



NFL Fourth Down Decision Factors

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What to Expect



Objectives



Overview



Hypothesis Questions



Literature



Design



Description and Findings



Conclusions and Moving Forward

Introduction and Objectives

- ▶ NFL Established in 1920
- ▶ Coaches can be hesitant to use data
- ▶ RFID chips in pads and balls (Grandinetti, 2019)
- ▶ Fourth down decision-making factors

Figure 1
NFL Logo



*Note: Adapted from NFL Closes New TV Rights Agreements, ABC Returns to Super Bowl Rotation
(<https://www.abc6.com/amazon-gets-thursday-night-games-nfl-nearly-doubles-tv-deal/>)*

Overview of Study

- ▶ Fourth down previously researched
- ▶ What are coaches looking at
- ▶ Decision factors can help coaches
 - ▶ And opponents
- ▶ Compare winning and losing groups



Hypothesis Questions

1. Do winning and losing coaches attempt conversions at the same rate?
2. Do some variables correlate with fourth down decisions?
3. Do winning and losing coaches have the same predictors for decision making?

Literature

- ▶ 3-4 wins a season on fourth down (Hadley, et al., 2000)
- ▶ Coaches conservative calling (Romer, 2006)
- ▶ Do not follow optimal strategy (Kovash & Levitt, 2009)
- ▶ Going for it every time had positive results (Palmquest, et al., 2020)
- ▶ Since 2014 12-17% conversion attempts (Yam & Lopez, 2019)

Research Design

- ▶ Quantitative
- ▶ Data from Pro Football Reference records
- ▶ 340 variables, every play between 2015-2020
- ▶ Regression models for main tests



Data Description

- ▶ 23,018 plays with 29 attributes used
- ▶ >0.500 is winning <=0.500 is losing

Figure 2

Included Variables for Analysis

Reg Season	Week	Yard Line	Seconds in Half	Game Half	Quarter
Goal to Go	Yards to Go	Yards on Drive	Timeout Called	Pos Team Timeouts Left	Def Team Timeouts Left
Score Diff	No Score Prob	Opp FG Prob	Opp Safety Prob	Opp TD Prob	FG Prob
Safety Prob	TD Prob	Home Rush EPA	Away Rush EPA	Home Pass EPA	Away Pass EPA
WP	Def WP	Division Game	Fourth Attempt	Game time Remaining	

Findings – Rates between groups

- ▶ Winning versus Losing attempt rates
- ▶ Winning conversion rate: 14.7%
- ▶ Losing conversion rate: 14.7%
- ▶ P-value = 1
- ▶ Not significant

