DEFLATEGATE: THE EFFECT OF THE 2006 RULE CHANGE REGARDING FOOTBALL PREPARATION ON RELEVANT GAME STATISTICS

by

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ABSTRACT

WILLIAM BRADFORD SATTERWHITE. DeflateGate: The effect of the 2006 rule change regarding football preparation on relevant game statistics. (Under the direction of DR. CRAIG A. DEPKEN II)

This study investigates the impact of 2006 NFL rule change on the 2015 DeflateGate controversy. This analysis contributes to the discussions surrounding Tom Brady, the Patriots and their role in game day football preparation. This study is unique in that the analysis using game and play level data looks at a rule change that previously had not been analyzed. The methodology used in this research is difference in difference regression analysis. The variable of interest is the interaction term between team effects and time effects. This study investigates the effect of the rule change on fumble statistics and passing statistics on offensive plays for visiting NFL teams. The study finds support for the claim that the 2006 rule impacted football preparation for Tom Brady and Peyton Manning, and football preparation for the New England Patriots and Indianapolis Colts. Both these quarterbacks and teams substantially improved their offense's ability to fumble less after the rule change. Other teams and quarterbacks did not experience this effect.

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TABLE OF CONTENTS

INTRODUCTION

Following the 2015 AFC Championship Game, the Indianapolis Colts charged the New England Patriots with intentionally under-inflating footballs. The controversy, known as DeflateGate, created a mini-crisis for the NFL. The Patriots denied allegations while the Colts claimed the Baltimore Ravens, the Patriot's previous opponent, tipped them off. This paper examines a 2006 NFL rule change that altered regulation surrounding football preparation and created the possibility for a scandal such as DeflateGate.

In 2006 the NFL changed the rules surrounding football preparation. Before 2006 visiting teams used footballs provided by the home team. This practice mirrored common practice in other sports. For example, MLB (2015) reports the MLB rules that the umpire "be assured by the home club that at least one dozen regulation reserve balls are immediately available for use if required." However, leading up to 2006, several prominent quarterbacks, most notably, Tom Brady and Peyton Manning, protested the NFL version of this rule. They argued that, each team should be able to provide footballs for use on offense. Manning and Brady shared the dangers of being handed a brand-new, slick football by the home team on a critical offensive play. Under the old rules, the home team provided all footballs. If a home team employee or player handed such a ball to the official, the visiting team might be at disadvantage.

Quarterbacks generally prefer worn-in footballs to slick, brand-new footballs. The worn-in footballs offer better grip and, perhaps, help quarterbacks be allowed to pass with greater accuracy. Therefore, Manning and Brady suggested that visiting teams provide footballs for their own use. This new arrangement would prevent a brand-new

football from being interjected into a drive. Quickly, Manning and Brady gained support and successfully persuaded the league with the help of twenty other NFL quarterbacks (Benbow, 2015). These quarterbacks signed a petition that asked the league to allow visiting teams to use their own footballs. At the time, this request was seen as reasonable and fair. In light of new events, the motives of these quarterbacks, specifically Manning and Brady, has come into question. This paper focuses on this rule change due to the recent events of DeflateGate and the controversy surrounding under-inflated footballs.

In 2006, no one thought much of this rule change. In other words, it was seen as net positive. Everyone benefited equally. However, recent events suggest otherwise. In the NFC Championship game, the Colts accused the Patriots of underinflating footballs. While the rule established a 12.5-13.5 P.S.I. range for footballs, the Colts felt the Patriots had altered their footballs below the lower 12.5 limit (Rothkranz, 2015). This issue appeared small on the surface. However, the Patriots, often perceived as an organization that bends the rules, had seasons earlier been penalized for videotaping opponents play signals. Moreover, the Patriots have had outstanding success including winning the most Super Bowls since 2000. Therefore, the Patriots' success combined with past infractions, generated a firestorm around this scandal. Some called for penalties against the team at the 2015 Super Bowl. Others downplayed the issue. As for the team, they denied all allegations. However, an important piece of information was added to the discussion. Commentators frequently referenced the 2006 rule as the change that created the possibility for DeflateGate. In other words, the 2006 rule change for which Manning and Brady advocated gave all teams the opportunity to skirt the rules in a new way. However,

the question remains: who took advantage of this opportunity and precisely what advantage did they gain?

McGarity and Linnen (2010) estimated the effect of an injury to the starting quarterback on game strategy. Using similar econometric techniques, this paper analyzes game and play level data. The 2006 NFL rule change potentially affected the environment surrounding ball preparation. Most quarterbacks acknowledged they prefer worn-in footballs to slick footballs (Rothkranz, 2015). However, the Colts alleged the Patriots under-inflated footballs beyond the regulation standard. This paper investigates the claims of under-inflation in the time period surrounding the rule change by analyzing relevant statistics. Specifically, fumble statistics and passing statistics are studied. These statistics are chosen because they are impacted by under-inflation which alters the grip and weight of a football.

This paper employs difference-in-difference techniques to assess changes in statistics around the rule change for each team. An under-inflated football has better grip and weighs less. Therefore, under-inflation will affect statistics impacted by grip and weight. Fumble statistics and passing statistics are chosen because they are the best indicators of changes in grip and weight. This paper studies several quarterbacks, and every organization from 2000-2010 in order to assess the impact of the rule change on fumble statistics and passing statistics.

LITERATURE REVIEW

Literature on shirking and doping provides additional insight into the circumstances surrounding the Patriots cheating scandal. Sharpe (2009) viewed cheating as rational under certain incentives. Moreover, Berentsen (2002) recognized that for some scenarios cheating was preferable for both the favorite and the underdog. In addition, he argued that cheating affects game outcomes. In fact, the 2006 rule change may have made cheating appear more preferable by lowering incentives against cheating. Therefore, regardless of favorite or underdog status, the incentive for the Patriots to cheat may have increased after the rule change.

Previous literature has studied forms of cheating and their impact on contest outcomes. Krakel (2007) defines cheating as a "tournament or contest-like situation between individuals who compete for a given winner prize… and these individuals have the opportunity to increase their winning probabilities by using illegal activities." In his scenario, Sharpe (2009) modeled "drug-taking as rational activity in which athletes respond to existing incentives." Therefore, Sharpe's solution involved "[altering] the incentives under which athletes operate." Regulations, for example, act as explicit incentives against cheating. Pressure from other implicit costs creates incentives against cheating. For example, Berri and Krautman (2006) relay the "possibility that a shirker will develop bad reputation" and, therefore, be less likely to engage in cheating practices. Thus, regulations provide upfront penalties while other costs, including damaged reputation, provide cheating disincentives.

These implicit costs and upfront regulations are involved in the 2006 rule change and potential under-inflation of footballs. First, NFL rules stated that footballs must be in

a certain pressure range. Intentional disobedience would be considered cheating. Second, the alleged under-inflation of footballs in the NFC Championship Game brought a firestorm of public disapproval. This cost represents the possible damage to reputation of those perceived as cheating. Interestingly, the Patriots were considered the favorites in the game. Berensten (2002) suggests that "for some parameter values, the favored player... is more likely to use performance-enhancing drugs that is the underdog." The Patriots, the favored player, were accused of cheating. Also, if cheating occurred, winning probabilities would be distorted.

In the case of the NFC Championship game, The NFL launched an investigation. The commission, led by Ted Wells, found statistically significant evidence that the Patriots footballs registered a pressure drop that exceeds the possible drop caused by atmospheric conditions. Later analysis of the data countered this result with more rigorous statistical analysis (Hassett, Sullivan & Vueger, 2015). Hassett et al., found the Wells Report contained several inconsistencies. For one, the purported methods were clearly stated; however, researcher couldn't replicate the results given these methods.

Also, the data set had unknowns. For example, did the referees measures the Patriots footballs first or the Colts first at halftime? This knowledge would affect interpretation of results; atmospheric conditions would cause the later set of footballs tested to rise while the others were being tested. The ambiguities presented a problem for the NFL. While public uproar was great, did they have enough evidence to suspend Brady and fine the Patriots organization? The case went to federal appeals court and the judge ruled in favor of Tom Brady. His rationale included the idea that the NFL went

beyond their jurisdiction in upholding Tom Brady's suspension. In other words, they didn't have enough evidence.

