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College Football Games and Crime

Abstract

There is a great deal of anecdotal evidence that college football games can lead to aggressive and destructive behavior by fans. However, to date, no empirical study has attempted to document the magnitude of this phenomenon. We match daily data on offenses from the NIBRS to 26 Division I-A college football programs in order to estimate the relationship between college football games and crime. Our results suggest that the host community registers sharp increases in assaults, vandalism, arrests for disorderly conduct, and arrests for alcohol-related offenses on game days. Upsets are associated with the largest increases in the number of expected offenses. These estimates are discussed in the context of psychological theories of fan aggression.

Keywords: college football, crime, aggression, alcohol, drinking

Fierce fighting on the football field and in the streets of this town for two hours was the result this afternoon of the game…members and followers of both teams were cut by blows from clubs, bricks, canes, and any other weapons that were handy, townsfolk and students joining in the melee.

--*New York Times, Nov. 22, 1903*

Introduction

College football is enormously popular in the United States, and there is evidence that its appeal is growing. In 1998, college football games attracted 37.4 million spectators. By 2006, attendance had risen to 47.9 million.[1] Nineteen of the 20 largest stadiums located in the United States are devoted to the sport, and there are plans to expand the capacity at a number of college football stadiums in the coming years.[2]

As the popularity of college football increases, so do concerns with regard to the behavior of its fans. According to observers, the charged, "winner-take-all" atmosphere often leads to violent behavior and even riots (MacDonald 2004). In an effort to discourage heavy drinking and "associated unruliness" during and after games, the majority of Division I-A schools currently prohibits stadium sales of alcoholic beverages (Wieberg 2005). In August of 2005, the National Collegiate Athletic Association (NCAA) recommended that all schools ban the sale of alcohol at sporting events.

Despite anecdotal reports that college football games lead to aggressive and violent behaviors among spectators, there has, to date, been no attempt to systematically document the phenomenon. Moreover, there has been surprisingly little study of the

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[1] These figures are provided by the National Collegiate Athletic Association. See www.ncaa.org.stats/football/attendance.

[2] Information on stadium capacity in the Unites States is available from Brown and Morrison (2007). Bunkley (2006) reported on plans to add seating to the University of Michigan's football stadium, already the largest in the nation. See also Raley (2007) and Wieberg (2007).

effect of other types of sporting events on such behaviors, although a number of psychological theories suggest that sporting events in general, and especially those that involve high levels of violence, might cause fans to act more aggressively than they would otherwise.

In fact, previous empirical research provides only limited support for the hypothesis that sporting events are causally related to violent or aggressive acts. For instance, Drake and Panday (1996) examined data on child abuse cases from Missouri in 1992. They found no evidence of a relationship between playoff games in the four major professional sports (baseball, basketball, football, and hockey) and reports of child abuse. Similarly, Sachs and Chu (2000) failed to find a statistically significant association between professional football games and domestic violence dispatches in the county of Los Angeles over a three-year period (1993-1995). White et al. (1992) examined the relationship between games played by The Washington Redskins, a professional football team, and emergency room admissions at two hospitals in northern Virginia over a two-year period (1988-1989). One of the 2 hospitals recorded a statistically significant spike in emergency room visits by women the day after Redskin victories, but there was no evidence of a relationship between game days and emergency room admissions at the other hospital.

Perhaps the best evidence of a link between sporting events and fan violence comes from two studies of prizefights and homicides. Phillips (1983) collected information on eighteen championship heavyweight prizefights that took place during the period 1973-1978. He found evidence that the U.S. homicide rate increased significantly 3 days after a prizefight. Miller et al. (1991) reanalyzed the data collected by Phillips

(1983), confirming this basic pattern of results. Although the three-day lag suggests that the estimated relationship between prizefights and homicides could be spurious (Baron and Reiss 1985), the work of Phillips (1983) and Miller (1991) has been used to buttress the claim that individuals are capable of reacting quite violently to sporting events viewed on the television as opposed to in person.[3]

Here, we examine daily offense data from 26 police agencies over the course of 6 football seasons (2000 to 2005). Each of these agencies had jurisdiction over a community in which a Division I-A college football team played its home games. Our interest is in whether assaults and other offenses such as vandalism departed from their normal pattern on game days. Specifically, we examine changes in the number of offenses reported by a particular police agency when the football program located in the community under its jurisdiction played a home game, and the change in offenses when the program played an away game. In addition, we investigate whether the outcome of the game affects the estimated relationship between games days and offenses, and explore the role of team rank. Finally, we experiment with introducing lags into the empirical model.

Our results suggest that the host community registers sharp increases in assaults on game days. In addition, there is evidence that vandalism, arrests for disorderly conduct, and alcohol-related arrests increase on game days, but no support for the hypothesis that away games are related to offenses. The largest estimated effects are found when an upset occurs, defined as when an unranked team beat a ranked team or when a lower-ranked team beat a higher-ranked team.

[3] See, for instance, Wann et al. (2001, p. 117). Felson (1996) provides a more critical appraisal of this body of work.

Some portion of the relationship between home games and offenses may be mechanical in nature, due to the fact that home games often attract a temporary, but substantial, influx of people from outside the host community. However, the results with regard to upsets suggest that fans react to the outcome of games. In the next section we discuss the potential links between sporting events and crime, paying special attention to the psychological theories of spectator aggression.

Sporting Events, Aggression, and Drinking

Clemson University is located in the small town of Clemson, South Carolina. Approximately 17,000 students attend Clemson University, and the town has a population of approximately 12,000. Yet, Clemson Memorial Stadium, which can seat more than 80,000 football fans, is often filled to capacity.

Obviously, college football games have the potential to draw thousands of spectators into relatively small communities. As the number of individuals in a community increases, so too do the opportunities for disputes and altercations having nothing to do with football. Our interest, however, goes beyond this sort of mechanical relationship. If away games, which presumably do not draw many spectators from outside the local community, are associated with changes in the number of offenses reported, this would suggest a more complex relationship between sporting events and crime. A similar argument could be made if the outcome of a game is found to affect the number of offenses.

Several theories from psychology offer explanations for aggressive, even criminal, fan behavior. For instance, Bandura (1973) posited that aggression can be viewed as a response to environmental stimuli such as televised violence. According to Bandura's social learning theory, under the right circumstances, simply observing a sporting event can be enough to trigger an act of aggression, regardless of the outcome of the event.[4] In contrast, the frustration-aggression hypothesis predicts that fans will react aggressively only when their favorite team loses. According to the frustration-aggression hypothesis, first proposed by Dollard et al. (1939), acts of violence or aggression are the result of being thwarted in an effort to attain a goal.[5] Cialdini et al. (1976), Branscombe and Wann (1992), and Wann (1993) also predicted that fans would be more likely to commit an aggressive or violent act in the event of a loss than in the event of a victory. Cialdini et al. (1976) described fans as attaching themselves to particular team, basking in the "reflected glory" of a victory, but reacting to a defeat almost as if they themselves had been on the field of play. Branscombe and Wann (1992) and Wann (1993) focused on the negative shock to self-esteem experienced by the dedicated fan whose favorite team loses a game. According to these authors, aggressive behavior after such a loss can be viewed as an attempt to recoup self-esteem.[6]

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[4] See Bandura (2007) for a review of social learning theory. Our discussion of the psychological theories of fan aggression also borrows from Wann et al. (2001), pp. 108-120. Wann et al. (2001, p. 110), provided a hypothetical example illustrating social learning theory in the context of a sporting event:

> when a football fan sees his favorite player deliver an especially vicious hit on an opposing player and receive praise for doing so, the spectator might be inclined, given sufficient provocation, to model the same behavior on the obnoxious opposing team's fan seated a few feat away.

