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NFL – Salary Worth of QBs, RBs, and WRs

Salary Worth Report – Summary

- **Context:** *This project aims to predict the salaries (APY) on NFL QB's, RB's, and WR's based on their performance data of the 2024-2025 Season. Using Linear Regression, Lasso, Ridge, ElastricNet, Gradient Boosting, and Random Forest, the goal is to identify underpaid and overpaid players (grouped by position).*
- **Reasoning Behind It:**
  - *All NFL players can be categorized into three groups based on their performance relative to their contract: underperforming, meeting, or exceeding the value of their contract. This project aims to accurately assess each player's true value based on their performance during the 2024-2025 season, providing a valuable resource for evaluating players as teams prepare for the upcoming NFL off-season.*
- **Machine Learning Model:**
  - *Preprocessing: Log transformation was applied to the 'APY' column, making the data more balanced and less skewed. Standard scaling was then used to adjust the features so they all have a similar scale, ensuring fair and effective training of the model.*
  - *Cross Validation: Ensured robust evaluation, reducing the risk of overfitting*
  - *Feature Importance: Multiple models were used to identify which features most influence the salary predictions*
  - *Different Models used:*
    - **Linear Regression:** Serves as the baseline model for predicting APY, assuming a linear relationship between input features and the target variable.
    - **Lasso:** Focuses on the most importance features by using L1 regularization. Eliminates irrelevant variables.
    - **Ridge:** Employs L2 regularization to prevent multicollinearity in the models.
    - **ElasticNet:** Uses a combination of Ridge and Lasso techniques for a balanced approach.
    - **Random Forest:** Non-linear model that handles complex feature interactions and will provide feature importance metrics.
- **Model Interpretations**
  - *The machine learning models tend to predict salaries that align more closely with the current QB market, but generally, they don't predict as high of a salary for RBs and slightly lower for WRs (than the market). While the models are accurate in their performance evaluations, they do not fully capture the higher salary potential of RBs and WRs, likely due to the model's focus on statistical performance rather than market dynamics or historical trends.*
- **Future Implications:**
  - *What statistics should organizations value when determining the contract of a player? How could we incorporate age/health into these models going forward?*
  - *How might identifying underpaid and overpaid players impact contract negotiations and team strategies going forward?*

Salary Worth Report – Summary Part 2

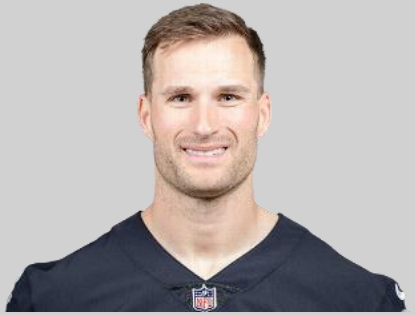
- **QB Model:**
  - Prerequisites: More than 300 passing attempts
  - *Input Variables Used:* 'TD_Int_ratio', 'total_epa', 'Passing.Rate', 'passing_yards_after_catch_per_attempt', 'rushing_yards_per_attempt', 'YDS_per_Attempt', 'plus_minues_expected_competition_percentage', 'rushing_tds'
  - *Model Chosen: Random Forest finished with the lowest RMSE*
  - *Random Forest Feature Importance Rankings - Top 5 (Most Important Variables Impacting APY):*
    - *'total_epa', 'passing_yards_after_catch_per_attempt', 'Passing.Rate', 'TD_Int_ratio', 'YDS_per_Attempt'*
  - **Top 3 Most Overpaid QB's 2024-2025 Season (Descending Order): Kirk Cousins, Jordan Love, and Daniel Jones**
  - **Top 3 Most Underpaid QB's 2024-2025 Season (Descending Order): Jayden Daniels, Sam Darnold, and Bo Nix**
- **RB Model:**
  - Prerequisites: More than 200 rushes
  - *Input Variables Used:* 'total_epa', 'YAC.Att', 'total_yards' , 'yards_per_touch', 'yards_per_carry', 'YBC.Att', 'Total_TDS', 'RYOE_per_Attempt'
  - *Model Chosen: Lasso and ElasticNet finished with the lowest RMSE*
  - *Random Forest Feature Importance Rankings - Top 5 (Most Important Variables Impacting APY):*
    - 'total_epa', 'RYOE_per_Attempt', 'total_yards', 'yards_per_touch' , 'Total_TDS'
  - **Top 3 Most Overpaid RB's 2024-2025 Season (Descending Order): Alvin Kamara, James Conner, and Rhamondre Stevenson.**
  - **Top 3 Most Underpaid RB's 2024-2025 Season (Descending Order): Kyren Williams, J.K. Dobbins, and Rico Dowdle**
- **WR Model:**
  - Prerequisites: More than 50 touches (catches + rushes)
  - *Input Variables Used:* 'receiving_yards_after_catch', 'Yards_per_touch', 'total_epa', 'total_yards', 'Total_Touches', 'catches', 'Total_Tds', 'Average_Separation', 'Expected_Yards_After_Catch_PlusMinus'
  - *Model Chosen: Random Forest finished with the lowest RMSE*
  - *Random Forest Feature Importance Rankings - Top 5 (Most Important Variables Impacting APY):*
    - 'Yards_per_touch', ', 'Average_Separation', 'receiving_yards_after_catch', 'total_epa', 'total_yards'
  - **Top 2 Most Overpaid WR's 2024-2025 Season (Descending Order): Amonra St. Brown and Deebo Samuel**
  - **Top 2 Most Underpaid WR's 2024-2025 Season (Descending Order): George Pickens and Jauan Jennings**

