

Article

The Effects of the Clock and Kickoff Rule Changes on Actual and Market-Based Expected Scoring in NCAA Football

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Abstract: Clock rule changes were introduced in the 2006 season with the goal of reducing the average duration of the game; these changes were reversed in 2007. In addition, in 2007 the kickoff rule was changed to create more excitement and potentially more scoring. We examine what happened to actual and expected scoring during these National Collegiate Athletic Association (NCAA) football seasons. The clock rule change in 2006 led to lower scoring which was not fully encompassed in the betting market, leading to significant returns to betting the under. Multiple rule changes in 2007 led to volatility in the betting market that subsided by season's end.

Keywords: rule change; amateur sports; scoring; gambling; betting; market efficiency; prediction markets

JEL Classification: L83

1. Introduction and Literature Review

Regulation and rule changes are instituted in business and in sports for a variety of reasons. In some cases regulation is introduced to protect consumers or players. In other cases, changes in rules occur to

simply increase revenues, lower costs, or achieve both simultaneously. When rules or regulations are changed, it provides a natural framework to perform a case study as to the financial ramifications of the changes to determine if they match the stated goals of the policy. Just as important and interesting is to study the market expectations of rule and regulation changes through financial markets. Understanding how financial markets performed before, during, and after rule changes provides insights into the thoughts and minds of investors and allows for testing of the efficient markets hypothesis.

The testing of stock price movements as they relate to accounting rules and regulation date back to the classic study of Fama *et al.* [1], where the role of new information on security prices was formally investigated. Over time, many research papers have investigated the role of regulation announcements and the implementation of regulations on stock prices (*i.e.*, Binder [2,3] and Schwert [4]). These studies on stock price movements relate back to the testing and further understanding of the implications of the efficient markets hypothesis (Fama [5,6]). Specific examples of where case studies of financial regulation on stock prices were performed include investigation of Sarbanes-Oxley (Jain and Rezaee [7]; Zhang [8]), Garn-St. Germain (Millon-Cornett and Tehranian [9]), Glass-Steagall Act: Section 20 (Cyree [10]) and reviews of bank regulation in general (Millon-Cornett [11] and Carow and Kane [12]).

Financial research into investor sentiment and feelings has been performed on a variety of fronts and is summarized in a literature review by Lucey and Dowling [13]. The role of investor feelings has been used to study stock market response to sporting events, where stock prices are examined and abnormal returns (if any) are calculated following sports contests. These findings have led to considerable debate in the literature surrounding market returns related to English football (soccer) on the London Stock Exchange (FTSE) (Ashton *et al.* [14,15] and Klein *et al.* [16]). Bell *et al.* [17] used a similar concept to study stock market returns of publicly-traded soccer clubs as it related to match results and expectations. Edmans *et al.* [18] studied sports sentiment and stock returns for major international sporting events such as the world cup and international cricket, rugby, and basketball.

It is also possible to study the expected and actual influences of rule changes on gameplay within a sport itself through the investigation of sports betting markets. Sport betting markets are simple financial markets which allow market participants to wager on the outcome of a game or the total number of points scored in a game through prices expressed as point spreads, totals, or odds.

Although sports gambling markets are simple in nature, they are quite popular, with estimates for annual sports wagering by the American Gaming Association being over \$3 Billion in Nevada (legally) and \$380 Billion illegally across the United States [19]. Rule changes that impact the style of play can be investigated through changes in betting market prices before games are actually played and changes to these prices can be tracked over time. In general, financial studies of sports wagering markets have been unable to reject market efficiency for large overall samples of games across sports. Sports betting markets were assumed to behave under the balanced book hypothesis, where point spreads and totals were assumed to be set to even the betting dollars on each side of the wagering proposition. If achieved, this would allow the sports book to profit without risk in this market, due to the commission charged on bets (a bet \$11 to win \$10 rule). Recently, Levitt [20] challenged the balanced book hypothesis showing that sports books are not balanced as bettors consistently prefer the favorite in data from a betting market tournament. Paul and Weinbach [21] confirmed this result with

betting market percentage data on sides (wagers on a team compared to the point spread) and totals (over/under bets) through data from actual on-line sports books.

Two studies that investigated betting market expectations related to rule changes in sports were Paul *et al.* [22] and Paul and Paul [23]. When the National Football League introduced the two-point conversion rule, it was found that the frequency of posted point spreads increased around key numbers such as three (a field goal differential). The increase in frequency of these key numbers outpaced the frequency of game outcomes of three by a wide (statistically significant) margin [22]. This change in policy by the sports book likely helped them from the greater likelihood of being “middled” (losing both sides of a wager) in NFL games.

Another instance where the betting market adjusted to a rule change was in the National Hockey League. When the NHL eliminated ties in games by adding a shootout, the totals (over/under) market went through a major adjustment. Overall scoring increased by nearly a goal-per-game, but the betting market actually over-adjusted early in the season. This led to profitable returns for under bettors [23] in the totals market. By the end of the season, however, the market appeared to completely adjust to the new rule changes as expected scoring mimics actual scoring within the league.