DATA AND METHODOLOGY

While there has been resolution in the short term to DeflateGate since the ruling, the controversy may not be over. This paper provides a unique contribution to the DeflateGate discussion in that it uses game data and play by play data from 2000-2010 to assess the situation. The data come from NFL Analytics and separate into two parts. First, game-level data provide the final statistics from each game played between 2000-2010. These data include playoff games. Summary statistics are available in Table B1 of Appendix B. Second, the play by play data offer each play from 2000-2012. Summary statistics are listed in Table B2 of Appendix B. For the purpose of consistency, only data from 2000-2010 was used. Therefore, the play by play data set was shortened so that it only encompassed 2000-2010.

This data presented the opportunity to test the hypothesis that once Manning and Brady successfully petitioned for the rule change, teams that had these quarterbacks as their starter took advantage of the rule. These quarterbacks influenced the preparation of footballs which among other things, led to increased grip. As such, this paper focuses on the increased ability of these teams to grip the football as evidenced in fumble statistics. In addition, the paper explores the effect of football preparation on other statistics. However, fumbles and fumbles lost are the primary focus.

If grip increased, teams that underinflated footballs would be less likely to fumble and lose fumbles. In addition, teams that underinflated footballs would have less-likelihood of completing and, perhaps, attempting long pass plays; the football might weigh less and, therefore, not travel as far. Possibly, more grip would help with the accuracy of shorter passes. For these passes, football weight would not be as big an issue

and the accuracy issue would outweigh the weight issue. Therefore, an underinflated football presents potential advantages and disadvantages. On one hand, fumbles might happen less often; on the other, passing might be affected. Long pass plays might be more difficult while short passes could be more accurate.

Furthermore, we would expect these results only to hold in away games, as presumably these teams would have all advantages of ball preparation in home games before the rule change. The study looks at all games, but specifically analyzes data from teams on offense during away games. This strategy is first applied to game-level data and, then, applied to play-by-play level data.

In constructing a model for statistical analysis, multiple techniques may be employed. For this study, difference in difference is used. This method can assess specific breaks in behavior or environment and regulation. It is used to assess before and after scenario in one regression equation. With this technique, economists create a quasi-experiment from the data. The effect of the treatment is measured while controlling for other effects. Difference in difference separates the treatment effect and, therefore, provides the best model for estimating the impact of the 2006 NFL rule change.

Another option, univariate regression, fails to isolate the treatment effect. Therefore, it is not chosen. Model 1 represents regression analysis with univariate regression.

Model 1

$$FUMBLES_i = \beta_0 + \beta_1 TEAM_i + \varepsilon_i$$

With one dependent variable, fumbles, and one independent variable, team, the model does not offer the necessary flexibility required to isolate structural changes like a

rule change. Furthermore, fumbles depend on more factors than one variable. Team effects cannot adequately describe fumbles; the model is likely incorrectly specified. Moreover, there is only one coefficient. The structural break, which difference in difference adequately measures, is hidden within the coefficient. It is impossible to determine the effect of the 2006 rule change.

Difference in difference, represented in Model 2, provides a suitable alternative. In this technique, an interaction term measures the structural break, known as the treatment, in a single regression. Separate dummy variables estimate time and team effects. Each coefficient displays the impact of the specific effect on the independent variable and the interaction term provides the effect of the structural break on each team.

Model 2

$$\text{FUMBLES}_i = \beta_0 + \beta_1 \text{ TEAM EFFECTS}_i + \beta_2 \text{ TIME EFFECTS}_i + \beta_3 \text{ INTERACTION}_i + \varepsilon_i$$

In this model, the team effect records each team's participation in a game for game level data and, with play by play data, each team's involvement in a play. Time effects measure whether or not the game or play was after 2005. The interaction provides insight into each team's behavior after 2006; it simply combines the team and time effects into one interaction term. In this way, the interaction represents team behavior after the rule change. With this model, team and time effects control for organizational and NFL changes. The interaction term captures the possible structural behavior change. It records the impact of the rule change on the dependent variable.

RESULTS

The results are strong. Using a difference-in-difference approach, game-level data shows that the Patriots and the Colts were the only teams that showed no team or time effects but a significant interaction term for fumbles lost. In fact, the time effects are insignificant for all teams. The interpretation follows: The Colts and the Patriots gained a significant advantage for losing fewer fumbles after the rule change on visiting games. They gained no such advantage on home games. The play-by-play data increased certainty of these results. Using fumbles and fumbles lost, the results for the Patriots remain. Passing statistics are less clear. In fact, additional rule changes that tightened pass defense regulations confuse the difference in difference approach. Therefore, the effect of the rule change on passing is undetermined.

Game Level Analysis

In this first step, I manually removed seasons and games in which Manning or Brady were not starting quarterbacks. Therefore, the Team Effects variable only represents games where Brady and Manning started the game. In following steps, I subtly shifted assumptions. Instead of focusing only on Manning or Brady as the starter, I focused on the organization as a whole. I assumed that the leadership of Brady and Manning, two of their generations greatest quarterbacks, influenced strongly, if not completely, the backup quarterback's preparation. Therefore, the 2008 Patriots season led by starting quarterback Matt Cassel is included after the first step in Patriot Team Effects. Coaches and players are considered in communication on all game issues, including football preparation. Because Manning isn't starting the game doesn't mean his influence doesn't still affect the team. The variable in the initial step that represented visiting teams

with Brady and Manning as the starting quarterback afterwards represents games with New England or Indianapolis as the visiting team.

As described above, models employ difference in difference. This approach separates the effects of an organization or quarterback and overall time factors like league changes that affect everyone equally and focuses specifically on the change in statistics from 2006 and forward for each NFL team. Again, the team effects variable represents each team, time effects variable captures events including and beyond 2006. The interaction term combines both effects to provide each team's response to the treatment, the 2006 rule change.

Model 3 uses game level data to capture games in which Manning and Brady started. This initial step comes from the hypothesis that each gained advantage from the rule change. Their consistent leadership in advocating for the rule change leads me to test them first, see if statistical outcomes changed, and then look at other teams if, in fact, the rule change made a difference. Therefore, team effects in Model 3 represent each game that Manning or Brady started at QB.

Model 3

$$\text{GAME STATISTIC}_i = \beta + \beta_1 \text{TEAM EFFECTS}_i + \beta_2 \text{TIME EFFECTS}_i + \beta_3 \text{INTERACTION}_i + \varepsilon_i$$

In the first model, I tested the hypothesis that teams that under-inflated footballs lost fewer fumbles at away games. Next, I used several passing statistics, namely completions, attempts, and completion percentage for the dependent variable. Finally, I finished with a model that estimated the effect of the rule change on winning percentage.

Table 1: Game level regression results

EVENTS	*FUML*	*COMPL*	*ATTEMPTS*	*COMPL%*	*WIN%*
Manning/Brady	0.041	3.103***	2.225***	0.056***	0.228***
	(0.084)	(0.535)	(0.806)	(0.009)	(0.051)
Time Effects	-0.008	0.699***	0.132	.018***	0.016
	(0.033)	(0.231)	(0.320)	(0.004)	(0.019)
Interaction	-0.383***	0.492	1.175	0.009	0.050
	(0.117)	(0.884)	(1.234)	(0.015)	(0.074)

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

As portrayed above, the rule change significantly affected fumbles lost in games that Brady and Manning started at quarterback; the interaction term is significant only when fumbles lost is the dependent variable. Graph A1 of Appendix A portrays the effect for fumbles lost statistic. For the other statistics, the rule change has no impact. For example, teams with Manning or Brady as the starter were more likely to complete more passes and win more games; the team effects terms are significant for completions, attempts, completion percentage and winning percentage. In addition, every team improved in completions and completions percentages, as demonstrated by the significant time effects variable. However, the interaction term for all statistics besides fumbles lost is insignificant. In addition, each regression results do not significantly change when controlled for weather including precipitation and cold weather factors. Therefore, in this

initial step, the only impact of the 2006 rule change on visiting teams with Brady or Manning as the starter is on fumbles lost. Using game level data, these teams lost a statistically significant fewer number of fumbles.

