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Performance Per Salary (PPS): A Tool for NFL Front Offices to Evaluate Running Back Spending Against the Cap

Author: Robert Greenberg

**Abstract**

The NFL has entered an era where top running backs (RBs) have more power over their contracts than ever before. Todd Gurley’s 2018 contract established new expectations for the money commanded by top-notch NFL RBs, signaling that contract inflation has extended to skill positions beyond quarterbacks. Similarly, Le’Veon Bell’s 2018 season-long strike and Ezekiel Elliot’s 2019 pre-season holdout - and eventual contracts - display the leverage of world-class RBs to an NFL franchise. Why are NFL teams’ General Managers willing to open their wallets to top NFL RBs approaching the end of their rookie deals, when recent rookie RB classes have performed so well and average-tier free agent classes have been sufficiently productive?Sports Reference’s Approximate Value (AV), Football Outsider’s Defense-Adjusted Yards Above Replacement (DYAR), and Defense-Adjusted Value Over Average (DVOA) are valued statistics to measure player performance, but they fail to factor in the business side of the equation. How can we use these metrics to make better team personnel decisions? Introducing a salary cap element will facilitate a deeper understanding of positional value relative to salary cap allocation and present a logical line of inquiry for evaluating RB’s value to teams. Basic analysis of RB’s DYAR against average annual salary brings into question whether signing an elite RB yields greater value than a rookie or replacement-level free agent.

Using NFL RB data from 2015-2018, I developed a Decision Tree based machine learning classification model to evaluate RBs on-field value compared to their average annual salaries. To do so, I created a variable titled Performance Per Salary (PPS), which compares DYAR and salary for all RBs based on percentile benchmarks, labeled as follows:

* Good value: a player who is paid less than the median salary, but performed above the 75th percentile for their position.
* Average value: a player who was paid between the 25th and 75th percentile and performed between the 25th and 75th percentile for their position.
* Poor value: a player who was paid more than the median salary, but performed below the 25th percentile for their position.

I performed the same procedures with rookie and free agent RBs to forecast relative PPS’s among these subsets. After training the model, I predicted the PPS labels of all rookies and free agents from the past four years with a score accuracy of 0.795 and 0.810, respectively.

The PPS model could have an impact on the way teams value RBs and assist in cap space decisions. Ultimately, this research could solve a problem front offices have faced for decades: Should teams pay higher salaries for established talent or could they get better bang for their buck elsewhere? Implementation of similar models for the rest of the skill positions will also be developed.

**Introduction and Statement of the Problem**

In 2017, we saw one of the most dominant RB seasons since that of Adrian Peterson in 2012. Todd Gurley went for over 2,000 yards, scored 19 touchdowns, and averaged over 6 yards from scrimmage per touch. His ability to make plays in the passing game in addition to the ground game is what made him such an effective weapon that season. To no one's surprise he was offered a record breaking contract during that offseason, becoming the highest paid RB to ever play the game. Over the past decade, the Running Back position in the NFL has changed drastically. Running Backs are not just expected to be effective rushers, but they are expected to participate in the passing game as well. One of the best running backs from the 2018 season, second-year player, Christian McCaffery finished eighth in receptions with 107 catches and sixth in rushing yards with 1,098 on the year (Pro Football Focus). With teams expecting more value out of their Running Backs, it is no surprise to see the elite bunch cashing in on their skills once their four-year long rookie deals expire . In 2008, there were only two running backs making more than 13 million a year, while in 2019, there are four Running Backs with an Average Annual Salary of 13 million or more. There is an ever-obvious trend that elite NFL running backs are demanding more money and NFL front offices are listening.

The market for great running backs is believed to be saturated at the top with a stark dropoff, however the statistics would argue otherwise. Over the last 4 seasons, rookie running backs have performed incredibly well. Saquon Barkely, Christian McCaffery, and Alvin Kamara are widely considered 3 of the best running backs in 2019, yet the three of them combined will make $12,842,581 this season. It’s indisputable to say that having a player like Alvin Kamara who makes $1,050,693 this season, yet rushed for 883 yards, received for 709 more and scored 18 combined TDs is fantastic value. On the other side of the ball, paying Giovanni Bernard $4,200,000 for 429 total yards and 3 TDs seems like very poor value.

This begs the question: How can GMs get better value out of their players with limited financial resources? The answer is simple: pay players what they're worth and not a penny more; which is easier said than done. The aim of this paper is to examine why NFL general managers are willing to allocate significant portions of the salary cap to RBs approaching the end of their rookie deals despite two apparent facts: first, rookie RB classes in recent years have performed incredibly well relative to their allocation of the salary cap,and second, replacement-level free agent RBs have been sufficiently effective with little impact on the cap.

**Related Literature**

There are many existing metrics that can be used to evaluate a players on-field performance. Rushing Yards, Rushing Attempts, Receiving yards, receiving targets, and TDs were once the standard for evaluating the performance of a running back. However, thanks to statisticians and football enthusiasts alike, there are many metrics today that do a better job piecing together an overall idea of a running back’s game. Approximate Value (AV), was first introduced on sports-reference.comin January of 2008. The purpose was to create a single-value that could compare players across positions and seasons. Additionally, footballoutsiders.com created many relevant statistics to paint a better picture of a running back’s on-field value. Metrics like Defense-adjusted Yards Above Replacement (DYAR), Defense-adjusted Value Over Average(DVOA), Effective Yards, Catch Rate and Success Rate have made player evaluation much more logical and provide a basis to evaluate running back’s strengths and weaknesses.

While these values are great at determining the different aspects of a running back’s performance, they fail to include the other side of the coin: salary. In 2001, Michael A. Leeds and Sandra Kowalewski published a paper on the Effect of the Salary Cap and Free Agency on the Compensation of Skill Position Players. This paper highlights the disparities in player performance compared to pay when the new Collective Bargaining Agreement was arranged in 1994, but focuses more on the NFL’s hard salary cap affects payment structures of an offensive unit as a whole. It fails to dive into the running back position in terms of interpreting relative value above replacement-level free agents and rookie running backs selected in the NFL Draft. The model I propose combines the prevalent DYAR statistic to evaluate a players performance and introduces with a salary cap element that will prevent General Managers from overpaying talent and guide them to find running backs that provide excellent value per their cap hits in a given year.

**Limitations of Study**

The NFL has a hard salary cap which is voted on each season by the owners. This salary cap determines the amount of money that teams have at will to sign players to contracts. Since (Give the year), the NFL draft has had salary values tied to tiered draft picks. The first overall pick made (x), the second overall pick made (y), and so on and so forth all the way until the very last pick of the seventh-round aka Mr. Irrelevant who made (z) amount of money in 2019. However, even with set incomes the structure of the deals is often l eft up to individual GMs to craft. There are many factors that can play into a players yearly contract: agents, contingencies, and bonuses are o. Many of these factors take place off of the field. However it’s

**References**

Leeds, Michael & Kowalewski, Sandra. (2001). Winner Take All in the NFL: The Effect of the Salary Cap and Free Agency on the Compensation of Skill Position Players. Journal of Sports Economics. 2. 244-256. 10.1177/152700250100200304.