Two significant rule changes were undertaken by the National Collegiate Athletic Association (NCAA) Football Rules Committee for the 2006 and 2007 seasons. In 2006, the clock rule was introduced to change the timing on plays and reduce the length of college football games. In 2007, this rule was reversed, but the committee also introduced a new kickoff rule to induce more returns by moving the kickoff spot back by 5 yards (from the 35 to the 30 yard line). The goal of our research is twofold. We examine the impact of these rule changes to determine how they impacted actual and expected scoring. We study if the rule changes had the anticipated impact on scoring by investigating total points scored (actual scoring) and the betting market total on the game (expected scoring). We aim to determine if the market anticipated the changes in scoring and how quickly it adjusted. When the 2006 rule was reversed and the new rule was introduced in 2007, we examine which effect had a bigger impact on scoring, the clock rule or the kickoff rule. The overall goal of this research is to determine how the NCAA football rule changes impacted on-field play and how the betting market reacted to these changes before, during, and after their initiation.

The NCAA is the governing body for major collegiate sports in the United States, with supervision of different sports for over 1200 colleges and universities. Major collegiate football is referred to as Division I, and this division currently has two subdivisions: the Football Bowl Subdivision (FBS) and the Football Championship Subdivision (FCS). The FCS uses a single-elimination playoff system to determine a champion; the teams participating in the playoffs are selected by an NCAA FCS committee. The FBS is significantly different from the FCS in two ways: (1) the FBS has a series of bowl games at the end of the regular season; and (2) the champion is not determined by the NCAA but rather by the Bowl Championship Series (BCS). While the authority of the BCS is sanctioned by the NCAA, this is the only NCAA sporting division that does not finish with an NCAA championship [24].

To expand upon the details of the rule changes and to obtain some semblance of the expectations related to these rule changes, consider the following details and quotes related to the rule changes in college football for the 2006 and 2007 seasons. Prior to the start of the 2006 college football season, the NCAA Football Rules Committee made “recommendations concerning the length of the game” in an attempt to shorten the duration of football games [25]. The recommendations included:

- (1). Starting the clock on kickoffs when the foot touches the ball, not the returning team;
- (2). Starting the clock when the ball is ready for play on a change of possession; and
- (3). Shorten the halftime allowance from 20 to 15 minutes.

According to NCAA Football Rules Committee chair and football coach at Pittsburg State Charles Broyles, “We looked at quite a few proposals to shorten the game... Starting the clock on the change of possession is probably our biggest change. We think this is a good change and that this will help reach our goals in this area [26].” Broyles was correct; Steve Wieberg wrote, “College football’s rules makers got what they wanted: a faster, shorter game.” He reports, of the opening week games, that in 2006 31 of the 72 games were completed in 3 hours or less, with four lasting as long as 3.5 hours. In 2005 only five of 52 games completed in 3 hours or less; 13 went 3.5 hours or longer [26].

Coaches noticed that these changes had an impact on play. West Virginia coach Rich Rodriguez stated, “Normally, in most games, you have 12 or 13 possessions. We had 10 on offense.” He went on to say, “So you’ve really got to make things happen offensively.” In a similar vein, South Florida coach Jim Leavitt noted, “People are very aware of the speed of the game right now [26].”

However, early in the season there did not appear to be many coaches viewing the changes as particularly problematic to game management. Texas Tech coach Mike Leach noted, “I don’t think they’re too hard to work around.” However, he also added, “I just think it’s dumb to shorten these games that have been a perfectly good length for years and years [26].”

Coach Leach’s assessment was ultimately shared by other coaches. According to Steve Wieberg [27], “Coaches hated the moves (the clock rule changes).” The NCAA rules oversight panel voted to eliminate the clock rule changes “... used last year that helped shave 14 minutes off of game times [28].” Additionally, the panel decided to change the kickoff from the 35 yard line to the 30 yard line beginning with the 2007 season. According to the football rules committee spokesman, Ty Halpin, the proposed justifications for changing the kickoff rule in NCAA football include creating “...more opportunities for what the committee feels is one of the most exciting plays in a game, and we’re not really sure, but it may increase scoring, too [29].” This was mirrored by Dave Parry, national coordinator of NCAA football officiating, who stated, “It will create a little more excitement, and we’ll get a little more movement of the ball [30].”

A number of coaches have commented regarding this rule change on scoring. According to Kentucky head coach Rich Brooks, “It’s going to be one of the most significant rule changes to come around in a decade.... You’re going to see scoring averages go up because of this rule change.” Auburn head coach Tommy Tuberville stated, “It will add more points to the scoreboard [31].” Mark Nelson, Louisville’s special teams coach, made the following prediction: “Add about seven points to the total score of every game [32].”

Regardless of the sport, rule changes are usually made with specific intentions. Often, rules are changes with the goal of increasing interest in the game. Bannerjee and Swinnen [33] investigated FIFA’s introduction of the golden goal rule, to “stimulate more attractive football” and Bannerjee *et al.* [34] noted that the NHL’s rule change regarding overtime results was done “in an effort to stimulate a more exciting and entertaining style of play.”

