

# **Officiating Bias: The Effect of Foul Differential on Foul Calls in NCAA Basketball**

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## *Abstract*

This study examines the pattern of foul calls exhibited during 365 NCAA basketball games during the 2004-2005 season. Results of the analysis indicate that officials are more likely to call fouls on the team with the fewest fouls, making it likely that the number of fouls will tend to even out during the game. This increased probability increases as the foul differential increases. In addition, there is a significant bias toward officials calling more fouls on the visiting team, and a bias toward foul calls on the team that is leading in score. The result is that the probability of the next foul being called on the visiting team can reach as high as .70 during some game circumstances. Finally, implications of this officiating bias are explored, including the fact that basketball teams have an incentive to play more aggressively, leading to more physical play over time.

## ***Introduction***

During a 2005 Final Four men's basketball semi-final game, the University of Illinois matched up with the University of Louisville to determine which team would advance to the championship game. Illinois, a team known for its aggressive defensive play, was whistled for the first seven fouls in the game. Subsequently, five of the next six fouls were called on Louisville. By the end of the game, Louisville was called for one more foul than Illinois (13-12), a dramatic turnaround given that the first seven fouls all went against Illinois.

The extent to which past events can predict a future outcomes in sport has been analyzed by researchers conducting "hot hand" research (see Dr. Alan Reifman's website, <http://thehothand.blogspot.com> for a survey). Scholars examining streakiness within basketball analyze seemingly non-random events, such as an individual player making consecutive baskets. They typically conclude, however, that such an event is random, meaning that an individual is not more likely to make the next shot if the previous shot was made (Gilovich, Vallone & Tversky, 1985). Rather than examining previous baskets made by individual players, this research examines the pattern of foul calls in men's intercollegiate basketball and evaluates whether they are influenced by previous events. In the case of the Illinois-Louisville game, is it just as likely that Illinois would have been called for five of the next six fouls after being called for the first seven fouls in the game? More broadly, is officiating behavior independent of prior actions? If it is not, are there discernible patterns of officiating behavior, and what are the implications of these patterns to the overall sport? The first section of the paper reviews existing research on biases in sports officiating. The second section uses a data set of 365 National Collegiate Athletic Association (NCAA) basketball

games to identify patterns in the sequence of officiating decisions. The final section addresses the implications of these patterns for the game of basketball.

### ***Theoretical Background***

According to Askins (1978), “the behavior of officials demonstrates an attempt to be fair rather than objective” (p. 20). Not only do officials attempt to officiate as fairly as possible, but they also seek to be perceived as fair by external agents such as players, coaches, and fans. However, in their attempt to be perceived as fair, officials may not necessarily be objective. Askins (1978) noted that it is impossible for officials to be purely objective, or “transcend the influences of the moment and adopt a stance, which is neutral and unbiased” (p. 19).

Clearly, fairness and objectivity are not perfectly aligned. For example, basketball officiating is very subjective, with high variance among officials as to what is or is not a foul. Given this fact, one way to measure the “fairness” of officials is to examine the number of fouls called on each team. Officials concerned with being perceived as fair have an incentive to keep track of the number of fouls called on each team, and they may have a propensity to call fouls with greater frequency on the team with fewer fouls. External agents may perceive the officiating crew as fair, but this approach to decision making is certainly not objective. Conversely, officials unconcerned about perception are more likely to ignore prior fouls and call each subsequent infraction “as they see it.”

While calling an approximately equal number of fouls on each team may give the perception of an unbiased official, it may actually be quite unfair and lead to unintended consequences. Take the example of one team that is significantly more aggressive than another team. An officiating crew that actively tries to keep the number of fouls called on

each team approximately equal is actually giving an advantage to the more aggressive team by either ignoring physical play by the aggressive team, or by being quick to whistle a foul by the less aggressive team. As one NCAA coach remarked, “We’ll play against a team that comes in and blatantly pushes our post players, and grabs and holds on defense, and the officials will call it the first time, and maybe the second. But eventually, they stop calling it and by the end of the game, we have just as many fouls even though they are the far more physical team.” If an officiating crew shows a consistent bias toward keeping the number of fouls equal, coaches may encourage their teams to play more aggressively. An unintended consequence is that as all coaches consistently pursue this strategy, and the overall aggressiveness and physical nature of the sport may increase.

