TOCQ: Tackle Opportunity Containment Quotient

Duke MSS Portfolio Presentation

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STA 583
April 5, 2024

The Big Data Bowl

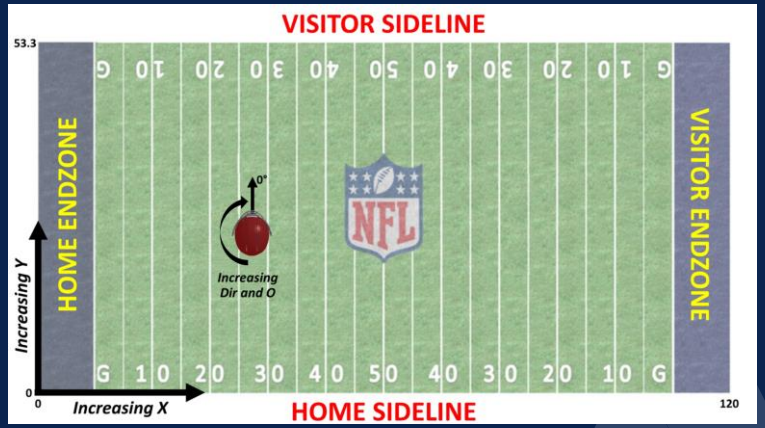
- Hosted by the National Football League
- Amazon “Next Gen Stats” player tracking data
- 2024 theme: Tackling

Motivation and Introduction

- Goal of football: Offense wants to advance ball
  - **Defense wants to tackle ball carrier**
- Box score only credits player who “made the tackle”
- Want metric to evaluate:
  - Players who see opportunities “slip away”
  - Players who are “in the right place at the right time”
- Motivating Play: **Week 2, 2022: New York Jets-Cleveland Browns**

The Data

- Weeks 1-9, 2022 NFL Season
- Player and Ball tracking data
  - Speed, Acceleration, Direction
  - (x, y) location
  - Player Orientation
  - 10 Frames/Second (subset)
- Game, Player, Play information



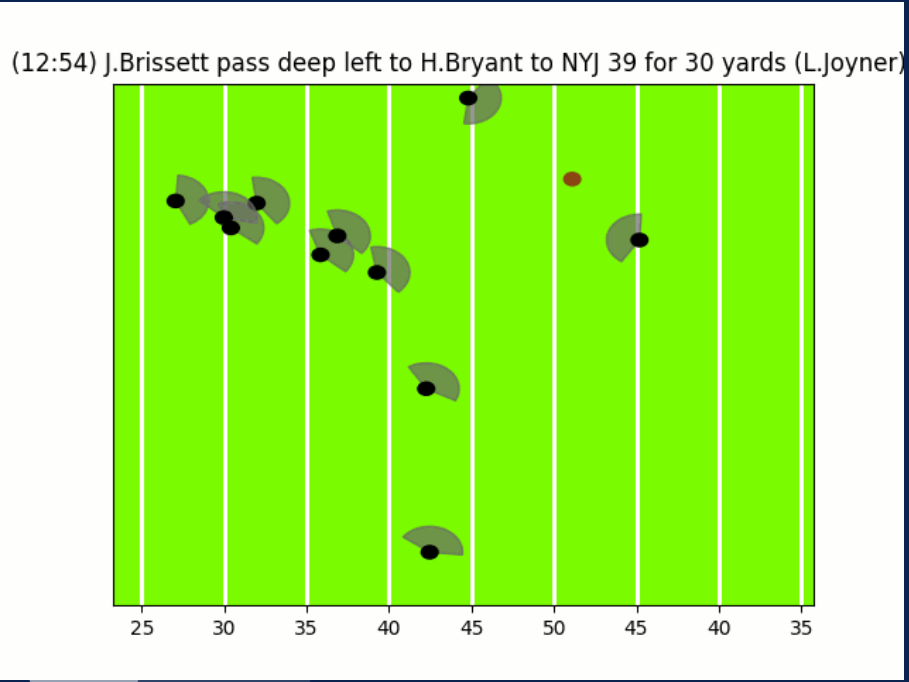
Defining TOCQ

- *Tackle Zone*: Radius r, 150 degree sector angle
  - $r = \max\left(1.25, 1.25 + st + \frac{1}{2}at^2\right), t = 0.1$
- *Tackle Opportunity*: Ball enters zone during play
- *Tackle Contained*: Play ends in tackle zone
- **All tackles contained are tackle opportunities**