The effects of rule changes in sports have covered a variety of other topics as well. These include the effects of rule changes on competitive balance in Formula 1 racing [35], Japanese professional

baseball [36], and across North American major sports leagues [37]. Still other works address the effects of rule changes on strategy and play style; Guedes and Machado [38] examine the effect of FIFA’s increase in the number of points awarded to winning a game on offensive efforts and Moschini [39] finds that the change led to a statistically significant increase in the expected number of goals. Banjeree *et al.* [34] investigate the NHL’s overtime rules change on play style during the both the regular and overtime periods. McCannon [40] investigates the effect of the three-point line being extended on men’s NCAA basketball finding that the change led to a decrease in three-point shooting and scoring along with a decrease in the percentage of successful two-point shots. Regarding rule changes and penalties, Witt [41] evaluates the effects of FIFA’s rule change regarding the increase in offenses qualifying as red-card worthy on the number of the number and types of penalties called.

This paper presents results concerning the effects of NCAA Football rule changes in 2006 and 2007 on total scoring, scoring margin, and competitiveness of the games. These results are then compared to what happened in the financial (betting) market for college football totals. The outcomes between actual and expected scoring due to the rule changes are compared. These results are then compared to the preseason predictions of the rules committee, the officials, and a variety of coaches. The next section provides analyses of the actual scoring data and findings. Section 3 presents the results from the totals betting market. Section 4 discusses the findings and concludes the paper.

2. Actual Scoring and Outcomes

The actual scoring data used in this study consists of the final scores from NCAA Division I football games in the 2005, 2006 and 2007 seasons. This includes all 2308 games involving at least one Division I Football Bowl Subdivision (FBS) team. The complete data set will be used in the overview provided in the next section. However, 364 matchups, totaling 1092 games, were played in each of the three seasons. To avoid dependence issues, most of the analysis was conducted using difference scores for these repeat matchups.

Table 1 presents summary statistics for the scores of the three seasons in six categories. In five of the six categories the total scoring decreased from 2005 to 2006 then increased with the 2007 season to a higher mean than that of the 2005 season. The exception was BCS bowl games as scoring in 2007 did not exceed that of the 2005 season.

Table 1. Summary scoring statistics for the 2005–2007 seasons.

		2005 Mean (StDev)	2006 Mean (StDev)	2007 Mean (StDev)			2005 Mean (StDev)	2006 Mean (StDev)	2007 Mean (StDev)
All games	Total score	52.60 (17.20)	47.53 (16.12)	55.41 (18.69)	Bowl games	Total score	56.61 (19.80)	51.44 (16.54)	57.69 (20.63)
	Winning score	35.11 (12.14)	32.51 (11.46)	36.46 (12.32)		Winning score	33.75 (10.32)	32.09 (8.917)	35.56 (13.06)
	Losing score	17.49 (9.852)	15.02 (9.448)	18.95 (10.99)		Losing score	22.86 (11.73)	19.34 (10.54)	22.12 (11.00)
	Margin	17.62 (13.90)	17.49 (13.47)	17.51 (14.00)		Margin	10.89 (9.814)	12.75 (10.37)	13.44 (12.55)
	N	718	792	798		N	28	32	32

Table 1. Cont.

		2005 Mean (StDev)	2006 Mean (StDev)	2007 Mean (StDev)			2005 Mean (StDev)	2006 Mean (StDev)	2007 Mean (StDev)
Non-conference games (reg. season)	Total score	52.13 (16.92)	47.88 (15.37)	54.20 (18.05)	BCS Bowl games	Total score	63.75 (14.5)	56.40 (17.60)	60.00 (12.27)
	Winning score	36.97 (13.33)	34.76 (12.19)	38.05 (13.28)		Winning score	34.75 (6.500)	36.20 (8.044)	40.00 (10.08)
	Losing score	15.16 (9.484)	13.13 (9.381)	16.15 (10.56)		Losing score	29.00 (8.832)	20.20 (12.34)	20.00 (6.892)
	Margin	21.80 (15.77)	21.63 (15.39)	21.91 (15.81)		Margin	5.750 (5.550)	16.00 (11.14)	20.00 (12.15)
	N	239	303	316		N	4	5	5
Conference games (reg. season)	Total score	52.61 (17.18)	47.03 (16.57)	56.09 (18.97)	Non-BCS Bowl games	Total score	55.42 (20.55)	50.52 (16.51)	57.26 (21.98)
	Winning score	34.22 (11.48)	31.06 (10.89)	35.40 (11.43)		Winning score	33.58 (10.92)	31.33 (9.000)	34.74 (13.54)
	Losing score	18.39 (9.661)	15.97 (9.186)	20.69 (10.89)		Losing score	21.83 (11.99)	19.19 (10.43)	22.52 (11.66)
	Margin	15.83 (12.46)	15.08 (11.47)	14.71 (11.78)		Margin	11.75 (10.19)	12.15 (10.34)	12.22 (12.46)
	N	451	457	450		N	24	27	27

The margin of victory was relatively stable for non-conference games over the period while the margin decreased in conference games. It was also relatively stable for non-BCS bowl games in both the 2006 and 2007 seasons. However, note that the margin of the BCS bowl games increased from 5.5 points in 2005 to 16 points in 2006, and then to 20 points in 2007. This coincides with the winning teams increasing scoring and the losers decreasing scoring in these games, on average.

