salary caps. Franck and Nüesch (2011) studied wage dispersion in the Bundesliga from 1995 to 2007 and found that both highly egalitarian and highly differentiated wage structures could lead to success, depending on the circumstances. However, moderate wage gaps often harmed team cohesion and performance. Teams with minimal salary gaps saw better team chemistry, while those with wide salary gaps benefitted from better individual performances from elite players, even if roster harmony suffered.

Research on salary cap management offers mixed conclusions. While some scholars support concentrating spending on star players, others emphasize a more balanced salary distribution. This reallocation represents not merely a fiscal decision but a strategic imperative. For instance, prioritizing investments in positions that enhance offensive efficiency (e.g., quarterbacks and wide receivers) or disrupt opposing offenses (e.g., edge rushers and cornerbacks) can significantly augment a team's capacity to implement contemporary NFL strategies, such as high tempo passing attacks or adaptable defensive schemes. Conversely, the neglect of these critical positions may precipitate stagnation, whose minimal investment in the quarterback position contributed to a winless season. This study, therefore, aims to fill that gap by examining how NFL teams can optimize salary cap allocation across positions to maximize success.

Despite the extensive body of literature examining salary caps and team performance, several methodological gaps exist. First, many studies aggregate total salaries without distinguishing the contributions of specific positions, potentially obscuring the nuanced value of key roles (Mondello & Maxcy, 2009). Second, the reliance on short time horizons and limited sample sizes undermines the robustness of previous findings (Zimmer, 2016). Third, the use of inconsistent measures of on-field performance, ranging from win percentage to playoff appearances, complicates the comparison of results across studies (Roach, 2023). By focusing on positional-level cap allocations over a multi-season dataset (2013-2024) and employing multiple performance metrics (win percentage and total wins), this study addresses these limitations and offers a more precise understanding of how strategic spending decisions influence team success.

3. Methodology Data

We used win percentage as our primary dependent variable to measure team success across seasons, providing a consistent way to compare performance year over year. To strengthen the analysis, we also included the total number of wins as a secondary dependent variable in our robustness checks. Our independent variables consist of salary cap spending percentages allocated to 10 key position groups: Quarterback, Running Back, Wide Receiver, Tight End, Offensive Line, Interior Defensive Line, Edge Rusher, Linebacker, Safety, and Cornerback. These variables give a detailed look at how teams distribute financial resources to each position group and how that impacts overall performance.

The dataset covers 384 team-season observations, representing every NFL team over a 12-season period from 2013 to 2024. The data, sourced from Kaggle, includes key metrics such as positional spending, total wins, win percentages, playoff appearances, and Super Bowl victories. Positional spending data were sourced from overthecap.com. Positional spending data included base salaries and prorated signing bonuses (as allocated for each specific league year). We then calculated the percentage of total cap spending for each position group by dividing the positional totals by the overall salary cap available to the team in that season. Additionally, the dataset tracks overall salary cap space and positional spending as a percentage of the total cap, which allows for meaningful comparisons across seasons. A full breakdown of the variables and their definitions is presented in Table 1.

Table 1:	Variables	and	Definitions
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Variable	Definition

W	The number of games won in the respective season
W_PCT	Winning percentage in the respective season
QB_P	Combined earnings as a percentage of the salary cap for all quarterbacks
	on the team in the respective season
RB_P	Combined earnings as a percentage of the salary cap for all running backs
	on the team in the respective season
WR_P	Combined earnings as a percentage of the salary cap for all wide receivers
	on the team in the respective season
TE_P	Combined earnings as a percentage of the salary cap for all tight ends on
	the team in the respective season
OL_P	Combined earnings as a percentage of the salary cap for all offensive
	linemen on the team in the respective season
IDL_P	Combined earnings as a percentage of the salary cap for all interior de-
	fensive linemen on the team in the respective season
EDGE_P	Combined earnings as a percentage of the salary cap for all edge rushers
	on the team in the respective season
LB_P	Combined earnings as a percentage of the salary cap for all linebackers
	on the team in the respective season
S_P	Combined earnings as a percentage of the salary cap for all cornerbacks
	on the team in the respective season
CB_P	Combined earnings as a percentage of the salary cap for all cornerbacks
	on the team in the respective season
Defense_P	Combined earnings as a percentage of the salary cap for all defensive
	players on the team in the respective season

Offense_P	Combined earnings as a percentage of the salary cap for all offensive		
	players on the team in the respective season		
Dead_Open_Specials	Combined amount as a percentage of the salary cap allocated to special		
	teams, dead cap space, and open cap space on the team in the respective		
	season		

Note: W and W_PCT are the dependent variables in this study

Empirical Analysis

We employed a multi-step approach to ensure both the thoroughness and robustness of our findings. First, we calculated descriptive statistics such as mean, median, standard deviation, and range—to summarize the dataset. This initial step helped us identify trends in positional spending and provided a preliminary view of win percentage distributions. Next, we constructed a correlation matrix to examine the relationships between the independent variables, which allowed us to detect potential multicollinearity that could distort the regression outcomes.