[5] For an in-depth discussion of the frustration-aggression hypothesis, see Berkowitz (1989). Miller (1941) modified the frustration-aggression hypothesis, arguing that aggression is not the inevitable response to frustration.

[6] Sociologists have also developed theories that can help explain spectator aggression. These theories typically focus on how individuals modify their behavior when part of a larger group or crowd. For instance, contagion theory posits that a single individual's attitude or actions can be quickly and uncritically adopted by other members of a group (Wann et al. 2001, p. 120). Simons and Taylor (1992) and Van Hiel et al. (2007) review the sociological theories of spectator aggression.

To date, few empirical studies have attempted to distinguish between the above theories. Goldstein and Arms (1971) asked male spectators a series of questions designed to gauge their level of hostility before and after a game between the U.S. Military and Naval academies. The authors found a comparable increase in hostility levels among fans of both the winning and losing teams, a result consistent with social learning theory but at odds with, for instance, the aggression-frustration hypothesis. Arms et al. (1979), using a similar approach to that employed by Goldstein and Arms (1971), also found support for the social learning hypothesis.

A number of researchers have explored the potentially pivotal role of alcohol consumption by fans. Although a large body of research documents that alcohol consumption can lead to aggressive behavior, there is no consensus as to why (Bushman and Cooper 1990; Ito et al. 1996; Pederson et al. 2000). There is, however, evidence that frustration intensifies the effect of alcohol on aggressive behavior (Ito et al. 1996), and speculation that, given certain triggers, intoxicated individuals will be more likely to exhibit what has been termed “displaced aggression” (Pederson et al. 2000).

College football games are often accompanied by day-long parties and heavy drinking. Neal and Fromme (2007) examined data collected from students attending The University of Texas at Austin. They found that football game days were associated with substantial increases in the amount of alcohol consumed. Similarly, Glassman et al. (2007) found that college football games days were associated with higher alcohol consumption than other “drinking occasions.”

University administrators and NCAA committee members are clearly concerned about the problems caused by excessive drinking at sporting events. In fact, all of the football programs represented in our sample had banned the sale of alcohol in their stadiums before 2000.

There is some evidence that banning alcohol can dampen the relationship between football games and aggressive fan behavior. After the University of Colorado Boulder prohibited stadium alcohol sales, game-day arrests, assaults, and ejections decreased significantly (Bormann and Stone 2001). Another study showed a decrease in game day drunk-driving arrests after Arizona State University implemented a ban on stadium sales of alcohol (Boyes and Faith 1993). However, Spaite et al. (1990) found no change in the number of injuries or illnesses reported by medical aid stations after the consumption of alcohol was prohibited in the stadium of a popular collegiate football team.[7]

The Data

There are 119 Division I-A NCAA football programs in the United States. We successfully matched daily offense data from the National Incident Based Reporting System (NIBRS) with 26 of these programs for the period 2000-2005. The remaining programs were located in communities under the jurisdiction of a police agency that did not participate in the NIBRS data collection effort.[8]

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[7] There is strong evidence of a causal link between alcohol consumption and crime outside of the university setting (Carpenter 2005; Saffer 2001; Joksch and Jones 1993). For instance, Carpenter (2005) used the adoption of restrictive drunk-driving laws to estimate the effect of heavy alcohol use on nuisance crimes (vandalism, drunkenness, disorderly conduct). Consistent with other research in this area, he found a decrease in these types of crime after these laws were implemented.

[8] The NIBRS data are available from the National Archive of Criminal Justice Data provided by the Inter-university Consortium for Political and Social Research (ICPSR). According to the Bureau of Justice Statistics, 5271 police agencies from 23 different states and representing 16% of the U.S. population were reporting incident-level crime data to the NIBRS as of December, 2003 (www.ojp.gov/bjs/nibrsstatus.htm).

The police agencies (and respective schools) included in the analysis are: Akron (The University of Akron), Ames (Iowa State University), Ann Arbor (The University of Michigan), Athens (Ohio University), Austin (The University of Texas at Austin), Blacksburg (Virginia Polytechnic Institute and

Our sample is composed of college football programs of varying sizes and ranks from across a large swath of the United States. Table 1 presents descriptive information for the 26 programs examined. Most were located in small- to medium-sized communities (population < 100,000), and most had stadiums that could seat between 30 and 70 thousand spectators. Eleven programs were located in the Midwest, 10 were located in the South, and 5 were located in the West. Six were ranked among the top 25 football programs in the United States by the College Football Data Warehouse for the period 2000-2005, 15 were ranked outside the top 25, and 5 were unranked.

College football teams typically start their seasons in late August or early September, and play their final regular-season games in late November or early December. Championship games are played in early December. With this schedule in mind, we analyzed offenses occurring between August 20 and December 10.[9] Eighteen football programs in our sample were located in communities under the jurisdiction of an agency that reported daily offense data for the entire period under study. Eight of the 26 agencies provided data to the NIBRS for only a portion of this period.[10]

State University), Boise (Boise State University), Clemson (Clemson University), Colorado Springs (United States Air Force Academy), Columbia (The University of South Carolina), Columbus (The Ohio State University), Denton (The University of North Texas), East Lansing (Michigan State University), Fayetteville (University of Arkansas), Huntington (Marshall University), Iowa City (The University of Iowa), Jonesboro (Arkansas State University), Kalamazoo (Western Michigan University), Lawrence (The University of Kansas), Logan (Utah State University), Lubbock (Texas Tech University), Morgantown (West Virginia University), Moscow (The University of Idaho), Mount Pleasant (Eastern Michigan University), Murfreesboro (Middle Tennessee State University), and Provo (Brigham Young University). Although campus police agencies can report to the NIBRS, our focus is on the larger community. Of the 26 universities represented in our sample, 12 had campus police agencies that reported offense data to the NIBRS.

[9] Bowl games, which typically take place in late December or early January, were not included in the analysis.

[10] Ann Arbor did not provide data for the period 1/1/2000 – 12/31/2002; Austin did not provide data for the period 8/20/2004-12/31/2005; Akron did not provide data for the period 1/1/2000 – 12/31/2002); Columbus did not provide data for the period 1/1/2000-8/19/2004; Denton did not provide data for the period 1/1/2000

The final data set is composed of 14,926 agency-days. A total of 1,516 football games are observed.[11] Ninety-two percent of these games were played on a Saturday, but no game was played on 35 percent of the Saturday observations; 4.8 percent of the games took place on a Thursday, and 4.0 percent took place on other days of the week (Table 2). In the empirical analysis below, we exploit this variation to distinguish day-of-the-week effects from the effect of game days on two Group A offenses (for which incident data are available) and three Group B offenses (for which arrest data are available). These offenses are listed below. [12]

<u>Group A Offenses</u>:

$Assault_{it}$ = assaults reported by agency *i* on day *t*.

$Vandalism_{it}$ = vandalism offenses reported by agency *i* on day *t*.

<u>Group B Offenses</u>:

DUI_{it} = arrests for driving under the influence reported by agency *i* on day *t*.

$Disorderly_{it}$ = arrests for disorderly conduct reported by agency *i* on day *t*.

$Liqour\ Law_{it}$ = arrests for liquor law violations reported by agency *i* on day *t*.[13]

– 12/31/2001; Fayetteville did not provide data for the period 1/1/2000 – 11/30/2003; Jonesboro did not provide data for the period 1/1/2000 – 8/19/2003; and Lawrence did not provide data for the period 1/1/2000 – 12/31/2001.

[11] Game data set were drawn from the College Football Data Warehouse website (www.cfbdatawarehouse.com). Championship games are coded as away games because they typically take place in a neutral venue. One hundred fifty-six games took place between football programs in the sample, and therefore appeared twice in the data: once as a home game for the football program located in the community in which the game was played, and once as an away game. Deleting these games from the data has no appreciable effect on the results reported below.

