Using a Novel Metric of Expected Points Above Average (EPAA) Versus Salary to Assess 2023 National Football League Kicker Value

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Abstract

In the National Football League (NFL), team salary caps mean money spent on players on one position reduces the ability to spend resources on others. Salary cap hits for kickers in 2023 ranged from under $1M to almost $6M, with cash salaries exhibiting an even wider range (<$1M to >$9M). Kickers have been primarily judged on the overall accuracy of their kicks within specific kick ranges. However, such an approach does not include factors such as wind, humidity, temperature, and other variables that could affect the probability of a successful kick. This paper describes a new, up-to-date metric, expected points above average (EPAA), that incorporates significant weather-related factors in addition to kick distance to evaluate kicker performance. Subsequently, each kicker's EPAA is compared to their salary to assess the cost of performance to determine kicker value. In 2023, there was no correlation between EPAA and kicker salaries. The lack of correlation between EPAA and salary presents an opportunity: NFL executives can use this metric as a screening tool to identify kickers that can deliver strong results at a relatively low cost to generate a source of potential competitive advantage in a salary-cap-constrained environment. Using this method for the most recent NFL season in 2023, twelve kickers were found to have high EPAA ratings and low cost and warrant further consideration as players who could improve rosters. Conversely, four kickers were identified as having low EPAA scores and high salaries and similarly could be evaluated further for potential replacement.

Introduction

In 2023, National Football League (NFL) teams were limited to a $224.8 million salary cap threshold. The NFL enforces a “hard cap,” meaning the cumulative spend for all players on a team must stay below the designated level, and money a team spends on one player, by definition, reduces the money available to spend on others. For many teams, quarterbacks will be the highest-paid players, and top NFL quarterbacks can utilize over $50 million of cap spend by themselves. While NFL kickers fall towards the lower end of the position spending range, NFL kicker salaries vary meaningfully (Sportrac). In 2023, kicker salaries ranged between below $1M to over $9M. Through salary cap management strategies based on calculation rules, NFL executives have the ability to alter "cap hit," but in spite of these measures, kicker salary cap hits in 2023 had a wide range of below $1M to almost $6M.

Kickers are critical members of football teams and have two main purposes: kickoffs, where they kick the ball away to the other team during the start of a half or after a score, and kicking attempts. Kicking attempts consist of extra points: a kick from thirty-three yards away worth one point after a team scores a touchdown, and field goals (FG), a kick varying in distance based on where the team offense is on the field, worth three points. A successful kick consists of a kicker kicking the football between the goalposts.

Many have measured kickers' effectiveness using various methods and performance metrics for different purposes. For example, prior work describes kicker value for fantasy football or evaluates kickers in clutch, high-pressure situations (Klein, Riske). The most common metric used to evaluate kickers is their accuracy for specified kick distance ranges. While this is a useful measure, it does not precisely assess how good a kicker is since many other factors, particularly weather, can affect the probability of a successful kick. To address this limitation and to attempt to determine which variables affect kick accuracy, several others have created logistic regression models to predict the probability of kick success by incorporating weather variables and other factors such as game situations (Clement, Long, Stuart, Riske, Pasteur and

Cunningham-Rhoades, Osborne and Levine). These prior analyses have two limitations. First, they are dated and kickers have improved over time (Stuart). Moreover, while kick distance is a significant factor in assessing kick success probability across all prior work, other weather variables such as wind speed are noted to be meaningful in some models but not others (Delong, Clement), again underscoring the need for a model with recent, up-to-date data. Second, prior analyses only focused on assessing kicker performance and did not measure the value of a kicker by mapping kicker performance to the cost of obtaining those results. This paper addresses both of these limitations.

In this analysis, I measure performance through the creation of a new logistic regression model with up-to-date data to determine the expected field goal and extra-point success probability based on kick distance and several important weather-related factors including wind speed, humidity, presence of precipitation, and temperature. Utilizing this model, the expected points that a kicker should have had in the most recent 2023 NFL season are determined, and then the kicker's actual performance is compared to his expected value to generate a metric called expected points above average (EPAA). Each kicker’s 2023 performance using EPAA is compared to his 2023 salary to determine which kickers offered the most value to their NFL teams in 2023. If no or minimal correlation between EPAA and salary exists, this approach would create a useful screening tool to identify kickers with a high EPAA and low salary, thereby offering a source of potential roster improvement and competitive advantage in a salary cap-constrained environment.

