NFL Time Management: The Role of Timeouts in End-Game Scenarios

Bryan Beasley

Ryan Greenwald

Nola Agha

University of San Francisco

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Abstract

Time management is an important part of game strategy in the National Football League (NFL), especially in the second half of a game that could be decided by a field goal. This paper determines the in-game factors that contribute to an NFL offensive team's total time taken to reach field goal range during the final six minutes of regulation in games that are within three points or less. Using data constructed from 2009-2011 NFL regular season games, we find that neither quarterback rating nor the number of All-Pro players affect the speed at a which a team reaches field goal range. However, counter to conventional wisdom, using an offensive timeout during the final drive of the game extends the time it takes to reach field goal range by 22 seconds. On the other hand, the mere availability of an offensive timeout decreases the time it takes to reach field goal range by 19 seconds. Both of these effects are found in games where the offense is behind by 1, 2, or 3 points, but not in tied games. These findings inform in-game coaching decisions for football head coaches.

Keywords: time management, NFL, dual objective decision making, timeout, game strategy, clock control

Introduction

> "It's about strategically giving your team the best chance to win. That's really the essence of it. How to do that? There's 1,000 different ways, based on the situations. Those situations present another set of circumstances that you have to spend a lot of time reviewing, understanding, preparing for. The game is going to happen so quickly, if you're not prepared for it, it could affect you." – Michael Lombardi, NFL Network Analyst and former NFL Player Personnel Executive

Time management in the National Football League (NFL) is a heavily discussed topic because the ability to manage the game offensively and defensively affects a team's probability of winning (Branch, 2011; Sackrowitz & Sackrowitz, 1996). For example, the 2012 Super Bowl featured New England Patriots head coach, Bill Belichick, making the unprecedented decision to let the New York Giants' Ahmad Bradshaw run for a 6-yard touchdown on the Giants' final possession. Belichick dwindled the clock down at the two-minute warning to the 57-second mark because he underestimated the sufficient time he needed to score with one timeout remaining. This mismanagement of time by Belichick and his staff minimized the Patriot's opportunity to respond to Bradshaw's touchdown.

Hadley, Poitras, Ruggiero, and Knowles (2000) estimate that efficient coaching accounts for three to four additional wins in a season. This dramatic difference in success suggests that it is a head coach's duty to utilize all information on-hand to influence their play-calling decisions to give their team the best chance of winning. Indeed, NFL teams have added entry-level positions known as quality control coaches who prepare statistical analysis on both sides of the ball. As evidence of the incredible importance placed on time management as part of the current NFL coaching strategy, many former quality control coaches including Lane Kiffin, Eric Mangini, Mike Munchek, Mike McCarthy and Raheem Morris have worked up from this rank to become head coaches in the league.

NFL teams use various techniques to manage the time left on the clock near the end of a game. When there are less than two minutes left in the game, players can control the clock by ending a play out of bounds, spiking the ball, or calling a timeout. Coaches, on the other hand, control the time by their choice of plays and using timeouts. Because timeouts are an important tool for coaches to control the clock, teams carefully guard their timeouts and rarely use them until the end of the half or the end of the game when they feel clock control is most important. Yet, a fascinating phenomenon occurs at the end of the game – even coaches in close games that require careful control of the clock rarely use their timeouts.

This inspired our focus on situations where the use of timeouts should be most prevalent, specifically, in games where the offense is down by three points or less with less than six minutes left on the clock. In these games the offensive teams should have two identical objectives: 1. to score a field goal, at minimum, to win or tie the game and 2. to manage the clock so that little or no time is left for the opponent to score (see Figure 1). If a field goal is the minimum score needed to avoid a loss, then the offensive team is actively positioning the ball to be at least at the opponent's 35-yard line so a game-

