Bankruptcy Behavior in the NFL:
Does the Overtime Structure Change the Strategy of the Game?

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ABSTRACT

Companies in financial distress have an incentive to take on high-risk/high-reward projects, known as 'bankruptcy behavior.' This paper investigates the activity of bankruptcy behavior outside of the corporate setting by analyzing the effects of the overtime structure in the NFL relative to College Football. Because of the difference in overtime structures, NFL teams will act differently when overtime is possible. The structure causes moral hazard, which happens because NFL teams views overtime differently than college football teams. I find evidence that NFL teams take on more risk late in the game to avoid overtime, or act as if they have bankruptcy behavior.

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I. INTRODUCTION

It has been shown that as companies go into financial distress, they can exhibit 'bankruptcy behavior.' These companies begin to take on risky projects that are potentially high reward, in order to get out of distressed times – also known as taking on risk shifting activities. When this activity occurs, the firm has the obligation to increase shareholder value but the bondholders receive first payment (if the firm has to sell off its assets) and thus are generally against the undertaking of such high risk/high reward strategies. Because of their obligation to the shareholders, firms have an incentive to take on these projects.

When this incentive exists, firms that are in trouble have a strong impulse to act with bankruptcy behavior. This incentive also exists outside the corporate setting. If bankruptcy behavior exists when an end-game situation is present, like the end of a sporting event or the end of an incumbent's term in politics (and they are up for re-election), an analysis of this situation will add to the current bankruptcy behavior literature. Sports allow us to analyze possible bankruptcy behavior within a controlled environment to observe how people react in end-game scenarios. This paper looks at the existence of bankruptcy behavior due to the rules set in the National Football League (NFL).

In football, overtime rules vary by league, and having a different overtime structure changes the strategy of the game. One league, NCAA college football, has overtime rules that say each team gets a chance to score, where teams keep going until one team outscores the other. The NFL says the first team to score in overtime wins the game (known as sudden death). If overtime structure causes teams in different leagues to act differently when they approach the possibility of going into overtime, their difference in strategy will be observable. The NFL's rules create a moral hazard issue, because these teams believe overtime success is influenced by something outside of their control; the coin flip. Because of this moral hazard, NFL teams should be more likely to act with risky plays late in the game.

The hypothesis tested in this study explores whether NFL teams are more likely to display bankruptcy behavior than college teams and therefore take on more high risk/high reward plays at the end of the game because they believe something other than talent will affect their chance to win (in overtime).[1] On the other hand, college football teams are more likely to choose lower risk plays, or run the clock out, in order to proceed to overtime because both teams have a realistic chance to win.

The next section discusses why the NFL is different than college football. Section three describes bankruptcy behavior, risk shifting, end game scenarios, and sports, while section four discusses the data. Section five will discuss the methodology and results while section six concludes.

[1] Peterson (2004) finds that since the rule change on the kickoff, the coin-flip in the NFL affects the outcome of the game. Although there is a 50/50 chance of winning the flip, a team willing to take it to the flip is willing to let something other than their talent have an effect on the game.

II. WHY THE NFL IS DIFFERENT THAN COLLEGE FOOTBALL

In both college football and the NFL, if teams are tied at the end of regulation they go to an overtime period. Before the overtime period begins, there is a coin flip. In both leagues the winner of the coin flip decides if they want the ball first. However, in college each team gets a chance from the 25 yard-line to score. If the score is tied after the first overtime period, they rotate who gets the ball first and continue playing until one team outscores the other team. After the second overtime period, teams can no longer attempt an extra point after a touchdown; they must go for a two point conversion. In the NFL, there is an overtime period, which lasts 15 minutes.[2] The first team to score wins the game, and if no one scores at the end of this period, the game is called a tie.[3]

As Che and Hendershott (2008) point out (about the NFL) "While the outcome of a coin flip to determine first possession is *ex ante* fair, immediately after the toss it is no longer fair because the winning team has a significant chance of scoring on the first possession." They also talk about Tom Donahoe's[4] quote on the overtime system: "[w]e don't like the current system. It just seems that too much depends on the coin flip – who wins it and who loses it." (Wall Street Journal, 2003)