The strong nature of this result calls for further investigation and, given the clear rule change in 2006, suggests some effect of this rule change on the preparation and play of Manning and Brady-led teams. Using this first step, the initial conclusion confirms the initial hypothesis: the rule change may not have affected everyone equally.

Play Level Analysis

From this game data, I moved to play by play data. This data set contains every play run from 2000-2012. For the purpose of investigation, I censored records from 2010-2012 in order to combine the two data sets. This merge allowed me to utilized visiting and home team variables from game-level data set in the play by play data. Therefore, I could replicate the models used with game-level data but accounting for each play. The information from the first data set, combined with additional variables provided by the play by play level data, offered to opportunity to confirm game level results.

The play level data contained both fumbles and fumbles lost. Since game level data revealed the effect of the 2006 rule on fumbles lost, I investigated both fumbles and fumbles lost for play level models. Moreover, the fumbles provided a stronger test of the hypothesis. Fumbles depend more on the offense. A running back may be fumble-prone. A quarterback may hang on to the ball well. The fumbles lost statistic is less linked to offensive performance. For example, two teams may have two fumbles in a game. However, they may not lose the same number of fumbles. Perhaps, a certain amount of

luck is involved in recovering fumbles. After all, once a fumbles occurs, both teams have the opportunity to recover the ball.

Therefore, fumbles are a better measure of grip. More succinctly, there is a closer link between fumbles and grip. Thus, fumbles offer more information than fumbles lost when measuring the effect of grip on ball security. With better grip being the most telling sign of under-inflation, fumbles are a more valuable statistic for this study. However, because fumbles lost was the only fumble statistic in the game level data, both fumbles and fumbles lost are measured with the play level model.

With play level data, I used a difference in difference approach with a probit model. Since, almost always, there is only only one fumble on a play, the probit models is appropriate. The dependent variable, fumbles and fumbles lost has only two possibilities: a fumble occurred on the play or a fumble did not occur on the play. Similarly, for fumbles lost, a fumble could be lost on the play or a fumble was not lost on the play. Therefore, the results of the probit model may be interpreted as the propensity to fumble or lose a fumble on any given play while game level data represent the overall change in fumbles lost for one game.

Model 4

$$\text{FUMBLES}_i = \beta_0 + \beta_1 \text{ TEAM EFFECTS}_i + \beta_2 \text{ TIME EFFECTS}_i + \beta_3 \text{ INTERACTION}_i + \varepsilon_i$$

Model 5

$$\text{FUMBLES LOST}_i = \beta_0 + \beta_1 \text{TEAM EFFECTS}_i + \beta_2 \text{TIME EFFECTS}_i + \beta_3 \text{INTERACTION}_i + \varepsilon_i$$

In Model 4 and 5, I started with three separate Team Effects variables. I tested the Patriots, the Colts, and then a combined variable that included both Patriots and Colts.

This broadened the scope of the initial step. With game level data, I only addressed games where teams started Brady or Manning. In this step, I made this subtle assumption shift: Instead of focusing only on games started by Manning or Brady, I focused on the organization. After all, Brady and Manning are two of the greatest quarterbacks of their generation and, possibly, all-time. Therefore, I assume that their leadership carries over somewhat, if not completely to the backup quarterback's preparation. So, for example, the 2008 Patriots season led by starting quarterback Matt Cassel is included as under the influence of Brady. In other words, the organization is a unit. This bridges other changes, such as Indianapolis Colts coach Tony Dungy's 2008 retirement. Thus, play level models include each team as a succinct unit. The variable in the initial that represented visiting teams with Brady and Manning as the starting quarterback now represents games with New England or Indianapolis as the visiting team. Also, as described above, New England and Indianapolis are analyzed separately and together as independent variables.

Interestingly, the Patriots and the combined term, representing both Patriots and Colts, had fewer total fumbles and lost less fumbles since 2006. However, in this step, the Colts interaction only had statistical significance for fumbles lost, not fumbles, at the 90% level. While this result confirms the initial game level step, it calls into question the initial conclusions. Patriots, at this step, consistently demonstrated fewer fumbles lost and fewer fumbles. However, the Colts do not have a statistically significant fewer number of fumbles. As qualified above, fumbles are the stronger, more direct test of grip; therefore, these results question the Colts self-interest in Manning's push for the rule change.

Table 2: Play level regression results (marginal effects)

EVENTS	*FUM*	*FUML*
Patriots	-0.00130	-0.000228
	(0.00203)	(0.00141)
Time Effects	-0.00296	-0.000223
	(0.000541)	(0.0.000382)
Interaction	-0.00715**	-0.00504*
	(0.00336)	(0.00246)
Colts	-0.00378	-0.000619
	(0.00215)	(0.00144)
Time Effects	-0.000357	-0.000239
	(0.000541)	(0.000382)
Interaction	-0.00538	-0.00453*
	(0.00348)	(0.00248)
Both	-0.00258	-0.000436
	(0.00150)	(0.00102)
Time Effects	-0.000168	-0.000110
	(0.000548)	(0.000387)
Interaction	-0.00646**	-0.00491**
	(0.00245)	(0.00177)

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Robustness Checks

For both game level and play level data, I repeated the regression for each organization. Game level passing statistics regression results are listed in Appendix B, Table B3 while play level fumble statistics regression results are listed in Appendix B, Table B4. With game level data, I found confirmation of the initial results with both passing and fumble statistic regression results. The Patriots and Colts both lost fewer fumbles with no discernable effect on passing post-rule change. When I tested for each organization in game level, the result held. Specifically, no discernable result appeared in the passing statistics. This may be because the correct passing statistic, yards a pass traveled in air, was not available for the time period. Further research may be needed to assess the impact of the rule change with use of this statistics. Fumbles statistic regression results showed that almost all organization did not experience fewer fumbles lost after the rule change. For more investigation of this fumble regression result, I went to play level data.

With the play level data, I increased the numbers of checks. Not only were regressions run that captured each organization for away games, these results tested both fumbles and fumbles lost. Finally, kicking plays were removed because a different football, the KBall, is used for kicking plays. Therefore, increased grip advantage from the rule change would not affect kicking plays. If anything, kickers prefer an inflated KBall rather than an under-inflated one. Therefore, fumbles should not be affected in the same way on kicking plays. In fact, when kicking plays are isolated, this assumption is confirmed. The rule change affected the KBall, but when each organization is tested, everyone benefited equally.

Play level regression results provide additional insight. Specifically, the organization loops confirm game level loops and the strongest results came from removing kicking plays. With these plays removed, Colts reappeared with the same results as the Patriots. The interaction was now significant with no other effects. This check results in perhaps the strongest conclusion. With kicking plays removed, the effect of the rule change is further isolated. As for the Colts, perhaps their special teams unit lost more fumbles and was less prepared. This fact would cover up the result of fewer fumbles on non-kicking, offensive plays. Since the results does not appear for the Colts until kicking plays are removed, I am more confident that the Colts had fewer fumbles on visiting, offensive, non-kicking plays - the very plays that we would expect to impacted by increased grip that may result from the rule change.

However, three other teams experience fewer fumbles and fumbles lost during this time period - the Atlanta Falcons, Chicago Bears and Miami Dolphins. Of these three teams, the Falcons and the Bears experienced fewer fumbles at the strongest check –when kicking plays were removed. However, the Dolphins did not. Were the Falcons and Bears also connected to the rule change? Or, are these results due to other factors? Regardless, only four teams show any impact on fumbles when kicking plays are removed. Of these four teams, two have direct links to the rule change that may have led to fewer fumbles. The significance of the interaction disappeared for the Dolphins, however, for fumbles on non-kicking plays. Therefore, it is less likely the rule change impacted the Dolphins in the same way as Patriots and Colts or, potentially, the Falcons and Bears. Further investigation is required as the possibility that either the Falcons or Bears took advantage of the rule change or had fewer fumbles due to other reasons.

