# Bye Weeks Impact on Seasonal Success in the National Football League

Benjamin Funk

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This study determines the effect of how the point in which a team's bye week during their regular season impacts their chances of making it to the postseason. Two different linear probability regression models are used to find how the independent variable bye week impacts the binary dependent variable of making the playoffs for a given team in a season. One model uses bye week as the week of the bye week while the other categorizes bye weeks into the beginning, middle, and end of season. Logit and Probit models are used to check for robustness within the base model. This study suggests that there is not enough evidence to suggest that the "when" of bye week in a team's schedule impacts that team's chances of making it into the postseason.

## Introduction

Every May, fans of the National Football League jump onto their favorite team's website or social media to scrutinize the team season schedule. Out of all things that appear on the schedule, fans seem to care most about one week in particular. This week is a team's bye week. Though bye weeks were created to boost revenue in the NFL, bye weeks allow for players to have a guaranteed rest from the brutal sport that is American football. This break from sports has been analyzed to increase team productivity in their following post bye games (Foreman). This can be backed up by psychology studies that show that time away from the workplace improves worker productivity (Fritz).

Though bye weeks impact subsequent performances, fans do not often care about who they play after a bye, but instead when they bye week is in the 17-week NFL season. Fans hope that their team has bye weeks near the end or middle of the week as they feel that the location of a bye will determine a team's overall success in a season. On the other hand, the location of a bye week is very important for teams and players. Teams that have older players tend to want bye weeks later into the season to allow their players to rest and recover before the final push for the playoffs. Some football coaches such as Woodie Haynes claim that bye weeks can throw off a hot team on a win streak. My research question is important not only for fans and teams, but the results may allow for the NFL to strategically assign bye weeks to teams to balance out the league.

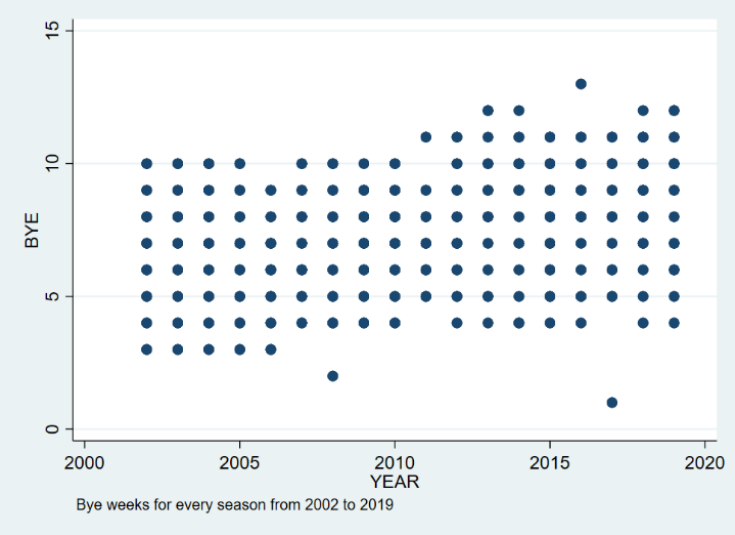
In this paper, I will analyze the impact of the timing of a team's bye week relative to their schedule with that team's chances of making it to the postseason. To do this I will use an ordinary least square regression model with the dependent variables being binary for whether a team makes the post season or not. My key variable will be the week number that a team has a bye in which will be interpreted as the percentage chance that a given team will make it to the playoffs per unit increase in later appearance of bye week. I will also control for other variables. My hypothesis is that teams that have their bye weeks later in the season will have a better chance of making it to the postseason.

## Data

My data comes from pro-football-reference.com. I am using season team stats and standings starting in 2002 all the way through 2019. I started my data in 2002 because it is the most recent team merger in the NFL with the addition of the Houston Texans creating the 32 team NFL league. The 2002 season was the beginning of the 1 bye week era in the NFL, meaning each team received 1 bye week during the 17-week NFL season. I end with the 2019 season as it is the latest completed season.

A great question is how a team makes it to the NFL playoffs. The NFL is a league that consists of 32 teams that are broken into the American Football Conference and the National Football Conference. Those two conferences are then broken down into groups of four, known as divisions, designated by a cardinal direction. In total, there are 4 divisions in each conference. The team with the best record at the end of the season in each division secures a ticket to the playoffs. These division winners only account for eight of the twelve teams that compete in the playoffs. The other four teams are known as the wildcard team. A wild card team is a team that

did not win their division but have a better record than anybody in their conference. The outcome of interest in my paper is a binary variable of whether a team makes the playoffs or not.