[12] Table 1 of the appendix provides descriptive statistics for the variables used in the analysis.

[13] According to the *Federal Register* (April 29, 1994) liquor law offenses include, "maintaining unlawful drinking places; bootlegging, operating a still; furnishing liquor to a minor or intemperate person; using a vehicle for illegal transportation of liquor; drinking on a train or public conveyance; and all attempts to commit any of the aforementioned."

Figure 1 shows the mean number of assaults by day of the week and whether a home or away game was played. It provides some support for the hypothesis that aggressive behavior, as measured by assaults, increased when the community under the jurisdiction of agency *i* hosted a college football game.[14] Figures 2-5 document a similar pattern for vandalism and the Group B offenses.[15] Taken together, Figures 1-5 suggest that college football games may in fact encourage fans to engage in a variety of unlawful behaviors. The next section introduces a more formal empirical strategy.

Estimation

We estimate a negative binomial regression model as described by, for instance, Cameron and Trivedi (1986) and Grootendorst (2002), in which the number of offenses reported, y_{it}, is related to whether a college football game was played by the following equation:

$$(1) \quad \ln E(y_{it}) = \alpha + \delta_0 Home_{it} + \delta_1 Away_{it} + \beta' \mathbf{X}_{it} + v_i + \varepsilon_{it},$$

where $Home_{it}$ is equal to 1 if the football program located in the community under agency *i*'s jurisdiction played a home game on day *t* (and equal to 0 otherwise), and $Away_{it}$ is equal to 1 if the program located in the community under agency *i*'s jurisdiction played

[14] For instance, on average, 6.74 assaults were reported on Saturdays when a home game was played, as compared to an average of 5.95 assaults on Saturdays when no game was played. It might be noted, however, that the difference between these figures is not statistically different at conventional levels.

[15] For instance, on average, there were 2.58 arrests for disorderly conduct on Saturdays when a home game was played, as compared to an average of 2.22 arrests on Saturdays when no game was played.

an away game on day t (and equal to 0 otherwise); X_{it} includes controls for Thanksgiving and Labor Day, as well as controls for day of the week, holiday weekends, month, and year; v_i is a vector of agency fixed effects which capture the influence of time-invariant factors such as region; and $\exp(\varepsilon_{it})$ follows a gamma distribution with mean of 1 and variance σ. If σ is assumed to equal 0, then the negative binomial reduces to the Poisson regression model, which is designed, and commonly used, for count data (Grootendorst 2002). However, because the hypothesis $\sigma = 0$ was consistently rejected at the .01 level, we employed the negative binomial regression model.

The Results

Estimated negative binomial regression coefficients are reported in Table 3. Our interest is on the relationship between game days and the number of offenses reported in the NIBRS. Although not shown, controls for Thanksgiving, Labor Day, day of the week, holiday weekends, month, and year are included.[16] Agency fixed effects are also included as covariates.

There is no evidence that playing an away game influences the expected number offenses reported by agency *i*. However, home games are associated with a 9 percent increase in assaults ($e^{.086} = 1.090$), our best measure of aggressive behavior, and are associated with an 18 percent increase in vandalism ($e^{.161} = 1.175$).[17]

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[16] The full results are provided in Table 2 of the appendix.

[17] If b is the estimated negative binomial coefficient, then [exp(b) -1] x 100 can be interpreted as the average percent change in $E(y_{it})$ from a one unit change in x_{it}, the covariate of interest. In the case of assaults, the estimated binomial coefficient of $Home_{it}$ is 0.086, and $(e^{.086} - 1) \times 100 = 9.0$. In the case of vandalism, the estimated binomial coefficient of $Home_{it}$ is 0.161, and $(e^{.161} - 1) \times 100 = 17.5$. Although Tables 3-7 present estimated negative binomial coefficients, these coefficients are converted to percent changes when the results are discussed in the text.

There is also evidence of a relationship between home games and the number of Group B offenses reported. Specifically, home games are associated with a 13 percent increase in arrests for drunk driving, a 41 percent increase in arrests for disorderly conduct, and a 76 percent increase in arrests for liquor law violations.

The results presented in Table 3 strongly suggest that, in keeping with news reports and other anecdotal evidence, college football games impose a cost on the host community in the form of additional crime. We now address the question of whether the magnitude of this cost can be predicted by the outcome of the game.

According to social learning theory, the relationship between and sporting events and aggression is the result of fans mimicking violence on the field. The outcome of the contest should have no appreciable impact. Likewise, if the results presented in Table 3 are entirely driven by game-day surges in population, we would expect the outcome of the contest to be irrelevant. In contrast, according to the frustration-aggression hypothesis, we should observe the strongest relationship between game days and offenses in the event of a loss.

Our first step in exploring whether the outcome of a game impacts the number of offenses reported is to replace the variables $Home_{it}$ and $Away_{it}$ in equation (1) with four mutually exclusive indicator variables defined as follows:

$Home\ Game\ Win_{it}$ = 1 if the program located in the community under agency *i*'s jurisdiction won a home game on day *t*, and = 0 otherwise.

$Home\ Game\ Loss_{it}$ = 1 if the program located in the community under agency *i*'s jurisdiction lost a home game on day *t*, and = 0 otherwise.

$Away\ Game\ Win_{it}$ = 1 if the program located in the community under agency *i*'s jurisdiction won an away game on day *t*, and = 0 otherwise.

Away Game Loss$_{it}$ = 1 if the program located in the community under agency *i*'s jurisdiction lost an away game on day *t*, and = 0 otherwise.

The results of this exercise are reported in Table 4. The estimated negative binomial coefficients of *Away Game Win*$_{it}$ and *Away Game Loss*$_{it}$ are never statistically significant at conventional levels, a pattern of results that leads us to focus on home games, where there is evidence that losses lead to larger increases in the number of offenses than wins. For instance, home game losses are associated with a 12 percent increase in assaults, but home game wins are associated with only an 8 percent increase in assaults. To take another example, home game losses are associated with a 24 percent increase in DUIs, but home game wins are associated with only a 10 percent increase in DUIs.

These estimates suggest that neither social learning theory nor temporary game-day surges in population can fully explain the relationship between college football games and offenses. However, the results presented in Table 4 are far from definitive. In fact, in 4 out of 5 cases we cannot reject the hypothesis that estimated negative binomial coefficient of *Home Game Loss*$_{it}$ is equal to the estimated coefficient of *Home Game Win*$_{it}$. Losses at home are associated with more arrests for DUI than wins at the .10 level.

Every Sunday during the college football season, the Associated Press publishes a ranking of the top 25 football programs in the United States. It is based on voting by 65 sportswriters and broadcasters from across the country, and is updated weekly.[18] In an effort to further explore the relationship between home games and offenses documented

[18] The data are available at: www.appollarchive.com/football/index.

in Tables 3 and 4, we used the Associated Press rankings to distinguish upsets from other possible outcomes.

An upset win was defined has having occurred if the program located in the jurisdiction of agency *i* was unranked and beat a program ranked in the top 25 on day *t*, or if the program located in the jurisdiction of agency *i* beat a higher-ranked team on day *t*. An upset loss was defined as having occurred when the program located in the jurisdiction of agency *i* was ranked in the top 25 and was beaten by an unranked program on day *t*, or the program located in the jurisdiction of agency *i* was beaten by a lower-ranked team on day *t*.