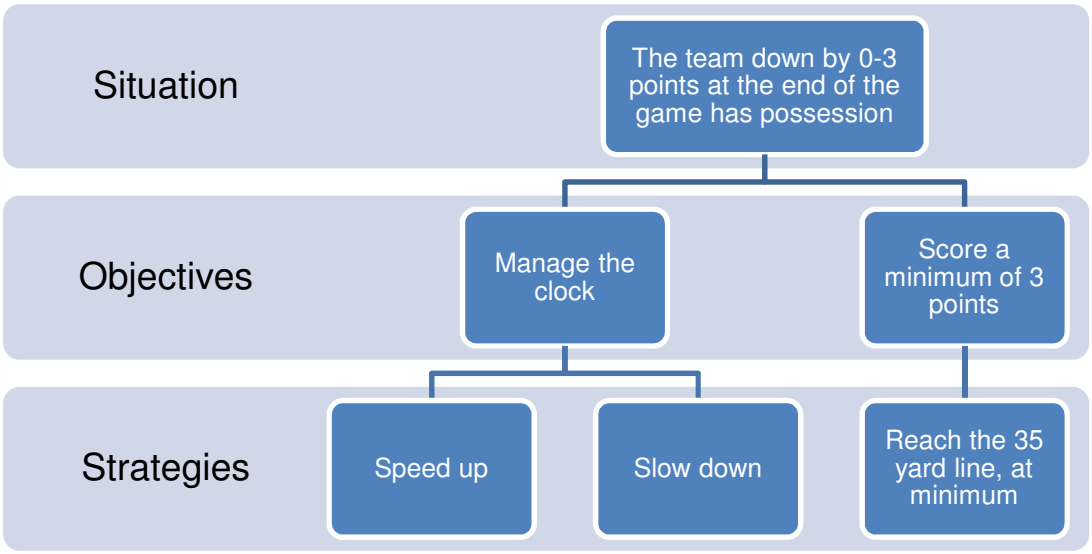

Figure 1. Different strategies employed by teams with identical objectives in the same situation.

winning or game-tying field goal can be attempted. Romer (2006) identifies the 35-yard line as the point where a team's decision to punt or attempt a field goal changes.

While the objectives of teams down by three points or less are identical, the time management strategies by which they achieve their objectives are a function of whether they are seeking to speed up the game or slow it down. Said differently, teams that take possession of the ball with several minutes left in the game achieve the objective field position by running as much time off the clock as possible while simultaneously putting themselves in scoring position. On the other hand, teams that take possession of the ball with little time left in the game achieve the objective field position by stopping the clock as much as possible and preserving enough time for their offense to score. This research carefully distinguishes between these different strategies to determine the variables that affect the speed at which a team moves down field. The critical similarity in both cases is the need to know which variables speed up or slow down the drive separate from the plays called by the coach. Thus, using secondary data obtained through content analysis of recent NFL games, the objective of this explanatory research is to investigate the in-game factors that affect a team's total time taken to reach field goal range.

As time management continues to play a significant role in game outcomes, understanding these variables will inform coaches and allow for adjustment of game decisions and play-calling. Existing research on this subject is minimal at best, which provides the opportunity to relate in-game variables to the total time an offense needs to move into scoring position.

Time Management

A considerable body of literature exists that examines the probabilities of success given certain in-game situations. Sackrowitz and Sackrowitz (1996) argued that when an offense focuses on maximizing time of possession, at the expense of focusing on scoring, the probability of scoring actually decreases. Despite their conclusion that an optimal strategy is to maximize the number of possessions in a game, in the time since their

results were published the discourse on time management in the NFL has continued to emphasize time of possession.

Similarly, both Alamar (2006) and Kovash and Levitt (2009) report that passing plays have a higher rate of expected returns than running plays, yet teams run and pass with equivalent frequencies. Further research (Alamar, 2010) confirmed this finding even after accounting for the outcome of the play in relation to the drive. Likewise, Romer (2006) reported divergence from optimal behavior in his analysis of fourth down attempts. He found a team's play calling choices are "dramatically more conservative" (p. 354) than one would expect based on probabilities of success in fourth down situations. Further investigation using kickoff strategies (Urschel & Zhuang, 2011) clearly confirms NFL coaches are both risk averse and loss averse which explains why their behavior diverges from decisions that would increase the probability of success.

The reality is that NFL teams still spend considerable time and effort controlling the time on the clock despite the availability of analytical research which suggests otherwise (Alamar, 2006, 2010; Kovash & Levitt, 2009; Romer, 2006; Sackrowitz & Sackrowitz, 1996; Urschel & Zhuang, 2011). Romer (2006) reminds us that coaches are not statisticians; instead, they make conservative, risk-averse decisions based on a variety of intangible variables at hand.

As coaches do not follow the strategies that result in the highest probability of winning, the body of research devoted to probabilities is of limited use to the present study. Instead, we follow the call of Bursik (2012) who suggested we set aside theoretical optimization and instead investigate the actual behaviors of actors in the NFL. Accordingly, given the reality that coaches do not select strategies that optimize the probability of success, we approach the time management decision at the end of the game from the perspective of a practitioner, specifically, a coach who continues to believe that retaining possession of the ball at the end of the game is the optimal strategy. Currently, coaches simultaneously attempt to score and to maintain possession of the ball through careful time management. Thus, the question at hand is which variables affect the speed at which the ball moves down field. More specifically, because timeouts are the primary tool used by coaches at the end of the game to manage time, it is imperative to know how the availability and use of timeouts affects the time management process. Without evidence to inform a coach's decision to hold timeouts or deploy timeouts, there is little incentive for a coach to change his ways. If a coach knew the average time needed to allow his offense to get into field goal range, a coach could better allocate his timeouts in order to give his team the proper amount of time to drive down the field.

