



QBR: What ESPN Analytics Learned

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Sloan Sports Analytics Conference

**TOTAL
QBR**

MISSION AND ORGANIZATION

- ESPN Analytics Team mission
- Identified the creation of a new NFL QB Rating as first project
- Designed rating system to leverage our data resources
- Created Expected Points and Win Probability models and performed Division of Credit analysis

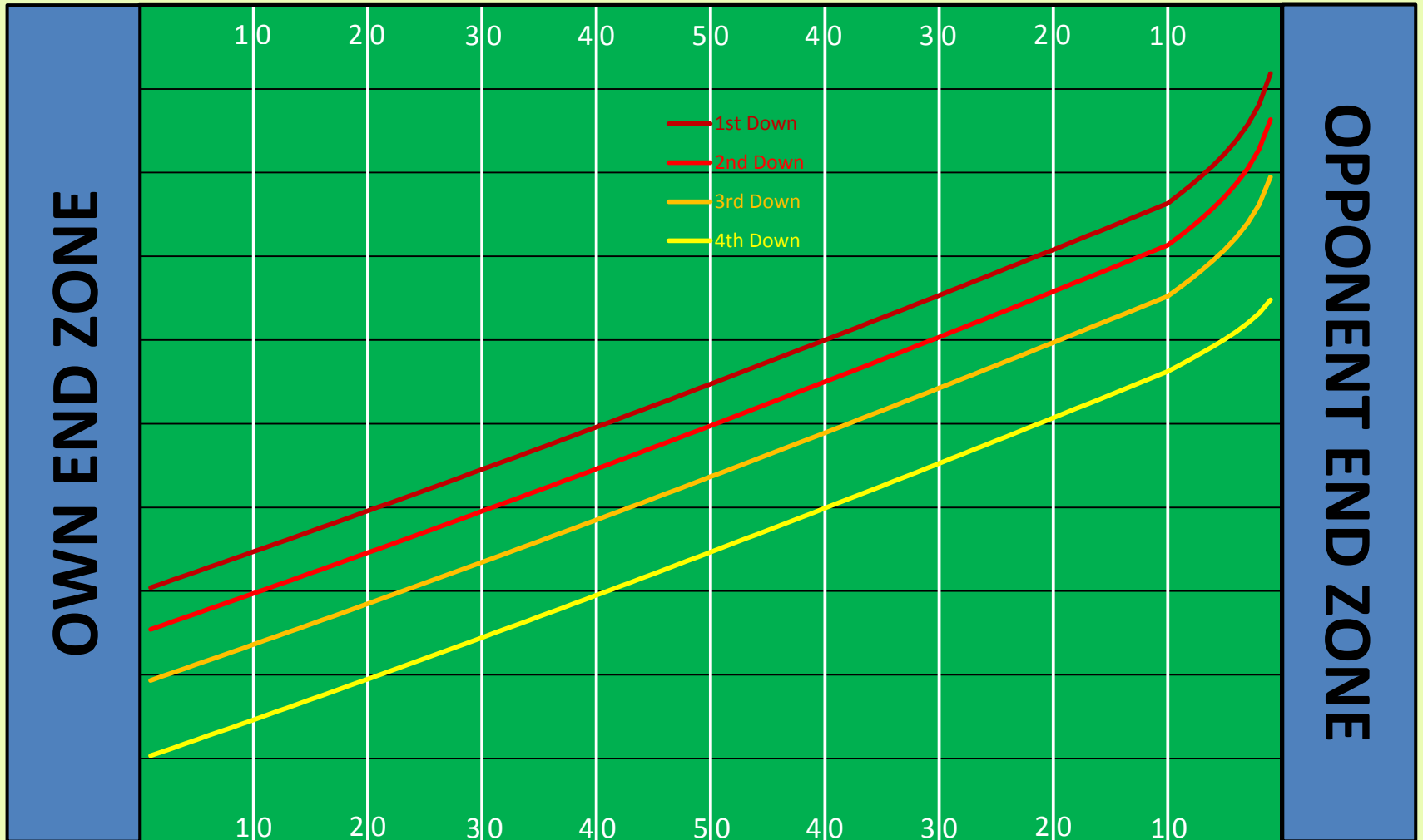
EXPERT TAKEAWAYS AND EXAMPLES

- Met with ESPN NFL analysts (former players and coaches) to get input
- Designed a Leverage Index based on the pre-play win probability to capture the “clutch” component
- Ran the 2008-2010 seasons and Tom Brady’s historic 2007 season through the algorithm
- Debuted QBR in one-hour Year of the QB special on ESPN August 5, 2011