But before the coin flip ever occurs in overtime, teams from both leagues try to win the game. Where:

$$\text{Winning}_i = \text{f (talent, management, team)}$$

The primary functions of winning are talent on the field, management (both in recruiting talent and coaching the existing talent), and the team's ability to work together. The subscript *i* represents the league, in this case both the NFL and college football. When different teams face these aspects, they will maximize their probability of winning given both their endowment at the beginning of the game as well as their opponent's endowment.

However, as a finite game comes to an end, the marginal valuation of an activity changes. As any given point in the game, t, approaches the end game, T, the expected value of the play, given the probability of scoring, changes.

$$\text{As } t \rightarrow T, \text{ the E (value (play)} \mid \text{possibility of scoring) changes.}$$

This happens because the value of a field goal is to add three points onto your score. For example, Romer (2006) points out that "a team trailing by two points with time running out is not indifferent between three points for sure and a three-sevenths chance of seven". This also means that a team that is down by four will find no value in a sure three point play, but will value the three-sevenths chance to score seven. The value of these plays

[2] In a playoff game there can be additional periods played, if needed, to determine a winner.
[3] This happens rarely, only once in this data set.
[4] Buffalo Bill's president and general manager at the time.

will change as the game approaches the end, meaning the marginal value of the plays will change.

If the overtime structure leaves the winning function unchanged (college football), the team will act as if t is continuous. Because overtime allows a chance for both teams in college football, their winning will continue to be:

$$\text{Winning}_{college\ football} = f(\text{talent, management, team})$$

Due to the fact that the winning function is the same, it can be thought that t is continuous throughout the game, including any overtime, in college football.

The NFL's different overtime rules mean the first team to score wins. This means the coin flip will now impact the outcome of the game, because the team that wins the flip also gets the first possession in overtime. The function of winning will change to:

$$\text{Winning}_{NFL} = f(\text{talent, management, team, coin flip})$$

This shows that as regulation ends, the original function for winning changes to include the coin flip. Because of this, professional football teams will not look at this as a continuous function.

In both leagues teams have a strong incentive to win in regulation, but due to the structure of the overtimes, college football teams will be more willing to proceed to overtime, whereas professional teams are not. This difference in overtime causes different reactions in the fourth quarter of play. Because the function of winning is continuous for college football, but is not in the NFL, a change in the strategy, should it exist, is measurable. It is also important to point out that I am assuming that the margin of victory is irrelevant; in close games teams do not care if they win by 1 or 10, they just want to win.

III. BANKRUPTCY BEHAVIOR, RISK-SHIFTING, END GAMES, AND SPORTS

a. Bankruptcy Behavior

When debt exists, the payoff function for a shareholder is kinked. Any revenue made up to the value of the loan goes directly to the lender. Under a kinked payoff function an agents' optimal level of production changes, depending on their position on the curve and expected value of the company. If a business begins to fail, and the value of the company falls below the amount owed to the bank, shareholders' (and agents') incentives change. At this point the agent becomes willing to take on high risk projects in order to make money, ignoring the incentives of the lender who will have to be paid back if (and only if) the project works.

This situation is nothing new. The fundamental conflict of interest between shareholders and bondholders has been recognized as early as Adam Smith: in good times, the

shareholders are treated to excess returns, but in bad times the stockholders lose their investment. It is during these bad times, where the classic example says the company (shareholders) will want to take on riskier projects than those sanctioned by the creditors when the debt was issued. However, this is also the time when the shareholders (to whom the boards' responsibilities lie) want to make money beyond what they owe their creditors. Therefore, the company shifts production from current non-money making ventures to projects with high expected returns, increasing their risks, and thus acting with bankruptcy behavior. Research further developed as Galai and Masulis (1976) and Myers (1984) discuss the idea of a firm increasing its leverage above an optimal point, which causes risk-shifting to occur.