Once we moved away from the probabilistic research, above, we have identified no previous research that utilizes time taken to reach scoring position as the dependent variable. Instead, informed by research on team production and determinants of scoring, we utilize the variables available to coaches as our independent variables. In other words, from the perspective of a coach standing on the sidelines, the variables in front of them are the amount of time left on the clock, their actual field position, the timeouts available to them and to their opponent, whether the two minute warning will occur during their drive, the quality of their players, and whether they are playing a home game or not. We explain each briefly here and provide more detail in the Methods section.

The amount of time left on the clock will be a strong indicator of the time taken to reach scoring position because this will determine whether a coach implements a strategy

to speed up or slow down (see Figure 1). Similarly, actual field position will dictate how fast a team needs to move downfield. The number of timeouts available to both teams will affect the time taken to reach scoring position because these are tools at the control of each coach that are available to stop the clock. Carter and Machol (1971) conducted probabilistic research on timeouts and Goldschmied, Nankin, and Cafri (2010) found that timeouts do not "ice" a kicker. Beyond that, there is no research that indicates how the availability or use of a timeout affects the time that it takes for a team to move into scoring position. Similar to timeouts, the two minute warning stops the clock and is used by coaches as a tool to control the clock and the speed at which they move downfield. The quality of players is a determinant of both production (Berri, Schmidt, & Brook, 2006) and scoring (Pfitzner, Lang, & Rishel, 2009) when measured for entire games and is thus likely to affect the speed at which a team moves downfield during a shorter portion of a game. Berri et al. (2006) found that a quarterback's success is tied closely to the skills of their teammates thus variables that capture both quarterback quality and team quality are included in our analysis. Finally, considerable evidence exists that home field advantage is real (e.g. Jamieson, 2010).

Because no research has investigated the variables that affect the time needed to move into scoring position at the end of a game, this research is very important and has practical applications for the thousands of football games played in high school, college, or professionally every year.

Method

Sample and Data

In the 2009-2010, 2010-2011, and 2011-2012 seasons there were 768 regular season NFL games. Within those, 83 possessions met the specific criteria for this research: the games were tied or within 3 points in the last 6 minutes of regulation play, the team behind had possession of the ball, and that team reached the 35-yard line before the end of the game. Postseason games are excluded because the league changed overtime rules beginning in the 2010–2011 season.

The data comes from NFL game books and play-by-plays from NFLMedia.com. Looking at the score lines going into a potential last possession, the play-by-plays include down and distance, time of the snap, stoppage of the clock, and timeout usage. The data omits factors such as weather conditions, field conditions, offensive style, strength of defense, kicker range, and failed attempts. These and other unobserved factors are accounted for in the residual error term.

Variables and Expectations

The dependent variable is the number of seconds it takes to move the offensive team from their starting position to the opponent's 35-yard line. As discussed before, this is the time that an offensive coach must control to achieve their two objectives: scoring and leaving as little time on the clock as possible for the opposing team should the offensive team score. Thus, there will be times when the offense has little time left and is running a hurry up offense, also referred to here as hurried. There will also be times when the offense is moving slowly downfield to run out as much time as possible, referred to here as not hurried.

Each of the nine independent variables and the expected direction of effect are

described in detail below. They are further summarized in Table 1.

The amount of time remaining in the game, measured in seconds, is the primary indicator of whether a team is seeking to speed up or slow down the clock. Thus, we expect the time remaining variable to be positive. The more seconds left in the game when the offensive team takes position, the longer it will take them to reach the 35-yard line.

Starting field position is measured as the distance from the offensive end zone, with 1 indicating a drive starting on a team's own 1 yard line and 65 indicating the objective 35-yard line (see Figure 2). Regardless of how fast or slow a team is attempting to move down field, we expect a team starting closer to the opponent's 35-yard line will take less time to reach that point.