$$TOCQ_X = \frac{\#\text{ of Tackles Contained by Defender X}}{\#\text{ of Tackle Opportunities for Defender X}}$$

$$TOCQ_T = \frac{\#\text{ of Tackles Contained by Team T}}{\#\text{ of Tackle Opportunities for Team T}}$$

Visualizing TOCQ



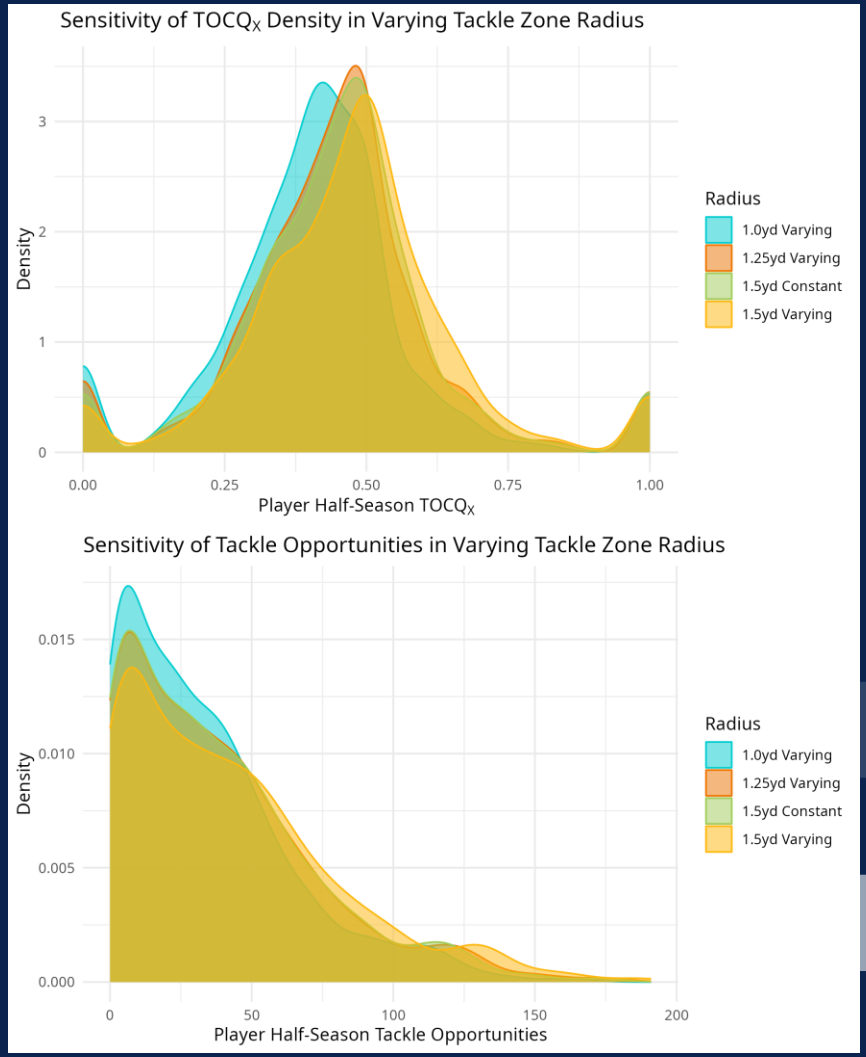
TOCQ_X Output of Example Play

Index	Player Name	Tackle Opportunity	Tackle Containment
41243_NYJ	C.J. Mosley	0	0
44815_NYJ	Solomon Thomas	0	0
46141_NYJ	Nathan Shepherd	0	0
46186_NYJ	Jordan Whitehead	0	0
46211_NYJ	D.J. Reed	0	0
46255_NYJ	Jake Martin	0	0
47881_NYJ	Quincy Williams	0	0
42467_NYJ	Kwon Alexander	1	0
54491_NYJ	Jermaine Johnson	1	0
41270_NYJ	Lamarcus Joyner	1	1
54469_NYJ	Ahmad Gardner	1	1