This problem is particularly acute when the firm is in financial distress. Daigle and Maloney (1994) find that of 41 bankruptcies from 1979-1990, 33 cases had reports of behavior that would be considered asset substitution. That is, the firm paid out to stockholders or started new lines of business, which is what they refer to as bankruptcy behavior.

b. Risk Shifting

Eisdorfer (2008) provides evidence of risk shifting behavior in the investment decisions of financially distressed firms. The act of risk shifting, which can also be called bankruptcy behavior, occurs when firms are finically distressed and have an incentive to take on negative-NPV (Net Present Value) projects because they will reap benefits if things go well, whereas the bondholders bear the cost if things go poorly. As Eisdorfer points out, there is little empirical evidence of whether the problem actually exists.

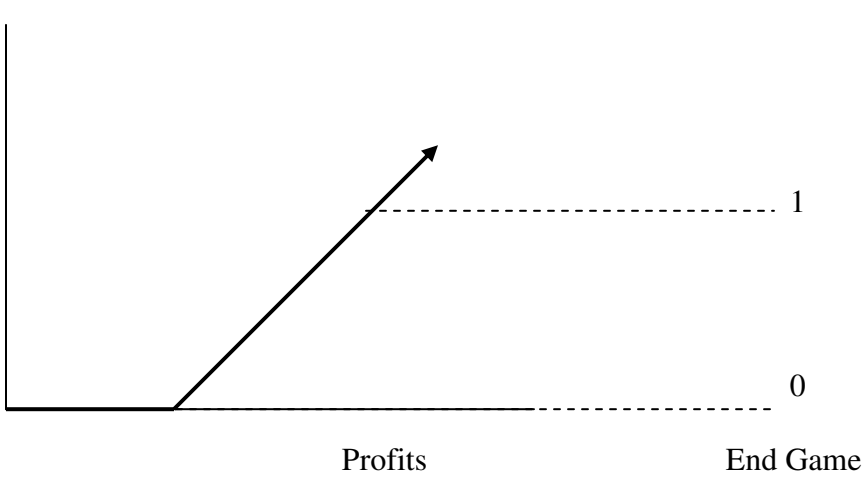
Early research (Galai and Masulis 1976 and Jensen and Meckling 1976) introduced theoretical ideas to mitigate the risk-shifting problem problem. The ability to reduce share-holders incentives to take these risks have found mixed results (Smith and Warner 1979, Barnea, Haugen, and Senbet 1980, Titman and Wessels 1988, Friend and Lang 1988, Frierman and Viswanath 1993, Barclay and Smith 1995b, Cheney and Gibson-Asner 2001, and Hennessy and Tserlukevich 2004). The connection of risk-shifting and debt maturity has been looked at by Barclay and Smith (1995a) and Guedes and Opler (1996) along with using managerial compensation contracts to mitigate this problem by Brander and Poitevin (1992), and John and John (1993).

It is obvious from the previously mentioned studies that this issue has been researched from a variety of different angles. This study will add to the literature on risk shifting activities by finding additional evidence of risk shifting activities in a unique setting.

c. End Games

As a company faces a kinked payoff function, the incentive to act with bankruptcy behavior arises. End game scenarios simulate the same payoff situation:

Figure I.



In an end game scenario the payoff function is binary (win or lose), rather than kinked, but the outcomes are observationally equivalent due to the skewed incentive structures. Either the venture will be successful, and profit, or the venture will not be successful, and will not profit. By definition, this is not bankruptcy behavior because there is no shifting of the cost burden to others. However some teams will still take increased risks, thus acting as if they have bankruptcy behavior.