For the main analysis, we applied a linear regression model with team and year-fixed effects to capture unobserved heterogeneity across franchises and temporal shifts. We then assessed how salary cap spending on specific positions, expressed as a percentage of the total cap, impacts team success. Using both Microsoft Excel and R Studio, this model allowed us to isolate the effects of spending on each position while controlling for other factors. To further validate our findings and check for any biases or distortions due to outliers or assumptions, we applied an additional regression model, using total wins as the dependent variable. In this secondary model, we also investigated whether spending on one position influenced the allocation to others. The empirical specifications for team i in year t are as follows:

```
(W PCTi,t) = \beta 0(W PCTi,t) = \beta 0
+
\beta 1(QB Pi,t)\beta 1(QB Pi,t)
+
\beta 2(RB Pi,t)\beta 2(RB Pi,t)
+
\beta3(WR Pi,t)\beta3(WR Pi,t)
+
\beta 4(TE Pi,t)\beta 4(TE Pi,t)
+
\beta5(OL Pi,t)\beta5(OL Pi,t)
+
\beta 6(LB Pi,t)\beta 6(LB Pi,t)
+
\beta7(S Pi,t)\beta7(S Pi,t)
+
\beta 8(CB Pi,t)\beta 8(CB Pi,t)
+
\beta 9(IDL Pi,t)\beta 9(IDL Pi,t)
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+
β10(EDGE Pi,t) β10(EDGE Pi,t)
+
ei.tei.t
(i = \text{teams}, t = \text{seasons})(1)
(WI,t) = \beta 0(WI,t) = \beta 0
+
\beta 1(QB Pi,t)\beta 1(QB Pi,t)
+
\beta 2(RB Pi,t)\beta 2(RB Pi,t)
+
\beta3(WR Pi,t)\beta3(WR Pi,t)
+
\beta 4(TE Pi,t)\beta 4(TE Pi,t)
+
\beta 5(OL Pi,t)\beta 5(OL Pi,t)
\beta 6(LB Pi,t)\beta 6(LB Pi,t)
+
\beta7(S Pi,t)\beta7(S Pi,t)
+
\beta 8(CB Pi,t)\beta 8(CB Pi,t)
+
\beta 9(IDL Pi,t)\beta 9(IDL Pi,t)
+
\beta 10 (EDGE Pi,t) \beta 10 (EDGE Pi,t)
+
ei.tei.t
(i = \text{teams}, t = \text{seasons}) (2)
```

4. Results

Preliminary Analysis

Our dataset consists of 384 team-season observations, representing all NFL teams across a 12season span from 2013 to 2024. The descriptive statistics provide insights into how teams allocate their salary cap resources and how those allocations align with team performance. The average winning percentage (W_PCT) across all teams was 0.5002, with a standard deviation of 0.1905, indicating moderate variability in team success. The data exhibited a relatively symmetrical distribution, as suggested by the similarity between the mean, median, and mode. However, two outliers were notable: the Cleveland Browns' winless season in 2017 and the Carolina Panthers' near-perfect regular season in 2015, with only one loss.

As presented in Table 2, teams allocated an average of 9.05% of their salary cap to quarterbacks (QB P), with spending ranging from as low as 0.76% to as high as 23.76%, highlighting the varied levels of investment in this critical position. The offensive line (OL P) received the largest share of cap space on average, with 15.59%, reflecting both the size of this positional group and the growing emphasis on protecting quarterbacks in a pass-heavy NFL. Wide receivers (WR P) received an average of 9.21%, with some teams allocating as much as 21.5% of their cap to their receiving corps. Spending on running backs (RB P) and tight ends (TE P) was notably lower, averaging 3.60% and 4.07%, respectively, reflecting a trend toward lower cap investment in these positions. On defense, interior defensive linemen (IDL P), edge rushers (EDGE P), safeties (S P), and cornerbacks (CB P) collectively received between 5.59% and 9.58% of the salary cap. This range underscores the importance of defense in roster construction, though with noticeable variation in how different teams prioritize these positions.