These increasing scoring margins coincided with a decline in average BCS bowl game television ratings, from Nielson ratings of 13.98 in 2005–2006 to 9.52 in 2007–2008. This corresponds with the findings of Salaga and Tainsky [42] in their work on Neilson ratings for BCS games; their results indicate that increases in the margin at a given quarter decrease ratings. The previously mentioned study investigates the uncertainty of outcome hypothesis while Grimshaw *et al.* [43] examines TV audiences for the NCAA men’s basketball Final Four games based on a consumer theory model. Future research into the factors affecting TV audiences for these games is warranted due to the financial stakes; the 2011–2014 television deal generates \$155 million per season for the BCS while the upcoming contract is estimated at \$470 million per year [42]. Given six BCS games in the upcoming season then the per-game figure is approximately \$78.3 million. For the sake of comparison, the NCAA men’s basketball tournament’s television deal currently averages \$771 million per year [43]. However, excluding any play-in games there are 63 games in this tournament resulting in a per-game figure of approximately \$12.2 million. Table 2 presents summary statistics for each of the BCS automatic bid conferences. This summary information reveals that the margin of victory decreased for these conferences between the 2005 and 2007 seasons. In five of the six conferences this is driven by increases in the losers’ scores.

Table 2. Scoring statistics for Bowl Championship Series (BCS) Automatic Bid Conferences.

		<i>2005 Mean (StDev)</i>	<i>2006 Mean (StDev)</i>	<i>2007 Mean (StDev)</i>			<i>2005 Mean (StDev)</i>	<i>2006 Mean (StDev)</i>	<i>2007 Mean (StDev)</i>
ACC	Total score	46.64 (15.05)	40.98 (16.82)	47.71 (13.93)	Big Ten	Total score	56.14 (13.78)	46.50 (17.59)	52.64 (17.97)
	Winning score	30.56 (11.21)	27.13 (10.36)	30.22 (9.150)		Winning score	37.05 (9.838)	31.68 (11.67)	33.30 (10.43)
	Losing score	16.09 (7.940)	13.84 (10.02)	17.49 (7.959)		Losing score	19.09 (9.215)	14.82 (9.848)	19.34 (10.27)
	Margin	14.47 (12.29)	13.29 (11.51)	12.73 (10.01)		Margin	17.95 (13.18)	16.86 (12.53)	13.95 (10.28)
	N	45	45	45		N	44	44	44
Big 12	Total score	54.35 (16.74)	52.02 (17.26)	62.18 (19.28)	PAC-10	Total score	59.25 (16.82)	44.84 (13.52)	53.47 (17.16)
	Winning score	37.10 (13.47)	33.02 (10.61)	41.00 (12.51)		Winning score	37.85 (12.20)	30.80 (9.236)	33.98 (10.96)
	Losing score	17.24 (9.013)	19.00 (9.314)	21.18 (11.13)		Losing score	21.40 (9.139)	14.04 (8.116)	19.49 (9.134)
	Margin	19.86 (15.65)	14.02 (10.03)	19.82 (13.75)		Margin	16.45 (13.48)	16.76 (10.93)	14.49 (10.62)
	N	49	49	49		N	40	45	45
Big East	Total score	49.54 (16.05)	49.21 (17.57)	53.36 (18.46)	SEC	Total score	43.88 (17.60)	42.20 (13.58)	53.90 (20.25)
	Winning score	34.39 (10.21)	31.68 (9.813)	33.89 (12.64)		Winning score	28.92 (11.18)	26.71 (9.115)	33.27 (11.93)
	Losing score	15.14 (9.679)	17.54 (9.879)	19.46 (9.693)		Losing score	14.96 (9.460)	15.49 (7.901)	20.63 (10.81)
	Margin	19.25 (11.76)	14.14 (8.902)	14.43 (12.92)		Margin	13.96 (10.93)	11.22 (10.32)	12.63 (10.40)
	N	28	28	28		N	49	49	49

Table 3 presents the results of two-tailed t-tests for the mean differences in each category from zero. The results from the repeated matchups are used in this analysis. The total, winning, and losing scores are all significantly lower at less than the 1 percent level in the 2006 season compared to the values for 2005. The total score decreased by 4.66 points per game. However, the margin of victory did not change significantly. This suggests that the implementation of the clock rule changes led to decreased scoring but did not have any statistically significant effect on the margin of victory. A comparison of the 2007 and 2005 seasons reveals that the kickoff rule changes led to total scoring increasing by 2.93 points per game, with this being driven primarily by increases in the losers' score by 1.77 points. This supports the results discussed in regard to Table 2. These results are statistically significant at the 5 percent level.

Table 3. Tests of significance for changes in scoring across the 2005–2007 seasons.

