Does Variability in Defensive Pass Coverage Schemes Lead to Successful Pass Defense?

By Peter Chapman

SPAX402: Predictive Analysis Using Athletics Data

The University of Delaware

December 9, 2025

Introduction and Research Question

- Dallas Cowboys prioritized zone coverage for pass defense through Weeks 1-9
- Very little man coverage as a result, especially compared to rest of the league
- Fans have been critical of DC Matt Eberflus for strict dedication to zone defense
- DAL defense struggled mightily during first 9 weeks of the 2025 season
- Many successful DCs are known to throw different looks at the opposing offense
  - Minnesota Vikings: Brian Flores
  - Kansas City Chiefs: Steve Spagnuolo
  - Philadelphia Eagles: Vic Fangio
- **Research Question**: Does variability in defensive pass coverage schemes have a relationship with pass defense success in the NFL?
- Focus of study: First 13 weeks of 2025 NFL season
- Variation in defensive pass coverage schemes recorded for each NFL team so far in 2025

Key Defensive Pass Coverage Schemes

- Ten different defensive pass coverage schemes used
- PFF definitions used for descriptions of each scheme
- Coverages are used selectively by each team
  - Most common: Cover 1, Cover 3
  - Least common: Cover 1 Double, Cover 3 Seam, Bracket Cover
- Some coverages are very similar to each other

Coverage Name	Description
Cover 0	A man-to-man coverage across the board with no deep defenders
Cover 1	Any form of man defense across the board with a defensive player as a single High Man concept
Cover 1 Double	Double single High Man coverage when it is clear the defense is targeting to double one offensive receiver
Cover 2	A two deep safety concept where any zone principle is applied; can include Tampa 2, 2 Traps, or 2 Combo/Match coverage
Cover 3	Any 3 Deep, 4 Under concept
Quarter	Cover quarters; 4 Deep, 3 Under concept where the corners are on #1, safeties on #2, and backside safety rotation dependent on formation
Cover 6	A quarters concept on half the field and a 2 Deep concept on the other half
Cover 2 Man	A 2 Deep safety concept where a man principle is applied; the underneath coverage will be in man across the board
Cover 3 Seam	A 3 Deep, 4 Under concept where the Curl/Flat defenders match #2 when they go vertical or out
Bracket Cover	When two offensive players have an in and out bracket by two defenders

Data Collection and Transformation

- Pro Football Focus (PFF) was the source of most data
  - Defensive pass coverage distribution for each NFL team in Weeks 1-13 of 2025
  - Player grades for each defensive player in both 2024 and 2025
- 2025 pass defense outcomes for each team provided by Sumer Sports
  - Raw defensive stats such as pass yards, pass touchdowns, and total Expected Points Added (EPA)
  - Efficiency statistics such as completion percentage, EPA/Play, and EPA/Pass
- Data transformation consisted of four steps
  - Calculate the average coverage grades for cornerbacks and safeties by team from 2024-2025
  - Find the average grade for pass rushers by team from 2024-2025
  - Quantify variability in the key defensive pass coverage schemes for each team
  - Organize all variables for each team in one data frame (.csv file)

Standardized Entropy

- **Definition**: Mathematical concept used to measure the variability or randomness of certain strategies, schemes, decisions, or even outcomes
- **Application**: Standardized entropy calculated for each NFL pass defense so far in 2025
- All 10 major pass defense outcomes considered for each team
- A high standardized entropy indicates high variability in defensive pass coverage scheme usage
- Perfect variability → Standardized Entropy of 100%
- Numerator represents the entropy; denominator standardizes for the number of pass defense options