CONCLUSION

This paper explores the connection between the 2006 rule change that allowed each team to supply their own footballs at away and home games and the impact of this rule change on key game statistics. This topic is primarily chosen because of the recent allegations against the Patriots that suggest possible misbehavior regarding football preparation. The 2006 rule change in frequently cited as a relevant shift in regulation that made under-inflation of footballs more likely. After all, if the rule change altered incentives to cheat in such a way that made cheating more preferable, then, perhaps, some teams took advantage of this regulation weakness.

Through econometric analysis, this study finds a link between fumbles and fumbles lost and the 2006 rule change. While the application of this finding does not constitute an accusation of cheating, it does raise questions about the impact of the 2006 rule change. Why did some teams benefit and most others did not? Was this shift because of an intentional change in behavior? These questions are not necessarily statistical questions. They are beyond the scope of this study.

In addition, this study finds no impact on the passing statistics. Interestingly, this was the primary focus of Tom Brady and Peyton Manning when they garnered signatures for petition to change regulation. It could be that the initial reason for the rule change did not, in fact, have as great an impact as anticipated beforehand. However, it could be that there was an effect, but that the data are limited. For example, the data do not record time the ball spent in the air. This would be a crucial statistic for testing a change in the quarterback's ability to complete long passes. After all, Brady has often been criticized until this season for his struggle to throw long passes. The data do not capture this

criticism most likely because the correct statistic is missing. Further study with relevant data could evaluate the impact of the rule change on passing statistics.

Finally, DeflateGate meant that more regulation was put in place regarding football preparation. Further study could investigate the effect of these rules on game statistics. In fact, if after the new 2015 rules the fumble effect evaporated, the result of the study would be strengthened. This research extension might only be possible assuming that the rules do not change again and more time passes under the current system.

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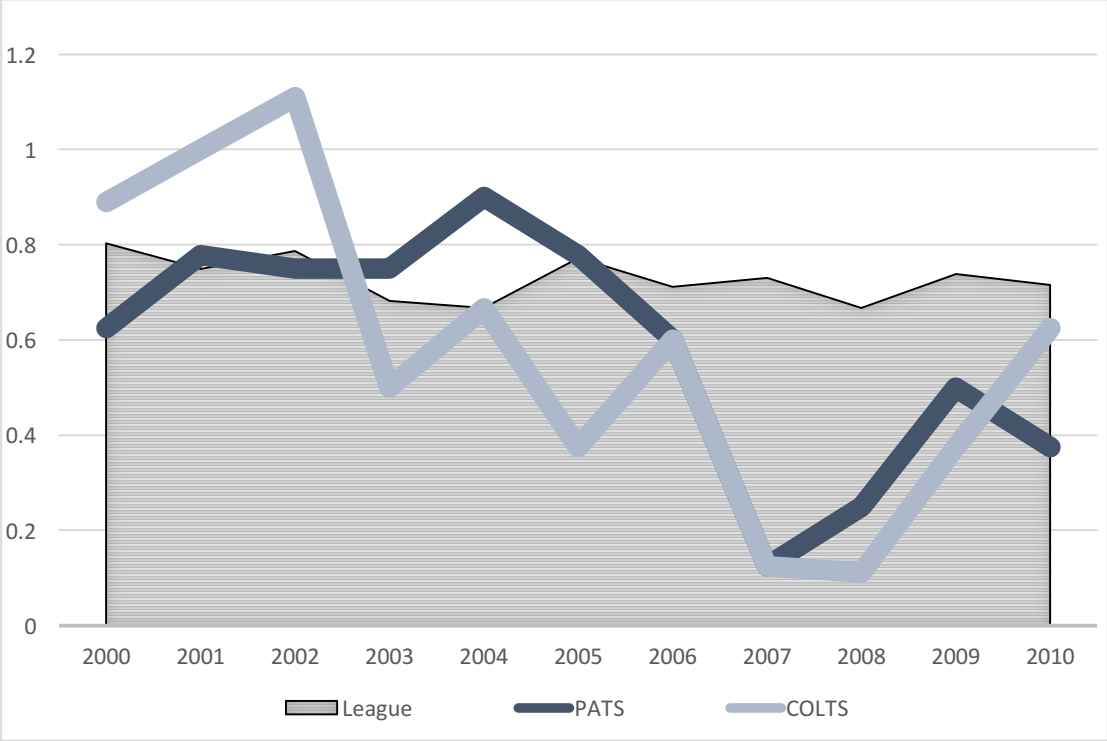
APPENDIX A: GRAPHS



Graph A1: Fumbles lost per game average by season

APPENDIX B: TABLES

Table B1: Game level data description
All statistics for the visiting team

Variables	Obs	Mean	Std. Dev.	Min	Max
Brady/Manning Starter (1=YES)	2,921	0.059	0.236	0	1
Fumbles Lost	2,921	0.729	0.854	0	5
Completions	2,921	19.6	6.04	1	43
Attempts	2,921	32.8	8.35	6	69
Completion Percentage	2,921	0.596	0.103	0.077	0.938
Pass Yards per Attempt	2,921	6.361	2.051	-.5	16.894
Pass Yards per Completion	2,291	10.644	2.910	-3.5	28
Outcome of Game (1=WIN)	2,921	0.430	0.495	0	1
Time Dummy (1=AFTER 2005)	2,921	0.457	0.498	0	1
Interaction Term (1=TIME*TEAM)	2,921	0.026	0.160	0	1

Table B2: Play level data description
All statistics for the visiting team

Variables	Obs	Mean	Std. Dev.	Min	Max
NE Patriots (1=YES)	235,151	0.033	0.180	0	1
IND Colts (1=YES)	235,151	0.033	0.178	0	1
Patriots+Colts (1=YES)	235,151	0.066	0.249	0	1
Fumbles	235,151	0.017	0.129	0	1
Fumbles Lost	235,151	0.008	0.091	0	1
Time Dummy (1=AFTER 2005)	235,151	0.455	0.498		
Interaction 1 (1=PATS*TIME)	235,151	0.015	0.121	0	1
Interaction 2 (1=COLTS*TIME)	235,151	0.015	0.120	0	1
Interaction 3 (1=BOTH*TIME)	235,151	0.029	0.169	0	1

Table B3: Game level passing statistics regression result
All statistics for the visiting team
Standard errors *italicized*

	Arizona Cardinals			Atlanta Falcons			Baltimore Ravens		
	ATL	TIME	INTER	ATL	TIME	INTER	BAL	TIME	INTER
Atts	2.972***	0.190	-0.0144	-4.674***	0.0465	4.553***	-2.012*	0.165	0.886
	(1.131)	*(0.316)*	*(1.657)*	*(1.005)*	*(0.315)*	*(1.724)*	*(1.180)*	*(0.316)*	*(1.698)*
Comp	1.009	0.700***	0.568	-4.209***	0.611***	3.305***	-2.151***	0.670***	1.498
	(0.831)	*(0.228)*	*-1.345*	*(0.668)*	*(0.228)*	*(1.148)*	*(0.732)*	*(0.229)*	*(1.141)*
Pass Yards	-0.330	7.309**	20.95	-45.96***	6.980**	30.02**	-39.54***	7.384**	18.61
	(10.18)	*(2.954)*	*(16.20)*	*(9.274)*	*(2.959)*	*(14.17)*	*(8.912)*	*(2.962)*	*(14.05)*
Pass Yards/Att	-0.593***	0.167**	0.590*	-0.555*	0.179**	0.165	-0.828***	0.172**	0.393
	(0.206)	*(0.0776)*	*(0.339)*	*(0.300)*	*(0.0772)*	*(0.423)*	*(0.266)*	*(0.0774)*	*(0.382)*
Pass Yards/Comp	-0.555*	-0.0245	0.791*	-0.232	0.00110	-0.0555	-0.821*	-0.00228	0.0991
	(0.304)	*(0.110)*	*(0.468)*	*(0.354)*	*(0.110)*	*(0.423)*	*(0.446)*	*(0.109)*	*(0.579)*

