Adjusting Pro Football Focus wins-above-replacement to forecast the average annual value of NFL player contracts

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Pro Football Focus

Abstract

Football is a noisy game, with a lot of dependent variables that influence each other on every play. Isolating each player's individual contribution and boiling this contribution down to a single metric with PFF wins-above-replacement (WAR, Eager and Chahrouri, 2020), has paved the way for more precise player valuation than ever before. Valuing the production of each player in terms of win-share is the natural first step, with the next being how to value each player from a contractual standpoint on the open market. In this paper, we adjusted PFF's WAR metric with NFL market factors to approximate the average annual value of each player were they to sign a new contract in a given offseason.

1 Introduction

The National Football League's (NFL) hard salary cap, coupled with a lack of competition in the labor market, has created a monopsony or "single-buyer" market structure. Over an extended period, a monopsony (here, the NFL teams as a collective) with a limited supply of resources (cap dollars), will eventually come to agreement on the value of each of their inputs. Here, the inputs would be each position on an NFL roster, and the "agreement" would be the maximum amount of money any team is willing to invest in each player.

Once the position markets find their equilibrium, we then have an improved understanding of the parameters associated with each new NFL contract. Because the markets are so well defined, we can compare players within each position group and project their future contracts much more accurately. We confined our analysis to 2011-present because of the NFL's adoption of the "rookie wage scale" in the 2011 collective bargaining agreement[1]. Veteran contracts now fall into a completely separate bucket as compared to rookie contracts.

In this paper, we sorted players into percentiles at their respective position using PFF WAR, and then accounted for each player's age, draft position, and historical position-market trends to derive a predicted per-year value on a new contract for every player in the NFL were they to reach the free agent market in a given offseason.

2 Methods

First, we used a simple calculation to determine how much each NFL player was paid relative to their position market. Mirroring NFL franchise tag calculations which use the average of the five largest salaries at each position, we used the average annual value of the top five players at each position. We then slotted every player's average annual value amount and took that as a percent of the top five at their respective position (Fitzgerald and Spielberger 2020). We ran this calculation for every non-rookie contract, excluding special teams players, signed from 2016-20 (n= 2,282). "Percent of Top Five AAV"

or “T5AAV” enabled us to cleanly compare contracts across positions. Below is an example calculation from the *2020 offseason*:

X player is a wide receiver

The top 5 highest-paid wide receivers in terms of average annual value earned $22 million per year, $20 million, $19.25 million, $18.171 million, and $18 million.

The average of those five figures is $19,484,200. Thus, the wide receiver T5AAV is $19,484,200.

If X player signs a 4-year / $40M contract, his average annual value is $10 million.

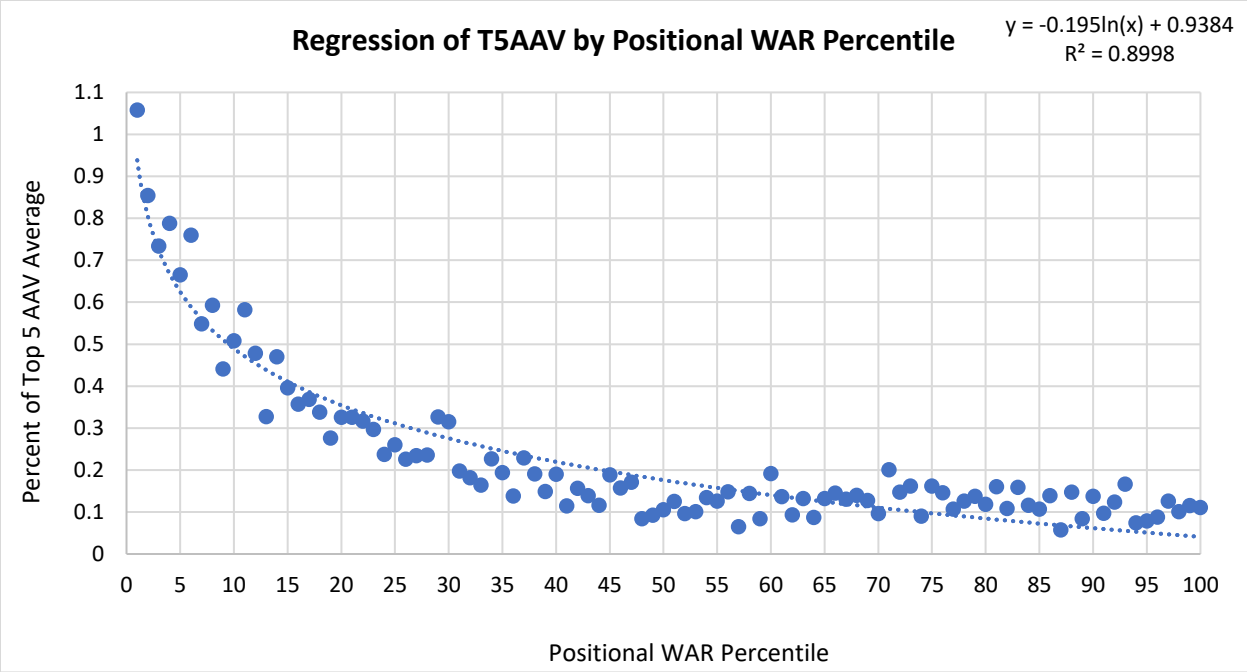
$10,000,000 / $19,484,200 = 51.32% T5APY.