Radius Sensitivity

Mean and SE of TOCQ_X score and opportunity with varying radius				
Radius	Mean TOCQ_X	SE TOCQ_X	Mean Player Opportunities	SE Player Opportunities
1.0yd Varying	0.4031020	0.1994383	33.47181	30.45966
1.25yd Varying	0.4378373	0.1971925	37.98504	34.02091
1.5yd Constant	0.4414003	0.1981126	37.57077	33.39981
1.5yd Varying	0.4648202	0.2003979	42.03337	37.17232

Mean and SE of TOCQ_T score and opportunity with varying radius				
Radius	Mean TOCQ_T	SE TOCQ_T	Mean Team Opportunities	SE Team Opportunities
1.0yd Varying	0.4197093	0.06903573	107.3321	22.52391
1.25yd Varying	0.4515254	0.06621810	121.8044	25.66440
1.5yd Constant	0.4542192	0.06463206	120.4760	26.04978
1.5yd Varying	0.4746512	0.06292535	134.7860	28.61944

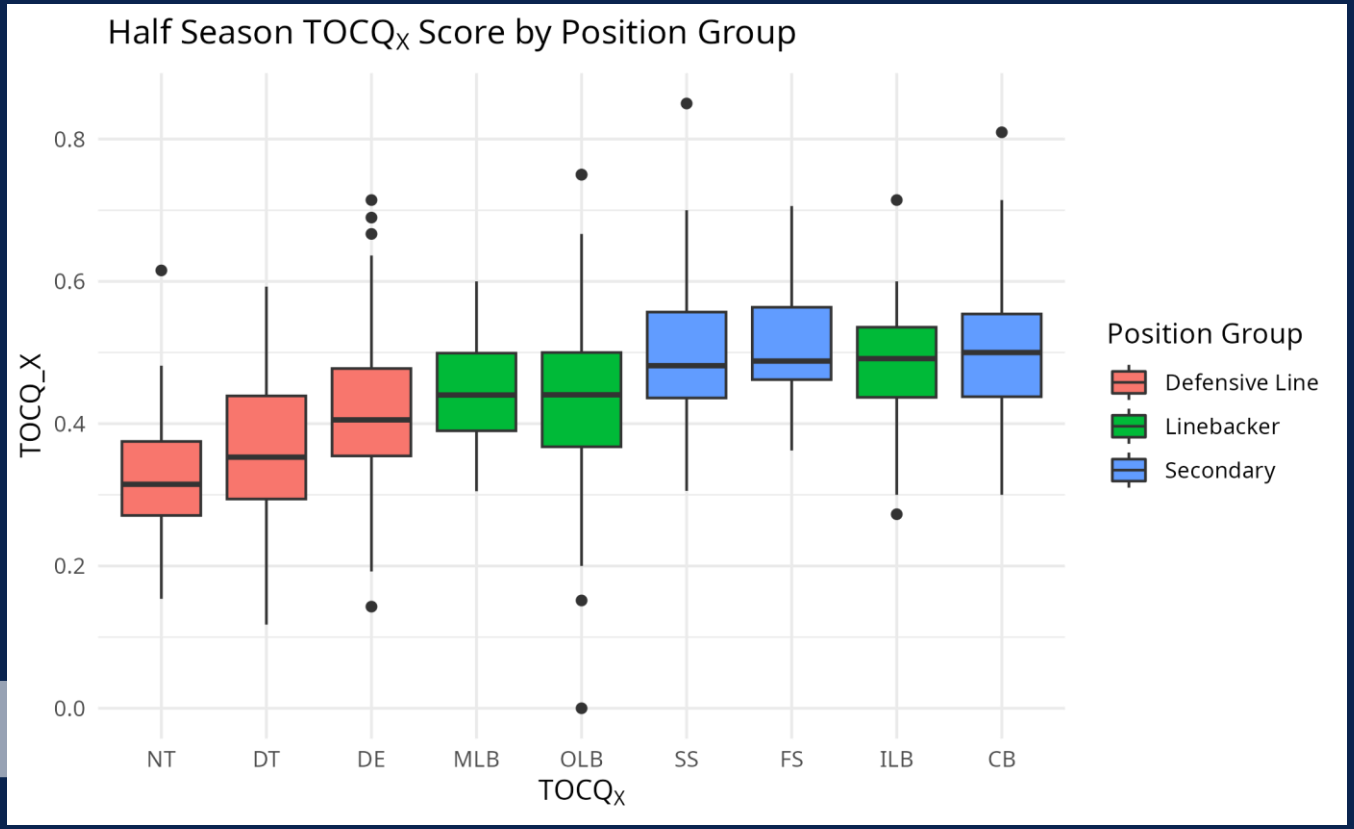


Player TOCQ (Half Season)