Methods

Data

I used the nflfastR (v2.3.1) dataset, which contains play-by-play data beginning in 1998. From the package, only plays involving field goals or extra points from 2015 to 2023 were included to allow for consistency in kicking rules. Variables studied for association with kick likelihood included distance, wind speed, humidity, type of surface, and rain. The presence of rain was determined from the weather string and included rain, snow, showers, and ‘Cloudy, chance of rain increasing up to 75%.’

Creation of Prediction Model

Variables noted to be significant on univariate analysis with a p-value of <0.05 (Table 1) were then used to create a multivariable logistic regression model, a tool used to predict a binary outcome, such as whether a kick goes in based on input variables. Distance was studied as both a linear and quadratic variable. The linear distance was selected as the best fit for the data by comparing the Akaike information criteria (AIC) metric. Additionally, I studied interactions between significant variables that are associated with kick likelihood. Temperature on univariate analysis was not significant but became significant when an interaction between temperature and distance was included. The final multivariable model included an interaction term between temperature and kick distance. The type of surface was not found to be significant on univariate analysis and was not included in the model. Only data points with complete values for each of these variables were included (16,768 of 20,905 kicks).

The logistic regression equation is represented as follows: *E(Kick)* represents the expected log odds for the success of a kicking attempt with coefficients (Table 2).

$$E(kick) = B_0 + B_1 * Distance + B_2 * WindSpeed + B_3 * Temp + B_4 * Humidity + B_5 * Temp * Distance$$

Calculation of EPAA (expected points above average)

Once the model computed the probability of making each kick, I assessed each individual kicker's season and determined how many points they earned relative to how many points that the average kicker would have had with the same opportunities to calculate EPAA. When weather information was missing for an individual kick in indoor stadiums, values for weather were imputed with average humidity, temperature of 70 degrees, and no rain. Otherwise, kicks with missing weather values were not used in the individual player calculations.

This metric allowed determination of how many "extra points" each kicker added to their respective teams relative to an average kicker. For example, if an average kicker had an eighty percent chance of making a field goal, which is worth three points, the expected points would be: 0.8 * 3 = 2.4. If the individual kicker made this field goal and garnered 3 points for their team, the EPAA value from this kick would be 0.6 (3.0 minus 2.4). The EPAA from a season was the summation of each of the kicks for an individual kicker and could be negative if the kicker performed below average.

Determination of player value

Individual kicker salaries for 2023 were assigned based on cash spent in the overthecap.com database (Over The Cap). In the scatterplot (Figure 3), each individual kicker from 2023 is represented by a point whose location is a function of his salary (x-axis location) and EPAA (y-axis location) in order to assess kicker value.

Results

The dataset consisted of 8,714 field goals (FGA) and 10,580 extra points (PATA) attempts by 102 kickers from the 2015-2023 NFL seasons. The association between individual variables and kick likelihood was studied in Table 1. As expected, longer kick distance was strongly correlated with lower kick success. In addition, humidity, wind speed, and the presence of rain were significantly associated with a decreased likelihood of kick success.

Table 1 - Univariate associations with kick success

Variable	Kicks made n=15,040 (89.7%)	Kicks missed n=1,728 (10.3%)	p-value*
Kick distance (mean, yards)	34.9	42.5	<0.001
Temperature (mean, ◦F)	60.2	59.7	0.29
Humidity (mean, %)	59.4	60.8	0.009
Wind Speed (mean, mph)	8.0	8.5	<0.001
Rain			0.001
No	14160	1592	
Yes	880	136	
Season (not included in prediction model)			0.27
2015	1474	170	
2016	1545	183	
2017	1483	182	
2018	1546	171	
2019	1516	202	
2020	1772	210	
2021	1887	213	
2022	1928	212	
2023	1889	185	

*T-test for continuous variable and chi-squared test for categorical

The coefficients for the prediction model are shown in Figure 1 using the univariate predictors, as well as temperature and its interaction term with distance.