Player X has a T5AAV of 51.32%

To provide a player example, the Carolina Panthers’ Robby Anderson signed a $10M AAV contract at WR during the 2020 offseason.

We decided to look at the 2-Year Cumulative PFF WAR for every player at each position prior to signing an unrestricted free agent contract or an extension. So, for every player that signed in the 2016 offseason, we would look at their 2014-15 PFF WAR. We ranked each player at each position by their 2-Year WAR and finally took their ranking as a percent of the total at the position (had to have logged at least one snap over the two years to be included). If you were the No. 2 PFF WAR wide receiver, for example, you’d be considered in the 99th PFF WAR percentile.

Next, we organized each player within their position group by converting their rank in 2-Year Cumulative PFF WAR into a percentile. We then regressed the “percent of top five average annual value” amounts on the PFF WAR percentiles. Before any adjustments to the PFF WAR percentiles were made, we observed a strong correlation between a player’s WAR percentile and the contract they signed.



x-axis: 1-x = percentile (e.g., 1 = 99th percentile)

Figure 1: Unadjusted regression of individual player "percent of top five average annual value" on PFF WAR positional percentile

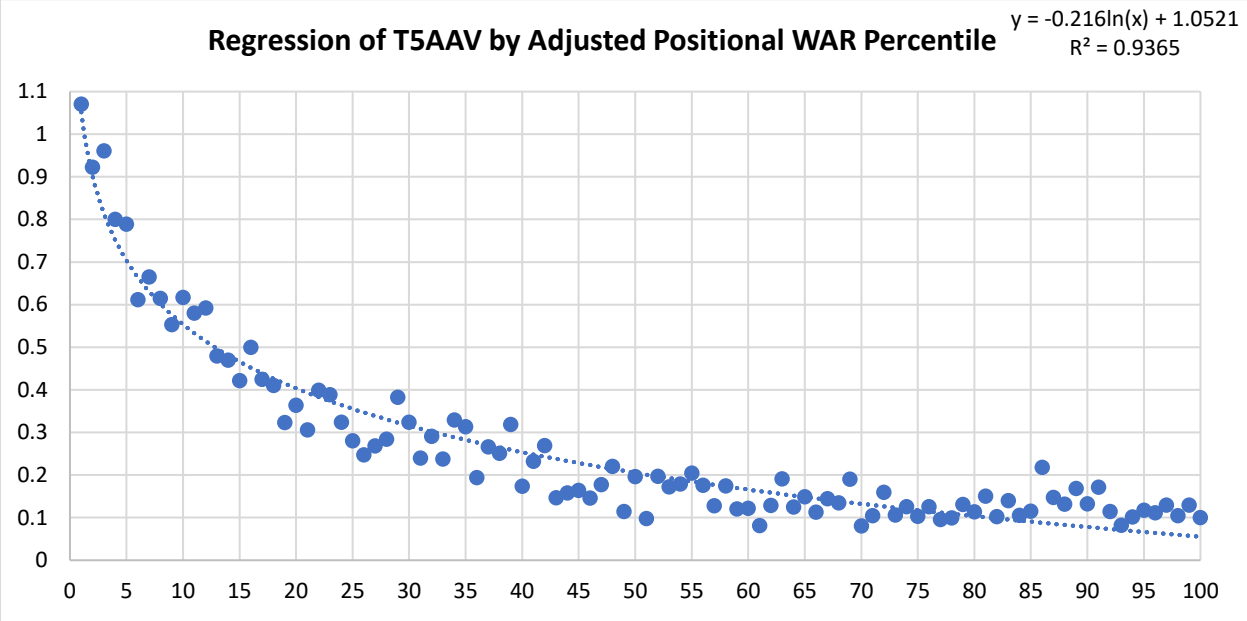
Finally, to account for market conditions, we adjusted the PFF WAR percentiles by age, draft position, and historical position market trends to most accurately reflect the intricacies of the true NFL contract landscape. We ran a series of regressions controlling for cohorts of age (e.g., 23-27, 28-30, 31+), draft position (e.g, 1-10, 11-20, 21-32, etc.) and position market (e.g., running back contractual quartiles pictured below).