Salary Worth Report – Feature Definitions

PLEASE NOTE: These predictions represent the model's evaluation of player performance and salary based solely on this year's data, without accounting for their entire career or historical salary trends. As a result, some outliers may appear, reflecting cases of underpayment or overpayment, as the model is purely assessing performance on a numerical basis for the 2024-2025 season.

TD_Int_ratio: The ratio of touchdowns to interceptions thrown by the quarterback.
total_epa: Total expected points added by a player's actions on the field.
Passing.Rate: The passer's efficiency, often calculated by completion percentage, yards, and touchdowns.
passing_yards_after_catch_per_attempt: Average yards gained after the catch per pass attempt.
rushing_yards_per_attempt: Average yards gained per rushing attempt.
YDS_per_Attempt: Average yards gained per attempt, for either passing or rushing.
plus_minues_expected_competition_percentage: A passer's actual completion percentage compared to their Expected Completion Percentage.
rushing_tds: The total number of touchdowns scored by rushing.
YAC.Att: Yards After contact per rush attempt.
total_yards: Total yards gained, including passing, rushing, and receiving.
yards_per_touch: Average yards gained per time the player touches the ball (rushing or receiving).
yards_per_carry: Average yards gained per rushing attempt.
YBC.Att: Yards Before Contact per attempt, showing how much ground a player gains before being hit.
Total_TDS: Total number of touchdowns scored by the player (rushing, receiving, or passing).
receiving_yards_after_catch: Total yards gained by the player after catching the ball.
total_touches: Total number of times a player has the ball, either by carrying, catching, or other methods.
catches: Total number of receptions made by the player.
RYOE_per_Attempt: rushing yards over expected per rushing attempt.
Expected_Yards_After_Catch_PlusMinus: A receiver's YAC compared to their Expected YAC.
Average_Separation: The distance (in yards) measured between a WR/TE and the nearest defender at the time of catch or incompletion.
APY: Average Annual Salary

OVERPAID QBs (Based off 2024-2025 Statistics)