Figure 1- Model Coefficients

```
Coefficients:
                             Estimate Std. Error z value Pr(>|z|)    
(Intercept)                 4.7540689  0.4565414  10.413  < 2e-16 ***
kick_distance              -0.0601294  0.0109001  -5.516 3.46e-08 ***
temperature                 0.0255259  0.0071137   3.588 0.000333 ***
humidity                   -0.0029416  0.0014696  -2.002 0.045323 *  
wind_speed                 -0.0268923  0.0055113  -4.880 1.06e-06 ***
rainYes                    -0.2262576  0.1079264  -2.096 0.036046 *  
kick_distance:temperature -0.0006223  0.0001747  -3.562 0.000368 ***
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Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
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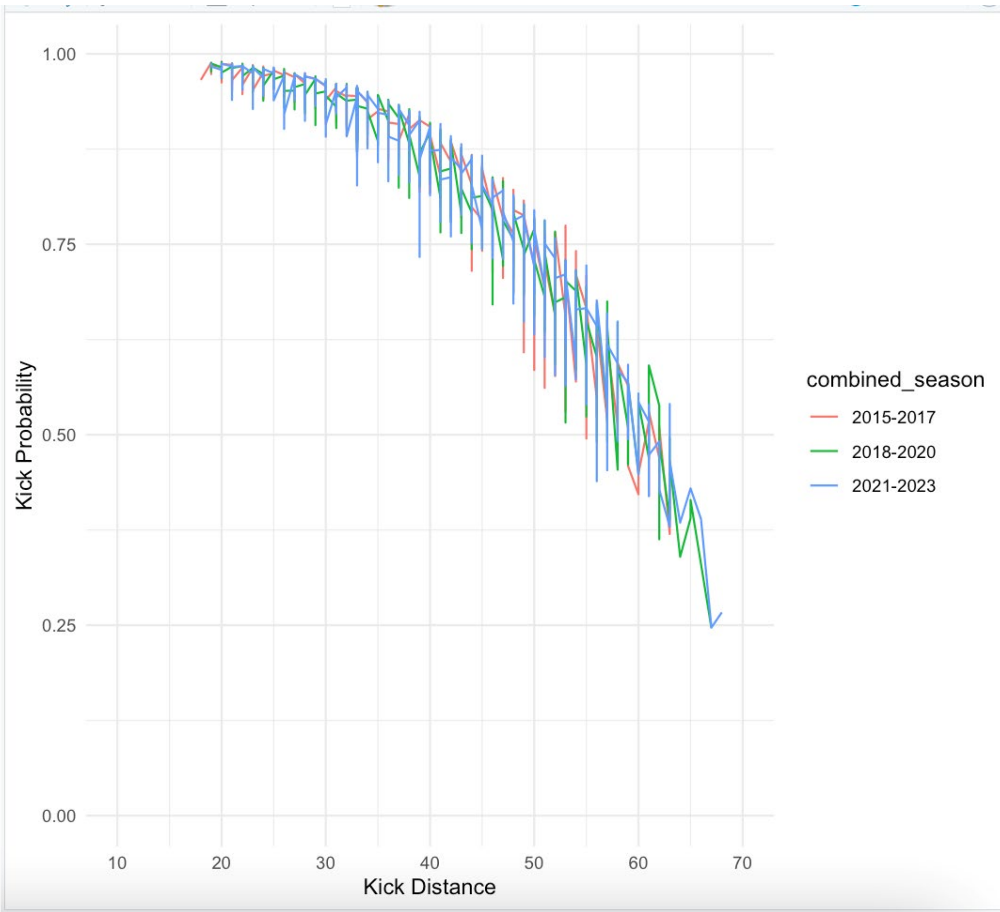
All variables remained significant at a p-level of less than 0.05 in the multivariable model. Decreasing kick distance, higher temperature, lower wind speed, lower humidity, and lack of rain increased the likelihood of a successful kick.

Figure 2 displays the likelihood of kick success by distance, where more recent seasons (2021-2023) are shown in blue, older seasons in red (2015-2017), and those in the middle (2018-2020) are in green. Kick probabilities by distance were not noticeably different over the study period.

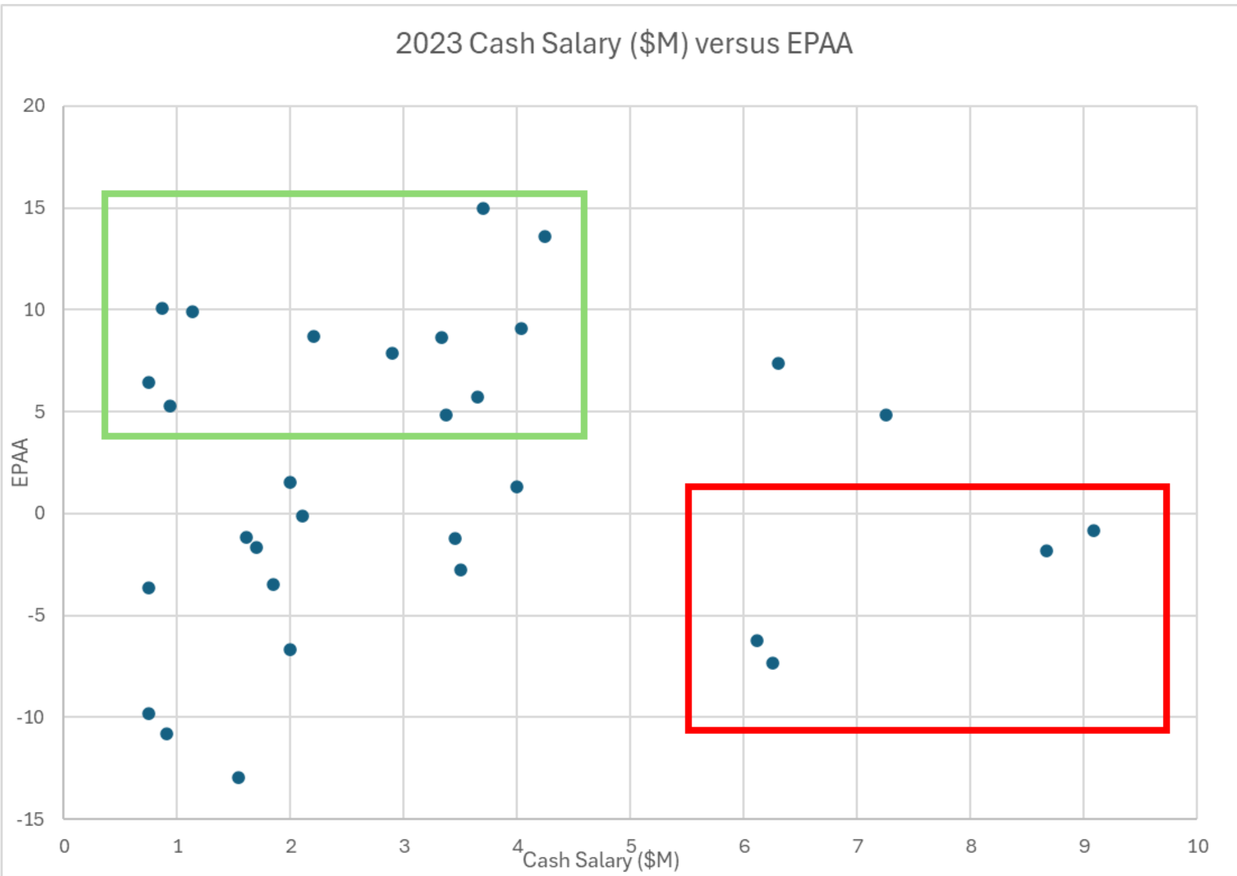
Figure 2 - Probability of kick success by distance across seasons



The EPAA for the 2023 season for each individual kicker was calculated, and annual salaries for each player were obtained from Overthecap.com and spotrac.com. Kickers who earned under $750,000 cash compensation in 2023 were excluded from as they largely reflected those who were cut or injured and did not kick enough to warrant inclusion in the EPAA vs salary analysis.

These values were plotted in 2 dimensions (salary and EPAA) in Figure 3. We can see that there is no correlation between EPAA and salary values. In the green box are players with good value in that they have high EPAAs and are relatively less costly. In the red box are players who have low value; namely, they have low EPAA scores and are expensive. Players who fall outside these boxes are those of intermediate value: those who have high EPAAs and are costly or those with low EPAAs and less costly.

Figure 3 - Individual players 2023 salaries plotted by EPAA



In total, 12 kickers were identified to be high value, and 4 kickers of poor value as shown in Table 2.

Table 2 - Individual kicker EPAA values and cash salary for 2023

Kickers with High Value on EPAA vs Cash Salary Metric in 2023, sorted by EPAA			
Kicker	Team	EPAA	Cash Salary ($M)
Harrison Butker	Chiefs	14.98	$3.70
Jake Elliott	Eagles	13.60	$4.25
Cameron Dicker	Chargers	10.10	$0.87
Chase McLaughlin	Buccaneers	9.93	$1.13
Chris Boswell	Steelers	9.08	$4.04
Nick Folk	Titans	8.69	$2.20
Greg Zuerlein	Jets	8.65	$3.33
Dustin Hopkins	Browns	7.86	$2.90
Brandon Aubrey	Cowboys	6.47	$0.75
Ka'imi Fairbairn	Texans	5.72	$3.65
Evan McPherson	Bengals	5.28	$0.94
Jason Sanders	Dolphins	4.83	$3.38

Kickers with Poor Value on EPAA vs Cash Salary Metric in 2023, sorted by EPAA			
Kicker	Team	EPAA	Cash Salary ($M)