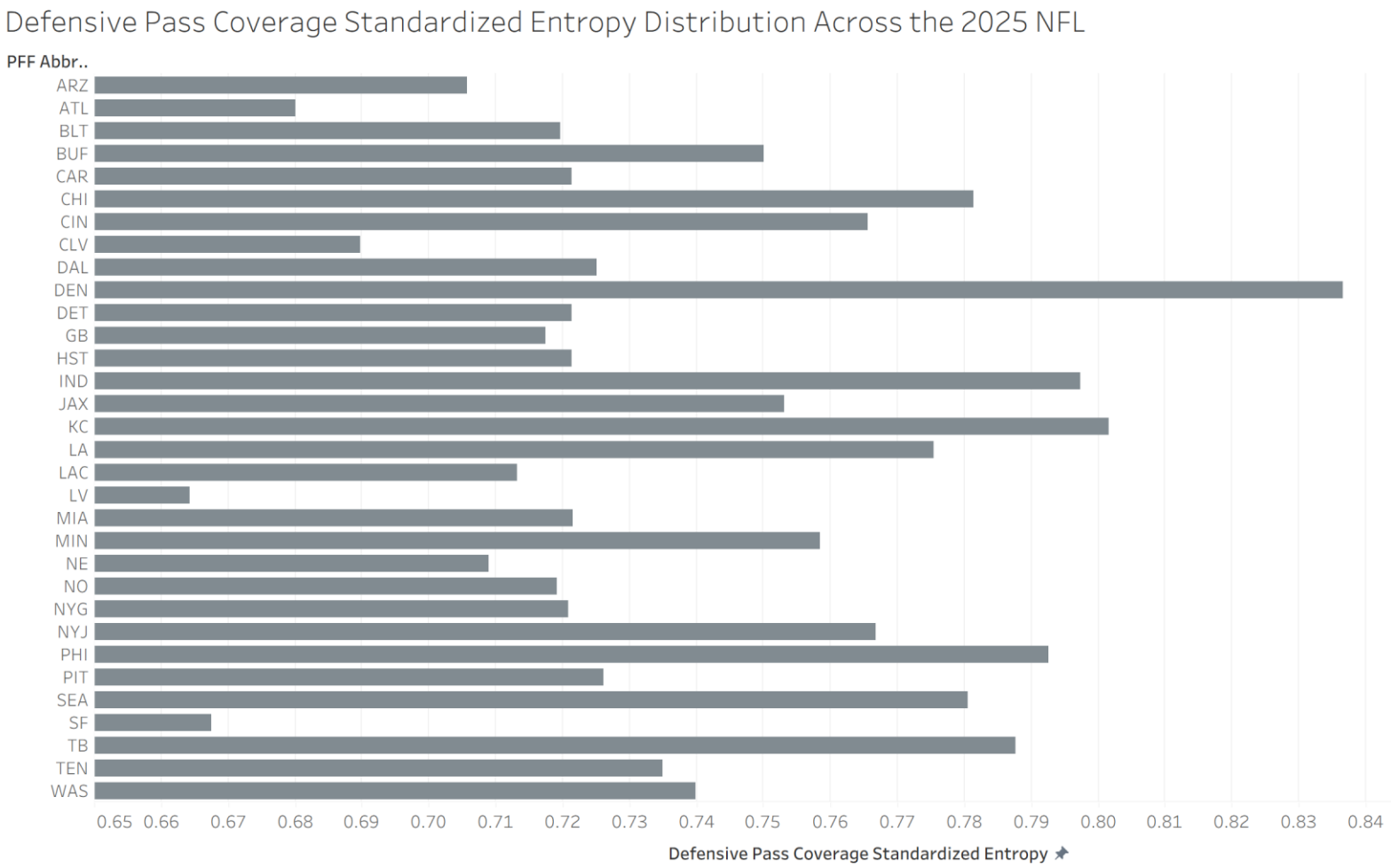
$$Coverage\ Standardized\ Entropy_{\ Team,Year} = \frac{|Cover\ 0\ \% * \ln(Cover\ 0\ \%) + Cover\ 1\ \% * \ln(Cover\ 1\ \%) + \cdots + Bracket\ Cover\ \% * \ln(Bracket\ Cover\ \%)|}{\ln(Number\ of\ Schemes = 10)}$$