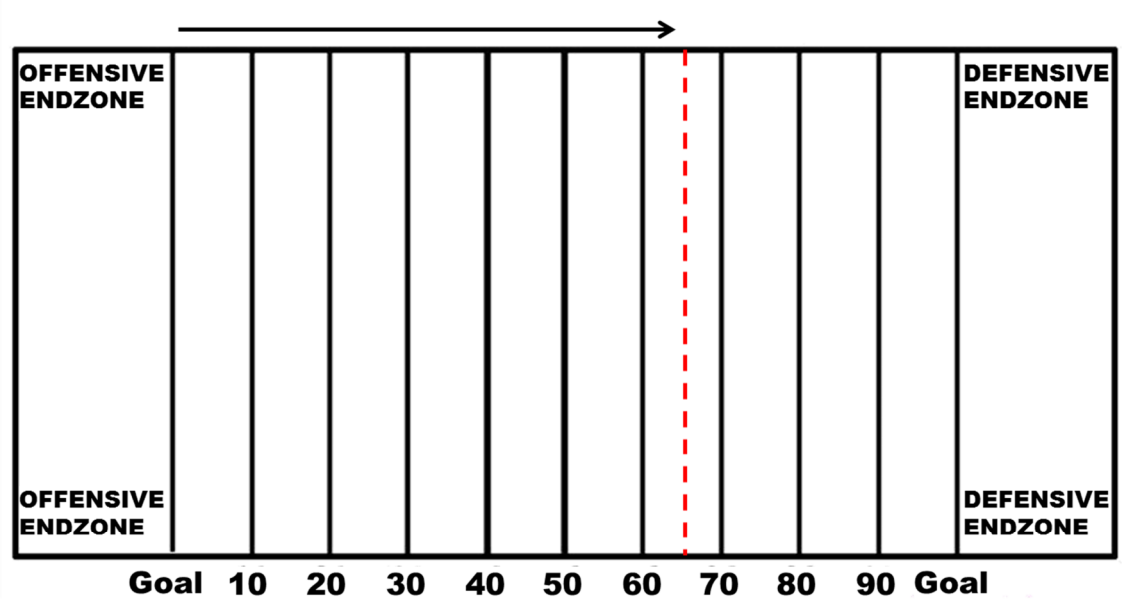

Figure 2. Starting field position is measured as the distance from the offensive end zone. The dotted line represents the 35 yard line as the minimum objective distance for scoring a field goal.

The number of offensive timeouts available is measured upon the commencement of the offensive drive. As discussed above, having timeouts available gives the offense a greater ability to control the clock and the time of possession, should they need to do so. Because teams seek to either retain time or run time off the clock, depending on the circumstances when they gained possession, we have no *a priori* expectation that the simple availability of timeouts will lead to an overall increase or decrease in the time taken to reach field goal range.

Offensive timeouts used measures the number of timeouts the offense used during their possession when the clock wasn't already stopped. Because the clock would not have stopped without the timeout, using the timeout effectively reduces the time it takes to reach field goal range by allowing fewer seconds to tick off the clock.

We also measure the number of timeouts the defense used during the offense's possession when the clock wasn't already stopped. When the offense has the ball, defensive timeouts are most often used to stop the clock to preserve time for the

defensive team should the offense score. By stopping the clock and preserving time, a defensive timeout should effectively reduce the time taken to reach field goal range.

In addition to timeouts, the two-minute warning will stop the clock. This artificially reduces the time it takes to reach the 35-yard line because the clock might have continued to move without this artificial stoppage. Inside the two-minute warning the clock also stops more frequently and should reduce an offensive team's time of possession. The two-minute warning's effect on an offensive drive is measured by a dummy variable.

The offense playing at their home stadium is also measured with a dummy variable. Having the benefit of reduced crowd noise when playing at home should allow for better on field communication and allow an offense to better execute.

In terms of players, a high quality quarterback can more successfully throw passes to the sidelines to stop the clock and more effectively throw long balls down field. Both effectively reduce the time taken to reach the 35-yard line. We suspect that a high quality quarterback will matter more when trying to speed up the game than when trying to slow it down. The quarterback rating at the end of the season is used to measure the quality of the team's quarterback.

The number of star players is measured as the number of offensive players elected to an All-Pro team in that specific season. Star players are more capable of moving the ball fast or slow, as needed, although similar to a quality quarterback, they will likely matter more in a situation where a team has limited time to move into scoring position.

Due to the fact that coaches will implement different strategies in different game situations, we further delineate our results by two factors: whether the game is tied or not and whether the team is playing a no huddle offense or not. Accordingly, we explain our expectations in the paragraphs below.

When the offensive team is losing by 1-3 points the singular goal is to score in order to tie or win the game. Thus, non-tied games may move faster to scoring position because more is at stake and the offensive team cannot risk running out of time. On the other hand, when a game is tied the offensive team has an incentive to score, but has an equally large incentive to maintain control of the ball and not turn it over. This often requires less risky plays, fewer long passes down field, more running plays, and thus a longer time to move the ball down field.