Table 5 presents estimates of (1) modified so that the effect of upsets at home on offenses can be distinguished from the effect of other possible outcomes.[19] Although not shown, away-games are also divided into upsets and non-upsets.[20]

Turning first to the Group A offenses, there is evidence that upsets lead to larger increases in assaults and vandalism than non-upsets. Expected assaults more than double with an upset loss at home, and increase by 36 percent with an upset victory. In contrast,

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[19] It might be noted that, by definition, games that resulted in an upset involved at least one ranked football program, and as a consequence might have generated more interest and drawn more spectators than games between two unranked teams. In order to control for this phenomenon, we include ten additional variables in X_{it}. The first five are based on the ranking of the football program located in the jurisdiction of agency *i*: an indicator equal to 1 on game day if the program was ranked in the top 5, and equal to 0 otherwise; an indicator equal to 1 on game day if the program was ranked 6-10, and equal to 0 otherwise; an indicator equal to 1 on game day if the program was ranked 11-15, and equal to 0 otherwise; an indicator equal to 1 on game day if the program was ranked 16-20, and equal to 0 otherwise; and an indicator equal to 1 on game day if the program was ranked 21-25, and equal to 0 otherwise. We also include five measures of the opponent's ranking: an indicator equal to 1 on game day if the opponent was ranked in the top 5, and equal to 0 otherwise; an indicator equal to 1 on game day if the opponent was ranked 6-10, and equal to 0 otherwise; an indicator equal to 1 on game day if the opponent was ranked 11-15, and equal to 0 otherwise; an indicator equal to 1 on game day if the opponent was ranked 16-20, and equal to 0 otherwise; and an indicator equal to 1 on game day if the opponent was ranked 21-25, and equal to 0 otherwise. Allowing for interactions between these sets of ranking measures produced similar results to those reported in Table 5.

[20] With two exceptions, the away-game estimates are not statistically significant. Away game upset wins are associated with a 43 percent increase in vandalism reported by agency *i*, and away game upset losses are associated with a 27 percent *decrease* in vandalism.

non-upset losses at home are associated with a (statistically insignificant) 6 percent increase in assaults, and non-upset wins are associated with a 7 percent increase.[21]

The results for vandalism exhibit a similar pattern. Expected vandalism increases by 61 percent with an upset loss at home, and by 46 percent with an upset win. Games played at home that did not produce an upset are associated with statistically significant, but much smaller increases in vandalism.[22]

The Group B results provide additional evidence that fan reactions are much stronger when upsets occurred. Expected arrests for disorderly conduct more than double with an upset loss at home, and increase by 93 percent with an upset victory; non-upset losses at home are associated with a (statistically insignificant) 20 percent increase in arrests for disorderly conduct, and non-upset wins are associated with a 25 percent increase in arrests for disorderly conduct.[23] Expected DUIs increase by 77 percent with an upset win at home, and by 57 with an upset loss; non-upset wins at home are associated with a (statistically insignificant) 5 percent increase in DUIs, and non-upset

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[21] The hypothesis that upsets at home had the same effect on assaults as games at home that did not produce an upset is easily rejected. The hypothesis that upset losses at home had the same effect on assaults as upset wins at home is rejected (p-value = 0.01), as is the hypothesis that upset wins at home had the same effect as non-upset losses (p-value = 0.03).

[22] The hypothesis that upsets at home had the same effect on vandalism as games at home that did not produce an upset is rejected at the .01 level. However, the hypothesis that upset losses at home had the same effect on vandalism as upset wins at home cannot be rejected at conventional levels.

[23] The hypothesis that upsets at home had the same effect on arrests for disorderly conduct as games at home that did not produce an upset is rejected at the .01 level. However, the hypothesis that upset losses at home had the same effect on arrests for disorderly conduct as upset wins at home cannot be rejected (p-value = 0.42).

losses are associated with a 22 percent increase.[24] Likewise, expected arrests for liquor law violations are highest in the event of an upset win or loss.[25]

Finally, in Table 6 we explore whether the closeness of the game can predict the number of offenses reported. Specifically, we divide home games into those in which the opponents were separated by eight points or less, and those in which the opponents were separated by more than eight points.[26]

The results occasionally lend support to the hypothesis that the closeness of the outcome matters. For instance, expected assaults increase by 12 percent with a close home game win, but increase by only 5 percent when the win was not close. The results for vandalism, disorderly conduct, and liquor law violations exhibit a similar pattern. However, only in the case of disorderly conduct are the differences between close games and games decided by more than eight points statistically significant at conventional levels. Experiments in which a close game was defined as one in which the opponents were separated by three points or less yielded very similar results.

Lagged Effects

Because previous authors such as Phillips (1983) and Miller et al. (1991) have argued that a sporting event can impact behavior days after it takes place, we introduce lagged values of the game variables to our analysis in Table 7. Specifically, we examine

[24] The hypothesis that upsets at home had the same effect on arrests for DUI as games at home that did not produce an upset is rejected at the .01 level. However, the hypothesis that upset wins at home had the same effect on arrests for DUI as upset losses at home cannot be rejected (p-value = 0.65).

[25]However, the hypothesis that upsets at home had the same effect on arrests for liquor law violations as games at home that did not produce an upset cannot be rejected (p-value = 0.30).

[26] Although not shown, away games are also divided based on closeness. The away-game estimates are never statistically significant at conventional levels.

the effect of upsets and non-upsets at home with lags of one and two days. Again, our focus is on home games because up to this point in the analysis there has been little evidence that an away game played by the football program located in agency *i*'s jurisdiction impacts the number of offenses reported by agency *i*.

Table 7 presents estimated negative binomial coefficients from a model with lags, and, for the purposes of comparison, estimated coefficients from a model without lags (originally presented in Table 4). In general, there is little support for the hypothesis that football games affect the number of offenses committed beyond the actual day they take place, although there is evidence that expected vandalism increases by 42 percent the day after an upset loss, and expected liquor law violations increased by 34 percent the day after a non-upset loss. These results raise the possibility that games may, under certain circumstances, affect the behavior of fans the beyond midnight and into the following day.

Robustness Checks

A number of robustness checks were conducted. For instance, we interacted day of the week with the month indicators, and, in separate regressions, we controlled for agency-specific linear trends by interacting agency and year with a variable equal to 1 in August, 2 in September, 3 in October, and so forth. None of these experiments produced results qualitatively different from those discussed above. In addition, we created three region variables (Midwest, Southwest, Southeast), which were interacted with the day of the week and month indicators. Again, the negative binomial estimates were qualitatively equivalent to those reported above.

Estimates of the standard Poisson model produced results that were consistent in terms of magnitude with those presented in Tables 3-7, but the estimated standard errors were typically much smaller. Previous researchers (see, for instance, Cameron and Trivedi 1986) have shown that estimated standard errors from a Poisson regression are biased downwards in the presence of overdispersion (that is, when the conditional mean of the count variable is different than the conditional variance). Tests clearly indicated the presence of overdispersion for all five of the offenses considered.[27]

Restricting the sample to only those football programs that were ranked in the top 25 by the Associated Press at some point during the period 2000-2005 produced results that were very similar to those presented in Tables 3-7. Estimated negative binomial coefficients for the 11 programs that were never ranked during this period were much less precise, but nevertheless were of similar magnitude to those presented in Tables 3-7. This pattern of results suggests that the estimates in Tables 3-7 are not being driven by a small subset of programs that are perennially ranked.

Conclusion

Our analysis provides evidence that college football games lead to increases in assaults and vandalism. Home games are associated with a 9 percent increase in assaults, our best measure of aggressive behavior, and an 18 percent increase in vandalism. For the typical agency in our sample, these estimates would translate into an additional 0.5 reports of assault and an additional report of vandalism on a Saturday when a home game was played as compared to a Saturday when no game was played.

[27] Overdispersion is indicated if the hypothesis $\sigma = 0$ cannot be rejected, where σ is the variance of $\exp(\varepsilon_{it})$ from (1). See Grootendorst (2002).

