

RUSH INDEPENDENT PASSING PLAYER EFFICIENCY NUMBER (RIPPEN)

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RIPPEN, Rush Independent Passing Player Efficiency Number, is a new measurement of passer performance. In a simulated world, how would a passer perform starting from their twenty yard line and only performing pass plays? The aspects of each play are simulated using a Bayesian model. This allows rookies and backups with minimal data to be fairly evaluated. Drives would end in a touchdown, field goal or turnover. A players RIPPEN is the average number of points they would be expected to score per drive. Our metric improves on existing passer rating systems because it is updated to current NFL data, does not weight passing touchdowns, and it is able to be more intuitively understood.

1. Introduction. The current passer rating measure has been around since 1973. NFL's Quarterback Rating:
Using the notation from [van Dohlen \(2011\)](#):

$$QBR = \left(\frac{\frac{C}{A} - 0.3}{0.2} + \frac{\frac{Y}{A} - 3}{4} + \frac{\frac{T}{A}}{0.05} + \frac{0.095 - \frac{I}{A}}{0.04} \right) \left(\frac{100}{6} \right)$$

where C = Number of Completions

Y = Number of Yards

A = Number of Attempts

T = Number of Touchdowns

I = Number of Interceptions

Each of these four components has a maximum of 2.375, so a “perfect” passer rating in the NFL is $\frac{(2.375)(4)(100)}{6} = 158.3$.

The NCAA passer rating is: $\frac{8.4Y+330T+100C-200I}{A}$

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This number ranged from -731.6 to 1261.6. Ridiculous.

Passer rating is bad. RIPPEN is better. The NCAA and NFL formulas are different. Mention this.

Tim Tebow example of why QBR is bad:

Read more about this. Might be interesting: - Would we add something like this to our results

DYAR and DVOA:

<http://www.nih.ticz.musclehedz.charlespoliquin.sportsci.org/2011/mep.htm>

JQAS: <https://www.degruyter.com/view/j/jqas.2011.7.3/jqas.2011.7.3.1359/jqas.2011.7.3.1359.xml?form>

A Statistical Analysis of NFL Quarterback Rating Variables Derek Stimel, Journal of Quantitative Analysis in Sports The Quarterback Prediction Problem: Forecasting the Performance of College Quarterbacks Selected in the NFL Draft Julian Wolfson et al., Journal of Quantitative Analysis in Sports Analyzing dependence matrices to investigate relationships between national football league combine event performances Brook T. Russell et al., Journal of Quantitative Analysis in Sports Isolating the Effect of Individual Linemen on the Passing Game in the National Football League Benjamin C Alamar et al., Journal of Quantitative Analysis in Sports Quantifying NFL Coaching: A Proof of New Growth Theory Kevin P. Braig, Journal of Quantitative Analysis in Sports

CITE Passer Rating CITE QBR

Don Steinberg: How I Learned to Stop Worrying and Love the Bomb <http://www.donsteinberg.com/qbrati>

Quarterback Rating: <http://www.nfl.com/help/quarterbackratingformula>

NFL Passer rating: <https://www.profootballhof.com/news/nfl-s-passer-rating/>

College Passer efficiency: <http://football.stassen.com/pass-eff/>

Defending Passer rating: Kerry Byrne <https://www.si.com/more-sports/2011/08/03/defending-qbr-rating>

PRO FOOTBALL; The N.F.L.'s Passer Rating, Arcane and Misunderstood <https://www.nytimes.com/2011/08/03/sports/football-the-nfl-s-passer-rating-arcane-and-misunderstood.html>

[Stimel \(2009\)](#) Looking for structural breaks in QBR.

[van Dohlen \(2011\)](#)

1.1. *Criticism of QBR.* Arbitrary scale (0 to 158.3??) Hard to interpret (What does 121.6 mean?) QBR overly credits QBs for scoring TDs.

2. Methods. We propose Rush Independent Passing Player Efficiency Number (RIPPEN). Describe what we did.

RIPPEN uses the exact same inputs as QBR: Completions, Yards, Interceptions, and Touchdowns.

2.1. *Theoretical Results.* Do we have any?

2.2. *Correlation between RIPPEN and winning.* Compare RIPPEN and winning to QBR and winning.

2.3. *Preliminary Results & Notes.* This will house all of amusing musings from the past few weeks while we wait for the overall paper to take form. First thing's first, we need to know what is left to be done:

2.3.1. *TO DO:*

- Type up Markov Chain
- Implement
- Censored Data

2.3.2. *Markov Chain Notation:*

-Markov-	Down 1	Down 2	Down 3	Down 4
Down 1	a	b	0	0
Down 2	c	0	d	0
Down 3	e	0	0	f
Down 4	0	0	0	1

$$a = Pr(y_{d,1} > 10)$$

$$b = 1 - a$$

$$c = Pr(y_{d,2} > 10 - y_{d,1})$$

$$d = 1 - c$$

$$e = Pr(y_{d,3} > 10 - y_{d,2} - y_{d,1})$$

$$f = 1 - e$$

2.3.3. *Closed Form? Here is all of the Notation:* Our notation becomes rather hairy around here, so bear with me. I will just go ahead and write down the equations we made up and try to tell which of the 14 different i's imply what:

3. Results.

3.1. *Bayesian Posterior Distributions Stuff.* What do the posterior parameters look like?

3.2. *Rodgers vs Tebow Example.*

3.3. *Distribution of RIPPEN.*

3.4. *Best Games/Seasons.*

4. Conclusion and Future Work. RIPPEN is good. We will do more eventually.

Adding a defensive adjustment.

Do we even want to add these things? How do we deal with pass interference. Defensive Holding? Sacks? Add another layer. Fumbles? Could treat similar to interceptions? Should interceptions ever result in negative numbers? How do we assign the negative numbers for interceptions?

References.

- STIMEL, D. (2009). A Statistical Analysis of NFL Quarterback Rating Variables. *Journal of Quantitative Analysis in Sports* **5** 1.
- VAN DOHLEN, P. (2011). Tweaking the NFLs Quarterback Passer Rating for Better Results. *Journal of Quantitative Analysis in Sports* **7** 22.

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