In fact, American college basketball has become much more physical over the last 25 years. According to the NCAA, the primary governing body of American intercollegiate sports, “Physical play and illegal contact have inhibited the game of skill that James Naismith envisioned” (NCAA, 2000; NCAA, 2004). Over the past eleven years, the NCAA has made reducing the rough play and physical contact a point of emphasis for officials and coaches (NCAA, 2007). However, these directives have been ineffective at reducing physical play. One possible explanation for this is the advantage gained by aggressive teams when officials actively try to keep an even number of fouls on each team.

### ***Literature Review***

Scholarly research from a variety of academic disciplines has indicated that officials exhibit bias in their decision making. A review of related literature revealed three broad categories of bias in officiating. Home field bias research attempts to demonstrate that officials favor the home team, game circumstance bias research attempts to demonstrate that

officials take into account the score of the game, and previous decision bias research attempts to demonstrate that officials take into consideration previous decisions in an attempt to even out the calls.

The most frequently studied bias is the propensity for officials to favor the home team (Nevill & Holder, 1999). Greer (1983) found that referee judgment differed in favor of the home team after prolonged periods of fan booing. Nevill, Balmer & Williams (2002) examined English Premier League football and found that crowd noise influenced referee decisions in favor of the home team. Likewise, Garicano, Palacios-Huerta & Prendergast (2005) examined the Spanish Primera Division and found that referees gave more penalty time at the end of games when the home team was trailing by one goal than when the home team was ahead by one goal. Similarly, Balmer, Nevill & Lane (2005) found that a home officiating bias occurred in European Championship Boxing when referees were required to make scoring decisions. Finally, Sutter & Kocher (2004) and Dohmen (2005) both identified a systematic home bias in soccer officials in the German Bundesliga.

Second, game circumstance bias attempts to identify whether or not officials attempt to take into account the score of the game in their decision making. The score differential and other external factors, such as keeping a nationally televised game close in score for the benefit of network television, has been empirically assessed. Thu et al. (2002) concluded that in nationally televised games, basketball officials had a tendency to call more fouls on the team that was leading the game. In this way, officials were giving an advantage to the trailing team and thereby keeping the score of the game closer than it otherwise would be. They found that this effect was more pronounced for nationally televised games than games that are only televised locally.

Finally, the notion that officials either consciously or subconsciously consider previous officiating decisions in determining future calls was put forth by Plessner & Betsch (2001), who analyzed sequential effects of penalty-kick calls in soccer. They found that “important referee decisions, such as awarding a penalty in a given situation, are influenced by previous decisions in similar situations” (p. 258). They identified three trends in referee decision making: the probability of awarding a penalty-kick increased if a penalty had not been awarded to the same team previously; officials were less likely to award a penalty kick when they had previously awarded a penalty-kick to the same team; and awarding a penalty-kick to one team increased the probability of giving a penalty-kick to the opposing team (Plessner & Betsch, 2001). However, their study was critiqued by Mascarenhas, Collins & Mortimer (2002) in part for relying on results using video-taped scenarios in a laboratory setting.

This study builds on the Plessner & Betsch (2001) research by using actual foul call data from NCAA basketball games rather than experimental results. While previous research has examined home field advantage, score differential, and prior decisions, this research analyzes the influence that the net difference in fouls has on referee decision making.

The basic hypothesis of this paper is that an officiating crew which has called a significantly higher number of fouls on one team will tend to feel pressure to equalize the foul count. This pressure may come from the home crowd (Glamser, 1990; Greer, 1983; Lehman & Reifman, 1987; Nevill, Balmer & Williams, 2002; Wright & House, 1989), network television (Thu et al., 2002), coaches and players (Askins, 1979; Smith, 1982), and may also be internal (Askins, 1979). According to Askins (1978),

Contrary to what most officials claim publicly, the various audiences have an impact upon their work...To suggest that officials are not influenced by audiences is to suggest they are not aware of their presence and this is not the case. During the course of any contest there are many incidents which appear ambiguous, even to veteran officials. When this occurs, officials do basically what all humans do in such situations, i.e., they seek clarification through any means available at the time. Crowd reaction may sometimes provide the cue, which prompts their decision. This could become a part of the so-called homecourt advantage (p. 18).

In summary, the work of the officiating crew is constantly being scrutinized by an external audience. Foul counts are posted in real-time for the fans, coaches, and players to scrutinize and voice their concerns when the foul differential is large, applying pressure on the officials to equalize the foul count.