It could easily be argued that these effects, although precisely estimated, are quite modest in terms of magnitude. However, we find that upset losses and wins can lead to much larger increases in these types of offenses. According to our estimates, expected assaults increase by 112 percent with an upset loss at home, and by 36 percent with an upset victory. For the typical agency in our sample this would translate into an additional 6.7 reports of assault in the case of an upset loss on a Saturday, and an additional 2.2 reports of assault in the case of an upset win. An upset loss at home on a Saturday is associated with an additional 3.4 reports of vandalism; an upset loss at home is associated with an additional 2.6 reports of vandalism.

The fact that upsets lead to substantially larger increases in assaults and vandalism than non-upsets suggests that social learning theory, which posits that fans are simply mimicking the violence they view on the field, cannot by itself explain why college football and aggressive/destructive behaviors are connected. In addition, the results with regard to upsets can be seen as evidence against the hypothesis that temporary surges in population on game days are the sole factor behind the positive relationship between offenses and home games.

Moreover, our results are not entirely consistent with explanations of fan aggression that predict that fans will be more likely to react aggressively to a loss than to a win (Dollard et al. 1939; Cialdini et al. 1976; Branscombe and Wann 1992; Wann 1993). For instance, if fan aggression at football games were simply the result of frustration, then games in which the home team won in an upset (where presumably more spectators were rooting for the home team than for the visiting team) would be associated with fewer assaults than non-upset losses at home. However, the data clearly reject this hypothesis. Although there is evidence that upset losses are associated with a larger increase in assaults than are upset wins, our results clearly indicate that expectations, and what happens to fans' behavior when they are not met, should be explicitly built into future attempts to model the relationship between aggression and sporting events.

Finally, our results indicate that college football games lead to increased arrests for alcohol-related offenses and disorderly conduct (the Group B offenses). Home games are associated with a 13 percent increase in arrests for drunk driving, a 41 percent increase in arrests for disorderly conduct, and a 76 percent increase in arrests for liquor law violations.

Again, in the event of an upset, these figures can be much larger. For instance, upset losses are associated with a 162 percent increase in arrests for disorderly conduct, and upset wins are associated with a 93 percent increase in arrests for disorderly conduct. For the typical agency in our sample, these figures correspond to an additional 1.5 arrests for disorderly conduct in the event of a Saturday upset loss, and an additional 0.9 arrests for disorderly conduct in the event of an upset win.

The relationship between home games and arrests may, in part, be due to communities choosing to provide extra police protection on game days. However, if this were the only mechanism at work, then it is unlikely that game outcomes such as upsets would be related to the number of Group B offenses. The fact that expected arrests for alcohol-related offenses and disorderly conduct are much higher in the event of upset wins than in the event of non-upsets suggests that fans may be engaging celebratory drinking. Recent work by Carpenter (2005) strongly suggests that alcohol consumption is causally related to crimes such as vandalism and disorderly conduct. Given this result, it is difficult to rule out the possibility that the relationship between college football games and aggressive behavior is entirely driven by alcohol consumption.

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Table 1.
Characteristics of Schools/Football Programs in Sample

		Number
Region	Southeast	7
	Midwest	11
	Southwest	3
	West	5
	Northeast	0
Community Population	<50,000	9
	50,000-100,000	7
	100,000-200,000	4
	200,000-500,000	4
	>500,000	2
Stadium Size	<30,000	2
	30,000-50,000	9
	50,000-70,000	7
	70,000-90,000	6
	>90,000	2
Ranking (2000-2006)	1-25	6
	25-50	6
	50-75	4
	75-125	5
	Not ranked	5

Table 2.
Distribution of Game days by Day of the Week

Day of Week	Games	Observations
Saturday	1382	2138
Sunday	5	2132
Monday	1	2133
Tuesday	7	2135
Wednesday	12	2137
Thursday	73	2113
Friday	36	2138
Total	1516	14926

Table 3. College Football Games and Number of Offenses

	Assaults	Vandalism	DUIs	Disorderly Conduct	Liquor Law Violations
Home Game	0.086***	0.161***	0.126***	0.346***	0.566***
	(0.027)	(0.032)	(0.040)	(0.072)	(0.077)
Away Game	0.007	0.025	0.017	-0.002	-0.051
	(0.027)	(0.033)	(0.041)	(0.075)	(0.079)
Agency Fixed Effects	Yes	Yes	Yes	Yes	Yes
Observations	14926	14926	14926	14926	14926
Groups	26	26	26	26	26
Log Likelihood	-27755.23	-28259.54	-16959.61	-15035.21	-18973.57

***p<=0.01; **p<=0.05; *p<=0.10

Notes: Estimated coefficients from a negative binomial regression model are reported. Standard errors are in parentheses. Although not shown, controls for day of the week, Thanksgiving, Labor Day, holiday weekends, month, and year are included. The full results are reported in Table 2 of the appendix.

Table 4. Winning vs. Losing

	Assaults	Vandalism	DUIs	Disorderly Conduct	Liquor Law Violations
Home Game Win	0.077***	0.150***	0.094**	0.345***	0.619***
	(0.029)	(0.036)	(0.043)	(0.079)	(0.085)
Home Game Loss	0.109***	0.186***	0.212***	0.351***	0.442***
	(0.042)	(0.049)	(0.061)	(0.104)	(0.111)
Away Game Win	0.014	0.029	0.024	-0.083	0.017
	(0.036)	(0.043)	(0.052)	(0.100)	(0.105)
Away Game Loss	0.001	0.022	0.012	0.054	-0.099
	(0.033)	(0.039)	(0.049)	(0.087)	(0.092)
Agency Fixed Effects	Yes	Yes	Yes	Yes	Yes
Observations	14926	14926	14926	14926	14926
Groups	26	26	26	26	26
Log Likelihood	-27754.91	-28259.29	-16957.90	-15034.46	-18971.97

***p<=0.01; **p<=0.05; *p<=0.10

Notes: Estimated coefficients from a negative binomial regression model are reported. Standard errors are in parentheses. Although not shown, controls for day of the week, Thanksgiving, Labor Day, holiday weekends, month, and year are included.

Table 5. The Relationship between Upsets and Number of Offenses

	Assaults	Vandalism	DUIs	Disorderly Conduct	Liquor Law Violations
Home Game Upset Win	0.308***	0.376***	0.572***	0.656***	0.782***
	(0.112)	(0.127)	(0.136)	(0.234)	(0.266)
Non-Upset Home Game Win	0.063**	0.108***	0.046	0.224***	0.419***
	(0.032)	(0.039)	(0.047)	(0.086)	(0.094)
Home Game Upset Loss	0.755***	0.476***	0.451*	0.963***	0.263
	(0.141)	(0.182)	(0.243)	(0.331)	(0.376)
Non-Upset Home Game Loss	0.057	0.137***	0.202***	0.182	0.375***
	(0.045)	(0.052)	(0.065)	(0.112)	(0.119)
Agency Fixed Effects	Yes	Yes	Yes	Yes	Yes
Observations	14926	14926	14926	14926	14926
Groups	26	26	26	26	26
Log Likelihood	-27734.19	-28240.85	-16944.42	-15014.53	-18952.48

***p<=0.01; **p<=0.05; *p<=0.10

Notes: Estimated coefficients from a negative binomial regression model are reported. Standard errors are in parentheses. Although not shown, controls for day of the week, Thanksgiving, Labor Day, holiday weekends, month, and year are included. Also included are indicators for away-game outcomes.