Overall, the data revealed that teams, on aver-

age, allocated 43.44% of their cap to offensive positions and 39.80% to defensive positions, showing a relatively balanced financial strategy between offense and defense. The remaining 15.65% of cap space was allocated to dead cap, open cap space, and special teams, which do not directly impact active players' on-field contributions.

Table 2

Descriptive Statistics

Variable	Mean	Median	SD	Min	Max
W	8.1354	8.0000	3.1227	0.0000	15.0000
W_PCT	0.5002	0.5000	0.1905	0.0000	0.9380
QB_P	0.0905	0.0852	0.0488	0.0076	0.2376
RB_P	0.0404	0.0360	0.0216	0.0087	0.1274
WR_P	0.0968	0.0921	0.0398	0.0176	0.2150
TE_P	0.0441	0.0407	0.0216	0.0046	0.1148
OL_P	0.1598	0.1559	0.0428	0.0406	0.2821
IDL_P	0.0895	0.0824	0.0426	0.0151	0.2790
EDGE_P	0.0984	0.0958	0.0444	0.0096	0.2583
LB_P	0.0659	0.0628	0.0297	0.0072	0.1709
S_P	0.0599	0.0559	0.0286	0.0128	0.1628
CB_P	0.0855	0.0831	0.0401	0.0138	0.2199
Defense_P	0.3994	0.3980	0.0726	0.1546	0.5736
Offense_P	0.4318	0.4344	0.0738	0.2296	0.6896
Dead_Open_Specials	0.1678	0.1565	0.0912	-0.0678	0.5421

Table 3 and Figure 1 provide a correlation analysis of the relationships between various positional spending categories. This analysis is critical for identifying any potential multicollinearity among the independent variables, as multicollinearity could skew the regression results. The correlation matrix indicates that most positional spending categories exhibit relatively low correlations with each other, reducing concerns about multicollinearity. Additionally, the variance inflation factor (VIF) values, shown in Table 4, are all below the generally accepted threshold of 10, further confirming that multicollinearity is not a significant issue in this dataset. These findings reinforce the robustness of the regression analysis, allowing for accurate insights into how salary cap allocation across different positions affects team success.

Table 3

Correlation Matrix

	QB_P	RB_P	WR_P	TE_P	OL_P	IDL_P	EDGE_P	LB_P	S_P	CB_P
QB_P	1.00	-0.13	-0.12	0.03	-0.04	-0.18	-0.07	0.03	-0.02	-0.13
RB_P	-0.13	1.00	-0.10	-0.04	0.00	-0.09	-0.01	0.08	0.04	-0.04
WR_P	-0.12	-0.10	1.00	-0.03	-0.04	0.05	0.05	-0.04	-0.04	0.06
TE_P	0.03	-0.04	-0.03	1.00	0.00	-0.06	0.08	0.05	0.04	-0.10
OL_P	-0.04	0.00	-0.04	0.00	1.00	-0.07	-0.03	-0.04	-0.12	-0.08
IDL_P	-0.18	-0.09	0.05	-0.06	-0.07	1.00	-0.17	-0.12	-0.12	0.14
EDGE_P	-0.07	-0.01	0.05	0.08	-0.03	-0.17	1.00	-0.07	-0.04	-0.10
LB_P	0.03	0.08	-0.04	0.05	-0.04	-0.12	-0.07	1.00	-0.05	-0.09
S_P	-0.02	0.04	-0.04	0.04	-0.12	-0.12	-0.04	-0.05	1.00	-0.06
CB_P	-0.13	-0.04	0.06	-0.10	-0.08	0.14	-0.10	-0.09	-0.06	1.00

Table 4

Variance Inflation Factor

Variable	QB_P	RB_P	WR_P	TE_P	OL_P
VIF	1.114646	1.056030	1.036804	1.023842	1.045471
Variable	IDL_P	EDGE_P	LB_P	S_P	CB_P
VIF	1.148896	1.079722	1.046930	1.057462	1.069743

Figure 1



Positional Spending and Winning Percentage

Regression Estimation: Win Percentage as Dependent Variable

The regression results in Table 5 highlighted how positional spending, particularly for quarterbacks, wide receivers, and offensive linemen, influenced team performance, measured by win percentage (W_PCT) and total wins (W). Model 1 is an OLS baseline model that did not control for team or year effects, treating all observations as independent across teams and seasons. Model 2 controlled team-level fixed effects, accounting for unobserved heterogeneity specific to individual franchises but not seasonal shifts. Model 3, which accounted for team and year effects, was found to be the best fit, as indicated by its higher Bayesian Information Criterion (BIC) value. The adjusted R-squared value of 0.262 suggested that positional spending explained 26.2% of the variation in win percentage, reflecting a moderately strong model fit.