Acting with bankruptcy behavior can be thought of as a politicians' term coming to an end. At the point in time when they are vying for re-election, they will change their policies in order to obtain the votes necessary for re-election. If they use current, or future, tax payer dollars to fund projects that are likely to get them re-elected, they will be using tax dollars not because they are socially optimal, but rather because it increases their re-election chances at the cost of the tax payer. In this situation the tax payer would be the bondholder, while the politician would be the residual claimant. A form of this has been shown with lame duck offices, in terms of 'midnight regulations' (Cochran 2001 and Davies and de Rugy 2008) and with less scrutiny from the agencies that produce them (McLaughlin 2008). Cochran (2001) says this exists because of the "'Cinderella constraint.' Simply put, as the clock runs out on an administration's term in office, would-be Cinderellas—including the President, Cabinet officers, and agency heads—work assiduously to promulgate regulations before they turn back into ordinary citizens at the stroke of midnight." Although this has been shown for lame duck offices, a similar idea is expected to occur during re-election campaigns.

This behavior can also be viewed in football, which is the focus of this paper. The overtime structure can change the strategy of the game in different leagues. Because teams in the NFL have something outside of the teams' control determining the outcome of the game (the coin flip), if it proceeds to overtime, they will act differently when the chance of overtime is imminent. The team will take on risky activity, or negative-NPV projects, in order to avoid overtime. In this situation the team would be the residual claimant, although there is no bondholder at this point. This difference in overtime causes the NFL teams' strategies to change, which causes them to act as if they have bankruptcy

behavior. This change in strategy illustrates how the overtime structure creates moral hazard, and thus causes them to act as if they have bankruptcy behavior.

d. Sports

Sports provide a controlled environment which makes it possible to measure things that can be difficult to test in a corporate setting. This works because both teams have to play at the same time, on the same field, in the same weather, etc. meaning that most of the variables that are commonly used (or would have been used) as controls are not needed. These are naturally controlled for, through the set-up of the game. Because this paper uses data on a team's score relative to their opponent's score, each game used will control for field characteristics and weather. Also because I only use games that are close at the end of the third quarter, in general the talent on the field should be similar.

Economists have used sports for years to answer many questions. Examples of research in sports include issues in discrimination (Goff, McCormick, and Tollison 2002 and Price and Wolfers 2008), misbehavior (Levitt 2002 and Kendall 2008), tournament theory (Lazear and Rosen 1981, Maloney and McCormick 2000 and Brown 2008), the Alchain-Allen theorem (Bertonazzi, Maloney, and McCormick 1993 and Brown, Rascher, McEnvoy and Nagel 2008), efficiency (Romer 2006, and Hakes and Sauer 2007), and economic impact (Baade and Dye 1988, Coates and Humphreys 2003 and Jasina and Rotthoff 2008). The controlled environment provides a great place to test both economic and financial theories.

Poulsen (2008) shows how risk shifting can be illustrated in football: "Woody Hayes, the legendary Ohio State University football coach known for grinding out yardage on the ground, used to say that three things can happen when you pass the ball, and two of them are bad. His philosophy is sound in a close game; in that case it is best to play conservatively and avoid the risk of incompletion or interception. But if you're down by three touchdowns in the fourth quarter, a conservative strategy will not get you back into the game quickly. Instead, you should throw a bomb—a long pass. True, the ball might be intercepted or fall incomplete, but if you were going to lose anyway, the downside is not that bad. On the upside is the chance of a big payoff—a touchdown. How does this relate to shareholders and bondholders? If it looks as if the firm will not be able to cover its obligations and thus the equity claim is worthless, shareholders may throw the bomb, i.e., take on risky projects that have big payoffs but high probability of failure. If the project does fail, bondholders lose, but the shareholders are no worse off since their claims were worthless anyway. But if the project succeeds, the shareholders will be the major beneficiaries."

Although the 'Hail Mary' pass is commonly though of as an example of this (Mahar and Paul 2003), or a hockey team pulling the goalie, the last play of the game doesn't give the whole picture. To measure if this action is detectable in the game, or if the overtime structure change the strategy of the game, it will be more valuable to see if this occurs throughout the fourth quarter of play.

