Taking Offense: The Evolution of Team Offenses in the NFL's Post-Merger Era

Introduction

The National Football League (NFL) is one of the most popular sports leagues in the world, and it is the most popular league in North America, with its championship match (the Super Bowl) often topping the charts as the highest-watched event in the United States each year (Nielsen, 2020).

As the football coach Bear Bryant once famously said, "Offense sells tickets, but defense wins championships." In the NFL's recent seasons, offenses have been heavily favoured over defenses, as changes to the NFL's rules which have emphasized the safety of quarterbacks (Cunningham, 2017) have inadvertently made the game simpler for offenses, and allowed NFL offenses to become much more efficient.

Throughout the history of the National Football League, teams' offenses have continued to adapt and change to overcome new defensive strategies, and defensive strategies have emerged to counter these offenses. Although this pattern allows for some level of a "chess match" between NFL offenses and defenses, changes to the league's rules over time have helped to emphasize the safety of quarterbacks in the league who are often faces of the league and their respective teams (Cunningham, 2017),.

These changes have skewed this 'battle' in favour of the offensive side of the ball (Cunningham, 2017), as well as increasing the frequency of NFL teams choosing to have pass attempts instead of running with the ball. (NFL, 2021)

Changes to the NFL rules have made it difficult for quarterbacks and NFL offenses in general to be compared to one another, as modern NFL offenses are significantly favoured by the NFL's rules compared to older NFL teams. In the history of the National Football League, there have been 12 instances of a quarterback throwing for over 5000 passing yards in a single season (Pro Football Reference, 2021). The first such season was Dan Marino's historic season in 1984 when he first broke the 5000-yard record. No quarterback reached this threshold again until Drew Brees in 2008. Since Brees' 2008 season, the 5000-yard record has been broken 10 times, despite having only been broken twice in the league's history up to that point.

There are many metrics which are popular for gauging the efficiency and overall value of an NFL team's offense, such as their net yards, net passing yards, net rushing yards, and total points scored. On top of these 'simpler' metrics, there are also a myriad of advanced statistics such as expected points added (EPA), quarterback ratings (QBR), and efficiency metrics such as completion percentages, and yards per attempt.

In this report, we will examine the evolution of NFL team's offenses throughout the history of the league, dating back to the merger between the AFL (American Football League) and the NFL in 1970. In particular, we will examine teams' offensive statistics, such as their passing statistics, rushing statistics and overall points scored throughout the post-merger era of the league to determine how changes to the NFL's rules have affected the development and ongoing performance of offenses in the NFL.

We will use regression techniques to analyze and predict these values, as well as to determine the relationships which these values have to one another. We will evaluate the changes in the relationships between these values over time, and we will compare the changes in these relationships and the development of new offensive strategies based on changes to NFL rules which favour quarterbacks and teams' offenses in general, to see how NFL offenses have reacted and adapted to these rule changes.

We expect to use regression discontinuities to examine how these offensive metrics have changed over time, as the NFL tends to implement rule changes during its off-season (NFL, 2021), so there is a 'hard cutoff' between times when certain rules are in play or are not in play in each NFL season.

The information which we will collect and examine in this report can also be used to determine how NFL defenses can best adapt to the changes which have been made by the NFL, to help bring more of a balance between the offenses in the league and their opponents' defenses. This information can also be use to help derive comparisons between NFL offenses over time, as these results can be used to determine the capability of an NFL team's offense in a given NFL season relative to the other offenses in the league.

The data which we will be examining is the seasonal offensive statistics of all NFL teams from 1970 and beyond, and the data will be collected from https://www.pro-football-reference.com/, a free-to-use online database of NFL scores and statistics throughout the league's history. We will collect the data from their website using the 'sportsref' and 'sportsipy' Python APIs, and we will then use R to analyze the data collected from their website.

Sources
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