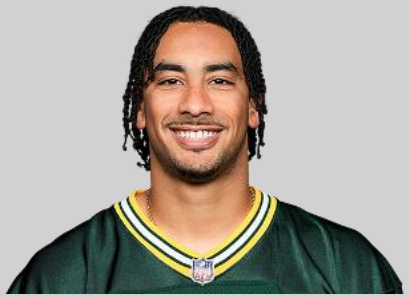


Actual APY: **$45,000,000**

RF Model Predicted APY: **$6,017,486**

Net Difference: $-38,982,514

Kirk Cousins

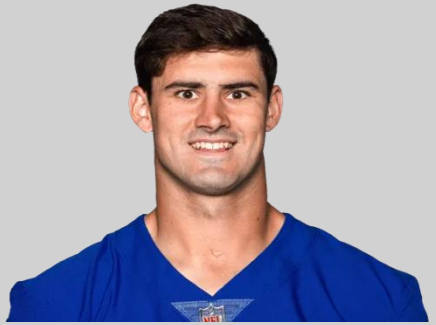


Actual APY: **$55,000,000**

RF Model Predicted APY: **$27,971,800**

Net Difference: $-27,028,200

Jordan Love



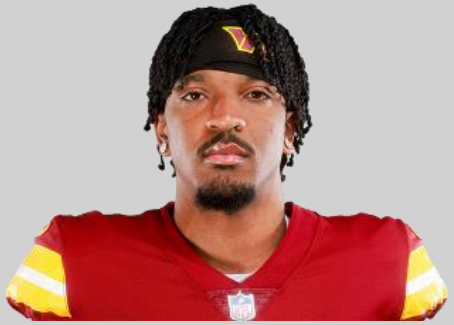
Actual APY: **$40,000,000**

RF Model Predicted APY: **$15,311,196**

Net Difference: $-24,688,803

Daniel Jones

UNDERPAID QBs (Based off 2024-2025 Statistics)



Actual APY: **$9,436,663**

RF Model Predicted APY: **$22,302,016**

Net Difference: $+12,865,353

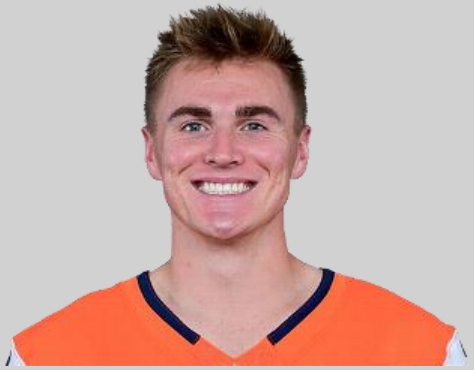
Jayden Daniels

Actual APY: **$10,000,000**

RF Model Predicted APY: **$17,199,360**

Net Difference: $+7,199,359

Sam Darnold



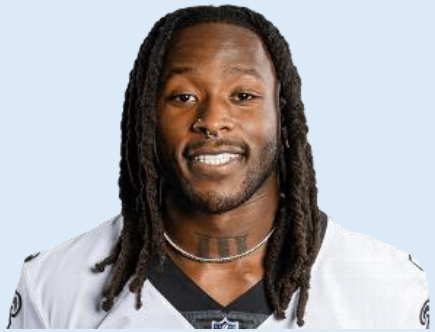
Actual APY: **$4,653,292**

RF Model Predicted APY: **$9,241,049**

Net Difference: $+4,587,757

Bo Nix

OVERPAID RBs (Based off 2024-2025 Statistics)