Table 6. Close Games vs. Games Decided by More than 8 Points

	Assaults	Vandalism	DUIs	Disorderly Conduct	Liquor Law Violations
Home Game Win Decided by ≤ 8	0.112**	0.142**	0.181**	0.502***	0.634***
	(0.054)	(0.067)	(0.082)	(0.138)	(0.149)
Home Game Win Decided by > 8	0.050	0.125***	0.048	0.169*	0.391***
	(0.034)	(0.041)	(0.049)	(0.090)	(0.099)
Home Game Loss Decided by ≤ 8	0.127**	0.128*	0.189**	0.374***	0.275*
	(0.055)	(0.066)	(0.082)	(0.137)	(0.151)
Home Game Loss Decided by > 8	0.045	0.147**	0.184**	0.050	0.432***
	(0.060)	(0.068)	(0.085)	(0.149)	(0.150)
Agency Fixed Effects	Yes	Yes	Yes	Yes	Yes
Observations	14926	14926	14926	14926	14926
Groups	26	26	26	26	26
Log Likelihood	-27746.35	-28246.61	-16950.79	-15013.87	-18951.48

***p<=0.01; **p<=0.05; *p<=0.10

Notes: Estimated coefficients from a negative binomial regression model are reported. Standard errors are in parentheses. Although not shown, controls for day of the week, Thanksgiving, Labor Day, holiday weekends, month, and year are included. Also included are indicators for away-game outcomes.

Table 7. Adding Lags to the Model.

	Assaults		Vandalism	
Home Game Upset Win_t	0.308***	0.255**	0.376***	0.326**
	(0.112)	(0.116)	(0.127)	(0.132)
Home Game Upset Win_{t-1}		0.113		0.171
		(0.096)		(0.108)
Home Game Upset Win_{t-2}		0.056		0.008
		(0.080)		(0.103)
Non-Upset Home Game Win_t	0.063**	0.025	0.108***	0.059
	(0.032)	(0.038)	(0.039)	(0.046)
Non-Upset Home Game Win_{t-1}		0.013		0.044
		(0.041)		(0.049)
Non-Upset Home Game Win_{t-2}		0.016		-0.007
		(0.036)		(0.044)
Home Game Upset $Loss_t$	0.755***	0.692***	0.476***	0.423**
	(0.141)	(0.145)	(0.182)	(0.185)
Home Game Upset $Loss_{t-1}$		-0.003		0.349**
		(0.115)		(0.142)
Home Game Upset $Loss_{t-2}$		0.071		-0.062
		(0.132)		(0.153)
Non-Upset Home Game $Loss_t$	0.057	0.023	0.137***	0.090
	(0.045)	(0.049)	(0.052)	(0.057)
Non-Upset Home Game $Loss_{t-1}$		0.017		0.071
		(0.049)		(0.059)
Non-Upset Home Game $Loss_{t-2}$		0.057		-0.017
		(0.045)		(0.056)
Agency Fixed Effects		Yes		Yes
Observations		14926		14926
Groups		26		26
Log Likelihood		-27719.3		-28213.88

***p<=0.01; **p<=0.05; *p<=0.10

Notes: Estimated coefficients from a negative binomial regression model are reported. Standard errors are in parentheses. Although not shown, controls for day of the week, Thanksgiving, Labor Day, holiday weekends, month, and year are included. Also included are indicators for away-game outcomes with lags.

Table 7 (continued). Adding Lags to the Model

	DUIs		Disorderly Conduct		Liquor Law Violations	
Home Game Upset Win_t	0.572***	0.531***	0.656***	0.545**	0.782***	0.661**
	(0.136)	(0.144)	(0.234)	(0.250)	(0.266)	(0.289)
Home Game Upset Win_{t-1}		0.189		-0.102		0.009
		(0.134)		(0.265)		(0.273)
Home Game Upset Win_{t-2}		-0.207		-0.276		-0.396
		(0.137)		(0.240)		(0.270)
Non-Upset Home Game Win_t	0.046	0.007	0.224***	0.126	0.419***	0.258*
	(0.047)	(0.057)	(0.086)	(0.113)	(0.094)	(0.136)
Non-Upset Home Game Win_{t-1}		0.082		0.198		0.260*
		(0.064)		(0.122)		(0.151)
Non-Upset Home Game Win_{t-2}		-0.035		-0.010		-0.120
		(0.063)		(0.105)		(0.122)
Home Game Upset $Loss_t$	0.451*	0.385	0.963***	0.840**	0.263	-0.010
	(0.243)	(0.248)	(0.331)	(0.347)	(0.376)	(0.394)
Home Game Upset $Loss_{t-1}$		-0.012		0.432		0.162
		(0.158)		(0.290)		(0.389)
Home Game Upset $Loss_{t-2}$		-0.160		-0.430		-0.349
		(0.183)		(0.391)		(0.354)
Non-Upset Home Game $Loss_t$	0.202***	0.159**	0.182	0.087	0.375***	0.216
	(0.065)	(0.072)	(0.112)	(0.135)	(0.119)	(0.156)
Non-Upset Home Game $Loss_{t-1}$		0.088		0.031		0.292*
		(0.074)		(0.143)		(0.169)
Non-Upset Home Game $Loss_{t-2}$		0.021		-0.073		-0.008
		(0.074)		(0.125)		(0.143)
Agency Fixed Effects		Yes		Yes		Yes
Observations		14926		14926		14926
Groups		26		26		26
Log Likelihood		-16933.28		-14997.25		-18922.09

***p<=0.01; **p<=0.05; *p<=0.10

Notes: Estimated coefficients from a negative binomial regression model are reported. Standard errors are in parentheses. Although not shown, controls for day of the week, Thanksgiving, Labor Day, holiday weekends, month, and year are included. Also included are indicators for away-game outcomes with lags.