Graham Gano	Giants	-7.33	$6.25
Tyler Bass	Bills	-6.24	$6.11
Jason Myers	Seahawks	-1.84	$8.67
Matt Gay	Colts	-0.81	$9.10

Kickers with Intermediate Value on EPAA vs Cash Salary Metric in 2023, sorted by EPAA			
Kicker	Team	EPAA	Cash Salary ($M)
Cairo Santos	Bears	7.40	$6.30
Justin Tucker	Ravens	4.86	$7.25
Brandon McManus	Jaguars	1.51	$2.00
Matt Prater	Cardinals	1.30	$4.00
Eddy Pineiro	Panthers	-0.11	$2.10
Jake Moody	49ers	-1.15	$1.61
Daniel Carlson	Raiders	-1.23	$3.45
Wil Lutz	Broncos	-1.65	$1.70
Younghoe Koo	Falcons	-2.76	$3.50
Joey Slye	Commanders	-3.50	$1.85
Blake Grupe	Saints	-3.62	$0.75
Greg Joseph	Vikings	-6.68	$2.00
Lucas Havrisik	Rams	-9.81	$0.75
Anders Carlson	Packers	-10.79	$0.91
Chad Ryland	Patriots	-12.97	$1.54

Discussion

In a salary cap-constrained environment, kicker value should go beyond measuring performance. Rather, the value should be determined by mapping effectiveness versus the cost to achieve it. Therefore, two inputs are needed: 1) A metric to assess performance and 2) Kicker salaries to assess cost. To evaluate performance, I created a logistic regression model that included all field goal attempts and extra point attempts from 2015-2023, where data were available. 2015 was chosen as the start year for analysis as that was the first year after the extra point distance was moved such that the snap was from the 15-yard line instead of the 2-yard line. Of the variables tested, kick distance and wind speed were most significant when determining the probability of a kick going in. Temperature was not significant by itself but became highly significant when an interaction with distance was included. This makes sense as colder air is denser, and the effect should be evident at longer distances and is consistent with prior work that cited that temperature matters when it is very cold (below freezing) for field goals beyond 25 yards (Burke). The prediction model found humidity to be a significant variable. Increasing humidity is associated with decreasing air density which might allow the ball to travel farther. However, greater humidity could also make the ball wet which could cause a kick to be more difficult or affect the quality of the hold. Data on hold quality was not easily available and testing hold quality in univariate analysis or with an interaction with humidity would be interesting for future study. Like humidity, the presence of rain also was modestly significant, and this finding is similar to findings in prior work. Collectively the prediction model was largely comparable to other efforts. Kick distance, not surprisingly, was the variable that had the lowest p-value when determining kick success. Humidity was not present or tested in many other prior models, but its effect appears modest and is potentially confounded by hold quality.