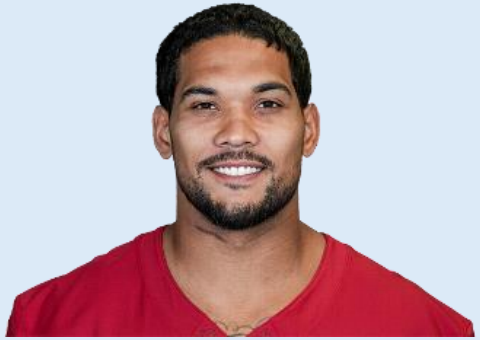


Actual APY: **$12,250,000**

ElasticNet Model Predicted APY: **$4,419,249**

Net Difference: $7,830,750

Alvin Kamara

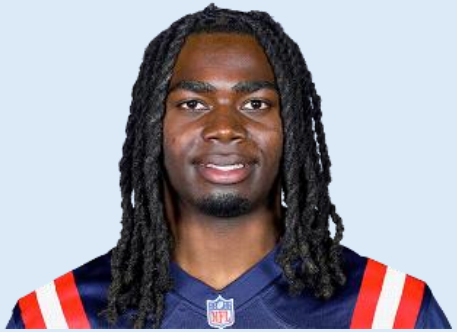


Actual APY: **$9,500,000**

ElasticNet Model Predicted APY: **$3,421,342**

Net Difference: $6,078,658

James Conner



Actual APY: **$9,000,000**

ElasticNet Model Predicted APY: **$3,850,460**

Net Difference: $5,149,539

Rhamondre Stevenson

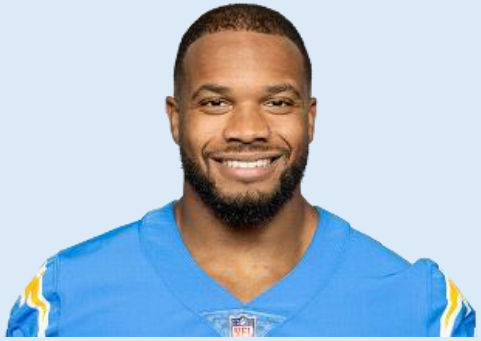
UNDERPAID RBs (Based off 2024-2025 Statistics)

Actual APY: **$992,602**

ElasticNet Model Predicted APY: **$6,379,638**

Net Difference: $+5,387,036

Kyren Williams

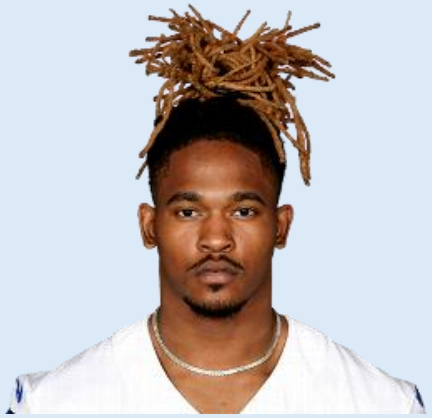


Actual APY: **$1,610,000**

ElasticNet Model Predicted APY: **$3,640,752**

Net Difference: $+2,030,752

J.K. Dobbins



Actual APY: **$1,255,000**

ElasticNet Model Predicted APY: **$3,034,264**

Net Difference: $+1,779,264

Rico Dowdle

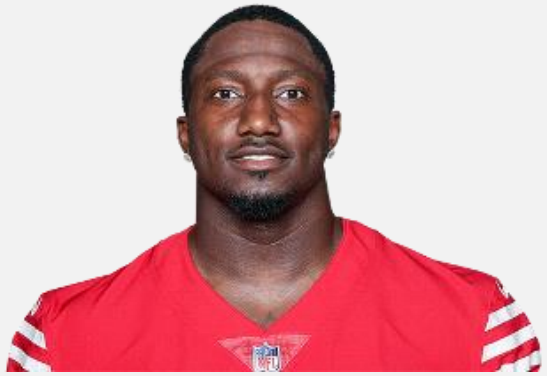
OVERPAID WRs (Based off 2024-2025 Statistics)

Actual APY: **$30,002,500**

RF Model Predicted APY: **$7,649,378**

Net Difference: $22,353,122

Amon-Ra St. Brown



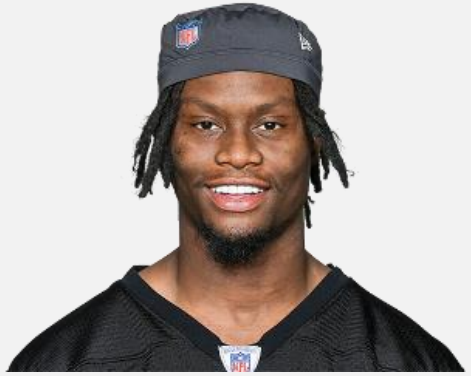
Actual APY: **$23,850,000**

RF Model Predicted APY: **$3,228,846**

Net Difference: $20,621,153

Deebo Samuel

UNDERPAID WRs (Based off 2024-2025 Statistics)



Actual APY: **$1,688,047**

RF Model Predicted APY: **$16,593,517**

Net Difference: $+14,905,469

George Pickens

Actual APY: **$5,945,000**

RF Model Predicted APY: **$15,295,760**

Net Difference: $+9,350,760

Jauan Jennings