Bye weeks for every season from 2002 to 2019

The independent variable of interest is the point in time of a bye week within a team's season. A bye week is a type of break in a season that each team receives. It allows for players and coaches to rest while also allowing for the NFL to stretch their 16-week season to a 17-week season to maximize revenues. Most bye weeks take place between week 4 and week 12 of each NFL season. There are some exceptions where bye weeks took place outside of this time frame such as in 2017 when Hurricane Irma hit Florida causing the Miami Dolphins and the Tampa Bay Buccaneers to have their bye week in the first week of the season. Otherwise, bye weeks are assigned randomly by computer to avoid possible bias.

With my dependent variable being a binary variable for whether a team makes it to the playoffs and my main independent variable for timing of bye week in a season schedule, I am also including several control variables. A variable for wins will be the number of wins that a team gets in a season. Another variable included is strength of schedule. Strength of schedule is a rating given to a team to show how difficult a team's schedule appears. It is a decimal number that increases as a season is harder and decreases as a season is easier.

# Method

To answer my research question, I have created two models. Both models use all the same variables with the only difference being how bye week is represented. In Model 1, bye week is represented by a number from 1 to 16 to represent which week that team's bye took place in that given season. Model 2 has bye week categorized into beginning, middle, and end of the season. Beginning will represent bye weeks 6 and below, middle will represent bye weeks 7 to 9, and end will represent bye weeks 10 and above. End and beginning are used in the model while middle is omitted to ensure variation in variables. I am representing bye week in a categorical way in case the relationship between bye week and making the playoffs is nonlinear.

Model 1:

$$Probability(Making\ Playoffs_{TY}) = \beta_0 + \beta_1(Bye\ Week_{TY}) + \beta_2(Wins_{TY}) + \beta_3(Strength\ fo\ Schedule_{TY}) + u_{TY}$$

Model 2:

$$Probability(Making\ Playoffs_{TY}) = \beta_0 + \beta_1(Beggining\ of\ Season_{TY}) + \beta_2(End\ of\ Season_{TY}) + \beta_3(Wins) + \beta_4(Strength\ fo\ Schedule_{TY}) + u_{TY}$$

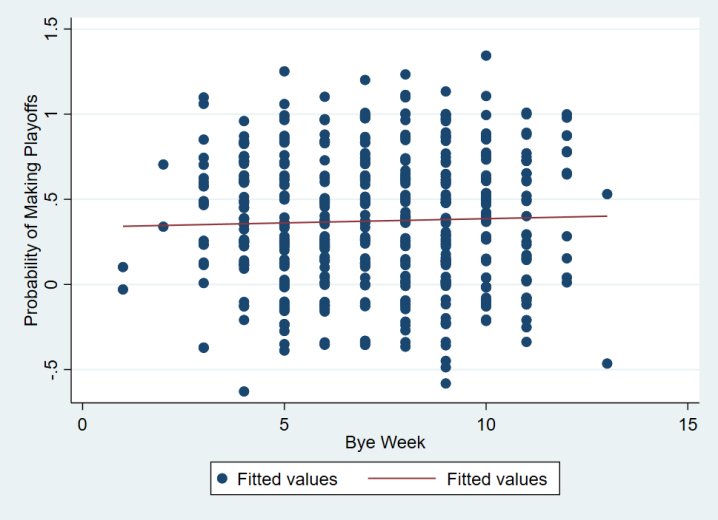
These models will control for a team's wins in a given year along with the strength of schedule rating for a team in a given year, and test to see if the timing of a team's bye week within their schedule increases, decreases, or does not impact a team's chances of making the playoffs. Thus, the coefficient for bye week will be the key to answering my research question. The model that I use has the dependent variable set as the percentage chance of a given team making the playoffs in a specific year. The main independent variable in my model is the location of a given team's bye week within a certain season. My data represents the population of 32 teams over 17 seasons of football which ensures random sampling within my model

Both of my models are linear probability models due to my dependent variable being binary. 1, if a team made it to the playoffs and 0, if a team did not. I can check the robustness of my models' by creating logit and probit models with the same variables as my linear probability

model. If the coefficients in my base models vary differently from the probit and logit models, my models may not be robust. I expect a team's wins to have positive correlations with a team making the playoffs. I also expect schedule difficulty to have a negative correlation as well.