Kicker effectiveness in 2023 was determined by using the kicker's actual performance in 2023 and compared to what the model would have predicted for a kicker under similar conditions. In 2023, EPAA ratings ranged from 14.98 (Harrison Butker, Chiefs) to -12.97 (Chad Ryland, Patriots). This means Harrison Butker, the kicker with the highest EPAA score, generated almost 15 points above what would have been expected from the average kicker kicking the same field goals and extra points. The magnitude of ~15 EPAA points is quite meaningful, as it is possible that these extra points could have made a difference in helping the Chiefs win games. Even if the extra points above average did not produce the winning margin, the performance of the kicking game can alter several strategic decisions and choices that could alter the trajectory of a game. The lowest EPAA score was generated by Chad Ryland of the Patriots, who anecdotally was thought to have a substandard season.

Beyond assessing individual kicker performance using EPAA, to determine kicker value, a player's EPAA was evaluated versus their salary to assess the cost of obtaining those results. While 2023 EPAA is based on 2023 performance and 2023 salary is likely based on expectations derived from the prior year or years of performance, it is still a valuable comparison to assess how a kicker performed relative to his contract. What is noticeable in Figure 3 is that no correlation between EPAA and kicker salaries appears to exist. This is possibly because 2023 salaries are mainly based on expectations derived from historical performance, and many kickers, like players at other positions, outperformed or underperformed their contracts. Kickers in the green square in Figure 3 represent the best value–they have high EPAA scores while costing the team less money than many of their peers. Conversely, kickers in the red rectangle have below-average EPAA scores while costing teams a lot of money. Table 2 groups kickers into high-, intermediate-, and poor-value categories. High-value kickers all generated at least a positive EPAA score of 4.83 while costing their team less than $5M cash salary in 2023. Poor value kickers had negative EPAA scores and cost teams over $6M in cash salary. Interestingly, some kickers generally considered to be among the best in the game, such as Justin Tucker of the Ravens, who generated a positive 4.86 EPAA in 2023 and would have made the high-value list based on performance but did not because of their relatively high salary and were dropped to the intermediate value category.

There are several limitations to this analysis. It’s possible that NFL executives value specific attributes of performance not captured by EPAA. For example, EPAA scores a kick relative to its predicted probability of going in but not on strategic value. “Clutch kicks,” or kicks in high-pressure situations, are not given any extra weight in the model. Similarly, it’s possible some executives would place greater value on long-distance kicks because it shortens the field for the team’s offense, and a missed kick from afar would set the opposing team up with a good field position. While longer distance kicks with a lower probability of going in offer potentially more EPAA points if a kick goes in, it is possible that a kicker can generate a high EPAA from a large volume of easier kicks. Further, there is also potential for selection bias in the model in terms of unequal opportunities to assess kick performance. For example, only the