IV. DATA

Using data from ESPN.com, I have collected game scores, by quarter, for all Division IA college football games from 2003-2007. I also have collected all NFL games from 2002-2007, from NFL.com. NFL teams have more games per season, but college has more teams. Therefore, I have a total of 1,582 professional games and a total of 3,780 college games.[5] Of these games, 6.6% of the professional games went into overtime (104) and 4.5% of the collegiate games went into overtime (171). There are a higher percentage of games going to overtime in the NFL which is representative of the increased parity in the league.

Paul Tagliabue, the NFL commissioner, said "There has been a trend in the last seven or eight seasons that the team winning the toss in overtime wins the game. That advantage of receiving the ball first is becoming unbalanced." (New York Times, 2003) This is also supported by Peterson (2004) who found that from 1974-2003 there were 365 overtime games in the NFL. In 72% of those overtime games, both teams had at least one possession. When the team won the toss, that team won 52% of the time. 44% of the teams that lost the toss won the game, with 5% tying.[6] Peterson goes on to point out that these numbers are missing an important change in the league. In 1994 there was a change in the kickoff rule; kickoffs were moved back 5 yards to the 30-yard line. Since this rule change, nearly one third of all games have been won on the opening possession, as opposed to slightly more than a quarter of the games under the old rule. Peterson says that it has been confirmed, by Richard E. Hawkins at Pennsylvania State University at Dubois, that before the rule change the coin flip did not matter, but after the rule change there is a statistical advantage to those who win the flip.

In my sample, there were 103 overtime games in the NFL; 63 were won by the team who won the coin flip (61%), and all of which were played after the kickoff rule change. The data lack information on whether both teams had a possession, but as the data seems to fall in line with Peterson and Hawkins, I assume that teams do believe that those who win the toss are more likely to win the game.

Because the NFL faces an overtime that can be determined by something other than the ability of the players, the team will view this as an end-game scenario. The fourth quarter of the regular game is the last chance the teams' decisions have an affect on the game; during this fourth quarter, should it exist, bankruptcy behavior will be observed.

[5] The games are for all Division IA schools. I include any game that has a D-IA opponent, even if the other school is not a D-IA school.
[6] I assume Peterson's numbers don't add to 100% due to rounding error.

Table I:

Overtimes by Year	NFL	College
2002	25	[No Data]
2003	26	33
2004	14[7]	32
2005	14	39
2006	12	34
2007	13	33
Total	103	171

V. METHODOLOGY AND RESULTS

To examine if teams act with bankruptcy behavior, I compare how college and professional teams behave when faced with the possibility of overtime. So the question is, do NFL teams act differently in the fourth quarter, or when in an end-game scenario, than a college football team relative to the other quarters of play. To test this I will look at scoring patterns throughout the game.

When looking at bankruptcy behavior, teams will only behave differently when the game is on the line. For that reason, I will look at only games that are close. I determined that a game that is within two scores to be close, or a game that is within 14 points after the third quarter is over.[8] When I drop observations that have a point spread of more than 14 points after three quarters, the NFL has 1187 of the 1582 games left (or 75%) and college has 2127 of the 3780 games left (or 56%).[9]

[7] It is not obvious why this dropped so much from 2003 to 2004.
[8] All the regressions have been done for 3, 7, 8, 10, and 16 points. The results are consistent.
[9] This is also an example of increased parity in professional football relative to college football.

When looking at the average scoring by quarter, scoring spikes in the second and fourth quarter in both college and professional football as seen below:

Table II:

NFL:				
	Q1	Q2	Q3	Q4
Away Team	3.51	6.02	4.13	5.92
(Std. Dev)	(4.02)	(4.72)	(4.29)	(5.29)
Home Team	4.35	6.27	4.32	6.33
(Std. Dev)	(4.34)	(4.95)	(4.31)	(5.37)

Table III:

College:				
	Q1	Q2	Q3	Q4
Away Team	5.17	6.71	5.15	6.23
(Std. Dev)	(5.11)	(5.54)	(4.98)	(5.73)
Home Team	5.67	6.97	5.27	7.25
(Std. Dev)	(5.10)	(5.59)	(5.06)	(5.96)

To test the change in the standard deviation, we can look at the standard deviation measures in a variance ratio test.