## Results

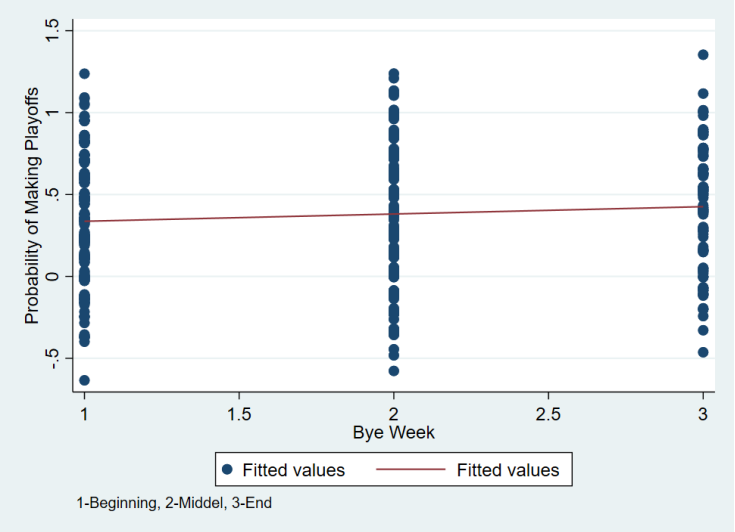
| | (1) | (2) | (3) |
|---|---|---|---|
| VARIABLES | Model 1 | Logit | Probit |
| | | | |
| BYE | 0.00387 | 0.000466 | 0.00225 |
| | [0.00545] | [0.00421] | [0.00424] |
| W | 0.120*** | 0.106*** | 0.106*** |
| | [0.00424] | [0.000996] | [0.00101] |
| SoS | -0.0110 | -0.0146** | -0.0150** |
| | [0.00788] | [0.00591] | [0.00604] |
| Constant | -0.616*** | | |
| | [0.0538] | | |
| | | | |
| Observations | 576 | 576 | 576 |
| R-squared | 0.597 | | |
| Standard errors in brackets | | | |
| *** p<0.01, ** p<0.05, * p<0.1 | | | |




Model 1's results show that a team's bye week does not have any statistically significant impact on a team's probability of making the playoffs. This model shows that the expected percent change in probability of 0.387 for a unit increase of bye week is not different from zero. The coefficient for a team's strength of schedule was not statistically significant either. The only variable that holds a statistical significance impact on the probability of making the playoffs is number of wins. A team adding a win to their record is expected to increase their chances of making the playoffs by 12 percentage points. This coefficient is significant to the 99% level of confidence.

When comparing the coefficients of the logit and probit model to the base model, there is very little variation in the numbers. The only concern is that the probit and logit model have the coefficient for strength of schedule being significant to the 95% confidence interval when the base model coefficient has a significance of 85%. My robustness check does seem to check out for Model 1, but it is possible that I did not satisfy all of the Gaus-Markov assumptions or I may need to use a non-linear model.

| | (1) | (2) | (3) |
|---|---|---|---|
| VARIABLES | Model 2 | Logit | Probit |
| | | | |
| beg | -0.0302 | -0.0154 | -0.0179 |
| | [0.0288] | [0.0226] | [0.0228] |
| end1 | 0.0123 | -0.00600 | -0.000150 |
| | [0.0348] | [0.0255] | [0.0271] |
| W | 0.120*** | 0.106*** | 0.106*** |
| | [0.00424] | [0.00109] | [0.00112] |
| SoS | -0.0109 | -0.0147** | -0.0150** |
| | [0.00788] | [0.00593] | [0.00606] |
| Constant | -0.577*** | | |
| | [0.0393] | | |
| | | | |
| Observations | 576 | 576 | 576 |
| R-squared | 0.598 | | |
| Standard errors in brackets | | | |
| *** p<0.01, ** p<0.05, * p<0.1 | | | |




Model 2 shows the exact same coefficients and significance levels for strength of schedule and total wins as Model 1. The categorized coefficients for bye week for both beginning and end of season are not statistically different from zero. Though the coefficients are not statistically significant, the model suggests that bye weeks in the beginning of the season decrease the probability of a team making the playoffs by -3.02 percentage points compared to having a bye week in the middle of the season. It also suggests that teams that have their bye week at the end of a season, have a 1.23 percentage point increase in their probability of making the playoffs.

## Conclusion

The results of both of my models conclude that there is not enough significant evidence to suggest that the timing of a team's bye in their schedule will increase their chances of making it to the playoffs. The coefficients correlated in the way that I hypothesized them, but they just lacked the statistical significance. I believe that a bigger sample size is needed in order to find the true impact of the bye week. It is also possible that the relationship between bye week and making the playoffs is non-linear and require a different type of model to analyze the try impacts. A different variable for difficulty of schedule rather than the strength of schedule rating may possibly correlate better with probability of making the playoffs. This research question could be further improved by looking at the number of days off resulting from a bye week rather than the point in time during a season the bye week occurs.

# Sources

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