Model 3 revealed that spending on key positions such as quarterback, wide receiver, offensive line, edge rusher, and cornerback had a significant positive impact on win percentage, whereas spending on running backs, tight ends, interior defensive linemen, linebacker, and safeties was not statistically significant. Specifically, quarterback spending (QB P) remained a highly significant predictor ($\beta = 0.618$, p < 0.01), reinforcing the critical role of this position in determining team success. This finding held across all models, showing the importance of quarterback investment for NFL teams. Wide receiver spending (WR P) also showed a strong and statistically significant positive effect ($\beta = 0.811$, p < 0.01), highlighting the importance of this position in contributing to team success. Offensive line spending (OL P) exhibited a significant positive effect ($\beta = 0.762$, p < 0.01), emphasizing the essential role of a strong offensive line in supporting team performance. Spending on edge rushers (EDGE P) had a strong, positive, and statistically significant relationship $(\beta = 0.536, p < 0.05)$, highlighting the importance of this position in defensive strategy. Cornerback spending (CB P) had a significant positive relationship with team success ($\beta = 0.682$, p < 0.01), further underscoring the importance of investing in this position to enhance overall team outcomes.

Although running back spending (RB P) showed a positive coefficient ($\beta = 0.726$), it was not statistically significant (p > 0.05), indicating that running back spending might not have a clear or consistent link to team performance. Tight end spending (TE P), while showing a positive coefficient ($\beta = 0.348$), was not statistically significant (p > 0.05), suggesting that this position might have a more variable impact on win percentage. Spending on the interior defensive line (IDL P) showed a positive coefficient ($\beta = 0.356$), but it was not statistically significant (p > 0.05), indicating a limited impact on team success. Linebacker spending (LB P) showed a positive coefficient ($\beta = 0.542$) but was not statistically significant (p > 0.05), suggesting a limited impact on team performance. Despite a positive coefficient ($\beta = 0.059$), safety spending did not show statistical significance (p > p)0.05), suggesting a less direct impact on win percentage

Robustness Check: Total Wins as Dependent Variable

To ensure the reliability of our findings, we conducted a supplementary analysis using total wins (W) as the dependent variable. As shown in Table 6, the results closely aligned with those obtained when using win percentage as the primary dependent variable. Key positions such as quarterback ($\beta = 9.767$, p < 0.01), wide receiver ($\beta = 12.934$, p < 0.01), offensive line ($\beta = 12.144$, p < 0.01), edge rusher ($\beta = 8.575$, p < 0.05), and cornerback ($\beta = 10.594$, p < 0.01) continued to demonstrate significant positive effects. These findings confirmed that strategic allocation of salary cap resources to these key positions not only increased win percentages but also resulted in a

higher total number of wins, reinforcing the consistency and robustness of the initial results. In conclusion, both models emphasized the importance of directing salary cap investments to-

Table 5

Regression Results (Dependent Variable: W_PCT)

Dep	endent	Variable:	Winning	Percentage
Dep	enaene	, and the let	· · · · · · · · · · · · · · · · · · ·	1 ereentage

Model	Model 1	Model 2	Model 3
QB_P	0.862***	0.592***	0.618***
	(0.200)	(0.198)	(0.199)
RB_P	0.501	0.600	0.726
	(0.441)	(0.435)	(0.450)
WR_P	0.453*	0.809***	0.811***
	(0.264)	(0.238)	(0.238)
TE_P	0.847*	0.317	0.348
	(0.433)	(0.424)	(0.425)
OL_P	0.512**	0.785***	0.762***
	(0.221)	(0.217)	(0.218)
IDL_P	0.425*	0.336	0.356
	(0.233)	(0.242)	(0.218)
EDGE_P	0.884***	0.508**	0.536**
	(0.232)	(0.217)	(0.218)
LB_P	0.367	0.455	0.542
	(0.319)	(0.334)	(0.343)
S_P	1.136***	0.033	0.059
	(0.333)	(0.347)	(0.338)
CB_P	0.453*	0.644***	0.682***
	(0.239)	(0.240)	(0.242)
Team		Controlled	Controlled
Year			Controlled
Constant	-0.117	0.037	-5.766
	(0.087)	(0.094)	(5.325)
Observations	384	384	384
R2	0.116	0.341	0.343
Adjusted R2	0.092	0.262	0.262
Residual Std. Error	0.182 (df = 373)	0.164 (df = 342)	0.164 (df = 341)
F Statistic	4.092***(df=10;373)	4.308*** (df=41;342)	4.236*** (df =42;341)
BIC	-160.58 (df = 12)	-88.58 (df = 43)	-83.97 (df = 44)

Notes: Standard errors in parentheses: *p < 0.1; **p < 0.05; ***p < 0.01.

ward critical positions—specifically quarter backs, wide receivers, offensive linemen,

edge rushers, and cornerbacks—to improve both win percentage and total wins. On the other hand,

positions with p-values exceeding 0.05, such as p-values exceeding 0.05, such as running back, interior defensive line, tight ends, and safeties, appeared to have less clear or significant impacts on

team success. This suggested that teams could benefit from reallocating resources to positions that have a more substantial and direct influence on overall performance.