Finally, there will be circumstances when a team is playing a no huddle offense. Generally this occurs later in the game and results in less time taken to move into scoring position. A high quality quarterback and more stars should facilitate teams moving quickly.

Table 1: Summary Statistics: Mean (sd)

		Not Tied	Not Tied		Tied	Tied	
	Total Sample	(all)	and Not Hurried	and Hurried	(all)	and Not Hurried	and Hurried
Observations	83	56	31	25	27	17	10
Total Time Taken	82.49 (51.42)	89.52 (52.62)	101.45 (61.24)	74.72 (35.28)	67.93 (46.43)	73.71 (52.96)	58.10 (32.75)
Time Remaining (seconds)	170.82 (87.91)	183.13 (87.40)	226.68 (82.90)	129.12 (58.54)	145.30 (84.93)	170.88 (88.21)	101.80 (60.54)
Starting Yard Line	28.16 (14.04)	24.54 (12.47)	27.32 (14.62)	21.08 (8.15)	35.67 (14.36)	38.35 (15.91)	31.10 (10.44)
Offensive Timeouts Available	1.81 (1.04)	1.79 (1.14)	2.13 (0.99)	1.36 (1.19)	1.85 (0.82)	2.00 (0.71)	1.60 (0.97)
Offensive Timeouts Used	0.51 (0.76)	0.46 (0.74)	0.45 (0.68)	0.48 (0.82)	0.59 (0.80)	0.47 (0.62)	0.80 (1.03)
Defensive Timeouts Used	0.53 (0.83)	0.45 (0.71)	0.45 (0.77)	0.44 (0.65)	0.70 (1.03)	0.82 (1.19)	0.50 (0.71)
Two Minute Warning	0.47 (0.50)	0.46 (0.50)	0.48 (0.51)	0.44 (0.51)	0.48 (0.51)	0.53 (0.51)	0.40 (0.52)
Home Game	0.53 (0.50)	0.52 (0.50)	0.61 (0.50)	0.40 (0.50)	0.56 (0.51)	0.65 (0.49)	0.40 (0.52)
Quarterback Rating	86.17 (12.66)	85.48 (12.15)	86.10 (12.29)	84.71 (12.17)	87.61 (13.80)	87.16 (13.90)	88.38 (14.32)
Number of All-Pro Players	0.87 (0.93)	0.88 (0.94)	0.81 (0.91)	0.96 (0.98)	0.85 (0.95)	0.88 (1.05)	0.80 (0.79)

Model

An ordinary least squares (OLS) model is used to estimate the time it takes to reach offensive field goal range.

$$\text{Total Time Taken to Reach} = \beta_0 + \beta_1 \text{Start Time} + \beta_2 \text{Starting Yard Line} + \beta_3 \text{Offensive TOs Avail} + \beta_4 \text{Offensive TOs Used} + \beta_5 \text{Defensive TOs Used} + \beta_6 \text{Two Minute Warning} + \beta_7 \text{Home Game} + \beta_8 \text{QB Rating} + \beta_9 \text{All-Pro Players} + u$$

Variance inflation factors (VIF) suggest no multicollinearity between the independent variables. A Breusch-Pagan test indicates the presence of heteroskedasticity ($\chi^2 = 7.13$, $p = 0.0076$) and White's robust standard errors are implemented.

Results

The summary statistics in Table 1 show that of the 83 observations, approximately 33% were tied games and 67% were games where the offense was down by 1, 2, or 3 points. In non-tied games, the offense took control of the ball with an average of 183 seconds left in the game, took more time to move the ball to the 35-yard line (mean=89.52), and started at their own 25 yard line. In contrast, in tied games the offense took control of the ball with an average of 145 seconds remaining in the game, took less time to move the ball to the opponent's 35-yard line (mean=67.93 seconds) but also had the advantage of starting at their own 35-yard line. Beyond the total time taken, seconds remaining, and starting yard line, the other notable difference between the tied and not tied subsamples is that the defense took more timeouts in tied games (mean=0.70) than in not tied games (mean=0.45). This behavior is consistent with trying to prevent the offensive teams from running out the clock.

The not-tied and tied sub-samples were further broken down into teams that played a no huddle, or hurry up, offense and those that did not. As expected, the no huddle offense occurred in situations where you would most expect it; with less time on the clock and when teams started further from field goal range in both the tied and not tied sub-samples. Also as expected, the hurry up offense reached field goal range in less time than offenses that were not hurried. In a not hurried tied game, the defense used more timeouts (mean=0.82) than in any other case, presumably to prevent the offense from taking excessive time off the clock.

