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For most athletes, productivity increases rather quickly, tops off, and then declines as skills diminish or health declines with age. Career length and the point where productivity "tops off" varies with one's sport. And, even within a given sport, the point where one reaches his or her prime may not be well-defined. In the National Football League (NFL), as quarterbacks learn the plays in a team's playbook and develop the ability to decipher defenses, their performance should increase with age, but only up to a point. Eventually, mental acuity depreciates with age and the constant physical punishment quarterbacks endure will also begin to adversely affect performance and hence quarterback ratings. Moreover, if NFL players are much stronger, faster, and more explosive than ever before, one could argue that quarterbacks take much harder and more destructive hits than ever before. Do NFL quarterbacks now reach their prime earlier than they did, say, a decade ago? In this note, we relate quarterback ratings to age and find that the age where productivity peaks surprisingly was about the same in 2005 as it was ten years earlier in 1995.

Table 1 gives the names and team affiliations of all NFL quarterbacks with a minimum of 200 pass attempts in 1995, their age as of September 1, 1995 (average age = 29.4 years), and their quarterback rating (average rating = 81.5).[1] Table 2 is similar to Table 1, but gives the same information for NFL quarterbacks (average rating = 80.1) in 2005 [with their age as of September 1, 2005, (average age = 28.5 years)]. All data are from www.databaseFootball.com. In several instances, two quarterbacks on the same team attempted more than 200 passes (e.g., the St. Louis Rams in 1995 and the Buffalo Bills, Baltimore Ravens, Philadelphia Eagles, Minnesota Vikings, and Arizona Cardinals in 2005). The leading quarterback for the San Francisco 49ers in 2005 had fewer than 200 pass attempts, but was included so that every NFL team was represented.[2]

For both years (1995 and 2005), the quarterback's rating was regressed against his age, his age squared, and the total number of pass attempts, as follows:

$$Rating = \beta_0 + \beta_1 Age + \beta_2 Age^2 + \beta_3 Attempts + \varepsilon$$

where ε denotes a stochastic disturbance (or error) term which may take on positive or negative values. If a quarterback's rating rises with age and then falls after a point, then b_1, the least squares estimate for β_1, should be positive and b_2, the least squares estimate for β_2, should be negative. The estimated coefficient on *Attempts*, b_3, should be positive, as teams with a strong passing game will make more intensive use of their quarterbacks. The peak point is found by taking the partial derivative of *Rating* with respect to *Age*, setting this derivative equal to zero, and solving for *Age* in terms of b_1 and b_2. That is,

$$\frac{\partial Rating}{\partial Age} = b_1 + 2b_2 Age = 0$$

or $Age^* = -b_1/2b_2$, where Age^* denotes the age where ratings peak or NFL quarterbacks reach their prime.

For quarterbacks with a minimum of 200 pass attempts in 1995, the estimated regression was (*t*-values in parentheses):

(1) $$Rating = \underset{(-2.44)}{-209.75} + \underset{(3.17)}{18.123\, Age} - \underset{(-3.01)}{.29208\, Age^2} + \underset{(2.01)}{.036\, Attempts}$$

$R^2 = .376$

For the same reference group in 2005, the least squares regression equation was:

(2) $$Rating = \underset{(-1.30)}{-154.80} + \underset{(1.80)}{15.029\, Age} - \underset{(-1.75)}{.2499\, Age^2} + \underset{(1.89)}{.0352\, Attempts}$$

$R^2 = .241$

A one-tailed *t*-test on the two coefficients of key interest here (namely, *Age* and Age^2) are significant at better than the .01 (.05) level in 1995 (2005). For equation (1), $Age^* = 31.02$ years; for equation (2), $Age^* = 30.07$ years. The age beyond which ratings fall is virtually the same for both groups of quarterbacks, with those in the 2005 season reaching their prime less than a year earlier than their counterparts in the 1995 season.

Concluding Remarks

The leading quarterbacks in the NFL in 2005 ranged in age from 22 (K. Orton of the Chicago Bears) to 36 (B. Johnson of the Minnesota Vikings). The range was slightly wider ten years earlier (K. Collins of the Carolina Panthers at 22 and W. Moon of the Minnesota Vikings at 38). If 22 is "too young" and 38 is "too old", at what age do quarterbacks reach their prime? The evidence presented here for two cohorts (1995 and 2005) suggests that the prime age for NFL quarterbacks is remarkably stable at about 31 years of age, despite the increased emphasis in recent years on off-season training and conditioning, not to mention the improvements in sports medicine and physical therapy.