	Buffalo Bills			Carolina Panthers			Chicago Bears		
	BUF	TIME	INTER	CAR	TIME	INTER	CHI	TIME	INTER
Attempts	1.210	0.377	-6.131***	-3.292***	0.194	-0.494	-2.871***	0.112	2.693*
	(0.979)	*(0.316)*	*(1.543)*	*(0.976)*	*(0.316)*	*(1.631)*	*(0.873)*	*(0.316)*	*(1.592)*
Comp	0.901	0.837***	-3.916***	-2.117***	0.753***	-1.439	-3.481***	0.631***	2.890**
	(0.789)	*(0.229)*	*(1.135)*	*(0.711)*	*(0.229)*	*(1.091)*	*(0.640)*	*(0.229)*	*(1.137)*
Pass Yards	0.916	9.148***	-39.36**	-10.66	8.764***	-28.01*	-60.46***	6.557**	46.48***
	(11.14)	*(2.949)*	*(16.38)*	*(8.871)*	*(2.961)*	*(14.38)*	*(7.903)*	*(2.953)*	*(14.22)*
Pass Yards/Att	-0.198	0.188**	-0.110	0.402	0.212***	-0.862*	-1.354***	0.155**	0.967**
	(0.328)	*(0.0770)*	*(0.459)*	*(0.270)*	*(0.0771)*	*(0.449)*	*(0.266)*	*(0.0771)*	*(0.413)*
Pass Yards/Comp	-0.480	0.00244	-0.0952	0.937**	0.0386	-1.170*	-1.339***	-0.0275	0.894
	(0.399)	*(0.109)*	*(0.589)*	*(0.431)*	*(0.109)*	*(0.649)*	*(0.434)*	*(0.109)*	*(0.618)*
	Cincinnati Bengals			Cleveland Browns			Dallas Cowboys		
	CIN	TIME	INTER	CLE	TIME	INTER	DAL	TIME	INTER
Attempts	1.748*	0.219	-0.844	-2.324**	0.178	0.418	-3.018***	0.0733	3.862**
	(0.990)	*(0.316)*	*(1.762)*	*(1.107)*	*(0.316)*	*(1.688)*	*(1.065)*	*(0.317)*	*(1.553)*
Comp	1.395*	0.735***	-0.518	-1.017	0.765***	-1.560	-2.701***	0.594***	4.008***
	(0.790)	*(0.228)*	*(1.404)*	*(0.903)*	*(0.228)*	*(1.314)*	*(0.755)*	*(0.229)*	*(1.185)*
Pass Yards	-2.585	7.811***	5.222	-27.11**	8.412***	-15.64	-37.61***	5.792*	69.84***
	(10.42)	*(2.947)*	*(17.77)*	*(12.35)*	*(2.942)*	*(16.97)*	*(10.01)*	*(2.957)*	*(14.41)*
Pass Yards/Att	-0.411	0.177**	0.248	-0.524	0.201***	-0.551	-0.652**	0.134*	1.625***
	(0.283)	*(0.0771)*	*(0.446)*	*(0.352)*	*(0.0768)*	*(0.474)*	*(0.277)*	*(0.0768)*	*(0.460)*
Pass Yards/Comp	-1.014***	-0.0156	0.502	-0.992*	-0.00337	0.0727	-0.527	-0.0547	1.740**
	(0.307)	*(0.109)*	*(0.569)*	*(0.584)*	*(0.108)*	*(0.737)*	*(0.483)*	*(0.108)*	*(0.460)*

	Denver Broncos			Detroit Lions			Green Bay Packers		
	DEN	TIME	INTER	DET	TIME	INTER	GB	TIME	INTER
Attempts	-0.277	0.152	1.362	1.791	0.0936	3.340*	4.543***	0.240	-1.615
	(1.183)	*(0.316)*	*(1.741)*	*(1.366)*	*(0.314)*	*(1.884)*	*(1.069)*	*(0.316)*	*(1.475)*
Comp	0.411	0.716***	0.132	-0.925	0.605***	3.786***	3.913***	0.752***	-1.181
	(0.761)	*(0.229)*	*(1.271)*	*(0.944)*	*(0.228)*	*(1.364)*	*(0.725)*	*(0.229)*	*(1.053)*
Pass Yards	5.414	7.779***	6.707	-23.53**	6.888**	35.81**	48.55***	7.709***	5.743
	(9.825)	*(2.958)*	*(15.90)*	*(11.47)*	*(2.954)*	*(16.18)*	*(9.973)*	*(2.944)*	*(14.78)*
Pass Yards/Att	0.367	0.190**	-0.163	-1.149***	0.168**	0.556	0.636**	0.170**	0.420
	(0.323)	*(0.0771)*	*(0.448)*	*(0.240)*	*(0.0774)*	*(0.344)*	*(0.288)*	*(0.0771)*	*(0.412)*
Pass Yards/Comp	0.162	-0.0129	0.435	-1.002***	-0.00900	0.281	0.430	-0.0243	0.712
	(0.430)	*(0.109)*	*(0.664)*	*(0.302)*	*(0.109)*	*(0.528)*	*(0.430)*	*(0.109)*	*(0.565)*
	Houston Texans			Indianapolis Colts			Jacksonville Jaguars		
	HOU	TIME	INTER	IND	TIME	INTER	JAC	TIME	INTER
Attempts	-4.426***	0.00644	7.675***	2.790***	0.139	1.786	-0.386	0.298	-3.318**
	(1.329)	*(0.314)*	*(1.925)*	*(1.046)*	*(0.315)*	*(1.660)*	*(1.099)*	*(0.316)*	*(1.546)*
Comp	-3.616***	0.522**	7.740***	3.627***	0.694***	0.919	0.121	0.779***	-1.912*
	(0.925)	*(0.314)*	*(1.453)*	*(0.635)*	*(0.228)*	*(1.148)*	*(0.714)*	*(0.230)*	*(1.031)*
Pass Yards	-47.89***	5.596*	94.80***	51.62***	7.621***	12.70	-2.593	8.645***	-21.45
	(14.28)	*(2.923)*	*(20.19)*	*(8.874)*	*(2.945)*	*(13.39)*	*(9.381)*	*(2.964)*	*(14.20)*
Pass Yards/Att	-0.879**	0.147*	1.537***	1.081***	0.184**	0.0463	-0.0158	0.185**	0.000239
	(0.443)	*(0.0766)*	*(0.560)*	*(0.257)*	*(0.0770)*	*(0.406)*	*(0.224)*	*(0.0776)*	*(0.366)*
Pass Yards/Comp	-0.993	-0.0217	1.041	0.638*	-0.00974	0.318	-0.268	0.00345	-0.113
	(0.710)	*(0.108)*	*(0.860)*	*(0.327)*	*(0.109)*	*(0.545)*	*(0.280)*	*(0.110)*	*(0.455)*