Regression Models

- Two statistical analysis models considered to answer research question
- Model 1: Simple linear regression (SLR) between opponent EPA per pass and pass coverage variability
- Model 2: Multiple linear regression model with other predictor (control) variables by team
  - Controls: Average CB coverage grade, average S coverage grade, and average pass rusher grade
  - Removes lurking variable bias: Other variables impact opponent EPA per pass, limiting ability to interpret the simple linear regression
  - Allows for more accurate results for the effect of coverage variability on opponent EPA per pass

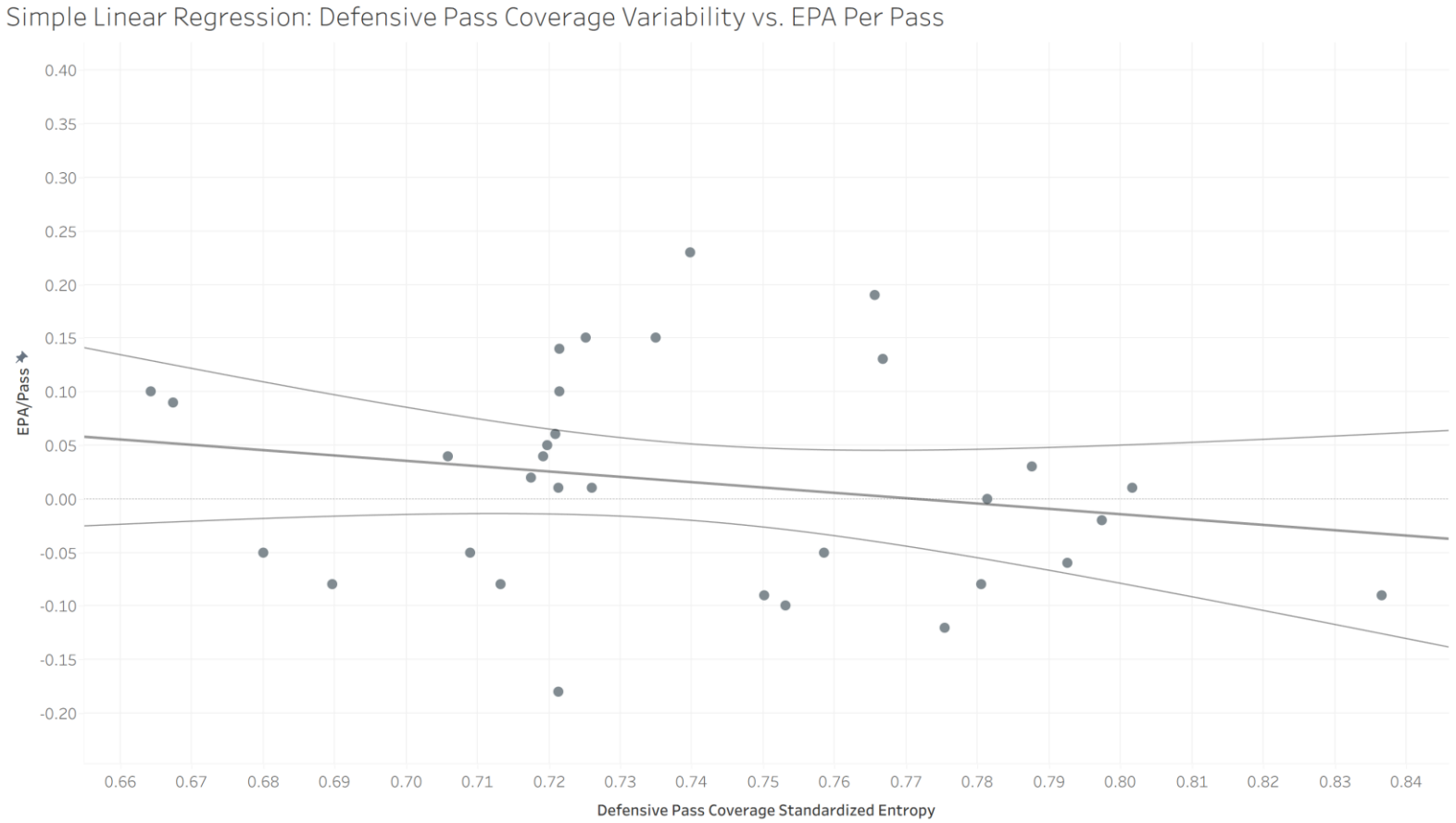
$$Opponent\ EPA\ Per\ Pass_{\ Team,\ Year} = \beta_0 + \beta_1 CoverageStandardizedEntropy_{\ Team,\ Year} + \varepsilon_{\ Team,\ Year}$$

