Fourth & Go
Uncovering the Statistical Drivers of Conversion Success

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INTRODUCTION

- The game is on the line midway through the 4th quarter; it's 4th and 3 on the 50-yard line. Go for it or punt and trust your defense to get a stop? This is a critical decision
- Research Question: Which situational, strategic, and team-quality factors have the most significant impact on the probability of a successful 4th down conversion?
  - Specifically, we aimed to determine how play-calling decisions –such as tempo, play type, and field position— influence conversionsuccess when controlling for game context variables.

PRIOR STUDIES

- Yam and Lopez (2019) found that NFL teams routinely lose win probability by choosing conservative fourth-down options like punting or kicking.
- Variables such as field position, yards-to-go, score differential, and player performance can accurately predict optimal fourth-down choices, revealing that teams could gain win-probability by going for it more frequently than they actually do. (Raymond, 2025)
- Romer (2006) used an Expected Points (EP) model to evaluate fourth-down decisions across field position and distance. His findings showed that NFL teams should go for it far more often than they actually do.

DATA & METHODOLOGY

- A hierarchical logistic regression model
  - Dependent variable: whether a particular fourth down play was converted for all fourth down plays in the NFL during the 2024 season
  - Binary variable (1 = success, 0 = failure)
  - Block 1: Situational control variables, such as yards to go, time remaining, and score differential
  - Block 2: Coach decision variables including pass vs. run, shotgun, play direction, and no-huddle
- Sources
  - Play-by-play data: nflfastr
  - DVOA values: NFL Final 2023 DVOA Ratings - ftnfantasy
  - Win rate values: NFL Pass Rush Run Stop Blocking Win Rate Rankings – ESPN

DESCRIPTIVE STATISTICS

Descriptive Statistics for Predictor Variables

	Minimum	Maximum	Mean	Std. Deviation
week	1	22	10.319	5.814
is_home_team	0	1	0.485	0.500
is_postseason	0	1	0.063	0.242
yardline_100	1	90	37.119	20.591
game_seconds_remaining	1	3555	1309.631	1066.768
goal_to_go	0	1	0.088	0.284
ydstogo	1	32	3.755	4.068
posteam_timeouts_remaining	0	3	2.343	0.944
defteam_timeouts_remaining	0	3	2.460	0.837
score_differential	-43	46	-5.940	11.474
div_game	0	1	0.333	0.472
is_dome_game	0	1	0.360	0.480
Net_DVOA	-0.471	0.434	-0.014	0.175
is_pass	0	1	0.598	0.491
shotgun	0	1	0.674	0.469
no_huddle	0	1	0.131	0.338
is_outside	0	1	0.632	0.482
fourth_down_converted	0	1	0.571	0.495

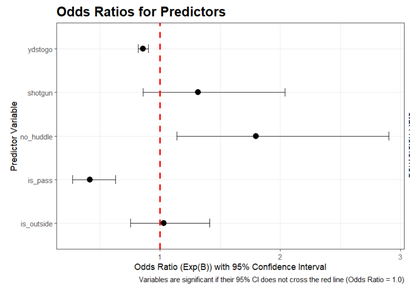
RESULTS

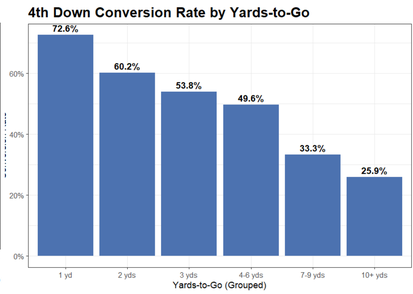
Hierarchical Logistic Regression Results

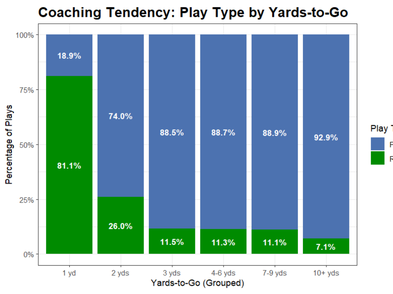
Variables	Model 1 (Block 1)	Model 2 (Final Block)
Game Situation Controls		
week	1.003 (.05)	1.012 (.619)
is_home_team	1.129 (.643)	1.107 (.432)
is_postseason	1.296 (.518)	.989 (.001)
yardline_100	1.0 (.009)	.998 (.169)
game_seconds_remaining	1.0 (.447)	1.0 (.481)
goal_to_go	.725 (1.082)	.818 (.411)
posteam_timeouts_remaining	1.013 (.022)	1.001 (.000)
defteam_timeouts_remaining	.934 (.452)	.951 (.242)
score_differential	1.003 (.149)	1.0 (.000)
div_game	1.155 (.748)	1.078 (.193)
is_dome_game	.898 (.47)	.898 (.452)
Net_DVOA	1.03 (.005)	1.033 (.005)
ydstogo	.82 (52.614)**	.853 (31.265)**
Coach Decision (Predictor) Variables		
is_pass		.421 (15.95)**
shotgun		1.276 (1.149)
no_huddle		1.777 (5.354)*
is_outside		1.043 (.069)
Block Chi-square	91.614**	24.233**
Model Chi-square	91.614**	115.848**
Cox & Snell R^2	.106	.132
Nagelkerke R^2	.143	.178
Hosmer and Lemeshow Sig.	.700	.429

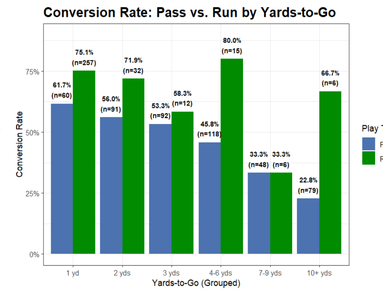
Note: Odds Ratio reported (Exp(B)); Wald values in parentheses; * $p < .05$; ** $p < .01$

- Our model correctly predicted 48.6% of the unsuccessful fourth down conversions and 80.7% of the successful fourth down conversions. The overall percentage of successfully classified fourth down conversions was 66.9%
- From the final model, three variables were statistically significant: yards to go, if it's a pass, and if it's no huddle or not
- For yards to go, every additional yard needed to go decreases the probability of converting a fourth down by 14.7%. For a pass play, the probability of converting a fourth down decreases by 57.9% compared to a run play. For a no huddle play, the probability of converting a fourth down increases by 77.7% compared to a standard huddle play









IMPLICATIONS, LIMITATIONS, AND FUTURE RESEARCH

- The likelihood of converting a fourth down is significantly determined by three factors: it is decreased by each additional yard needed, while being significantly increased by the use of a no-huddle formation and calling a run play over a pass
- Coaching Implications: For a coach, they should do a run play that's no-huddle to have the best chance of converting a fourth down. At the same time, they should take into account the yards to get the first down
- Limitations:
  - One year of data
  - Does not account for player-level factors (injuries, personal groupings, fatigue)
  - Does not account for weather factors
  - Does not account for play design (formations)
- Future Research:
  - Include multiple seasons of NFL data
  - Add offensive and defensive formations and personal
  - Add player tracking data (blocking angles, separation, route depth, decision making)
  - Expand into machine learning to predict the probability of converting any given 4th down scenario