RB Historical Veteran Contract Breakdown, Since 2013					
Quartile	Min. AAV	Max AAV	Total	Per Offseason	Avg. Annual Value
1	$5,176,667	$16,015,853	54	6.75	$7,680,795
2	$2,000,000	$5,176,667	67	8.375	$2,904,847
3	$1,048,750	$2,000,000	91	11.375	$1,141,801
4	$910,000	$1,048,750	129	16.125	$801,715

Table 1: Quartiles of average annual value for non-rookie running back contracts signed 2013-20.

3 Results

We found that adjusted PFF WAR percentiles and the average annual value of their contract as a percent of the top five at the respective position are very strongly correlated, with an r^2 of .9365.



x-axis: 1-x = percentile (e.g., 1 = 99th percentile)

Figure 2: Adjusted regression of individual player "percent of top five average annual value" on PFF WAR positional percentile

Now that we had a proven method of predicting average annual values of NFL contracts retrospectively, the focus shifted to forward-looking projections. Because the goal is to forecast into the future, we determined the average yearly growth of the top five average annual value for each position group. As pictured below, each position market over a number of years tends to grow at a similar rate to the average yearly NFL salary cap growth.

Position	**Percent Growth in T5AAV Since 2013**
Center	7.4%
Cornerback	7.3%
Interior Defender	8.3%
Edge Defender	8.0%
Guard	8.4%
Running Back	5.7%
Off-ball linebacker	7.9%
Quarterback	9.1%
Safety	8.2%
Left Tackle	9.1%
Tight End	7.0%
Wide Receiver	7.0%

Right Tackle	13.6%
-	-
Salary Cap Growth	**7.1%**

Table 2: Percent growth in the top five annual average value contracts at each NFL position and NFL salary cap, 2013-20

While year-over-year growth of the top five average annual values of each respective position is not linear, we use a baseline of 7.1% as derived from examining year-over-year growth of the NFL salary cap over the same period.

4 Conclusions and Future Applications

The biggest challenge in contract valuation for NFL teams is deciphering which statistics are the most stable and predictive for each position. Positions like offensive line do not accrue traditional statistics and proper evaluation is more reliant on film grades, which is the primary input of PFF WAR.

Using adjusted PFF WAR percentiles to compare each player relative to their positional peers, clubs can gain a better understanding of both the markets as a whole and the value of each player individually. Manual adjustments to account for variables such as injury history will of course be necessary, but a very strong starting point is provided here.

Clubs may use the average annual value projections to determine the surplus value generated over each player's existing contract compared to the current market rate of each individual's production. Forecasting potential future liabilities can better inform decision-making in the present, including free agent acquisitions as well as draft capital expenditures (whether via trade or draft picks).

With continuing uncertainty surrounding the financial landscape of the NFL, clubs may begin to forecast various valuations depending on salary cap growth, and more efficiently construct their roster with potentially fewer resources at their disposal.

References

[1] 2011 National Football League Collective Bargaining agreement: https://nflpaweb.blob.core.windows.net/media/Default/PDFs/2011%20CBA%20Updated%20with%20Side%20Letters%20thru%201-5-15.pdf

[2] Fitzgerald, J., Spielberger, B. "The Drafting Stage: Creating a Marketplace for NFL Draft Picks" https://www.amazon.com/Drafting-Stage-Creating-Marketplace-Draft-ebook/dp/B085LW17XW