$$VarianceRatio = \frac{SD : College}{SD : NFL}$$

Table IV – Variance ratio test:

Std. Dev.	Close Games only			
	Q1	Q2	Q3	Q4
NFL	4.198	4.840	4.308	5.336
College	5.111	5.567	5.023	5.873
pr (college/pro) = 1	0	0	0	0
f-test =	1.4823	1.3233	1.3594	1.2113

It is expected that both the NFL and college football teams will increase their scoring activity in the second and fourth quarters as time expires. The question will then be, how can it be determined if NFL teams are changing their scoring patterns in the fourth quarter differently than college teams. Using a variance ratio test, measuring the standard deviation (SD) of college scoring relative to the SD of NFL scoring will tell us if they are consistently scoring throughout the game. The f-test gives us the measure of how close these are to one, so as the f-test is lower the ratio is closer to one. Although the effect is not statistically significant, we see the f-test drops a lot in the fourth quarter, revealing the SD of scoring for the NFL increases more than the SD for college football, providing some support for the idea of bankruptcy behavior in the NFL.

Although this gives some support for bankruptcy behavior, the lack of statistical significance means more is required before I can say that these risk shifting activities do occur in the NFL. I will do four more tests to check for bankruptcy behavior.

Tests:
a. Correlation Among Quarters
b. Consistent Scoring
c. Scoring Relative to your Opponent
d. Regressed on Each Quarter

a. Correlation Among Quarters:

Another way to look at this is by examining the correlation of scoring between different quarters. If the correlation of scoring in the fourth quarter is different than quarters one through three, or if scoring in the fourth quarter of the college data is different than scoring in the fourth quarter of the NFL data, then information can be obtained from these scoring patterns.

Table V:

Correlation Matrix, NFL

	Q1	Q2	Q3	Q4
Q1	1.0000			
Q2	-0.1006	1.0000		
Q3	-0.0690	-0.0563	1.0000	
Q4	0.0291	0.0091	0.0101	1.0000

Table VI:

Correlation Matrix, College

	Q1	Q2	Q3	Q4
Q1	1.0000			
Q2	-0.0872	1.0000		
Q3	-0.0512	-0.0585	1.0000	
Q4	0.0614	0.0264	0.0621	1.0000

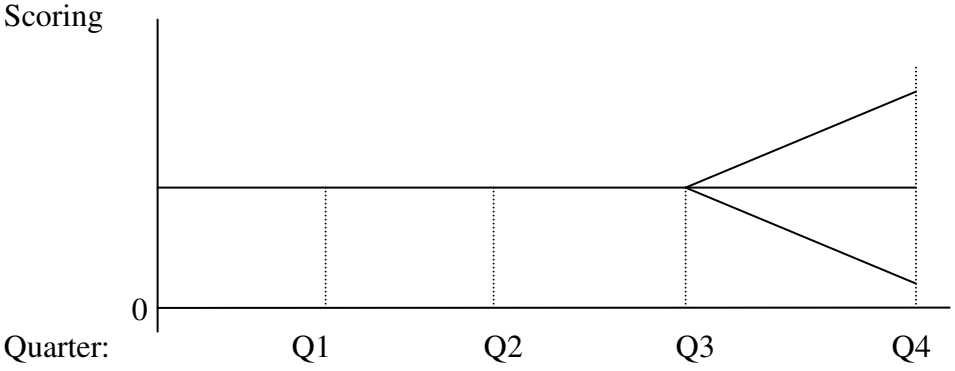
Looking at the bottom row of each of the above tables (V and VI) shows that although the fourth quarter is not very correlated with any of the other quarters, the correlation is higher in college than it is in the NFL. An explanation for the fourth quarter to be relatively more correlated within college football (when compared to the NFL), is that bankruptcy behavior is occurring in the NFL. This does not show any statistical support for bankruptcy behavior, but it does not refute it.

b. Consistent Scoring:[10]

To examine this activity more closely, I look at scoring over the duration of the game. If a team has the ability to score in the first quarter, they should have the ability to continue to score each quarter after that. I look at scoring over the quarters to see if it is consistent. More specifically I want to know if there is something different about the scoring in the fourth quarter relative to the rest of the quarters.