	Kansas City Chiefs			Miami Dolphins			Minnesota Vikings		
	KC	TIME	INTER	MIA	TIME	INTER	MIN	TIME	INTER
Attempts	1.919*	0.283	-2.946*	-2.618**	0.126	2.156	2.133*	0.347	-4.922***
	(1.061)	*(0.316)*	*(1.598)*	*(1.198)*	*(0.316)*	*(1.663)*	*(1.197)*	*(0.315)*	*(1.851)*
Comp	1.718*	0.806***	-2.873**	-2.133***	0.678***	1.309	2.153**	0.843***	-3.937***
	(0.880)	*(0.229)*	*(1.210)*	*(0.685)*	*(0.229)*	*(1.070)*	*(0.858)*	*(0.228)*	*(1.289)*
Pass Yards	49.53***	10.36***	-78.63***	-22.58**	7.849***	3.283	35.46***	9.946***	-62.72***
	(12.51)	*(2.941)*	*(16.90)*	*(9.069)*	*(2.964)*	*(13.93)*	*(11.14)*	*(2.952)*	*(15.55)*
Pass Yards/Att	1.007***	0.238***	-1.743***	-0.0142	0.199***	-0.487	0.684**	0.215***	-0.952**
	(0.274)	*(0.0772)*	*(0.385)*	*(0.348)*	*(0.0770)*	*(0.466)*	*(0.286)*	*(0.0773)*	*(0.403)*
Pass Yards/Comp	1.453***	0.0750	-2.471***	-0.0140	0.0181	-0.614	0.630	0.0301	-0.961
	(0.391)	*(0.109)*	*(0.385)*	*(0.465)*	*(0.109)*	*(0.606)*	*(0.399)*	*(0.109)*	*(0.587)*
	New England Patriots			New Orleans Saints			New York Giants		
	NE	TIME	INTER	NO	TIME	INTER	NYG	TIME	INTER
Attempts	1.603	0.210	-0.464	1.572	0.0176	5.383***	1.046	0.250	-1.789
	(1.060)	*(0.316)*	*(1.656)*	*(1.159)*	*(0.314)*	*(1.701)*	*(0.453)*	*(0.317)*	*(1.485)*
Comp	2.029***	0.725***	-0.108	0.289	0.523**	6.059***	0.542	0.752***	-1.041
	(0.751)	*-0.229*	*(1.183)*	*(0.758)*	*(0.227)*	*(1.202)*	*(0.769)*	*(0.230)*	*(1.093)*
Pass Yards	28.82***	7.789***	6.919	16.87**	6.190**	54.53***	20.40**	8.535***	-18.53
	(9.525)	*(2.948)*	*(16.34)*	*(8.256)*	*(2.944)*	*(14.27)*	*(10.18)*	*(2.966)*	*(14.33)*
Pass Yards/Att	0.673**	0.179**	0.218	0.286	0.171**	0.422	0.373	0.192**	-0.239
	(0.304)	*(0.0769)*	*(0.455)*	*(0.211)*	*(0.0776)*	*(0.337)*	*(0.234)*	*(0.0778)*	*(0.328)*
Pass Yards/Comp	0.444	-0.00609	0.204	0.889***	0.0218	-0.721	0.709**	0.00967	-0.354
	(0.395)	*(0.109)*	*(0.564)*	*(0.327)*	*(0.110)*	*(0.453)*	*(0.307)*	*(0.110)*	*(0.459)*

	New York Jets			Oakland Raiders			Philadelphia Eagles		
	NYJ	TIME	INTER	OAK	TIME	INTER	PHI	TIME	INTER
Attempts	-0.385	0.288	-2.681	3.634***	0.469	-9.019***	0.654	0.131	1.822
	(1.318)	*(0.316)*	*(1.707)*	*(1.332)*	*(0.313)*	*(1.898)*	*(0.968)*	*(0.317)*	*(1.519)*
Comp	0.0802	0.772***	-1.527	1.951*	0.942***	-7.337***	-0.197	0.662***	1.699*
	(0.797)	*(0.229)*	*(1.203)*	*(1.034)*	*(0.227)*	*(1.327)*	*(0.757)*	*(0.230)*	*(1.024)*
Pass Yards	-5.478	8.347***	-10.38	23.48*	10.56***	-85.15***	0.512	6.864**	32.73**
	(10.74)	*(2.965)*	*(14.81)*	*(12.08)*	*(2.939)*	*(16.14)*	*(11.33)*	*(2.956)*	*(15.61)*
Pass Yards/Att	-0.0607	0.178**	0.194	-0.0470	0.208***	-0.798*	-0.179	0.158**	0.790*
	(0.279)	*(0.0774)*	*(0.397)*	*(0.275)*	*(0.0771)*	*(0.443)*	*(0.305)*	*(0.0772)*	*(0.430)*
Pass Yards/Comp	-0.370	-0.0190	0.557	0.218	0.0119	-0.394	0.125	-0.0256	0.745
	(0.389)	*(0.109)*	*(0.581)*	*(0.531)*	*(0.109)*	*(0.705)*	*(0.512)*	*(0.109)*	*(0.678)*
	Pittsburgh Steelers			San Diego Chargers			Seattle Seahawks		
	PIT	TIME	INTER	SD	TIME	INTER	SEA	TIME	INTER
Attempts	-4.799***	0.105	2.595	-1.797	0.159	1.159	0.537	0.131	1.901
	(1.182)	*(0.316)*	*(1.589)*	*(1.144)*	*(0.316)*	*(1.721)*	*(1.224)*	*(0.316)*	*(1.659)*
Comp	-2.584***	0.656***	1.899*	-1.097	0.682***	1.221	0.258	0.694***	0.756
	(0.707)	*(0.230)*	*(1.038)*	*(0.754)*	*(0.229)*	*(1.132)*	*(0.832)*	*(0.229)*	*(1.184)*
Pass Yards	-18.26*	7.165**	24.75*	-5.486	6.785**	37.06**	18.44	8.526***	-17.72
	(9.690)	*(2.963)*	*(14.89)*	*(11.11)*	*(2.948)*	*(16.87)*	*(11.36)*	*(2.959)*	*(15.64)*
Pass Yards/Att	0.519*	0.178**	0.226	0.275	0.151**	1.025*	0.418*	0.213***	-0.890**
	(0.308)	*(0.0769)*	*(0.467)*	*(0.340)*	*(0.0763)*	*(0.524)*	*(0.253)*	*(0.0776)*	*(0.351)*
Pass Yards/Comp	0.566	-0.00230	0.0886	0.286	-0.0452	1.377**	0.952**	0.0477	-1.509***
	(0.408)	*(0.109)*	*(0.584)*	*(0.463)*	*(0.108)*	*(0.688)*	*(0.464)*	*(0.109)*	*(0.568)*

	San Francisco 49ers			Saint Louis Rams			Tampa Bay Buccaneers		
	SF	TIME	INTER	STL	TIME	INTER	TB	TIME	INTER
Attempts	-0.661	0.217	-0.832	5.798***	0.385	-5.848***	0.675	0.161	1.131
	(1.215)	*(0.316)*	*(1.644)*	*(1.229)*	*(0.315)*	*(1.612)*	*(1.055)*	*(0.314)*	*(2.032)*
Comp	-0.713	0.769***	-1.709	5.468***	0.921***	-6.241***	1.484**	0.730***	-0.246
	(0.899)	*(0.229)*	*(1.171)*	*(0.842)*	*(0.228)*	*(1.171)*	*(0.712)*	*(0.228)*	*(1.298)*
Pass Yards	-8.941	8.651***	-23.27	68.78***	11.28***	-104.0***	-6.295	7.400**	18.49
	(11.54)	*(2.959)*	*(14.68)*	*(9.557)*	*(2.946)*	*(13.98)*	*(9.191)*	*(2.963)*	*(14.77)*
Pass Yards/Att	-0.246	0.199**	-0.490	1.083***	0.253***	-2.183***	-0.331	0.169**	0.509
	(0.298)	*(0.0774)*	*(0.371)*	*(0.321)*	*(0.0770)*	*(0.410)*	*(0.217)*	*(0.0777)*	*(0.338)*
Pass Yards/Comp	0.104	0.0115	-0.388	0.760	0.0662	-2.147***	-1.042***	-0.0406	1.271**
	(0.506)	*(0.109)*	*(0.647)*	*(0.466)*	*(0.109)*	*(0.607)*	*(0.338)*	*(0.109)*	*(0.530)*

	Tennessee Titans			Washington Redskins		
	TEN	TIME	INTER	WAS	TIME	INTER
Attempts	-0.602	0.293	-3.269*	-1.797	0.122	2.255
	(1.394)	*(0.314)*	*(1.951)*	*(1.198)*	*(0.316)*	*(1.757)*
Comp	0.127	0.835***	-3.773***	-2.034**	0.650***	2.187*
	(0.909)	*(0.228)*	*(1.308)*	*(0.796)*	*(0.229)*	*(1.222)*
Pass Yards	3.044	9.162***	-38.74**	-28.64***	7.180**	24.91*
	(10.77)	*(2.954)*	*(15.73)*	*(10.62)*	*(2.961)*	*(14.71)*
Pass Yards/Att	0.265	0.207***	-0.711*	-0.582*	0.172**	0.386
	(0.267)	*(0.0773)*	*(0.415)*	*(0.314)*	*(0.0774)*	*(0.385)*
Pass Yards/Comp	0.272	0.0122	-0.395	-0.496	-0.0139	0.430
	(0.454)	*(0.109)*	*(0.711)*	*(0.418)*	*(0.109)*	*(0.560)*

Table B3: Game level passing statistics regression result (marginal effects)
All statistics for visiting team
Standard errors *italicized*