Table 6

Regression Results (Dependent Variable: W)

Dependent Variable: The Number of Games Won

Model	Model 1	Model 2	Model 3
QB_P	13.145***	8.817***	9.767***
	(3.308)	(3.271)	(3.274)
RB_P	5.858	8.357	12.861*
	(7.275)	(7.208)	(7.405)
WR_P	7.113*	12.857***	12.934***
	(3.998)	(3.936)	(3.910)
TE_P	13.187*	4.309	5.438
	(7.154)	(7.021)	(6.989)
OL_P	8.313**	12.945***	12.144***
	(3.655)	(3.588)	(3.580)
IDL_P	6.571*	5.226	5.941
	(3.844)	(4.003)	(3.987)
EDGE_P	13.755***	7.551**	8.575**
	(3.581)	(3.590)	(3.591)
LB_P	4.203	5.405	8.534
	(5.264)	(5.533)	(3.591)
S_P	17.916***	-0.160	0.789
	(5.502)	(5.752)	(5.727)
CB_P	6.158	9.224**	10.594***
	(3.945)	(3.971)	(3.986)
Team		Controlled	Controlled
Year			Controlled
Constant	0.247	1.228	-207.385**
	(1.438)	(1.552)	(87.599)
Observations	384	384	384
R2	0.104	0.327	0.338
Adjusted R2	0.080	0.246	0.257
Residual Std. Error	2.996 (df = 373)	2.711 (df = 342)	2.693 (df = 341)
F Statistic	4.311***df=10;373)	4.054*** (df =41;342)	4.147*** (df =42;341)
BIC	1,992.67(df = 12)	2,067.06 (df = 43)	2,066.67 (df = 44)

Notes: Standard errors in parentheses: *p < 0.1; **p < 0.05; ***p < 0.01.

5. Discussion

The purpose of this study was to examine how NFL teams could optimize salary cap allocation across key positions to maximize team success and win games. The results of this study emphasized the crucial link between how NFL teams allocated their salary cap and their overall success, particularly when it came to investing in key positions. Our analysis highlighted that spending more on quarterbacks, wide receivers, offensive linemen, edge rushers, linebackers, and cornerbacks had a significant positive effect on team performance, whether measured by win percentage or total wins. These findings suggested that teams must have prioritized a significant portion of their salary cap for these positions if they wanted to enhance their chances of success. The results were further confirmed by robustness checks using total wins as an alternative variable, reinforcing the idea that smart financial management, especially in these positions, was essential for sustained success in the NFL.

The critical role of the quarterback was well known, and our findings strongly supported this view. Teams that underinvested in their quarterbacks saw a significant drop in their chances of winning. This finding was consistent with previous research by Zimmer (2016) and Mulholland and Jensen (2019), which emphasized the quarterback's role in driving team victories. For example, the Kansas City Chiefs' victory in Super Bowl LVII, achieved with a quarterback-centric cap allocation (16.5%), whereas the San Francisco 49ers spent just 0.4% of their cap on their quarterback (Clawson, 2024), exemplifies how prioritizing high-impact positions can translate to champion ship success. This contrasts with teams like the 2023 New York Jets, whose high QB spending failed to compensate for deficiencies in other areas, underscoring the need for strategic balance. In contrast, teams such as the 2022 Green Bay Packers and 2023 Denver Broncos, which allocated over 20% of their cap to quarterbacks (Aaron Rodgers and Russell Wilson, respectively), struggled with roster depth and failed to advance in the playoffs. This supports the tournament theory argument that rewarding elite talent drives performance, but also highlights the limitations of overconcentration of financial resources on a single player.

This finding, however, contrasted with studies by Winsberg (2015) and Jeffords and Potts (2019), which argued for a more balanced salary distribution. Our findings suggested that teams needed to pay quarterbacks in line with their critical value, especially as NFL offenses continued shifting towards more pass-heavy strategies. The increasing reliance on explosive passing plays and quick decision-making has elevated the quarterback position's importance, making strategic investment in this role a necessity rather than a luxury. However, teams must also ensure that excessive spending on a single player does not come at the expense of roster depth, particularly in critical supporting positions such as the offensive line and receiving corps.