OLS regression of the total sample (Table 2) indicates that time remaining, offensive timeouts used, and the two minute warning are associated with an increase in the amount of time it takes to reach the 35-yard line. Specifically, for every one-second of additional time remaining when the offense takes possession of the ball, there is a 0.48 second increase (p=0.0001) in time taken to reach the 35-yard line. As expected, teams with more time on the clock when they obtain possession at the end of a game attempt to leave as little time as possible on the clock for the opponent by slowing down their play.

Every offensive timeout used on the drive is associated with a 18.11 second increase (p=0.002) in time taken to get into field goal range. Because a timeout stops the clock, its main effect is expected to be a reduction in the time taken to reach field goal range. Instead, it appears as if the opposite is occurring. The two minute warning has a

similar effect. Offensive drives that are affected by the two minute warning are 15.49 seconds longer (p=0.042).

Also of interest is that the mere availability of an offensive timeout is associated with a 16.05 second decrease in the total time taken to reach the 35-yard line.

Starting field position, defensive timeouts used, whether the offense was at home, the quarterback rating, and the number of All-Pro players on the offense were all statistically insignificant at $p > 0.05$.

Table 2: Effect on Total Time Taken to Reach the 35-Yard Line in the Last Six Minutes of NFL Games that are Tied or Within 3 Points

	Total Sample		Not Tied		Tied	
	β	t	β	t	β	t
Time Remaining (seconds)	***0.476	8.69	***0.542	9.64	0.239	1.93
Starting Yard Line	-0.343	-1.13	-0.125	-0.34	-0.767	-1.40
Offensive Timeouts Available	***-16.047	-3.57	***-19.836	-4.13	0.508	0.04
Offensive Timeouts Used	***18.109	3.30	***22.571	3.57	8.601	0.83
Defensive Timeouts Used	-3.149	-0.65	0.741	0.12	-13.770	-1.58
Two Minute Warning	*15.493	2.07	10.694	1.22	37.811	1.92
Home Game	-6.763	-0.94	-12.297	-1.49	18.224	1.11
Quarterback Rating	-0.168	-0.57	-0.275	-0.69	0.263	0.42
Number of All-Pro Players	-2.022	-0.46	-2.852	-0.58	-8.483	-0.90
Constant	44.834	1.83	45.390	1.39	20.100	0.31
N	83		56		27	
R^2	0.6523		0.7316		0.6091	

Note. Two-tailed *p < 0.05, **p < 0.01, ***p < 0.001. OLS with robust standard errors. Dependent variable is total time taken to reach the 35-yard line.

A Chow test (F(10,63), p=0.021) indicates games that are tied and those that aren't have statistically different coefficients. From Table 2 it is clear that games that are not tied reflect estimates that are very similar to the total sample except that drives affected by the two minute warning are not significantly lengthened or shortened.

Table 3 presents regressions that further differentiate not tied games and tied games by whether the offense was playing a hurry up offense or not. There are not enough degrees of freedom to generate estimates in tied games that played a hurry up offense, but in games that were not tied and used a hurry up offense, every additional All-Pro player on the team was associated with a 12.2 second decrease (p=0.021) in time taken to reach the 35-yard line. The number of offensive timeouts available was associated with a 17.24 second decrease (p=0.0002) in the time taken to reach field goal range and the number of offensive timeouts used was associated with a 13.57 second increase (p=0.028) in the time taken to move down field. A standard huddle offense in a tie game had no statistically significant determinants.

Table 3: Effect on Total Time Taken to Reach the 35-Yard Line in the Last Six Minutes of NFL Games that are Tied or Within 3 Points with a Hurry Up Offense

	Not Tied				Tied		
	and Not Hurried		and Hurried		and Not Hurried		and Hurried
	β	t	β	t	β	t	
Time Remaining (seconds)	***0.620	5.89	***0.481	7.08	0.064	0.33	
Starting Yard Line	-0.125	-0.22	0.395	0.90	-0.618	-0.82	
Offensive Timeouts Available	*-22.658	-2.42	***-17.238	-4.97	29.325	1.15	
Offensive Timeouts Used	23.631	1.86	*13.567	2.42	4.425	0.13	
Defensive Timeouts Used	2.916	0.28	10.211	1.54	-5.553	-0.43	
Two Minute Warning	10.452	0.58	4.930	0.63	48.642	1.55	
Home Game	-18.958	-1.24	-1.179	-0.17	0.666	0.02	
Quarterback Rating	-0.513	-0.72	0.496	1.37	0.246	0.19	
Number of All-Pro Players	1.830	0.21	*-12.207	-2.59	-14.103	-1.07	
Constant	49.939	0.71	-15.270	-5.03	-4.882	-0.03	
N	31		25		17		10
R^2	0.7271		0.8832		0.7248		not enough df

Note. Two-tailed *p < 0.05, **p < 0.01, ***p < 0.001. OLS with robust standard errors. Dependent variable is total time taken to reach the 35-yard line.