METHOD OUTLINE

- For each play
 - Team Expected Points Added
 - Divide Credit to Quarterback
 - Assign Clutch Weight from pre-play situation
- To get QBR
 - Sum over all plays (of interest)
 - Rescale to 0-100

Expected Net Points for Possessing Team By Down and Field Position (10 Yards or Goal To Go)



DIVISION OF CREDIT

- Basic concept: Regress on the variability of performance against role of QB, receiver, blockers
 - Based on Alamar work
- Things divided:
 - Completions, yards after catch, incompletions, interceptions, interception returns
 - Sacks
 - Rushes, Scrambles

DIV-CREDIT: SACKS ON QB

- Brady vs Cassel
 - Patriots sack %: 5.0%, 4.8%, 3.0%, 8.2%, 3.5%
- Cutler vs Hanie/McCown
 - 6.8% v 13.5%
- If you want to give credit for avoiding sacks, must take away credit for not avoiding them
- Consistency of QB sack blame through time
- Percentage of Blame:
 - Against 5+ rushers: 57%
 - Against 4- rushers: 52%

DIV-CREDIT: LONG PASSES

- More air yards vs yards after catch -> More to QB
 - Deep passes vs screen passes
- More air yards vs less air yards -> More to receiver
 - Randy Moss v Daunte Culpepper

CLUTCH WEIGHT

- Pre-play “importance”
- Depends on how close game is and time left
- Play of average importance has clutch weight of 1.0
- Ranges from about 0.25 (a play that is $\frac{1}{4}$ as “important” as an average play) to about 2.6 (a play that is slightly more than $2\frac{1}{2}$ times as “important” as an average play)
- QBs with bad defense not rewarded

OPPONENT ADJUSTMENT

- Adjusted using Simple Rating System technique

- Best:

	Opp. Adj. QBR	QBR	Diff
Aaron Rodgers	85.2	85.1	0.1
Drew Brees	84.0	82.6	1.4
Tom Brady	74.1	72.5	1.6
Tony Romo	70.1	68.4	1.6
Matt Ryan	67.5	68.3	-0.7

- Worst:

	Opp. Adj. QBR	QBR	Diff
Blaine Gabbert	18.2	21.1	-2.9
Curtis Painter	21.7	23.4	-1.7
Sam Bradford	24.9	27.3	-2.5
Tim Tebow	28.3	27.2	1.2
Mark Sanchez	29.8	33.6	-3.9

- Big Changes:

	Opp. Adj. QBR	QBR	Diff
Matt Cassel	41.9	48.8	-7.0
Mark Sanchez	29.8	33.6	-3.9
Carson Palmer	65.4	62.3	3.1
Philip Rivers	67.2	64.3	2.9

OPPONENT ADJUSTMENT ON DEFENSES

- If a division has strong or weak QBs, then a defense can see big change.

- Best Defenses:

	Opp. Adj. QBR	QBR	Diff
Lions	33.0	48.0	-15.1
Chiefs	38.0	37.6	0.4
Bears	39.0	45.2	-6.1
Ravens	39.8	36.5	3.4
Jets	42.3	44.8	-2.5

- Worst Defenses:

	Opp. Adj. QBR	QBR	Diff
Chargers	69.0	68.2	0.7
Colts	66.0	65.4	0.6
Bills	63.7	63.7	0.0
Browns	61.7	46.4	15.3
Titans	59.6	58.3	1.4

A WRITER USES QBR

- **Situational Performance**
 - Example: Facing the blitz
- **Career Patterns**
 - Example: Potential 2012 breakouts
- **Clutch-weighted EPA**
 - Example: Points added per cap dollar
- **Styles of Play**
 - Example: Ball discipline, sacks, interceptions and Eli Manning
- **Fantasy Predictions**
 - QBR and CWEPA predict **fantasy value** better than traditional stats