Figure 1. Mean Assaults

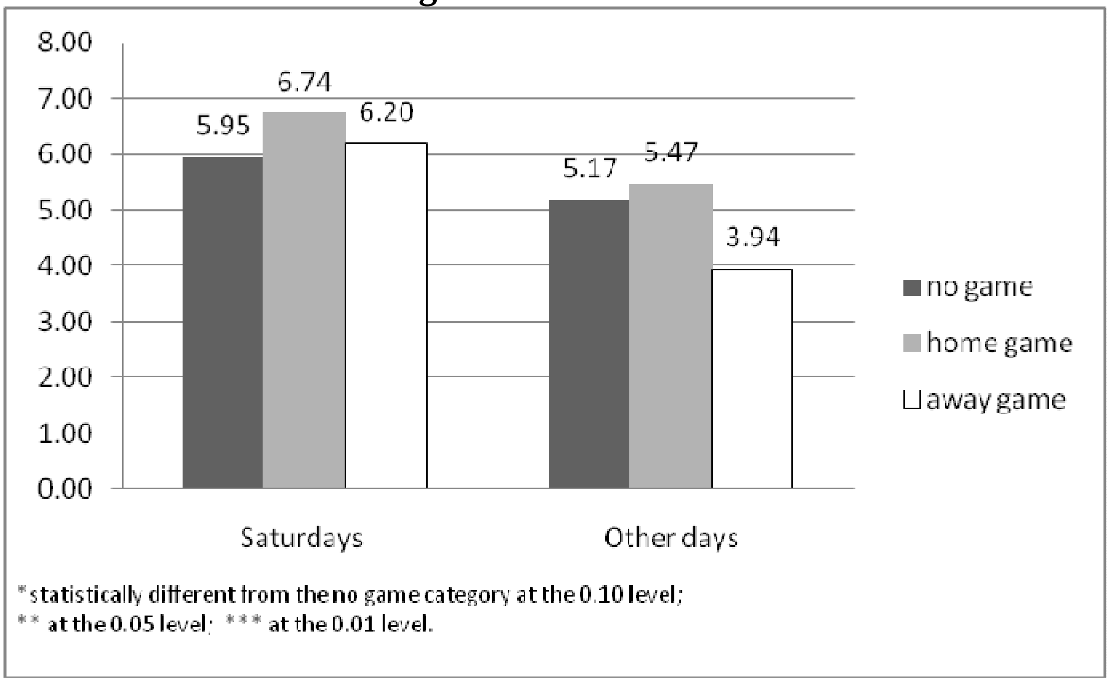


Figure 2. Mean Vandalism Offenses

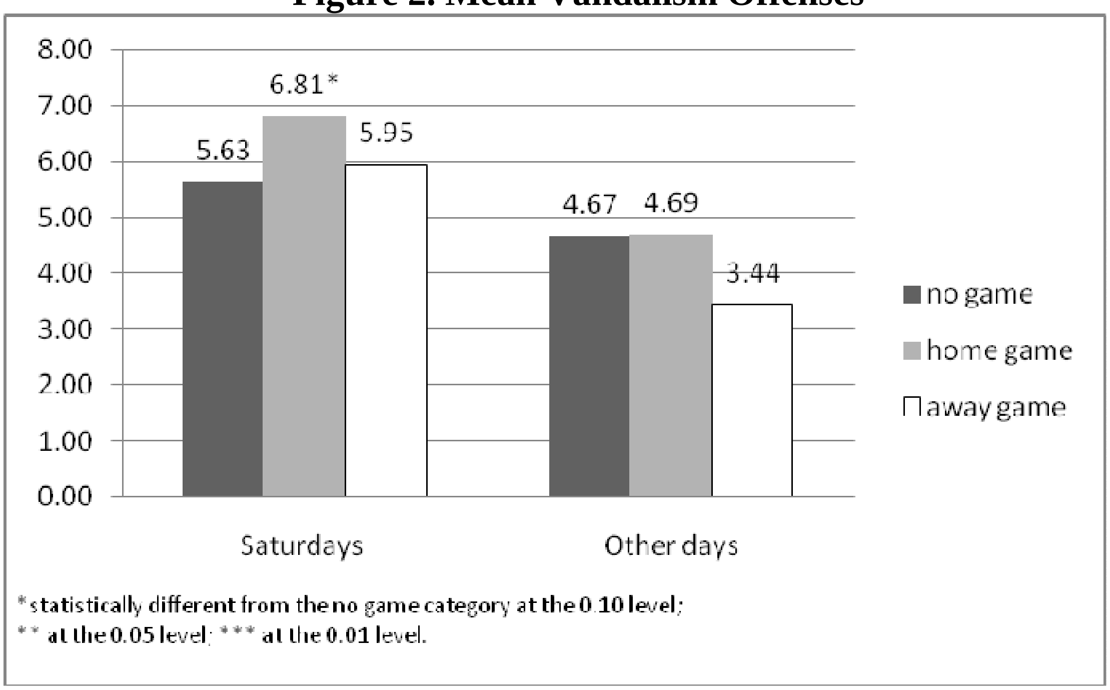


Figure 3. Mean Arrests for DUI

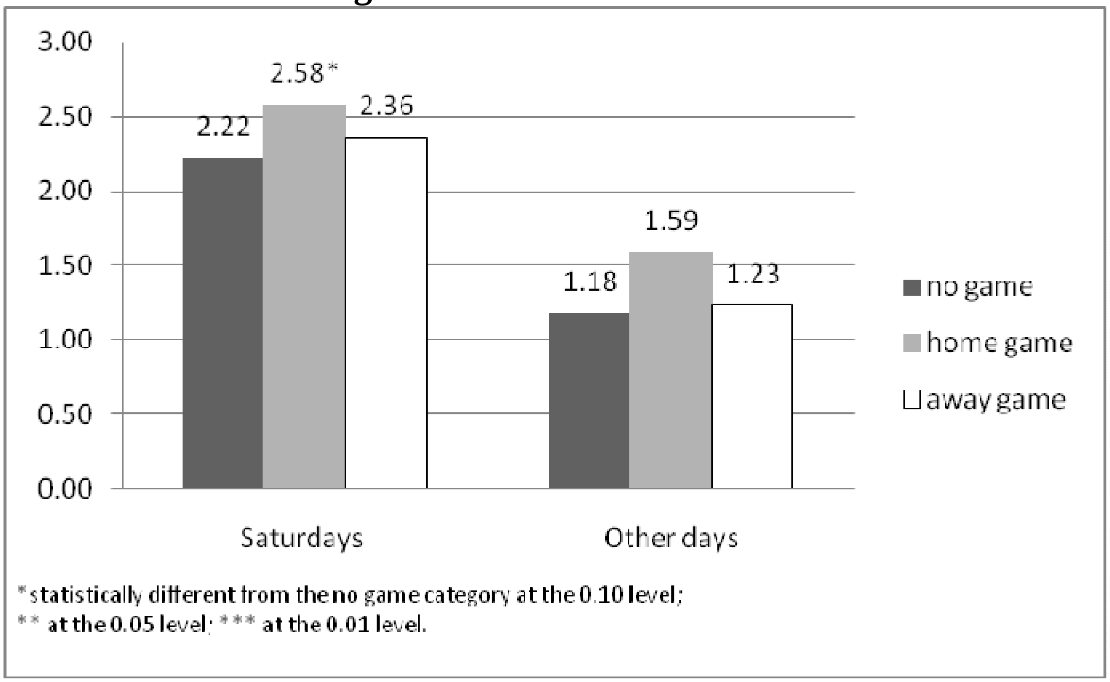


Figure 4. Mean Arrests for Disorderly Conduct

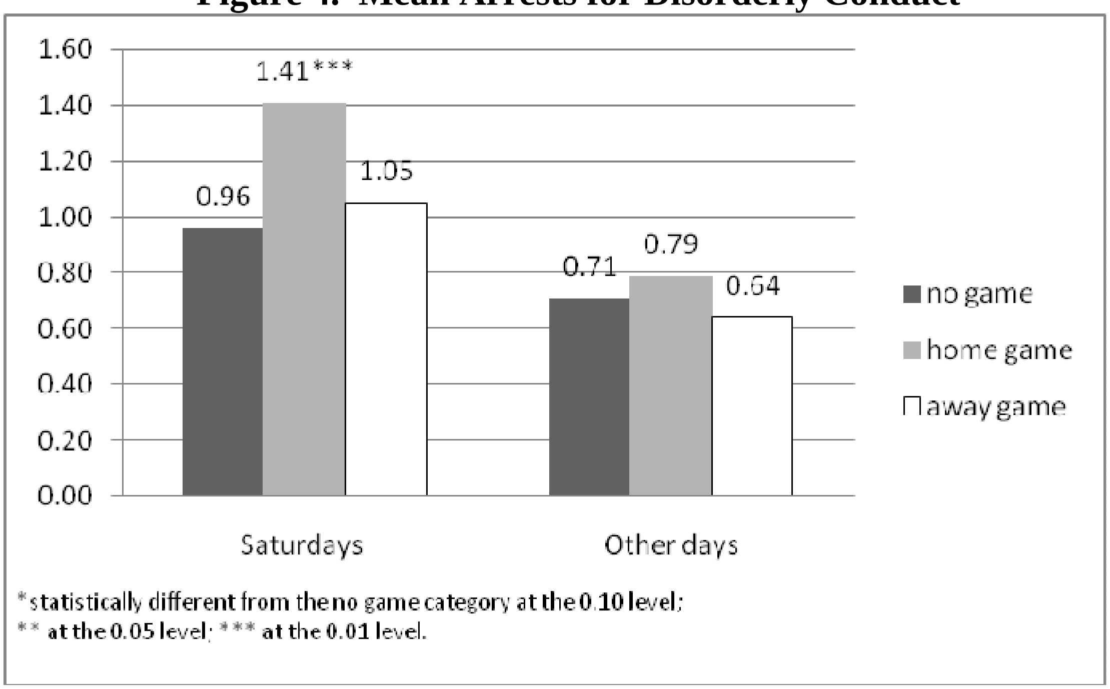
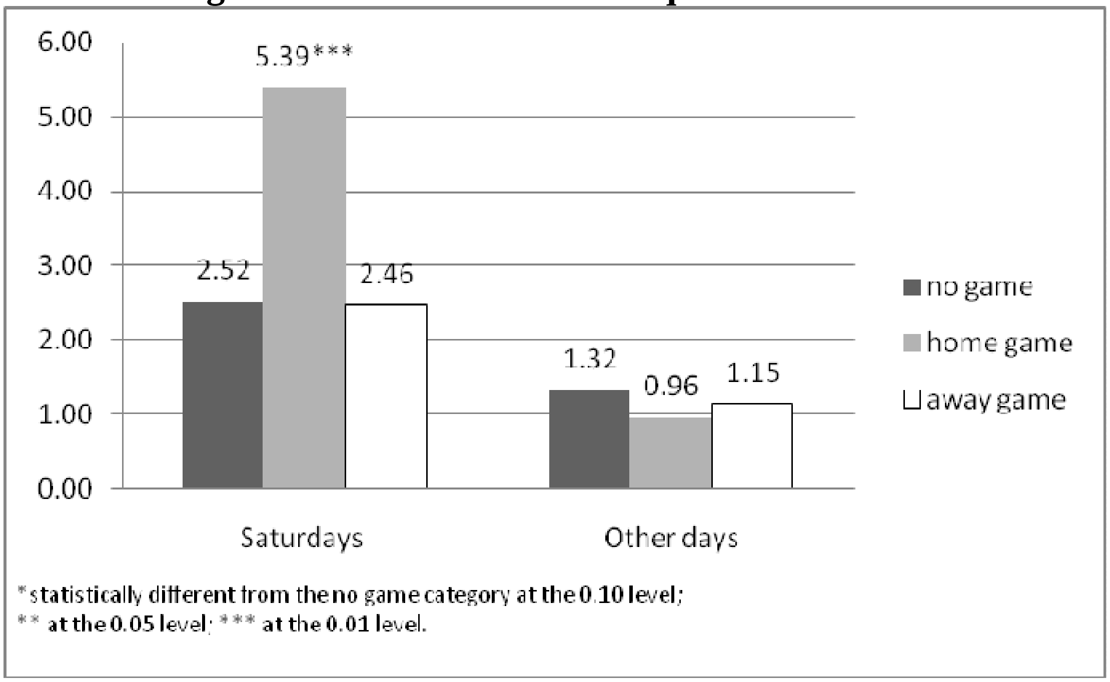


