The Value of Rookies

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Topic

2 Main Inquiries

- How do NFL running backs and wide receivers on their rookie contracts compare to those on veteran contracts?
- Which of these positions on average is more productive and therefore more worth paying a large contract to?

Data Summary

Approximate Value

Approximate Value: “an attempt to put a single number on the seasonal value of a player at any position” (PFR’s founder Doug Drinen)

Approximate Value Calculation for Running Backs:
Team Offensive Points = 100 * (team offensive points per drive) / (league average offensive points per drive)
Team Points for Skill Positions = Team Offensive Points * 6/11
Team Points for Rushers = Team Points for Skill Positions * .22 * [(Team Rush Yards / Team Total Yards) / .37]
Approximate Value = (Rushing Yards) / (Team Rushing Yards) * Team Points for Rushers

Approximate Value Calculation for Wide Receivers:
Team Points for Receivers = (Team Points for Skill Positions) – (Team Points for Rushers) * .74
Approximate Value = Receiving Yards / Team Receiving Yards * Team Points for Receivers

2021 player and team stats from Pro Football Reference (PFR): https://www.pro-football-reference.com/years/2021/
2021 cap hit data from Spotrac: https://www.spotrac.com/nfl/rankings/cap-hit/
Approximate value formula from Pro Football Reference (PFR): https://www.pro-football-reference.com/blog/indexd961.html?page_id=8061

Table 1: Running Backs (2021 NFL Season)

Season	Player Name	Position	Team	Rookie or Veteran*	Rushing Yards	Approximate Value	Cap Hit
2021	Jonathan Taylor	RB	IND	Rookie	1811	11.6	$1,779,352
2021	Nick Chubb	RB	CLE	Veteran	1259	6.5	$4,782,381
2021	Joe Mixon	RB	CIN	Veteran	1205	7.35	$8,126,471
2021	Najee Harris	RB	PIT	Rookie	1200	6.02	$2,372,263
2021	Dalvin Cook	RB	MIN	Veteran	1159	6.18	$5,113,026
2021	Antonio Gibson	RB	WAS	Rookie	1037	5.37	$1,121,054
2021	Ezekiel Elliott	RB	DAL	Veteran	1002	5.64	$6,820,000
2021	Elijah Mitchell	RB	SFO	Rookie	963	5.46	$705,892
2021	Derrick Henry	RB	TEN	Veteran	937	5.5	$13,500,000
2021	Damien Harris	RB	NEW	Rookie	929	6.21	$1,071,534
2021	Melvin Gordon	RB	DEN	Veteran	918	5.07	$8,941,176
2021	Austin Ekeler	RB	LAC	Veteran	911	5.76	$5,750,000
2021	Javonte Williams	RB	DEN	Rookie	903	4.98	$1,611,955
2021	Alvin Kamara	RB	NOR	Veteran	898	5.08	$5,000,000
2021	Josh Jacobs	RB	LVR	Rookie	872	4.51	$3,254,367
2021	Devin Singletary	RB	BUF	Rookie	870	5.43	$1,108,956
2021	David Montgomery	RB	CHI	Rookie	849	4.16	$1,111,577
2021	Sony Michel	RB	LAR	Rookie	845	5.28	$1,792,731
2021	Leonard Fournette	RB	TAM	Veteran	812	4.82	$3,250,000
2021	Aaron Jones	RB	GNB	Veteran	799	5.17	$4,464,706

*Veteran status designates that the player was not playing on their rookie contract

Table 2: Wide Receivers (2021 NFL Season)

Season	Player Name	Position	Team	Rookie or Veteran*	Receiving Yards	Approximate Value	Cap Hit
2021	Cooper Kupp	WR	LAR	Veteran	1947	22.85	$5,300,000
2021	Justin Jefferson	WR	MIN	Rookie	1616	17.5	$2,982,455
2021	Davante Adams	WR	GNB	Veteran	1553	21.49	$16,787,500
2021	Ja'Marr Chase	WR	CIN	Rookie	1455	18.9	$5,603,571
2021	Deebo Samuel	WR	SFO	Rookie	1405	17.75	$2,099,279
2021	Tyreek Hill	WR	KAN	Veteran	1239	16.61	$14,650,500
2021	Stefon Diggs	WR	BUF	Veteran	1225	16.96	$6,378,954
2021	Tyler Lockett	WR	SEA	Veteran	1175	15.74	$8,050,000
2021	Diontae Johnson	WR	PIT	Rookie	1161	10.69	$1,167,535
2021	D.J. Moore	WR	CAR	Rookie	1157	10.55	$3,554,510
2021	Mike Williams**	WR	LAC	Rookie	1146	14.86	$15,680,000
2021	Keenan Allen	WR	LAC	Veteran	1138	14.68	$15,700,000
2021	Chris Godwin	WR	TAM	Veteran	1103	12.79	$15,983,000
2021	CeeDee Lamb	WR	DAL	Rookie	1102	13.11	$3,184,094
2021	Tee Higgins	WR	CIN	Rookie	1091	14.09	$1,974,270
2021	Michael Pittman Jr.	WR	IND	Rookie	1082	17.19	$1,957,466
2021	Darnell Mooney	WR	CHI	Rookie	1055	11.77	$850,513
2021	Brandin Cooks	WR	HOU	Veteran	1037	9.47	$5,588,236
2021	Mike Evans	WR	TAM	Veteran	1035	11.84	$7,697,500
2021	Amari Cooper	WR	DAL	Veteran	865	11.8	$22,000,000