Wide receivers had also become increasingly important as the league moved towards a more pass-focused game. Our analysis showed a strong positive link between spending on wide receivers and team success, aligning with Calvetti Jr.'s (2023) findings. The connection between quarter backs and wide receivers—where each's performance relied on the other's—illustrated why investing in these positions was so vital. Teams that failed to allocate enough resources to these areas might have struggled to compete in a league that was growing ever more reliant on the passing game. This finding further highlights the strategic shift in NFL roster construction, where passing efficiency has become a dominant factor in offensive success. As rule changes continue to favor passing offenses, teams that fail to allocate sufficient resources to wide receivers may find themselves at a competitive disadvantage.

Offensive line spending emerged as another key factor for success. While previous research, such as that by Winsberg (2015) and Jeffords and Potts (2019), downplayed its significance, our findings indicated otherwise. We found that higher investments in the offensive line had a strong positive relationship with winning, supporting conclusions from Calvetti Jr. (2023) and Mulholland and Jensen (2019). This suggests that the value of offensive line investments extends beyond mere protection for the quarterback-it directly influences a team's ability to sustain offensive drives, reduce sack rates, and improve overall scoring efficiency. In a league increasingly dependent on high-tempo, pass-heavy schemes, teams that neglect offensive line investments risk limiting their offensive potential and exposing their quarterbacks to greater injury risks.

When it came to defensive spending, our findings were a bit more complex. While spending on edge rushers and cornerbacks showed a significant positive effect on team performance, we didn't observe the same result for defensive tackles and safeties. This contrasted with Mulholland and Jensen's (2019) findings, which identified these positions as critical for success. This difference might have been due to shifts in NFL strategies, where edge rushers were increasingly valuable for disrupting opposing quarterbacks, and cornerbacks were key for defending against the league's passheavy offenses. Our results reinforce the importance of defensive adaptability-teams prioritizing investments in edge rushers and cornerbacks are better equipped to counter modern highpowered passing offenses. This underscores a broader trend in salary cap strategy: rather than evenly distributing resources across all defensive positions, successful teams appear to target investments in areas that most directly impact the current offensive environment.

One particularly interesting finding was the importance of spending on cornerbacks-a position that hadn't received much attention in previous research. Our results showed a strong positive link between cornerback spending and team success, underscoring the growing importance of this position in the NFL's pass-dominated environment. As offensive strategies continue to evolve, cornerbacks may soon be as valued as wide receivers. This aligns with recent roster trends where teams have placed greater emphasis on securing elite cover corners, particularly those capable of neutralizing top-tier receivers in single coverage. The increasing prevalence of spread offenses and quick passing attacks suggests that the ability to disrupt timing routes and limit explosive plays is more valuable than ever. Consequently, teams that fail to invest in high-quality cornerbacks may struggle to contain top offenses, reinforcing the need for a more nuanced approach to defensive spending.

On the other hand, our study pointed to the decreasing value of the running back position. Consistent with Zimmer's (2016) findings, our results suggested that teams should have allocated less of their salary cap to running backs, whose contributions to winning had diminished in today's passfirst league. This trend supported the broader shift towards reallocating resources from running backs to more impactful positions, both on offense and defense, which might have provided a more effective strategy for long-term success. This finding further highlights the evolving nature of positional value in the NFL. While running backs were once considered central to offensive efficiency, our results suggest that their production can often be replicated at lower costs, particularly through committee-based approaches or rookie contracts. Teams continuing to invest heavily in running backs may face diminishing returns, as their cap allocation could be better utilized in positions with a greater direct impact on winning.

While the NFL's hard salary cap promotes parity, market size still influences financial strategies. Large-market teams, like the Cowboys, Patriots, and Rams, benefit from higher revenue streams, enabling them to absorb cap inefficiencies, restructure contracts, and aggressively pursue free agents, particularly in quarterback-driven offenses. In contrast, small-market teams, such as the Jaguars, Bengals, and Packers, must maximize draft picks and player development, as they lack the financial flexibility to compete in high-priced free agency. The Bengals' 2021 strategy of building around Joe Burrow while keeping costs low on offensive line and secondary exemplifies a sustainable model, whereas the Rams' 2021 "winnow" approach led to a Super Bowl but required drastic cap adjustments in later seasons.