$$\begin{aligned} &Opponent\ EPA\ Per\ Pass_{\ Team,\ Year} \\ &= \beta_0 + \beta_1 CoverageStandardizedEntropy_{\ Team,\ Year} \\ &+ \beta_2 averageSafetyCoverageGrade_{\ Team,\ Last\ 2\ Years} \\ &+ \beta_3 averageCornerCoverageGrade_{\ Team,\ Last\ 2\ Years} + \beta_4 averagePassRusherGrade_{\ Team,\ Last\ 2\ Years} \\ &+ \varepsilon_{\ Team,\ Year} \end{aligned}$$



League-Wide Distribution of Defensive Pass Coverage Standardized Entropy

High: Denver Broncos, 83.66%
Low: Las Vegas Raiders, 66.43%



Simple Linear Regression Model Results

$$\widehat{Opponent\ EPA\ Per\ Pass}_{Team,2025} = 0.384144 - 0.498298\ Standardized\ Entropy_{Team,2025}$$

R-Squared: 4.19%
P-Value: 0.261051

Multiple Linear Regression Results

$$\widehat{Opponent\ EPA\ Per\ Pass}_{Team,\,2025} = 0.09764 - 0.3899 CoverageStandardizedEntropy_{Team,\,2025} - 4.66936 averageSafetyCoverageGrade_{Team,\,2024-2025} - 0.71344 averageCornerCoverageGrade_{Team,\,2024-2025} - 0.29354 averagePassRusherGrade_{Team,\,2024-2025}$$

- Two relevant predictor variables
  - Average cornerback coverage grade
  - Average pass rusher grade
- Variables may be clinically significant
  - Defensive pass coverage standardized entropy
  - Average safety coverage grade
- Defensive pass coverage variability has become less important; positional grades hold more importance in determining opponent EPA per pass
- Lurking variable bias has been partially addressed, but other variables can still be added

Variable	Coefficient	P-Value
Coverage Standardized Entropy	-0.3899	0.3559
Average Safety Coverage Grade	-4.66936	0.5424
Average Cornerback Coverage Grade	-0.71344	0.0448
Average Pass Rusher Grade	-0.29354	0.0503
Constant	0.09764	0.7729

Conclusion and Future Research

- Wide range of defensive pass coverage variability results in the 2025 NFL Weeks 1-13
  - Low: Las Vegas Raiders, 66.43%
  - High: Denver Broncos, 83.66%
- Defensive pass coverage standardized entropy had similar results in both models
  - Negative relationship with opponent EPA per pass
  - Statistically insignificant at most statistical significance levels
  - May still hold clinical significance from a coaching perspective
- Average PFF grades by position had negative relationships with opponent EPA per pass
- **Conclusion**: More research should be performed using the MLR model
  - Add more control variables to model to eliminate more lurking variable bias
    - PFF grades
    - Offensive EPA per pass
    - Injuries on both sides of the football
  - Different dependent variable of interest
    - Expected points added per drop back (EPA / drop back)
    - Interception rate (INT%)