Figure 5. Mean Arrests for Liquor Law Violations



Appendix Table 1. Descriptive Statistics for Count Variables

	All days	No game	Home game	Away game
Assaults	5.32	5.21	6.63	6.00
	(10.07)	(9.90)	(12.30)	(10.42)
0.25 quantile	0	0	1	1
0.50 quantile	2	2	2	2
0.75 quantile	6	6	7	7
0.90 quantile	13	12	15	15
Vandalism	4.87	4.73	6.62	5.73
	(11.11)	(11.00)	(12.98)	(10.88)
0.25 quantile	0	0	1	1
0.50 quantile	2	2	3	2
0.75 quantile	5	4	7	6
0.90 quantile	11	11	15	15
DUIs	1.35	1.24	2.49	2.26
	(2.63)	(2.42)	(3.86)	(3.95)
0.25 quantile	0	0	0	0
0.50 quantile	0	1	1	1
0.75 quantile	2	1	3	3
0.90 quantile	4	3	7	6
Disorderly Conduct	0.77	0.72	1.36	1.01
	(1.51)	(1.42)	(2.21)	(1.93)
0.25 quantile	0	0	0	0
0.50 quantile	0	0	0	0
0.75 quantile	1	1	2	1
0.90 quantile	2	2	4	3
Liquor law violations	1.62	1.39	4.99	2.35
	(4.65)	(3.94)	(11.00)	(4.31)
0.25 quantile	0	0	0	0
0.50 quantile	0	0	1	1
0.75 quantile	1	1	5	3
0.90 quantile	4	4	13	7

Note: Standard deviations in parentheses.

Appendix Table 2. College Football Games and Offenses, Full Results

	Assaults	Vandalism	DUIs	Disorderly Conduct	Liquor Law Violations
Home Game	0.086***	0.161***	0.126***	0.346***	0.566***
	(0.027)	(0.032)	(0.040)	(0.072)	(0.077)
Away Game	0.007	0.025	0.017	-0.002	-0.051
	(0.027)	(0.033)	(0.041)	(0.075)	(0.079)
Labor day	0.206***	0.152**	0.311***	0.578***	1.287***
	(0.055)	(0.071)	(0.110)	(0.156)	(0.165)
Thanksgiving	-0.070	-0.097	0.300***	0.125	-0.140
	(0.061)	(0.075)	(0.091)	(0.175)	(0.192)
Holiday weekend	-0.055**	-0.097***	-0.065*	-0.197***	-0.298***
	(0.022)	(0.026)	(0.033)	(0.060)	(0.061)
Tuesday	0.036*	-0.096***	0.065	0.173***	0.094***
	(0.019)	(0.023)	(0.040)	(0.056)	(0.067)
Wednesday	0.031	-0.047**	0.251***	0.177***	0.417***
	(0.019)	(0.023)	(0.038)	(0.057)	(0.064)
Thursday	0.066***	-0.029	0.573***	0.309***	0.831***
	(0.019)	(0.024)	(0.037)	(0.056)	(0.063)
Friday	0.160***	0.267***	0.878***	0.687***	1.504***
	(0.019)	(0.022)	(0.035)	(0.054)	(0.061)
Saturday	0.296***	0.348***	1.204***	0.788***	1.730***
	(0.024)	(0.029)	(0.041)	(0.068)	(0.074)
Sunday	0.307***	0.258***	0.968***	0.776***	1.422***
	(0.018)	(0.023)	(0.035)	(0.053)	(0.061)

Appendix Table 2 (continued). College Football Games and Offenses, Full Results

	Assaults	Vandalism	DUIs	Disorderly Conduct	Liquor Law Violations
2001	-0.054***	0.095***	-0.179***	-0.068	-0.257***
	(0.018)	(0.022)	(0.029)	(0.052)	(0.055)
2002	0.067***	0.193***	0.125***	0.153***	-0.016
	(0.017)	(0.022)	(0.027)	(0.049)	(0.053)
2003	0.043**	0.198***	0.033	0.113**	0.042
	(0.018)	(0.022)	(0.030)	(0.050)	(0.053)
2004	0.163***	0.175***	0.109***	0.276***	-0.032
	(0.017)	(0.022)	(0.029)	(0.049)	(0.053)
2005	0.131***	0.164***	0.118***	0.359***	0.032
	(0.018)	(0.022)	(0.029)	(0.049)	(0.053)
August	0.046***	-0.041*	0.080***	0.183***	0.799***
	(0.017)	(0.021)	(0.030)	(0.047)	(0.050)
September	0.070***	-0.024	0.035	0.144***	0.365***
	(0.013)	(0.016)	(0.022)	(0.036)	(0.039)
November	-0.089***	-0.063***	-0.028	-0.231***	-0.260***
	(0.013)	(0.016)	(0.023)	(0.038)	(0.042)
December	-0.125***	-0.206***	-0.018	-0.420***	-0.485***
	(0.019)	(0.024)	(0.032)	(0.057)	(0.062)
Agency Fixed Effects	Yes	Yes	Yes	Yes	Yes
Observations	14926	14926	14926	14926	14926
Groups	26	26	26	26	26
Log Likelihood	-27755.23	-28259.54	-16959.61	-15035.21	-18973.57

***p<=0.01; **p<=0.05; *p<=0.10

Notes: Estimated coefficients from a negative binomial regression model are reported. Standard errors are in parentheses.