*Veteran status designates that the player was not playing on their rookie contract

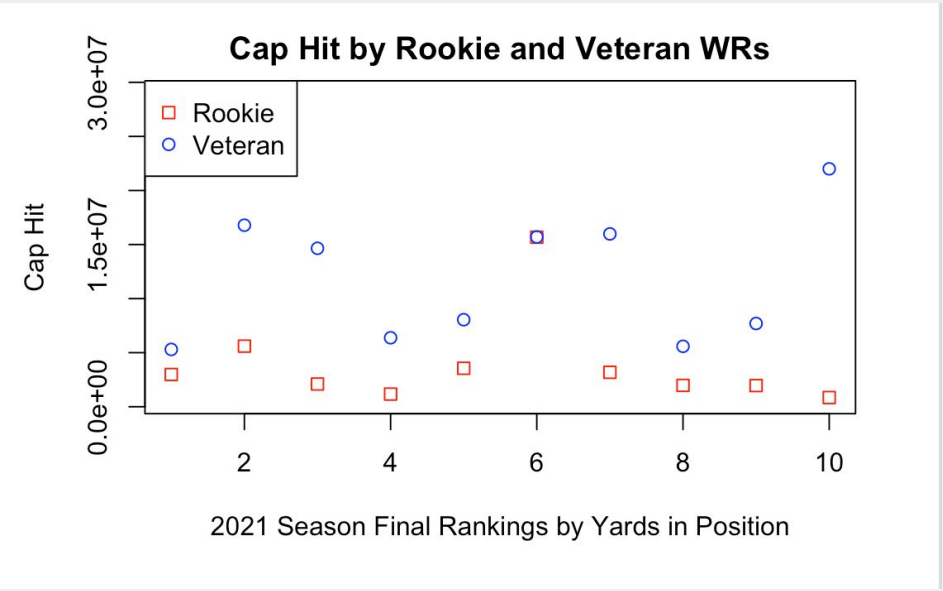
**Mike Williams played on a fifth-year option, which is designated as part of a rookie contract

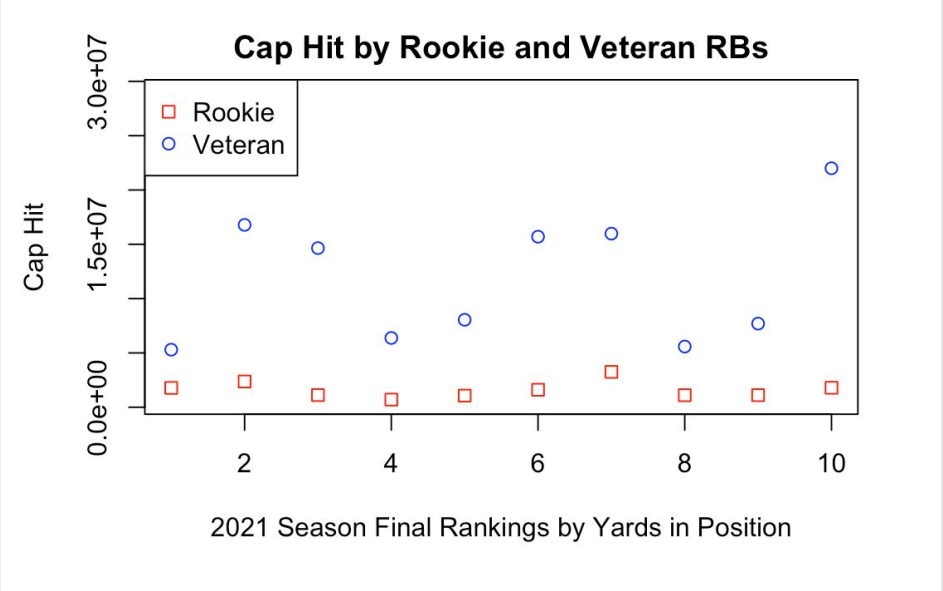
Table 3: Summary of Wide Receivers and Running Backs Statistics from the 2021 NFL Season