	<i>t</i> -statistic	<i>p</i> -value	Mean Difference
2006–05 total score	−3.858	0.000	−4.659
2006–05 winning score	−3.274	0.001	−2.571
2006–05 losing score	−3.036	0.003	−2.088
2006–05 margin	−0.569	0.570	−0.484
2007–05 total score	2.253	0.025	2.934
2007–05 winning score	1.421	0.156	1.168
2007–05 losing score	2.391	0.017	1.766
2007–05 margin	−0.693	0.489	−0.599

Degrees of freedom for all tests equals 363.

3. Financial Market Expectations and Outcomes

The next step in our analysis is to examine the financial (betting) market reaction to the rule changes in NCAA football. As was seen in the previous section, scoring declined in 2006 when the NCAA introduced rules aimed at shortening the length of the game. When these rules were reversed in 2007, the NCAA also introduced a change in the placement of the kickoff which was likely to result in better starting field position for the offense. The combination of these rule changes in 2007 led to increased scoring beyond the levels seen in 2006 and even in 2005 (prior to the rule changes).

Given that the betting market for college football is a simple financial market, it is possible to trace the rule changes in college football to their implications on prices. In the case of analyzing rules that impact scoring, the totals market is the market we will investigate. The totals market is commonly known as the over/under market and is a simple financial market where bettors can wager on whether the combined score of both teams will be greater than or less than the posted number by the sports book. Previous studies of market efficiency in the college football wagering market has shown the market to be efficient in the aggregate, although simple strategies of wagering on the under at the highest totals has been shown to reject market efficiency [44].

The question pertaining to this study is if the betting market adjusted to these rule changes and, if it did, how quickly did the market adjust? Given that the rule changes were announced in advance, sports book managers and bettors alike were able to analyze and hypothesize about the impact of these changes before the season began. Even if the rule changes could not be incorporated immediately, it is likely if one assumes market efficiency (and the incentives present in the market) that the impact of the rule changes would quickly be realized and prices would adjust to their unbiased values.

To begin, we will examine the year prior to the rule changes, 2005, and then compare these results to 2006 and 2007. We examine what happened each season in the aggregate to allow for enough observations to perform possible meaningful tests on market efficiency. It is important to understand that small sample sizes in sports betting markets can reveal unreliable results as noted in Osborne [45]. Given that we are interested in specific years and are attempting to understand the speed of adjustment of the market in those seasons, we believe the relatively large number of games in a college football season (over four times as many games as an NFL season), we believe the data set is large enough to provide insight on the issues of interest. The following table shows the mean and standard deviation of

the total for each season. For each year studied, the first four weeks of the season and the results for the season as a whole are presented.

Table 4. Descriptive statistics summarizing totals by season.

Week	2005 Season	2006 Season	2007 Season
	Mean Total (Standard Deviation)	Mean Total (Standard Deviation)	Mean Total (Standard Deviation)
Week 1	50.55 (5.71)	47.52 (4.96)	49.36 (5.16)
Week 2	51.53 (6.31)	47.71 (5.91)	50.32 (7.48)
Week 3	51.32 (5.63)	47.68 (5.08)	53.08 (8.77)
Week 4	51.60 (7.43)	47.05 (6.37)	53.88 (8.23)
Entire Season	51.96 (7.08)	47.73 (6.52)	54.50 (8.27)

The results of Table 4 above illustrate that when the new clock rules were introduced in 2006, totals immediately fell. In Week 1, the mean total fell by 3 points. By Week 4, the mean total was around 4.5 points lower than it was at the same time in 2005. By the end of the season, the mean total was over 4 points lower than in 2005. The standard deviation of the total also fell by around a half point. Compared to the actual scoring results, where scoring on the average in 2006 was shown to decrease nearly 5 points compared to 2005, the average total fell, but not quite as much as actual scoring.

In 2007, with the change back of the clock rules and the movement of the kickoff from the 35 to 30 yard line, there appeared to be a bit more confusion in the totals market. Totals only rose slightly (compared to 2006) in Weeks 1 and 2, but jumped by Week 3 to levels beyond those seen in 2005. Overall, totals rose by about 7 points compared to 2006 and about 2.5 points compared to 2005. The standard deviation also rose in 2007. This compares quite closely to the actual change in scoring, which would be predicted under the efficient markets hypothesis, as actual scoring rose by nearly 8 points from 2006 to 2007 and was between 2.5 and three points greater than it was in 2005.

The next step in analyzing the market is to compare betting market results during these years to see how simple strategies of wagering on the over or the under-performed before and after the college football rule changes. The following three tables show the over and under record in the 2005, 2006, and 2007 seasons. For each season, individual week results for Weeks 1–4 and the overall season results are shown. Table 5 includes information on the number of overs, unders, and pushes, the under win percentage, and the log likelihood ratio test for a fair bet (win percentage equal 50%) from Even and Noble [46].

Before the rule changes, in 2005, overs and unders split nearly evenly in the totals betting market. With the introduction of the new clock rules in 2006, the under did considerably better than the over. The 53.16% win percentage of simply betting the under was great enough to reject the null hypothesis of a fair bet at the 10% level. This result is not overly surprising given the previous findings in this

paper, as the actual amount of scoring fell by a greater amount than the betting market total, resulting in more wins on betting the under.