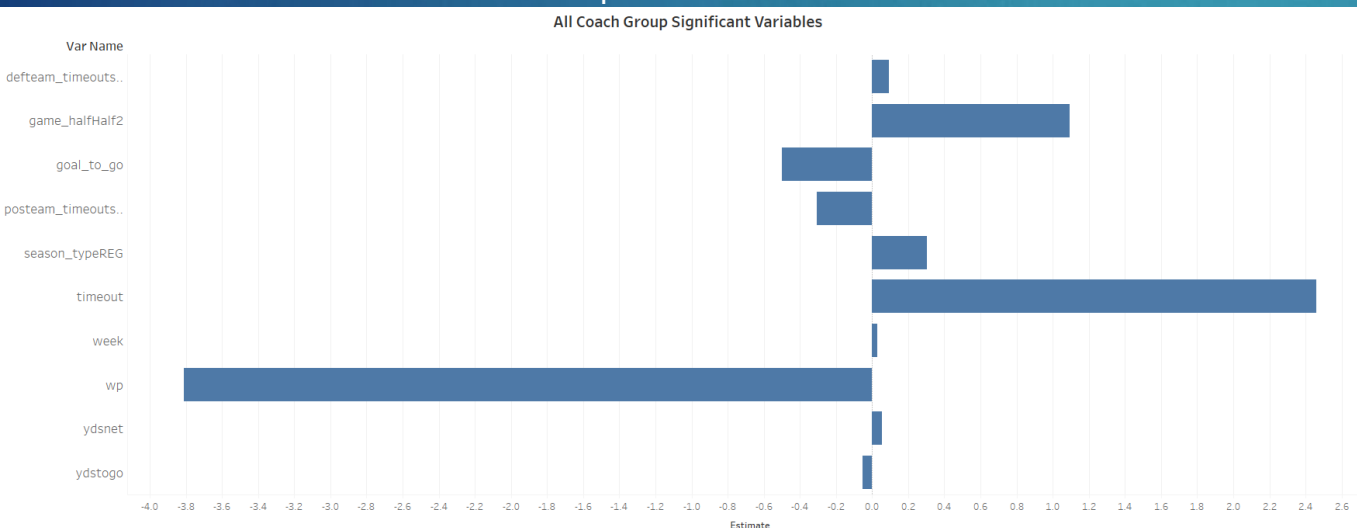
Figure 3
Coaching Decision by Group

Coaching Decision by Group		
Coaching Group	Decision	
	Attempt	Kick
Losing	1,203	6,981
Winning	2,181	12,653
Grand Total	3,384	19,634

Findings - All NFL coaching group

- ▶ What factors for all coaches
- ▶ Regression model
- ▶ Alpha of 0.10
- ▶ 10 significant variables

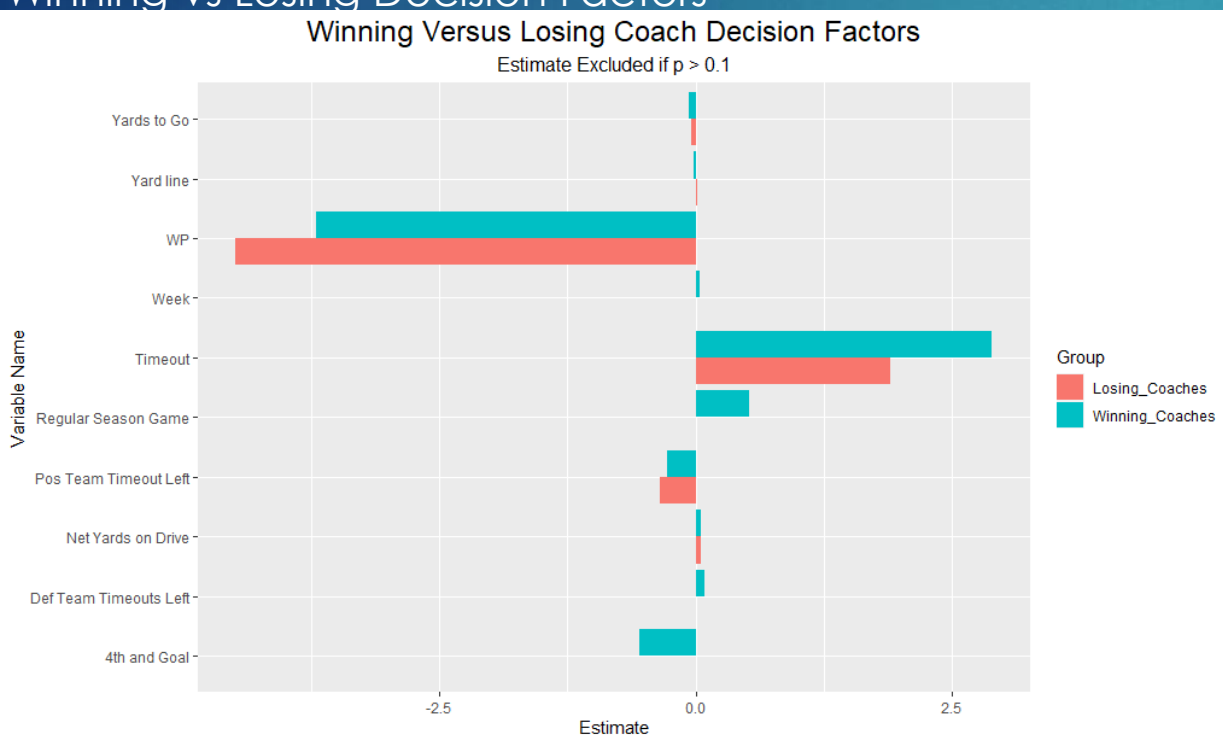
Figure 4
Attributes for All Coach Group



Findings – differences between groups

- ▶ Similar procedure to all coaches group
- ▶ Differences in groups

Figure 5
Winning vs Losing Decision Factors



Conclusion

- ▶ Failed to prove difference in call rate
- ▶ Found average NFL coach significant factors
- ▶ Compare winning and losing coaches
- ▶ Used to help improve decision making

Recommendations

- ▶ Including Survey Data
- ▶ Season by season win loss
- ▶ Creating full prediction models
- ▶ Creating coach by coach tendencies

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