	Arizona Cardinals			Atlanta Falcons		
	ATL	TIME	INTER	ATL	TIME	INTER
Fumbles	0.00278	-0.000599	0.0031	0.0000163	-0.000322	-0.00554
	-0.00199	*-0.000544*	*-0.00284*	*-0.00207*	*-0.000542*	*-0.00327*
FumblesL	0.000334	-0.000463	0.00308	-0.000198	-0.000247	-0.0039
	-0.00146	*-0.000385*	*-0.00202*	*-0.00147*	*-0.000382*	*-0.00242*
Fumbles NK Plays	0.00234	-0.000345	0.00467	-0.000573	8.34E-06	-0.00631*
	-0.0023	*-0.000621*	*-0.00325*	*-0.00239*	*-0.000618*	*-0.00377*
FumblesL NK Plays	0.000421	-0.000266	0.00339	-0.000133	-0.000248	-0.00431
	-0.00167	*-0.000441*	*-0.00232*	*-0.00169*	*-0.000439*	*-0.00275*

		Baltimore Ravens			Buffalo Bills	
	BAL	TIME	INTER	BUF	TIME	INTER
Fumbles	0.00417**	-0.000431	-0.00133	0.00173	-0.000495	0.000793
	-0.00183	*-0.000545*	*-0.00272*	*-0.00202*	*-0.000543*	*-0.00307*
FumblesL	0.00161	-0.000334	-0.000404	0.00149	-0.00033	-0.000395
	-0.00131	*-0.000385*	*-0.00194*	*-0.00139*	*-0.000384*	*-0.00215*
Fumbles NK Plays	0.00439**	-0.0000907	-0.00204	0.00257	-1.51E-04	-0.000161
	-0.0021	*-0.000622*	*-0.00313*	*-0.00229*	*-0.00062*	*-0.0035*
FumblesL NK Plays	0.00132	-0.000137	-0.0000954	0.00183	-0.000114	-0.000576
	-0.00153	*-0.000441*	*-0.00225*	*-0.00158*	*-0.00044*	*-0.00246*

		Carolina Panthers			Chicago Bears	
	CAR	TIME	INTER	CHI	TIME	INTER
Fumbles	0.00042	-0.000408	-0.00239	0.00552***	-0.000279	-0.00610**
	-0.00199	*-0.000542*	*-0.00316*	*-0.00194*	*-0.000543*	*-0.00304*
FumblesL	-0.00726	-0.000377	0.000961	0.00288**	-0.000228	-0.00368*
	-0.00146	*-0.000383*	*-0.00221*	*-0.00135*	*-0.000383*	*-0.00217*
Fumbles NK Plays	0.000903	-0.000786	-0.00292	0.00579***	6.88E-05	-0.00739**
	-0.00226	*-0.000619*	*-0.0036*	*-0.00223*	*-0.00062*	*-0.00351*
FumblesL NK Plays	-0.00737	-0.000158	0.000629	0.00326**	0.000208	-0.00509*
	-0.00167	*-0.000439*	*-0.00255*	*-0.00155*	*-0.00044*	*-0.00254*

	Cincinnati Bengals			Cleveland Browns		
	CIN	TIME	INTER	CLE	TIME	INTER
Fumbles	-0.00122	-0.000654	0.00543*	-0.000408	-0.000503	0.000906
	-0.00212	*-0.000543*	*-0.00301*	*-0.00215*	*-0.000542*	*-0.0032*
FumblesL	-0.00126	-0.000439	0.00296	0.000901	-0.000322	-0.000827
	-0.00154	*-0.000384*	*-0.00217*	*-0.00145*	*-0.000383*	*-0.00222*
Fumbles NK Plays	-0.0000637	-0.00034	0.00516	-0.00155	-2.24E-04	0.0021
	-0.00236	*-0.00062*	*-0.00337*	*-0.00253*	*-0.000618*	*-0.0037*
FumblesL NK Plays	-0.000839	-0.000216	0.00247	0.000566	-0.000136	-0.0000408
	-0.00173	*-0.00044*	*-0.00246*	*-0.0017*	*-0.000439*	*-0.00255*
	Dallas Cowboys			Denver Broncos		
	DAL	TIME	INTER	DEN	TIME	INTER
Fumbles	0.00522***	-0.00031	-0.00474	-0.00382*	-0.000592	0.00369
	-0.00188	*-0.000544*	*-0.00291*	*-0.00213*	*-0.000542*	*-0.00316*
FumblesL	0.002	-0.000248	-0.00302	-0.00335**	-0.000491	0.00482**
	-0.00135	*-0.000384*	*-0.00214*	*-0.00161*	*-0.000383*	*-0.00223*
Fumbles NK Plays	0.00603***	0.0000389	-0.00577*	-0.00548**	-3.12E-04	0.00486*
	-0.00214	*-0.000621*	*-0.00332*	*-0.00251*	*-0.000619*	*-0.00367*
FumblesL NK Plays	0.00224	-0.0000262	-0.0034	-0.00474**	-0.000337	0.00682***
	-0.00155	*-0.00044*	*-0.00245*	*-0.00194*	*-0.00044*	*-0.00261*

	Detroit Lions			Green Bay Packers		
	DET	TIME	INTER	GB	TIME	INTER
Fumbles	-0.00774***	-0.000774	0.0110***	-0.000171	-0.000476	-0.0000234
	-0.00249	*-0.000542*	*-0.00331*	*-0.00202*	*-0.000543*	*-0.00298*
FumblesL	-0.00251	-0.000491	0.00485**	0.000558	-0.000311	-0.0011
	-0.00166	*-0.000383*	*-0.00224*	*-0.00139*	*-0.000384*	*-0.0021*
Fumbles NK Plays	-0.00103***	-0.00052	0.0138***	0.000342	-1.78E-04	0.000356
	-0.00297	*-0.000618*	*-0.00388*	*-0.0023*	*-0.00062*	*-0.00337*
FumblesL NK Plays	-0.00393*	-0.000317	0.00636***	0.000873	-0.000441	-0.00237
	-0.00201	*-0.000439*	*-0.00265*	*-0.00159*	*-0.000441*	*-0.00237*
	Houston Texans			Indianapolis Colts		
	HOU	TIME	INTER	IND	TIME	INTER
Fumbles	0.00323	-0.000475	-0.00118	-0.00378*	-0.000357	-0.00538
	-0.00244	*-0.000542*	*-0.00329*	*-0.00215*	*-0.000541*	*-0.00348*
FumblesL	-0.0000336	-0.000351	0.000156	-0.000619	-0.000239	-0.00453*
	-0.00183	*-0.000382*	*-0.00245*	*-0.00144*	*-0.000382*	*-0.00248*
Fumbles NK Plays	0.00371	-0.000174	-0.00103	-0.00381*	-1.44E-05	-0.00816**
	-0.00279	*-0.000619*	*-0.00374*	*-0.00244*	*-0.000617*	*-0.00406*
FumblesL NK Plays	-0.0000468	-0.000151	0.000607	-0.0000408	-0.000014	-0.00625**
	-0.00216	*-0.000438*	*-0.00284*	*-0.00161*	*-0.000438*	*-0.00286*