Table 5. Over/Under Records and Fair Bets by Season.

a. 2005 NCAA Football Season—Over/Under Record.

Week	Overs	Unders	Pushes	Under %	Log Likelihood Fair Bet
Week 1	20	25	1	56.56%	0.5567
Week 2	25	23	0	47.92%	0.0834
Week 3	23	21	0	47.73%	0.0909
Week 4	21	23	0	52.28%	0.0909
2005 Season	336	330	6	49.55%	0.0541

b. 2006 NCAA Football Season—Over/Under Record.

Week	Overs	Unders	Pushes	Under %	Log Likelihood Fair Bet
Week 1	23	21	0	47.73%	0.0909
Week 2	24	26	0	52.00%	0.0800
Week 3	21	29	0	58.00%	1.2855
Week 4	20	28	1	58.33%	1.3396
2006 Season	334	379	9	53.16%	2.8420*

c. 2007 NCAA Football Season—Over/Under Record.

Week	Overs	Unders	Pushes	Under %	Log Likelihood Fair Bet
Week 1	19	27	1	58.70%	1.3984
Week 2	32	18	1	36.00%	3.9729**
Week 3	21	27	2	56.25%	0.7520
Week 4	33	14	1	29.79%	7.9051***
2007 Season	339	370	12	52.19%	1.3559

Note: The log likelihood test statistics have a chi-square distribution with one degree of freedom. Critical values are 2.706 ($\alpha = 0.10$), 3.841 ($\alpha = 0.05$), 6.635 ($\alpha = 0.01$).

In 2007, multiple rule changes appeared to cause some confusion in the betting market. There was great volatility early in the season, with some weeks where the over dominated and other weeks where the under outperformed the over. In Weeks 2 and 4, scoring was so high that the over won enough to reject the null hypothesis of a fair bet at the 5% level in Week 2 and at the 1% level in Week 4. By the end of the season, however, unders did slightly better than overs, but not nearly as well as in 2006. It appeared that uncertainty reigned early in the 2007 college football season due to the multiple rule changes, but by the end of the season the total pretty well reflected the actual amount of scoring that happened in college football games.

Detailed betting data available from Sportsinsights [47] can shed further light in terms of what happened in the totals market during these seasons. Sportsinsights publishes the betting percentages on each side of the wagering proposition for college football and other sports. This information was used to test the balanced book hypothesis (the notion that sports books set prices to even the betting action on each side of the proposition). The balanced book was soundly rejected in college football [21] in addition to other sports. Although this study and more recent research illustrated that the book was not

balanced, the point spreads and totals studied were still shown to serve as an unbiased forecast of game outcomes (despite clear betting biases toward the favorites and overs).

Table 6. Betting Public Perception: Betting Percentage on the Over.

Year	Average % on Over	Standard Deviation on Over
2005	63.12	16.25
2006	65.69	15.09
2007	64.08	13.75

Table 6 presents the mean percentage bet on the over for the 2005–2007 seasons. As is clearly seen in the table, bets on the over are much more popular than bets on the under. Wagers on the over received greater than 60% of the betting action throughout the sample period. In 2006, the percentage bet on the over rose to 65.69%, an increase of nearly 2.5% over 2005. Due to the clock rule changes, totals fell in 2006. These lower totals likely proved to be even more tempting to over bettors, due to their pre-existing bias that already existed for wagering on the over. This increase in betting percentage on the over also likely contributed to the under being a winning wager overall during the 2006 NCAA football season. In 2007, with the rise in the total due to the reversal of clock rules and the introduction of the kickoff rule, the percentage bet on the over fell by about 1.5% compared to where it was in 2006, which was slightly higher than it was in 2005, but the betting market went back to a more even split between overs and unders during that season.

Overall, the effects of the clock rules were anticipated by the book makers as they lowered totals, but bettors did not fully grasp the effects. This led to slightly higher totals than there should have been and a winning season for under bettors in 2006. The reversal of the clock rules and the introduction of the new kickoff rule in 2007 was met with some confusion in the early season by both bookmakers and bettors. By the end of the season, it appeared that the market adjusted to the new rules in place for college football.

4. Discussion and Conclusions

The results reveal that the clock rule changes instituted in the 2006 season and the kickoff rule change that began with the 2007 season had an effect on scoring in Division I Football Bowl Subdivision (FBS) games. Using 2005 as the base year, we found that the clock rule changes of 2006 decreased total scoring by 4.66 points per game, with the winners' scores decreased by 2.57 points and the losers' scores decreased by 2.09 points on average. These results are statistically significant at the 5 percent level or lower. The elimination of the clock rule changes for the 2007 season allowed us to compare the effects of the kick rule change against the scoring of the 2005 season. We found that total scoring increased by 2.93 points per game, with the losers' scores earning the bulk of the increase, receiving 1.77 points on average. Nevertheless, neither rule change had a statistically significant effect, at any generally accepted level, on the margins of victory during these seasons. It is not clear from the results that the games are more competitive on average. This suggests that other rule changes may be necessary to reduce the margin.