best kickers may get a chance to attempt longer, lower-probability field goals, and therefore, the data for longer distances may not reflect the entire range of kickers. This selection bias increases the expected probability of kick success at longer distances relative to an average kicker and therefore lowers collective EPAA scores for kickers that attempt deep kicks. Moreover, it’s possible that an excellent kicker has a low EPAA simply because he is on a very strong offense that scores touchdowns often and has fewer field goal attempts. However, EPAA, even in this case, can be helpful to calculate since it captures utilization–a team that relies less on its kicker for field goals may not want to allocate as many dollars to the position.

These limitations mean EPAA should not be considered the definitive measure of kicker effectiveness. Rather, EPAA could be used as a screening tool and a good starting point to evaluate kicker performance because it is a quantitative, objective metric that aims to account for multiple variables outside of only accuracy and kick distance. Other limitations in the analysis could be attributed to the model itself. I was not able to incorporate variables such as wind direction, hold quality, or altitude. Wind direction and hold quality were difficult to find and/or had lots of missing data. I tested kicks from Denver (city at high altitude) on univariate analysis as a proxy for altitude, but this was not found to be significant (data not shown) though others have found kicks from Denver have success probabilities similar to fields goals that are several yards shorter from lower altitude locations. To estimate the cost of performance, I used the 2023 cash salary as this number rather than the salary cap number, which is the actual dollars a team spent on the player in that calendar year. It's possible that a cash salary each year does not reflect an average salary, given teams can move cash around in a multi-year contract for salary cap management. Nonetheless, the actual cash spent reflects the true cost for that calendar year. Finally, I only mapped 2023 EPAA versus 2023 salaries. It is possible that EPAA and salary could be correlated in other years.

Conclusions

EPAA is an up-to-date metric that utilizes critical weather-related factors in addition to typically used factors of kick accuracy and distance to assess kicker performance. When comparing EPAA to kick salaries in 2023, no correlation exists. While EPAA may not capture everything important to NFL managers, at a minimum, comparing EPAA to salaries can provide NFL executives with a useful screening tool to evaluate the value they are getting from their own kickers and to assess value in other kickers. In 2023, twelve kickers screened well, generating a high EPAA value while having low to intermediate salaries and warrant further consideration as players who could potentially improve rosters at an attractive cost. Conversely, four kickers did not fare well on this metric by having a negative EPAA score and a high salary and should be evaluated further for potential replacement.

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