Wide Receivers		**Running Backs**	
Number of Rookies	10	Number of Rookies	10
Number of Veterans	10	Number of Veterans	10
Max Approximate Value	22.85	Max Approximate Value	11.60
Min Approximate Value	9.47	Min Approximate Value	4.16
Mean Approximate Value	15.03	Mean Approximate Value	5.80
Standard Deviation Approximate Value	3.65	Standard Deviation Approximate Value	1.54
Min Cap Hit	$850,513.00	Min Cap Hit	$705,892.00
Max Cap Hit	$22,000,000.00	Max Cap Hit	$13,500,000.00
Mean Cap Hit	$7,859,469.15	Mean Cap Hit	$4,083,872.05
Standard Deviation of Cap Hit	$6,465,272.70	Standard Deviation of Cap Hit	$3,319,199.92

Data Visualization

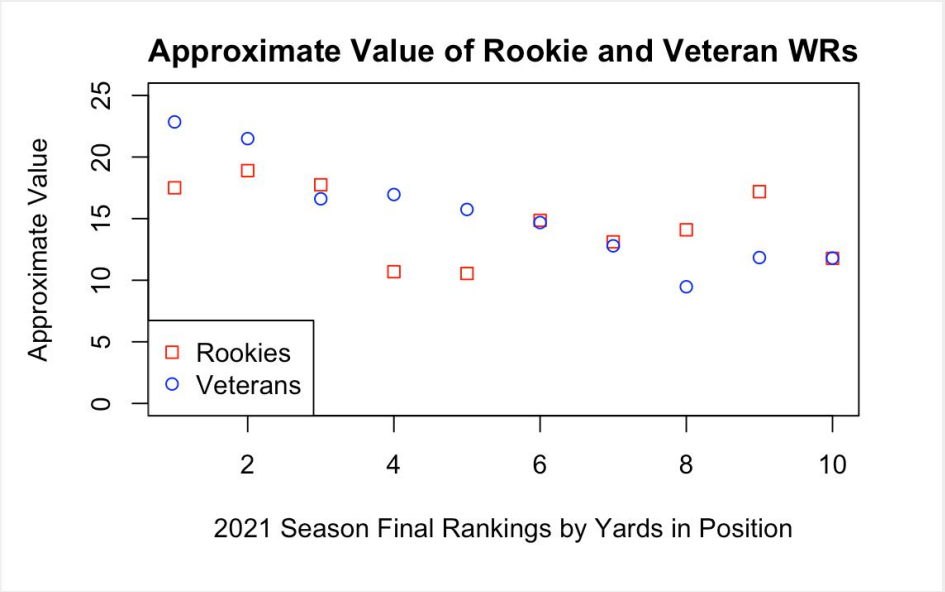
Cap Hit Between Rookies and Veterans

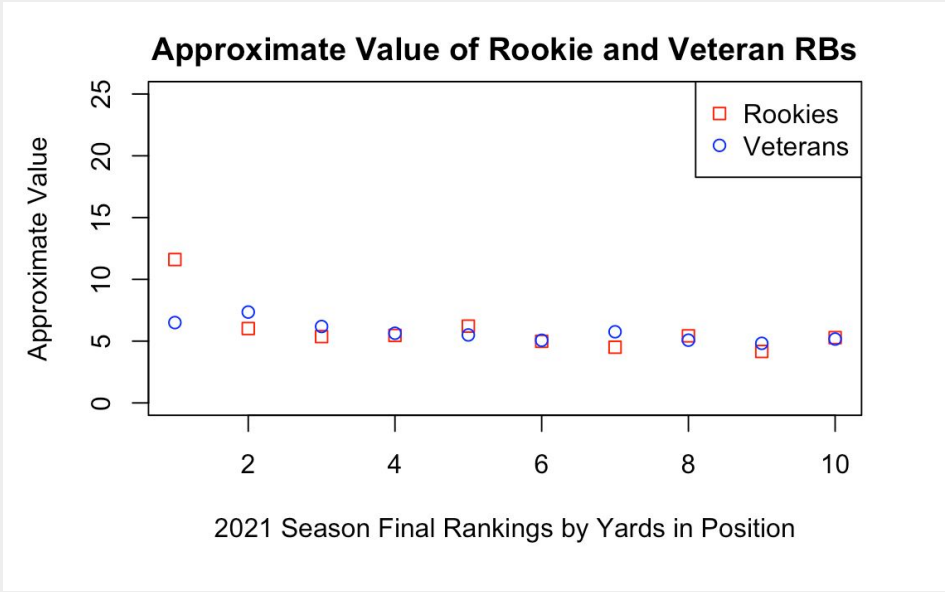




No questioning the difference - veterans get paid more than rookies.
However…

Approximate Value Between Rookies and Veterans





Surprisingly similar! WR position shows some more variance, but all in all, the top 10 rookies and veterans in the WR and RB positions perform at a very comparable level.