In the over/under market for college football, the total fell due to the clock rule changes in 2006. These lower totals spurred more betting action on the over during this season (due to the behavioral

bias which already exists in this market where bettors prefer wagering on the over rather than the under) and led to under bets significantly outperforming over bets. The financial market for NCAA football totals betting showed much volatility early in the season in 2007, due to the reversal of the clock rules and the introduction of the kickoff rule. By the end of the season, however, market expectations and actual results meshed with general findings of market efficiency with the slight (but normal compared to previous studies) behavioral bias of bettors toward the over.

The predictions of the kick rule change by various coaches were generally correct; scoring averages increased with this rule. However, statements by coaches that it may have a “huge impact” or be one the “most significant” rule changes appear a bit strong, at least in regard to scoring. Our results suggest that the timing rule changes had a much stronger impact on scoring in these games.

Overall, rule changes in sports change the manner of play on the field, influence the way fans respond to the sport, and influence financial (betting) markets related to the game. The major rule changes which occurred in college football in 2006 and 2007 led to changes in scoring that were mostly predictable ex-ante by sports book managers, but still led to some biased results due to the behavioral preferences of market participants.

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Author Contributions

All listed authors contributed equally to the research completed and writing of the paper.

Conflicts of Interest

The authors declare no conflicts of interest.

References

1. Fama, E.; Fisher, L.; Jensen, M.; Roll, R. The Adjustment of Stock Prices to New Information. *Int. Econ. Rev.* **1969**, *10*, 1–21.
2. Binder, J. Measuring the Effects of Regulation with Stock Price Data. *Rand J. Econ.* **1985**, *16*, 167–183.
3. Binder, J. The Event Study Methodology Since 1969. *Rev. Quant. Finance Account.* **1998**, *11*, 111–137.
4. Schwert, G. Using Financial Data to Measure Effects of Regulation. *J. Law Econ.* **1981**, *24*, 121–158.
5. Fama, E. Efficient Capital Markets: A Review of the Theory and Empirical Work. *J. Finance* **1970**, *25*, 383–417.
6. Fama, E. Efficient Capital Markets II. *J. Finance* **1991**, *46*, 1575–1617.
7. Jain, P.; Rezaee, Z. The Sarbanes-Oxley Act of 2002 and Capital Market Behavior: Early Evidence. *Contemp. Account. Res.* **2006**, *23*, 629–654.

8. Zhang, I. Economic Consequences of the Sarbanes-Oxley Act of 2002. *J. Account. Econ.* **2007**, *44*, 74–115.
9. Millon-Cornett, M.; Tehranian, H. An Examination of the Impact of the Garn-St. Germain Depository Institutions Act of 1982 on Commercial Banks and Savings and Loans. *J. Finance* **1990**, *45*, 95–111.
10. Cyree, K. The Erosion of the Glass-Steagall Act: Winners and Losers in the Banking Industry. *J. Econ. Bus.* **2000**, *52*, 343–363.
11. Millon-Cornett, M. Stock Market Reactions to the Depository Institutions Deregulation and Monetary Control Act of 1980. *J. Bank. Finance* **1989**, *13*, 81–100.
12. Carow, K.; Kane, E. Event-Study Evidence of the Value of Relaxing Longstanding Regulatory Restraints on Banks: 1970–2000. *Q. Rev. Econ. Finance* **2002**, *42*, 439–463.
13. Lucey, B.; Dowling, M. The Role of Feelings in Investor Decision-Making. *J. Econ. Surv.* **2005**, *19*, 211–237.
14. Ashton, J.; Gerrard, B.; Hudson, R. Economic Impact of National Sporting Success: Evidence from the London Stock Exchange. *Appl. Econ. Lett.* **2007**, *10*, 283–285.
15. Ashton, J.; Gerrard, B.; Hudson, R. Do National Soccer Results Really Impact on the Stock Market? *Appl. Econ.* **2011**, *43*, 3435–3452.
16. Klein, C.; Zwergel, B.; Heiden, S. On the Existence of Sports Sentiment: The Relation between Football Match Results and Stock Index Returns in Europe. *Rev. Manage. Sci.* **2009**, *3*, 191–208.
17. Bell, A.; Brooks, C.; Matthews, D.; Sutcliffe, C. Over the Moon or Sick as a Parrot? The Effects of Football Results on a Club's Share Price. *Appl. Econ.* **2012**, *44*, 3435–3452.
18. Edmans, A.; Garcia, D.; Nurli, O. Sports Sentiment and Stock Returns. *J. Finance* **2007**, *62*, 1967–1998.
19. American Gaming Association. Available online: <http://www.americangaming.org/industry-resources/research/fact-sheets/sports-wagering> (accessed on 19 March 2014).
20. Levitt, S. Why are gambling markets organized so differently from financial markets? *Econ. J.* **2004**, *114*, 223–246.
21. Paul, R.J.; Weinbach, A.P. Sportsbook Behavior in the NCAA Football Betting Market: Tests of the Traditional and Levitt Models of Sportsbook Behavior. *J. Prediction Markets* **2009**, *3*, 21–37.
22. Paul, R.J.; Weinbach, A.P.; Mahar, J. The Betting Market Response to the 2-Point Conversion in the NFL. *J. Bus. Econ. Persp.* **2007**, *33*, 98–110.
23. Paul, R.J.; Paul, K.K. Market Reaction to a Structural Change: The Totals Market of the NHL. *Bus. Res. Yearb.* **2007**, *14*, 53–59.
24. Wallace, R. FBS vs. FCS. Available online: <http://www.differencebetween.net/miscellaneous/difference-between-fbs-and-fcs/> (accessed on 19 March 2014).
25. NCAA Press Release. Available online: <http://football.refs.org/rules/NCAA2006pr.html> (accessed on 19 March 2014).
26. Wieberg, S. Teams get adjusted to rules shortening game. *USA Today*, 4 September 2006.
27. Wieberg, S. NCAA rules committee proposes reworking football time-saving rules. *USA Today*, 14 February 2007.
28. NCAA Press Release. Available online: <http://fs.ncaa.org/Docs/PressArchive/2007/Playing%20BRules/NCAA%20Football%20Rules%20Committee%20Votes%20To%20Restore%20Plays>