Discussion

In every case analyzed here, starting field position played no role in the time taken for a team to move downfield at any pace. It appears that skilled coaches and teams can effectively control the clock and move the ball into field goal range regardless of where they begin their drive. The pace at which an offense moves is also unrelated to home field advantage or the quality of a team's quarterback.

In almost every case, the time left on the clock at the beginning of an offensive drive played a clear role in whether the team moved quickly downfield or not. This is in line with our expectation on time management strategies in end-game scenarios. Coaches maximize the odds of scoring while simultaneously leaving the defensive team with as little time left on the clock as possible.

Interestingly, there were two findings that ran counter to our *ex ante* predictions in terms of the role timeouts play in managing the clock. First, taking an offensive timeout increases the time taken to get into field goal range. Second, the availability of offensive timeouts decreases the time it takes to reach field goal range. Each of these unique findings is discussed below.

Offensive Timeouts Taken

The specific act of taking a timeout cannot lengthen the time of a drive because by definition a timeout stops the clock. Yet, the results show taking a timeout increases the time taken to get into field goal range by anywhere from 13 to 22 seconds. Because a timeout itself cannot lengthen a drive, it appears that the act of taking a timeout has residual carry on effects that affect the game once play resumes.

From a strategic view point, the offensive team is attempting to increase the odds that it scores and to leave little time on the clock for the opponent. In this context,

offensive timeouts are used to increase the odds of scoring because stopping the clock with an offensive timeout does not run out time on the clock.

Thus, we assume that a team that does use an offensive timeout is probably in one of two different situations to increase the odds of scoring:

1. the offensive team is not operating efficiently and thus used a timeout to regroup or avoid a penalty
2. the offensive team is trying to stop the clock to preserve enough time to score or get into scoring position

In the first case, it is conceivable that an offense that is struggling offers an advantage to the defense by taking a timeout. While the offense is using the timeout to re-group, the defense is using the timeout to more effectively defend an offensive play. In this case, it appears that taking an offensive timeout benefits the defense more than the offense.

In the second case, the offense may view the timeout as a tool to preserve time or get into scoring position, but the result may be that the time taken also affords the defense time to rest, regroup, and better defend the next play.

From these two scenarios, it is unclear if taking a timeout lengthens the drive because it benefits the defense in some way or if taking a timeout reflects that the offense is struggling. While it's conceivable that both are occurring within this sample, the coefficient on two-minute warnings seems to provide some help in determining which effect is predominate. The game stoppage for the two minute warning occurs regardless of the momentum of the offense or the time management strategies of the offense. Yet, the effect is the same as an offensive timeout. In the full sample the two minute warning increases the time taken to reach the 35-yard line by 15 seconds ($p=0.04$) and in the tied sub-sample, it increases the time by almost 38 seconds ($p=0.07$). Because both a voluntary and involuntary stoppage result in an increase in the time taken to reach the 35-yard line, we conclude that in most cases an offensive timeout lengthens the time it takes to reach scoring position by affording benefits to the defense.

Offensive Timeouts Available

Consistent with their risk averse and loss averse behavior, teams carefully retain their timeouts for the end of the game. In a situation where the offense needs to score and needs to stop the clock, a timeout is often the only way to do so. Thus, timeouts are valuable in one important scenario. Yet, the reality is that most teams don't end up in this scenario. There are only 83 observations in a three-season time span where close games resulted in a losing or tied offensive team successfully reaching the 35-yard line. Even within these 83 observations where we might be most likely to see offensive teams need to use their timeouts, there is still a reluctance to do so. Only 19% of the offensive teams used all of their available timeouts while 63% used no timeouts at all. On average, offensive teams in this sample had 1.8 timeouts available but used only 0.51 timeouts.

Despite the fact that most teams do not find themselves in a close or tied game at the end of the second half, this lack of opportunity to use timeouts does not fully explain why teams retain timeouts but rarely use them. These results show the simple availability of timeouts, not their use, reduces the amount of time it takes a team to move downfield. Perhaps a team with more timeouts available plays with more confidence and takes more chances knowing that they have a timeout available if necessary. There may be a peace of

mind from having a timeout available which allows the offense to operate more efficiently and, thus, less time is needed for the offense to reach scoring position.