	Jacksonville Jaguars			Kansas City Chiefs		
	JAC	TIME	INTER	KC	TIME	INTER
Fumbles	0.000497	-0.000428	-0.00158	-0.00622***	-0.000631	0.00585*
	-0.00205	*-0.000543*	*-0.0031*	*-0.00236*	*-0.000541*	*-0.00333*
FumblesL	0.00124	-0.000344	-0.000957	-0.00357**	-0.0004	0.000214
	-0.00138	*-0.000384*	*-0.00207*	*-0.00171*	*-0.000382*	*-0.00245*
Fumbles NK Plays	0.000497	-0.000428	-0.00158	-0.00677***	-3.27E-04	0.00617
	-0.00205	*-0.000543*	*-0.0031*	*-0.00236*	*-0.000541*	*-0.00333*
FumblesL NK Plays	0.00124	-0.000344	-0.000957	-0.00340*	-0.00018	0.000166
	-0.00138	*-0.000384*	*-0.00207*	*-0.00171*	*-0.000382*	*-0.00245*
	Miami Dolphins			Minnesota Vikings		
	MIA	TIME	INTER	MIN	TIME	INTER
Fumbles	0.00441**	-0.000299	-0.00545*	0.00209	-0.00419	-0.00165
	-0.00193	*-0.000543*	*-0.00306*	*-0.00194*	*-0.000543*	*-0.00299*
FumblesL	0.00382***	-0.000178	-0.000487**	0.0013	-0.000343	-0.0000309
	-0.00127	*-0.000384*	*-0.00214*	*-0.00135*	*-0.000384*	*-0.00205*
Fumbles NK Plays	0.00514**	0.00000495	-0.00509	0.00222	-1.37E-03	-0.00704
	-0.00221	*-0.00062*	*-0.00344*	*-0.00222*	*-0.00062*	*-0.00337*
FumblesL NK Plays	0.00424***	0.0000307	-0.000475**	0.0011	-0.000161	0.000722
	-0.00147	*-0.00044*	*-0.00241*	*-0.00157*	*-0.000441*	*-0.00234*

	New England Patriots			New Orleans Saints		
	NE	TIME	INTER	NO	TIME	INTER
Fumbles	-0.0013	-0.000296	-0.00715**	-0.0011	-0.000472	-0.0000673
	-0.00203	*-0.000541*	*-0.00336*	*-0.00208*	*-0.000543*	*-0.00304*
FumblesL	-0.000228	-0.000223	-0.00504**	0.000495	-0.000307	-0.00121
	-0.00141	*-0.000382*	*-0.00246*	*-0.0014*	*-0.000384*	*-0.00211*
Fumbles NK Plays	-0.00203	0.0000492	-0.00790**	-0.00161	-1.62E-04	0.0000391
	-0.00228	*-0.000619*	*-0.00374*	*-0.0024*	*-0.00062*	*-0.00349*
FumblesL NK Plays	0.000453	0.0000101	-0.00556**	0.000118	-0.000859	-0.00159
	-0.00158	*-0.000439*	*-0.00273*	*-0.00164*	*-0.000439*	*-0.00159*
	New York Giants			New York Jets		
	NYG	TIME	INTER	NYJ	TIME	INTER
Fumbles	0.00189	-0.000473	-0.000242	0.000201	-0.00041	-0.00196
	-0.00196	*-0.000544*	*-0.00287*	*-0.00204*	*-0.000543*	*-0.00302*
FumblesL	-0.00156	-0.000409	0.00201	0.00151	-0.000244	-0.0034
	-0.00154	*-0.000384*	*-0.00215*	*-0.00143*	*-0.000383*	*-0.00227*
Fumbles NK Plays	0.00251	-0.000125	-0.00124	0.000906	-8.35E-05	-0.00243
	-0.00222	*-0.000621*	*-0.00328*	*-0.00231*	*-0.00062*	*-0.00341*
FumblesL NK Plays	-0.00182	-0.000204	0.00218	0.000593	-0.0000184	-0.00388
	-0.00177	*-0.00044*	*-0.00248*	*-0.00163*	*-0.000439*	*-0.00256*

		Oakland Raiders			Philadelphia Eagles	
	OAK	TIME	INTER	PHI	TIME	INTER
Fumbles	-0.00113	-0.000611	0.00428	-0.00601***	-0.000657	0.00645**
	-0.00208	*-0.000543*	*-0.00304*	*-0.00232*	*-0.000542*	*-0.00317*
FumblesL	-0.00132	-0.000441	0.00304	-0.00419**	-0.000468	0.00457**
	-0.00152	*-0.000383*	*-0.00217*	*-0.00174*	*-0.000383*	*-0.00231*
Fumbles NK Plays	-0.00536	-0.000307	0.00447	-0.00548**	-2.93E-04	0.00472
	-0.00236	*-0.00062*	*-0.00343*	*-0.00261*	*-0.000619*	*-0.00365*
FumblesL NK Plays	-0.00141	-0.000244	0.00342	-0.00446**	-0.000253	0.00448**
	-0.00175	*-0.00044*	*-0.00248*	*-0.002*	*-0.000439*	*-0.00268*
		Pittsburgh Steelers			San Diego Chargers	
	PIT	TIME	INTER	SD	TIME	INTER
Fumbles	-0.00623***	-0.000638	0.00573*	0.00171	-0.000396	-0.00269
	-0.00229	*-0.000542*	*-0.00325*	*-0.00208*	*-0.000542*	*-0.00316*
FumblesL	-0.00338**	-0.000418	0.00264	0.000762	-0.000266	-0.00274
	-0.00164	*-0.000383*	*-0.00234*	*-0.00143*	*-0.000383*	*-0.00225*
Fumbles NK Plays	-0.00836***	-0.000353	0.00700*	0.00616	-9.52E-05	-0.00228
	-0.00271	*-0.000618*	*-0.0038*	*-0.00238*	*-0.000619*	*-0.00356*
FumblesL NK Plays	-0.00398**	-0.000211	0.00274	0.00162	-0.0000322	-0.00344
	-0.00192	*-0.000439*	*-0.00272*	*-0.0016*	*-0.00044*	*-0.00254*

	Seattle Seahawks			San Francisco 49ers		
	SEA	TIME	INTER	SF	TIME	INTER
Fumbles	-0.00145	-0.000489	0.00312	0.00149	-0.000507	0.0011
	-0.00212	*-0.000542*	*-0.00312*	*-0.00199*	*-0.000543*	*-0.00301*
FumblesL	-0.000804	-0.0004	0.00166	0.000113	-0.000349	0.00164
	-0.0015	*-0.000384*	*-0.00215*	*-0.00138*	*-0.000384*	*-0.00211*
Fumbles NK Plays	-0.00159	-0.000192	0.00941	0.00189	-1.76E-04	0.00574
	-0.00244	*-0.000619*	*-0.00356*	*-0.00227*	*-0.00062*	*-0.00346*
FumblesL NK Plays	-0.00149	-0.000208	0.00229	0.00149	-0.000114	-0.000583
	-0.00178	*-0.00044*	*-0.00251*	*-0.00158*	*-0.00044*	*-0.00245*

	Saint Louis Rams			Tampa Bay Buccaneers		
	STL	TIME	INTER	TB	TIME	INTER
Fumbles	0.00125	-0.000398	-0.00247	-0.00232	-0.000549	0.00241
	-0.00193	*-0.000543*	*-0.00308*	*-0.00214*	*-0.000542*	*-0.00315*
FumblesL	0.000884	-0.000317	-0.00816	-0.00124	-0.000449	0.0032
	-0.00134	*-0.000384*	*-0.00213*	*-0.00152*	*-0.000384*	*-0.00214*
Fumbles NK Plays	0.000648	-0.0000947	-0.00232	-0.00289	-2.63E-04	0.00325
	-0.00224	*-0.000619*	*-0.00354*	*-0.00246*	*-0.000619*	*-0.00359*
FumblesL NK Plays	0.000725	-0.000102	-0.00109	-0.00111	-0.000249	0.00341
	-0.00156	*-0.00044*	*-0.00247*	*-0.00172*	*-0.00044*	*-0.00243*

	Tennessee Titans			Washington Redskins		
	TEN	TIME	INTER	WAS	TIME	INTER
Fumbles	-0.00139	-0.000534	0.00183	0.00344*	-0.000371	-0.00308
	-0.00207	*-0.000543*	*-0.00309*	*-0.00193*	*-0.000543*	*-0.00297*
FumblesL	-0.00173	-0.000405	0.00196	-0.00248*	-0.000265	0.00228
	-0.00153	*-0.000383*	*-0.00223*	*-0.00131*	*-0.000384*	*-0.00206*
Fumbles NK Plays	-0.00176	-0.000234	0.00224	0.00283	-1.17E-04	-0.0014
	-0.00239	*-0.000619*	*-0.00355*	*-0.00224*	*-0.00062*	*-0.00337*
FumblesL NK Plays	-0.00189	-0.000227	0.00292	-0.00232	-0.0000762	0.00173
	-0.00177	*-0.00044*	*-0.00253*	*-0.00153*	*-0.000441*	*-0.00236*