- %2BWhile%2BAttempting%2BTo%2BMaintain%2BShorter%2BOverall%2BGame%2BTime.html (accessed on 19 March 2014).
29. Associated Press. Available online: <http://sports.espn.go.com/ncf/news/story?id=2835266> (accessed on 19 March 2014).
 30. Brunt, C. College Football Changes Kickoff Rule. Available online: <http://www.washingtonpost.com/wp-dyn/content/article/2007/08/16/AR2007081601365.html> (accessed on 19 March 2014).
 31. Hood, S. New Kickoff Rule Gets (Special) Teams Attention. Available online: <http://sports.yahoo.com/ncaaf/news?slug=rivals-146383&prov=rivlas&typs=lgns> (accessed on 19 March 2014).
 32. Dodd, D. Kick Back and Enjoy as Returns Grow More Intriguing. Available online: <http://www.sportsline.com/collegefootball/story/10323027> (accessed on 19 March 2014).
 33. Banerjee, A.N.; Swinnen, J.F.M. Does a Sudden Death Liven Up the Game? Rules, Incentives, and Strategy in Football. *Econ. Theor.* **2004**, *23*, 411–421.
 34. Banerjee, A.N.; Swinnen, J.F.M.; Weersink, A. Skating on Thin Ice: Rule Changes and Team Strategies in the NHL. *Can. J. Econ.* **2007**, *40*, 493–514.
 35. Mastromarco, C.; Runkel, M. Rule Changes and Competitive Balance in Formula One Motor Racing. *Appl. Econ.* **2009**, *41*, 303–314.
 36. La Croix, S.J.; Kawaura, A. Rule Changes and Competitive Balance in Japanese Professional Baseball. *Econ. Inq.* **1999**, *37*, 353–356.
 37. Fort, R.; Lee, Y.H. Structural Change, Competitive Balance, and the Rest of the Major Leagues. *Econ. Inq.* **2007**, *45*, 519–532.
 38. Guedes, J.C.; Machado, F.S. Changing Rewards in Contests: Has the Three-Point Rule Brought More Offense to Soccer? *Empir. Econ.* **2002**, *27*, 607–630.
 39. Moschini, G. Incentives and Outcomes in a Strategic Setting: The Three-Points-for-a-Win System in Soccer. *Econ. Inq.* **2010**, *48*, 65–79.
 40. McCannon, B.C. Strategic Offsetting Behavior: Evidence from National Collegiate Athletic Association Men’s Basketball. *Contemp. Econ. Policy* **2011**, *29*, 550–563.
 41. Witt, R. Do Players React to Sanction Changes? Evidence from the English Premier League. *Scot. J. Polit. Econ.* **2005**, *52*, 623–640.
 42. Salaga, S.; Tainsky, S. The effects of outcome uncertainty, scoring, and pregame expectations on Neilson ratings for Bowl Championship Series games. *J. Sport. Econ.* **2013**, doi:10.1177/1527002513497236.
 43. Grimshaw, S.; Sabin, R.P.; Willes, K.M. Analysis of the NCAA men’s Final Four TV audience. *J. Quant. Anal. Sport.* **2013**, *9*, 115–126.
 44. Paul, R.J.; Weinbach, A. Bettor Preference and Market Efficiency in Football Totals Markets. *J. Econ. Financ.* **2005**, *29*, 409–415.
 45. Osborne, E. Efficient markets? Don’t bet on it. *J. Sport. Econ.* **2001**, *2*, 50–61.
 46. Even, W.E.; Noble, N.R. Testing efficiency in gambling markets. *Appl. Econ.* **1992**, *24*, 85–88.
 47. Sportsinsights. Available online: <http://www.sportsinsights.com> (accessed on 19 March 2014).