Half Season TOCQ_X Scores (minimum 30 Opportunites)

Top 10 Individual Players				Bottom 10 Individual Players			
Player Name	Team	Position	TOCQ_X	Player Name	Team	Position	TOCQ_X
Levi Wallace	PIT	CB	0.7142857	Za'Darius Smith	MIN	OLB	0.1515152
Derrick Barnes	DET	ILB	0.7142857	Marquan McCall	CAR	NT	0.1538462
Terrance Mitchell	TEN	CB	0.7142857	Roy Lopez	HOU	DT	0.1587302
Darrick Forrest	WAS	SS	0.6956522	Vita Vea	TB	NT	0.1857143
D.J. Wonnum	MIN	OLB	0.6666667	Greg Gaines	LA	NT	0.1944444
Charvarius Ward	SF	CB	0.6603774	Carl Davis	NE	NT	0.2000000
Kyle Hamilton	BAL	FS	0.6571429	Tommy Togiai	CLE	DT	0.2051282
Michael Davis	LAC	CB	0.6410256	Abdullah Anderson	ATL	DE	0.2285714
Cameron Dantzler	MIN	CB	0.6376812	Teair Tart	TEN	DT	0.2340426
Derek Stingley	HOU	CB	0.6166667	Daron Payne	WAS	DT	0.2346939