Empirical Methodology

Question

- How do NFL running backs and wide receivers on their rookie contracts compare to those on veteran contracts?
- Which of these positions on average is more productive and therefore more worth paying a large contract to?

Equations

- $Ln(Approximate\ Value(WR)) = \beta_0 + \beta_1 ReceivingYards + \beta_2 Rank + \beta_3 RookieDummy$

- $Ln(Approximate\ Value(RB)) = \beta_0 + \beta_1 RushingYards + \beta_2 Rank + \beta_3 RookieDummy$

Equations (cont.)

- $Ln(Cap\ Hit(WR)) = \beta_0 + \beta_1 ReceivingYards + \beta_2 Rank + \beta_3 RookieDummy$

- $Ln(Cap\ Hit(RB)) = \beta_0 + \beta_1 RushingYards + \beta_2 Rank + \beta_3 RookieDummy$

Anticipated Results

- **Question 1**
  - We expect similar production from both veterans and rookies
  - We expect yards and rank to be indicative of Approximate Value, but not the rookie dummy
- **Question 2**
  - We expect wide receivers to be more productive based on their pay and therefore worth paying later into their careers
  - We expect to see the rookie dummy be indicative of cap hit

Potential Problems

- Small Scope of Data
  - One year of data
  - Only used top players at each position
- Difference in how AV is calculated by position

Results: Approximate Value

Table 1: Determinants of Approximate Value in Top 20 Veteran and Rookie Wide Receivers

	Coefficients	*Standard Error*	*Significance Level*
Intercept	2.339	0.457	***
Receiving Yards	0.00043	0.00028	
Rank	-0.016	0.012	
Rookie Dummy	-0.043	0.064	
Observations	20		
R Square	0.693		
Adjusted R Square	0.635		

p < 0.10, ** p < 0.05, *** p < 0.01

$$Ln(Approximate\ Value(WR)) = \beta_0 + \beta_1 ReceivingYards + \beta_2 Rank + \beta_3 RookieDummy$$

Table 2: Determinants of Approximate Value in Top 20 Veteran and Rookie Running Backs

	Coefficients	*Standard Error*	*Significance Level*
Intercept	0.788	0.207	***
Rushing Yards	0.0009	0.0002	***
Rank	0.0036	0.0060	
Rookie Dummy	-0.036	0.041	
Observations	20		
R Square	0.853		
Adjusted R Square	0.826		

p < 0.10, ** p < 0.05, *** p < 0.01

$$Ln(Approximate\ Value(RB)) = \beta_0 + \beta_1 RushingYards + \beta_2 Rank + \beta_3 RookieDummy$$

Results: Cap Hit

Table 3: Determinants of Cap Hit Among Top 20 Veteran and Rookie Wide Receivers

	Coefficients	*Standard Error*	*Significance Level*
Intercept	18.986	2.233	***
Receiving Yards	-0.0017	0.0014	
Rank	-0.073	0.057	
Rookie Dummy	-1.378	0.312	***
Observations	20		
R Square	0.559		
Adjusted R Square	0.476		

p < 0.10, ** p < 0.05, *** p < 0.01

$$Ln(Cap\ Hit(WR)) = \beta_0 + \beta_1 ReceivingYards + \beta_2 Rank + \beta_3 RookieDummy$$

Table 4: Determinants in Cap Hit among Top 20 Veteran and Rookie Running Backs

	Coefficients	*Standard Error*	*Significance Level*
Intercept	15.678	1.041	***
Rushing Yards	0.00006	0.00077	
Rank	-0.012	0.030	
Rookie Dummy	-1.427	0.204	***
Observations	20		
R Square	0.766		
Adjusted R Square	0.722		

p < 0.10, ** p < 0.05, *** p < 0.01

$$Ln(Cap\ Hit(RB)) = \beta_0 + \beta_1 RushingYards + \beta_2 Rank + \beta_3 RookieDummy$$

Key Takeaways

- Results: Approximate Value
  - High R^2 in Table 1 and 2
  - Being a rookie doesn’t have as much of an impact on approximate value
- Results: Cap Hit
  - High R^2 in Table 3 and 4
  - Significance of being a rookie
- Similar output at significantly different salaries among top 10 veterans and top 10 rookies

Conclusion

- Both runnings backs and wide receivers have similar production levels on their rookie contracts when compared to on veteran contracts
- Wide receivers are paid more than running backs, but are of more value to NFL teams using approximate value