Graphically, if scoring is consistent, the line will remain smooth. If not it will remain smooth until the fourth quarter, where the scoring pattern will change if we observe bankruptcy behavior:

Figure II:



$$Q\,(t+1)_i = \beta_0 + \beta_1 Qt_i + e$$

Where Qt_i is the quarter t and i is for the NFL or college football. If teams score consistently throughout the game, a good predictor of the 2nd quarter score should be the 1st quarter score, and so on.[11]

[10] Although robustness checks b, c, and d reveal information, the regressions have very low predictive powers (low R-squares). However, they do signal something about the data with significant variables, despite not having meaningful magnitudes.

[11] This regression is run with a constant, but it is not reported for simplicity.

Table VII:

	NFL:	College:
	Q t+1	Q t+1
Q1	-0.116	-0.095
	(4.93)**	(5.71)**
Q2	-0.05	-0.053
	(2.75)**	(3.82)**
Q3	0.013	0.073
	(0.49)	(4.06)**
Obs	2374	4254
R-Squared	0 - 0.01	0 - 0.01

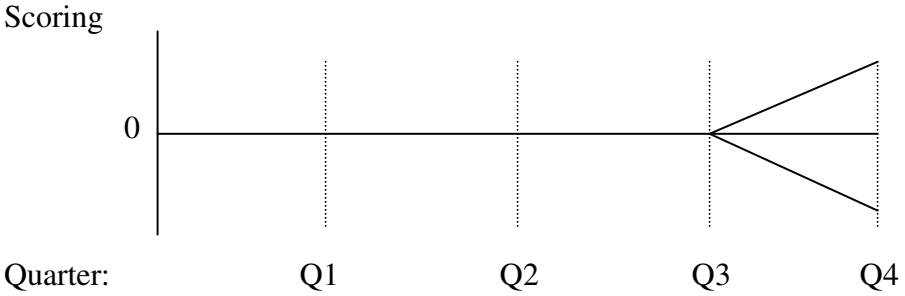
Absolute value of t statistics in parentheses
* significant at 5%; ** significant at 1%

Table VII shows that in the NFL, the first three quarters seem to be related to the previous quarter, but the fourth quarter is independent; while in college, all four quarters are significantly related to each previous quarter. This supports the existence of bankruptcy behavior in the NFL.

c. Scoring Relative to your Opponent:

Because the sample is restricted to games that are within two touchdowns after the third quarter, the home team's scoring relative to the away team should also be relatively consistent throughout the game. This should be true unless there is bankruptcy behavior in the fourth quarter, at which time the score would become different (but in which way it would go is a different question). If bankruptcy behavior is evident in the NFL, the fourth quarter outcomes should vary, while the scoring should remain constant in the fourth quarter for college football.

Figure III:



$$Q1a_i = \beta_0 + \beta_1 Q1b_i + e$$

Regressing Q1a (the away team's score in the first quarter) on Q1b (the home team's score in the first quarter) should, on average, have a significant relationship. Regressing Q4a and Q4b should diverge in the NFL if bankruptcy behavior prevails, but not in

college. The following charts show how the scoring is related when the home teams score is regressed on the away teams score, by quarter.

Table VIII:

NFL:

	Q1a	Q2a	Q3a	Q4a
Q1b	-0.01			
	(0.36)			
Q2b		0.013		
		(0.45)		
Q3b			0.038	
			(1.32)	
Q4b				0.015
				(0.52)
Constant	3.562	5.937	3.971	5.833
	(21.52)**	(26.81)**	(22.47)**	(24.50)**
Observations	1184	1184	1184	1184
R-squared	0	0	0	0

Absolute value of t statistics in parentheses
* significant at 5%; ** significant at 1%

Table IX:

College:

	Q1a	Q2a	Q3a	Q4a
Q1b	0.024			
	(1.12)			
Q2b		0.073		
		(3.38)**		
Q3b			0.057	
			(2.66)**	
Q4b				0.044
				(2.11)*
Constant	5.033	6.205	4.851	5.912
	(30.36)**	(32.38)**	(31.14)**	(30.21)**
Observations	2127	2127	2127	2127
R-squared	0	0.01	0	0

Absolute value of t statistics in parentheses
* significant at 5%; ** significant at 1%

As seen in table IX, in college the scoring between teams is related to the opponent's scoring, whereas in the NFL (table VIII) each quarter's scoring is independent of the opponent's scoring. Although the NFL scoring is not consistent through the first three quarters, it is still inconsistent during the fourth quarter where it is consistent in college football. This shows no support for bankruptcy behavior, but also does not refute bankruptcy behavior in the NFL.

d. Regressed on Each Quarter:

Another way to look at this, in a similar manner, is to look at a regression of all quarters (independently) on fourth quarter scoring. Q4 is the fourth quarter, where t will be all other quarters and i is the NFL or college scoring.

$$Q4_i = \beta_0 + \beta_1 Qt_i + e$$

Table X:

	NFL: Q4	College: Q4
Q1	0.04	0.078
	(1.51)	(4.43)**
Q2	0.014	0.038
	(0.63)	(2.37)*
Q3	0.016	0.079
	(0.63)	(4.42)**
Constant	5.816	5.644
	(23.62)**	(27.40)**
Observations	2374	4254
R-squared	0	0.01

Absolute value of t statistics in parentheses
* significant at 5%; ** significant at 1%

As seen above in table X, when an NFL game is regressed on the fourth quarter there is no significance. The scoring that occurs in the fourth quarter is independent of the other quarters played for the NFL. In college football data, the fourth quarter is significantly related to scoring in the other quarters. Because the fourth quarter is related to the other quarters in college football, but not in the NFL, this supports bankruptcy behavior in the NFL.

VI. CONCLUSION

Bankruptcy behavior occurs in business when the person in charge tries to make a last ditch effort to make money. They take on high risk/high reward projects, which they might not normally take, because they believe they have no other option to obtain a positive outcome.

High risk/high reward behavior can also happen in football. In the National Football League, an overtime game goes to the team that scores first. However, in college, when a game goes to overtime each team gets a chance to score and the winner is whoever scores more points, given equal attempts for each team. Because of this rule difference, moral hazard exists in the NFL and they act differently than college teams when overtime is likely. Moral hazard, which happens in an end game scenario, causes NFL teams to take on risky plays, or act with bankruptcy behavior.

Using data of scoring by quarter for both college and NFL games that were close in the fourth quarter, I find evidence that bankruptcy behavior exists in the NFL. Looking at scoring variation by quarters, it is noticeable that the variation increases more in the NFL than in college. This by itself is interesting, but is insignificant and thus doesn't reveal for sure if bankruptcy behavior exists. To confirm the existence of bankruptcy behavior, I conduct four more tests:

a. Correlation Among Quarters: Does not refute
b. Consistent Scoring: Supports
c. Scoring Relative to your Opponent: Does not refute
d. Regressed on Each Quarter: Supports

With all four producing similar results, either supporting the hypothesis or not refuting it, I conclude that NFL teams act with bankruptcy behavior in close games. This is interesting in light of the fact that the NFL believes their overtime structure has no adverse affects on the game, although I am in no way implying that this has a positive or negative affect.

Other methodologies could be used to measure these activities as well. It would be interesting to look at the number of fumbles, interceptions and turnovers, and how these statistics change in close games. In addition, yards per play, on average, should change in the fourth quarter if bankruptcy behavior exists. Testing these would be value enhancing to this analysis, but due to data limitations, I leave them to future research.

Another issue for future research is how teams tire as a game proceeds. It is often thought, although to my knowledge never shown, that defenses tire throughout the game at a different rate than the offense. If this is true, then this could affect why scoring changes are different as the game goes on.

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