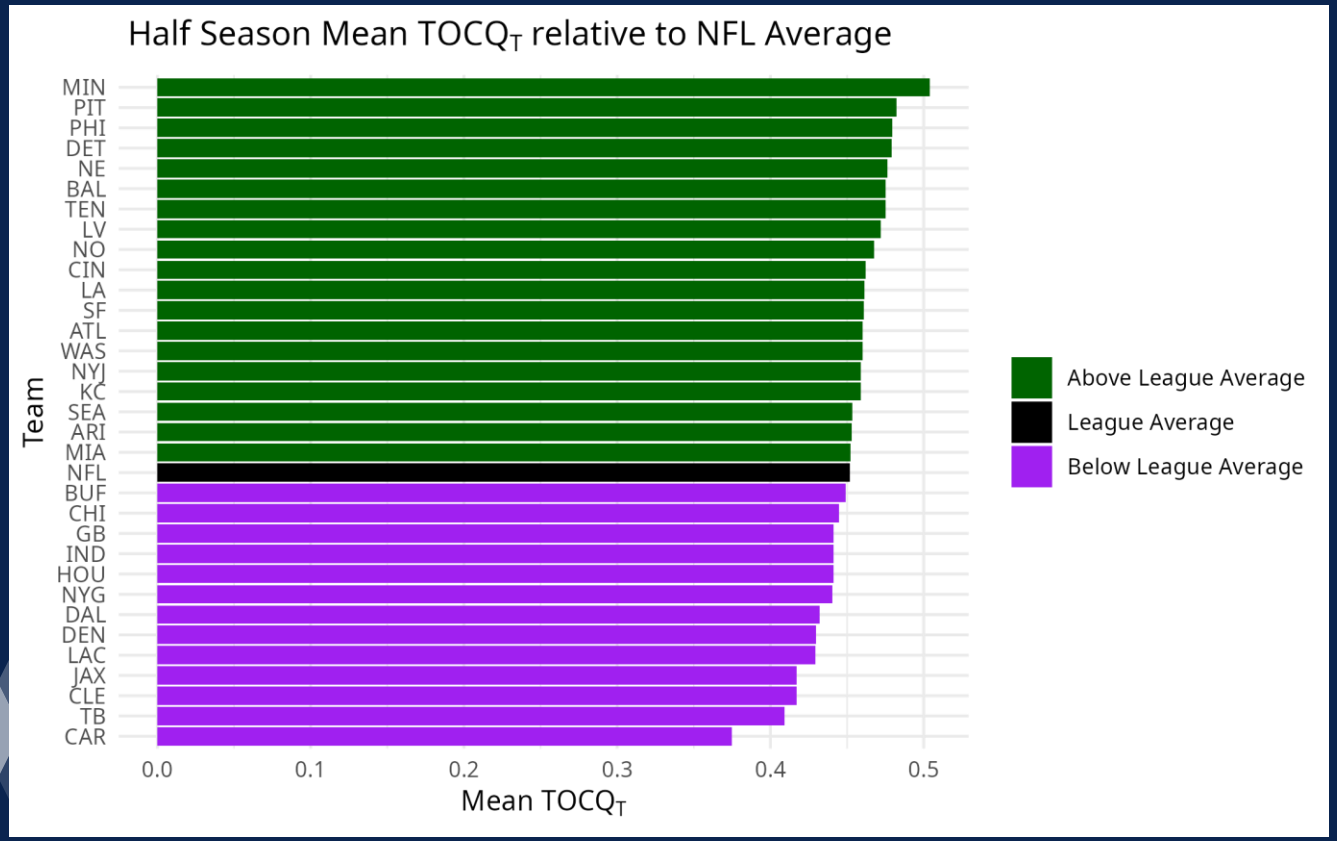
Player TOCQ (Position Group)