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TOTAL
QBR

MEASURE OF QB IS WHEN *NOT* UNDER PRESSURE

QBR When Pressured

Rank	QB	QBR	%AxnPlys
1	Donovan McNabb	42.7	29%
2	Chad Henne	38.5	33%
3	Michael Vick	31.1	32%
4	Drew Brees	29.1	19%
5	Aaron Rodgers	27.9	24%

QBR When Not Pressured

Rank	QB	QBR	%AxnPlys
1	Aaron Rodgers	93.3	76%
2	Drew Brees	90.4	81%
3	Tom Brady	86.2	83%
4	Matt Schaub	86.1	73%
5	Matt Ryan	84.9	79%

Worst Not-Pressured

- Tyler Palko
- John Skelton
- John Beck
- Seneca Wallace
- A.J. Feeley
- Donovan McNabb
- Blaine Gabbert
- Curtis Painter
- Tim Tebow
- Kerry Collins
- Caleb Hanie

(LOTS OF) TIME IN POCKET IS BAD

t Range	QBR
1-1.9	64.6
2-2.9	60.7
3-3.9	53.9
4-4.9	52.2

- Time in pocket is a mixed number
 - Partially reflects blocking
 - Partially reflects quick routes
 - Partially reflects offensive/defensive approach

SOME QBS DRAW PENALTIES

- 2011: Flacco, Fitzpatrick, Ryan
- 2010: Ryan, Flacco, P. Manning
- 2009: Flacco, Cutler, Roethlisberger
- 2008: Frerotte, Ryan, Rivers
- Penalty skills:
 - offsides
 - defensive pass interference

WINNING QBR = WINNING?

Team with Advantage in Game
Regular Season Since 2008

	W-L-T	Win Pct
Total Yardage	708-311-1	.695
Turnover Differential	649-178-1	.784
NFL Passer Rating	811-242-1	.792
Total QBR	888-135-1	.868

- Takeaway: Correlation was not the goal, but is useful. QB's effectiveness relates strongly to team's effectiveness.

WHAT'S NEXT?

- Other positions?
- College version
- More charting?
- Going backwards in time
 - Estimation?
- Better website information to show what's under it

QUESTIONS?

- Frequently Asked Questions:
 - Is it subjective?
 - Is it a black box?
 - How does division of credit work?
 - How come quarterbacks get blame for sacks?
 - Explain the clutch index.
 - Why no defensive adjustment?
 - What is the point of a new rating?
 - Does QBR relate to winning?

DIVISION OF CREDIT, COMPLETIONS

- Short passes, 55%
- Long passes, 48%
- Credit divided on Air yards + Expected YAC

DIVISION OF CREDIT, INCOMPLETIONS

Percent of Total EPA Associated with Incompletion (Not An Interception)			
Air Yards → Incompletion Type ↓	Up to 3 Yards	4-10 Yards	11+ Yards
Overthrow	44%	44%	45%
Underthrow	40%	47%	47%
Defended, Batted, Tipped, Dropped Int (by Defense)	41%	44%	47%
Dropped by Receiver	27%	31%	31%
Throwaway vs Up to 4 Pass Rushers	52%	52%	52%
Throwaway vs 5+ Pass Rushers	57%	57%	57%
Miscommunication, Spike, Other Incompletion	55%	55%	48%

- Interceptions similar
 - Some debit also for interception return
 - More for short passes to sideline (60%)
 - Less for deep passes or middle of the field (20%)

DIVISION OF CREDIT, RUSHES

Percent of Marginal EPA Associated with Segment of Yardage on Designed Rush		
Direction → Portion of Yards Gained ↓	Inside Tackles	Outside Tackles
Negative Yardage	46.28%	47.6%
0-4 Yards from Line of Scrimmage	34.59%	39.95%
5-10 Yards from Line of Scrimmage	50.9%	61.7%
11+ Yards from Line of Scrimmage	89%	93%

Percent of Total EPA Associated with Scramble		
Direction →	Inside Tackles	Outside Tackles
	90%	81%

RUNNING QB'S

- If not PK

ESPN