If coaches are aware that having more timeouts available exerts a positive psychological effect on teams then coaches will chose to retain as many timeouts as possible. An alternate explanation is that coaches are already aware of the peculiar phenomenon uncovered here—that using an offensive timeout increases the time it takes for a team to reach field goal range. In either case, it appears entirely plausible that the defense benefits more from a stoppage at the end of the game than does the offense.

Conclusion

Coaches seek to achieve two objectives near the end of a close or tied NFL game: to move the ball into scoring position and to leave as little time on the clock as possible for the opponent. Achieving these two objectives requires that a coach know what factors are most influential in affecting the time of the drive. Thus, this research informs dual-objective, end-of-game coaching decisions by estimating the factors that affect the time needed to reach scoring position.

Romer (2006) discussed that the 35-yard line was the spot where a team's choice to punt or kick a field goal changes. To maximize the chances of getting into field goal range, this sample shows the average NFL team with 1.8 timeouts available needs 80 seconds to produce a successful drive to the target 35-yard line from the mean starting field position at the 30-yard line.

In some cases, like Bill Belichick in Super Bowl XLVI, coaches are overly optimistic and ineffectively judge the adequate amount of time for the offense to make a last possession run. A large part of this optimism may stem from the idea that player personnel make a difference (Sackrowitz & Sackrowitz, 1996). However, the results show that neither quarterback rating nor the number of All-Pro players affect the time of the drive.

Instead, we identified two peculiar effects found in games where the offense is behind by 1, 2, or 3 points, but not in tied games. First, counter to conventional wisdom, using an offensive timeout during a possession in the last six minutes of the game extends the time it takes to reach field goal range. It appears this effect occurs because both an offensive timeout and the two-minute warning provide a benefit to the defense in the final minutes of a close game. Second, quite opposite of the first effect, we found each additional offensive timeout available decreases the time it takes to reach field goal range. It appears the mere existence of a timeout provides a confidence or peace of mind to the offense that allows them to perform better.

These important findings on timeouts, as well as the variables that affect the time of a drive, inform the time management decisions made by coaches and practitioners during critical offensive drives at the end of close games. Football coaches at all levels, athletes, and analysts can all benefit from these results.

References

Alamar, B. C. (2006). The passing premium puzzle. *Journal of Quantitative Analysis in Sports*, *2*(4), Article 5.

Alamar, B. C. (2010). Measuring risk in NFL playcalling. *Journal of Quantitative Analysis in Sports, 6*(2), Article 11.

Berri, D. J., Schmidt, M. B., & Brook, S. L. (2006). *The wages of wins: Taking measure of the many myths in modern sport*. Stanford, CA: Stanford University Press.

Branch, J. (2011, January 12). Using time, and timeouts, wisely. *The New York Times*. Retrieved from http://www.nytimes.com/2011/01/13/sports/football/13clock.html

Bursik, P. B. (2012). Behavioral economics in the NFL. In K. Quinn (Ed.), *The Economics of the National Football League* (pp. 259-276). New York, NY: Springer.

Carter, V. & Machol, R.E. (1971). Operations research on football. *Operations Research, 19*(2), 541-544.

Goldschmied, N., Nankin, M., & Cafri, G. (2010). Pressure kicks in the NFL: An archival exploration into the deployment of timeouts and other environmental correlates. *Sport Psychologist, 24*(3), 300-312.

Hadley, L., Poitras, M., Ruggiero, J., & Knowles, S. (2000). Performance evaluation of National Football League teams. *Managerial and Decision Economics, 21*(2), 63-70.

Jamieson, J. P. (2010). The home field advantage in athletics: A meta-analysis. *Journal of Applied Social Psychology*, *40*(7), 1819-1848.

Kovash, K., & Levitt, S. D. (2009). Professionals do not play minimax: Evidence from Major League Baseball and the National Football League. *NBER Working Paper* 15347.

Pfitzner, C. B., Lang, S. D., & Rishel, T. D. (2009). The determinants of scoring in NFL games and beating the over/under line. *New York Economic Review*, *40*(1), 28-39.

Romer, D. (2006). Do firms maximize? Evidence from professional football. *Journal of Political Economy, 114*(2), 340-365.

Sackrowitz, H. H., & Sackrowitz, D. D. (1996). Time management in sports: Ball control and other myths. *Chance, 9*(1), 41-55.

Urschel, J., & Zhuang, J. (2011). Are NFL coaches risk and loss averse? Evidence from their use of kickoff strategies. *Journal of Quantitative Analysis in Sports, 7*(3), 1-15.