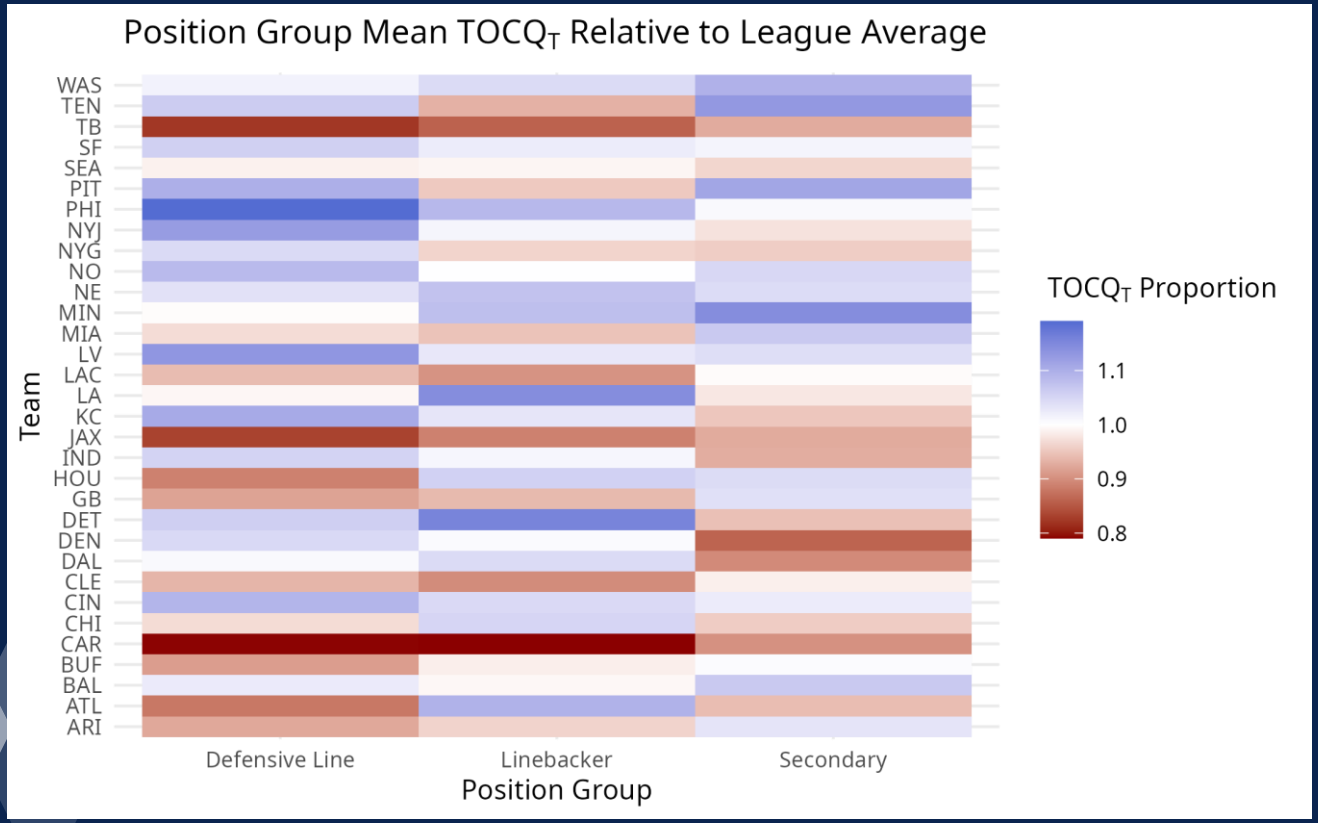
Team TOCQ (Game)

Team TOCQ_T Single Games							
Top 10 Team Games				Bottom 10 Team Games			
Team	Week	Opponent	TOCQ_T	Team	Week	Opponent	TOCQ_T
BUF	6	KC	0.6276596	CAR	5	SF	0.2258065
SF	8	LA	0.5982143	CAR	7	TB	0.2519084
CHI	3	HOU	0.5973154	CLE	1	CAR	0.2830189
PIT	5	BUF	0.5964912	NYG	2	CAR	0.3027523
TB	2	NO	0.5940594	BUF	4	BAL	0.3046875
KC	6	BUF	0.5905512	HOU	5	JAX	0.3047619
NO	8	LV	0.5862069	TB	8	BAL	0.3172414
BAL	9	NO	0.5769231	CHI	1	SF	0.3190184
TEN	9	KC	0.5743243	NO	3	CAR	0.3258427
NYJ	4	PIT	0.5684932	DEN	2	HOU	0.3260870

Team TOCQ (Half Season)



Team TOCQ (Position Group)



Conclusion

- Introduced **TOCQ** with team and player parametrizations
- Tackle zone radius has minimal impact on TOCQ scores, larger impact on # of opportunities
- Defensive linemen have lower **TOCQ**, secondary players have higher **TOCQ** (in general)
- Top teams tend to have higher **TOCQ,** lower teams tend to have lower **TOCQ**

Limitations and Future Steps

- 9 weeks of data = 12500 plays
  - 2 players have 30 opportunities in a game
  - Team sample size of 8-9
- Frame event inconsistency
  - Pass and run plays have different frame sets
  - Missing pass rush events that did not result in sacks
  - Unclear how event tagging was done
- Blocker presence is ignored
- Consider predictive approach (Predicting who picks up a tackle containment on a play)

Questions?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