Our findings suggest small-market teams should prioritize long-term investments in key positions (e.g., offensive line, cornerbacks) while staying flexible with quarterback contracts to maintain roster depth. Large-market teams, meanwhile, can afford greater risk in high-cost signings, knowing they can restructure deals when needed. Understanding how market size affects cap allocation helps teams make informed spending decisions, ensuring competitiveness within the NFL's salary cap constraints.

In sum, this study provided a thorough look at salary cap strategies in the NFL. We reaffirmed the importance of investing in crucial positions like quarterbacks and wide receivers, while also offering fresh insights into the value of offensive linemen, edge rushers, and cornerbacks. Our findings challenged some traditional views and aligned with emerging trends in the NFL's tactical evolution, offering practical recommendations for teams aiming to optimize their salary cap management and maximize their chances of on-field success.

Theoretical Implications

Our findings contribute to the debate between Tournament Theory and Team Cohesiveness Theory, offering insights into how salary cap allocation impacts team success in the NFL. Tournament theory (Lazear & Rosen, 1981) suggests that investing heavily in top performers enhances competition and team performance. Our results support this, as teams allocating significant cap space to quarterbacks, wide receivers, and offensive linemen consistently achieved better outcomes. For instance, the Kansas City Chiefs' 16.5% cap allocation to Patrick Mahomes was instrumental in their Super Bowl LVII victory, reinforcing the importance of prioritizing elite talent in key positions. However, our findings also suggest diminishing returns when quarterback spending exceeds 18-20% of the cap, as seen with the 2023 Denver Broncos and 2022 Green Bay Packers, whose heavy quarterback investments led to roster depth issues and underperformance.

Conversely, team cohesiveness theory (Levine, 1991) emphasizes balanced salary distribution to enhance team harmony. While we do not find support for strictly even cap allocation, our results highlight the importance of maintaining flexibility to invest in critical supporting positions, particularly offensive line and secondary defense. The Philadelphia Eagles' 2022 Super Bowl run exemplifies this, as their top-ranked offensive line—accounting for 15.8% of their cap—provided stability that contributed to their deep playoff success.

Our findings challenge prior research advocating for a more evenly distributed salary structure across all positions (Winsberg, 2015; Jeffords & Potts, 2019). Instead, they align with Kim et al. (2020), who found that targeted salary dispersion among key positions leads to better performance. These results suggest that a hybrid approach of blending both theories may be the most effective strategy, allowing teams to invest in elite talent while maintaining cap flexibility for key supporting roles. Future research should further examine how evolving league trends and rule changes impact optimal salary cap strategies.

Practical Implications

Our findings provide practical insights for NFL teams, emphasizing the importance of focusing on key positions like quarterbacks, wide receivers, and offensive linemen to enhance team success. The strong link between quarterback spending and team performance highlights the necessity for franchises to prioritize elite talent in this role. In today's offense-driven game, securing and retaining a top-tier quarterback is essential. Teams must balance quarterback investment with maintaining roster depth to sustain long-term success.

The results also offer strategic insights on defensive spending. The impact of cornerback and edge rusher investments reflects the growing importance of countering high-powered passing offenses. For instance, the San Francisco 49ers' 2022 investment in elite edge rushers (Nick Bosa) and top-tier cornerbacks helped them build a dominant defense, complementing their cost-efficient quarterback strategy. Conversely, the 2023 Los Angeles Rams allocated a significant portion of their cap to interior defensive linemen while neglecting their secondary, which left them vulnerable against passing-heavy teams. To improve defensive efficiency, teams should consider shifting resources from lower-impact positions like interior defensive line and safeties to premium positions like edge rushers and cornerbacks.

Additionally, spending on running backs continues to show diminishing returns in today's passheavy NFL. The 2023 Dallas Cowboys opted to release Ezekiel Elliott, reallocating resources toward their offensive line and receiving corps. In contrast, the New York Giants' continued reliance on expensive running back contracts limited their ability to invest in offensive line improvements, contributing to offensive inefficiencies. Teams should prioritize cost-effective running back strategies—such as committee-based approaches and rookie contracts, while investing more in offensive line depth and wide receivers.

NFL managers may also consider strategic roster planning based on cap constraints when making salary cap decisions. Small-market teams should emphasize draft-and-develop strategies, investing in offensive line depth and hybrid defensive players to maximize cap efficiency. Largemarket teams can afford greater risk in high-cost signings, particularly in quarterback and passrusher contracts, knowing they have financial flexibility to restructure deals. Rebuilding teams should allocate higher percentages to foundational positions (OL, DL) before committing large contracts to QBs or WRs.