Table 1. NFL Quarterbacks with 200 or More Pass Attempts, 1995

Player	*Team*	*Age*	*Attempts*	*Rating*
American Conference				
J. Kelly	Buffalo Bills	35	458	81.1
D. Marino	Miami Dolphins	33	482	90.8
D. Bledsoe	New England Patriots	23	636	63.7
B. Esiason	New York Jets	34	389	71.4
J. Blake	Cincinnati Bengals	24	567	82.1
V. Testaverde	Cleveland Browns	31	392	87.8
N. O'Donnell	Pittsburgh Steelers	29	416	87.7
J. Harbaugh	Indianapolis Colts	31	314	100.7
M. Brunell	Jacksonville Jaguars	24	346	82.6
C. Chandler	Houston Oilers	29	356	87.8
J. Elway	Denver Broncos	35	542	86.4
S. Bono	Kansas City Chiefs	33	520	79.5
J. Hastetler	Oakland Raiders	34	286	82.2
S. Humphries	San Diego Chargers	30	478	80.4
National Conference				
T. Aikman	Dallas Cowboys	28	432	93.6
D. Brown	New York Giants	25	456	73.1
R. Peete	Philadelphia Eagles	29	375	67.3
G. Frerotte	Washington Redskins	24	396	70.2
E. Kramer	Chicago Bears	30	522	93.5
S. Mitchell	Detroit Lions	27	583	92.3
B. Favre	Green Bay Packers	25	570	99.5
W. Moon	Minnesota Vikings	38	606	91.5
J. George	Atlanta Vikings	27	557	89.5
K. Collins	Carolina Panthers	22	433	61.9
J. Everett	New Orleans Saints	32	567	87.0
T. Dilfer	Tampa Bay Buccaneers	23	415	60.1
D. Krieg	Arizona Cardinals	36	521	72.6
C. Miller	St. Louis Rams	30	405	76.2
M. Rypien	St. Louis Rams	32	217	77.9
S. Young	San Francisco 49ers	33	447	92.3
R. Mirer	Seattle Seahawks	25	391	63.7

Table 2. NFL Quarterbacks with 200 or More Pass Attempts, 2005

Player	*Team*	*Age*	*Attempts*	*Rating*
American Conference				
K. Holcomb	Buffalo Bills	32	230	85.6
J. Losman	Buffalo Bills	24	228	64.9
G. Frerotte	Miami Dolphins	34	494	71.9
T. Brady	New England Patriots	28	530	92.3
B. Bellinger	New York Jets	25	266	72.9
K. Boller	Baltimore Ravens	24	293	71.8
A. Wright	Baltimore Ravens	29	266	71.7
C. Palmer	Cincinnati Bengals	25	509	101.1
T. Dilfer	Cleveland Browns	33	333	76.9
B. Roethlisberger	Pittsburgh Steelers	23	268	98.6
D. Carr	Houston Texans	26	423	77.2
P. Manning	Indianapolis Colts	29	453	104.1
B. Leftwich	Jacksonville Jaguars	25	302	89.3
S. McNair	Tennessee Titans	32	476	82.4
J. Plummer	Denver Broncos	30	456	90.2
T. Green	Kansas City Chiefs	35	507	90.1
K. Collins	Oakland Raiders	32	565	77.3
D. Brees	San Diego Chargers	26	500	89.2
National Conference				
D. Bledsoe	Dallas Cowboys	33	499	83.7
E. Manning	New York Giants	24	557	75.9
D. McNabb	Philadelphia Eagles	28	357	85.0
M. McMahon	Philadelphia Eagles	26	207	55.2
M. Brunell	Washington Redskins	34	454	85.9
K. Orton	Chicago Bears	22	368	59.7
J. Harrington	Detroit Lions	26	330	72.0
B. Favre	Green Bay Packers	35	607	70.9
B. Johnson	Minnesota Vikings	36	294	88.9
D. Culpepper	Minnesota Vikings	28	216	72.0
M. Vick	Atlanta Falcons	25	387	73.1
J. Delhomme	Carolina Panthers	30	435	88.1
A. Brooks	New Orleans Saints	29	431	70.0
C. Simms	Tampa Bay Buccaneers	25	313	81.4
K. Warner	Arizona Cardinals	34	375	85.8
J. McCown	Arizona Cardinals	26	270	74.9
M. Bulger	St. Louis Rams	28	287	94.4
A. Smith	San Francisco 49ers	23	165	40.8
M. Hasselback	Seattle Seahawks	29	449	98.2

Footnotes

1. The quarterback rating system instituted in 1960 is the most common metric used to evaluate a quarterback's performance. The formula (modified in 1973) is: Rating = [(A + B + C + D)/6] · 100, where A = (Completion Percentage – 30)/20, B = [(Yards/Attempts) – 3]/4, C = (Touchdowns/Attempts)/5, and D = 2.375 – [(Interceptions/Attempts)/4].

2. A 2-sample *t*-test comparing the average age and average ratings of quarterbacks in 1995 and 2005 (with a minimum of 200 pass attempts each season) revealed no discernible differences by age ($p = .369$) or by rating ($p = .635$).