By adopting a data-driven approach to salary cap allocation, NFL teams can enhance long-term competitiveness while avoiding inefficiencies in roster construction. These insights serve as a framework for general managers to optimize spending, maximize player impact, and build sustainable success in an evolving NFL landscape.

Limitations

One limitation of this study was that it relied solely on salary cap allocation data to measure team investment. While these figures offered a useful perspective on how teams distributed their financial resources, they didn't capture other critical factors that contribute to success, like coaching strategies, player development, or in-season adjustments. For example, a team might invest heavily in a particular position, but if the player isn't properly developed or used strategically, that investment might not yield the expected results. Future research could benefit from looking into qualitative aspects like coaching effectiveness and mid-season changes to complement the salary cap data.

Another limitation is the potential for omitted variable bias. Although our analysis underscores the impact of positional spending on team outcomes, it excludes a range of non-financial considerations that can shape performance, including coaching quality, player development programs, and player injuries. Coaches' tactical strategies and leadership styles may magnify or mitigate the effects of specific salary allocations, while robust developmental structures can help teams maximize the value of their cap investments. Similarly, injuries to key players can disrupt the intended benefits of even the most strategically allocated rosters. Future studies might incorporate these variables to develop a more comprehensive understanding of the complex factors that drive team success.

Additionally, this study focused on positional spending as a percentage of the salary cap but didn't explore the differences within those positions across seasons. Grouping all offensive linemen or linebackers together, for example, may overlook the distinct roles within those groups, such as the differences between left tackles and right tackles or between inside and outside linebackers. A more detailed analysis that distinguishes between these roles could offer a more nuanced understanding of how various positions contribute to team success.

Suggestions for Future Research

Future studies could expand on our study by incorporating non-financial performance metrics to provide a clearer understanding of how salary cap investments impact on-field success. Factors like player performance data, coaching efficacy, injury history, and team cohesion could help explain why some financial allocations are more effective than others. Subsequent research could employ qualitative or mixed methods approaches, which would allow researchers to evaluate how well teams are utilizing their salary cap across different positions, moving beyond just the financial aspect.

Another area for future research is examining emerging trends in salary cap management, particularly the rise of hybrid positions and the growing role of analytics in financial decision-making. Investigating how versatile players, such as safetylinebacker hybrids or mobile quarterbacks, impact roster construction and spending priorities could offer valuable insights into evolving positional value. Additionally, exploring how data-driven decision-making, such as the use of advanced metrics in contract structuring, shapes salary cap efficiency would contribute to a more refined understanding of modern team-building strategies.

Future research would be to extend the dataset over a longer time period or explore how salary cap trends play out in other professional sports leagues that operate under similar financial constraints. Including data from leagues like the NBA or European soccer leagues could allow for a comparative analysis of how different organizations manage their salary cap and its effect on success. This comparison might reveal general principles of cap management or sport-specific strategies that could inform best practices across leagues.

Lastly, future research could examine positional analysis by focusing on specific roles within each position group. For example, comparing the value of left tackles versus right tackles or inside linebackers versus outside linebackers could provide more detailed insights into how teams should allocate their resources. Additionally, examining the rise of hybrid roles, like safety-linebacker combinations in modern defensive schemes, could offer fresh perspectives on how teams can optimize their roster construction and salary cap strategies.

6. Conclusion

This study explored how salary cap allocation affects team success in the NFL, with a focus on key positions like quarterbacks, wide receivers, offensive linemen, and defensive players such as edge rushers and cornerbacks. Analyzing data from 384 observations over a 12-season span (2013-2024), we examined how financial investments in these positions impact win percentage. The results show that higher spending on quarterbacks, wide receivers, and offensive linemen is strongly associated with better team performance. Similarly, spending on defensive positions like edge rushers and cornerbacks has a significant positive effect on success. On the other hand, spending on roles like running backs and tight ends didn't have a noticeable impact on wins,

which suggests that teams might benefit from reallocating resources from these positions to more influential ones like quarterbacks and wide receivers.

This research adds to the literature by providing new evidence on the value of targeted salary cap spending, challenging earlier views that advocate for a more balanced spending approach across positions. By highlighting which positions are most linked to success, this study provides how NFL teams can better align their financial strategies with their performance goals on the field. The findings offer practical insights for NFL teams looking to optimize their salary cap management. Teams may focus their investments on quarterbacks, wide receivers, and offensive linemen, while also showing strong financial support for key defensive roles like edge rushers and cornerbacks. By allocating players' salaries away from less impactful positions, such as running backs, teams can make better use of their financial resources and build more competitive rosters, especially as the NFL continues to trend toward a more pass-heavy style of play.

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