This study examines two main hypotheses. First, the foul differential at the end of a period will be smaller than would be expected if officiating crews ignored previous calls. Since officials have a bias toward calling an approximately even number of fouls on each team, the foul differential at the end of the half or game will not be as high as would be expected if no bias occurred. Second, when a discrepancy in the number of fouls called on each team occurs, it is more likely that the next foul will be called on the team with fewer fouls, and that this likelihood increases as the foul discrepancy increases. In examining these results, home-court advantage and score differential will be controlled for.

### ***Methods***

Data on the number and sequence of fouls called during 365 NCAA men's college basketball games played during the 2004-2005 basketball season were collected from the



game box scores posted on [www.espn.com](http://www.espn.com). The games examined include all intra-conference games in the Big Ten, Big East, and ACC, as well as the NCAA tournament games. Intra-conference games are examined so that the officiating crews are selected by the conference rather than one of the universities. These three conferences were chosen as representative conferences of major college basketball in the United States. While they are three of the premier conferences in NCAA men's basketball, there are some differences in style of play across the conferences. Specifically, the Big East has a reputation as a league with a more physical style of play than the other two conferences. NCAA tournament games were included to examine officiating patterns during games played at neutral venues.

In total, 272 regular season games pitting a visiting team against a home team, 30 neutral court conference tournament games, and 63 neutral court NCAA tournament games were examined. To avoid the difficulty of trailing teams intentionally fouling toward the end of games, only fouls called in the first half were included in the analysis. The entire data set included 5,529 personal fouls called during 365 games, for an average of 15.1 fouls called in the first half. Flagrant fouls were included as personal fouls, but technical fouls which are not very common, were not included in the analysis. The data contain the team committing the foul, the time the foul was called, and the current score.

Several tests are used to analyze the hypotheses. First, the foul differential at the end of the half is examined for the 272 regular season games. If foul calls are independent, then the distribution of the foul differential at the end of each half should approximate a binomial distribution. A comparison of the standard deviations of the distribution of the empirical foul differential with what would be expected with a binomial distribution is used to test the assumption of independence. If the standard deviation is significantly smaller than the

expected standard deviation, it suggests that foul calls are not independent. An F-test is used to compare the empirical standard deviation with the expected. In addition, the mean foul differential is tested against the hypothesis of zero. A negative foul differential indicates fewer fouls called on the home team, and is an indication of home bias.

Secondly, a logistic regression model is used to test the how the likelihood of a foul is affected by which team is the home team, the foul differential, and the score differential. In the model, the binary dependent variable is *foulhome*, which takes the value 1 if the foul is on the home team, and 0 if the foul is on the visiting team. Independent variables include *netfouls*, which is the net difference of the number of fouls called on the home team less the number of fouls called on the visiting team prior to the current foul call. It is a positive number if the number of fouls on the home team exceeds the fouls on the visiting team. The score is incorporated in two variables. *Hmlead* is a dummy variable that is 1 if the home team is winning and 0 otherwise, and *scorenet* is the point difference between the home team and the visiting team. In addition, dummy variables are used for the Big Ten and ACC conferences, while the dummy for Big East was omitted. The model is applied to 4142 foul calls from the 272 games played at one team's home court. The model is listed as equation 1:

$$\text{Ln}\left(\frac{P_h}{1 - P_h}\right) = \beta_0 + \beta_1 \text{netfouls} + \beta_2 \text{Hmlead} + \beta_3 \text{scorenet} + \beta_4 \text{ACC} + \beta_5 \text{Bigten}$$

Since home advantage has been extensively documented to influence officiating decisions, an analysis of games played on a neutral court is a valuable way to isolate some of the suggested officiating patterns. Therefore a second logistic regression is employed with slight modification and used on the 93 neutral court games (30 conference tournament games and 63 NCAA tournament games) from the sample. The model specification is the same as in equation 1, with the exception that the "home" team is the team with the better seed, as the

game is played at a neutral venue. This allows for comparison of effects without home bias, and also allows for a measure of team quality, since the better seed is generally a team of better quality. Both logistic regressions were run using the Stata software package. The logistic regression was run under several specifications, including robust standard errors, and using clustered observation standard errors, with each game as a cluster. This is done as an attempt to adjust for the fact that observations may not be independent as required under the logistic specification. The significance level for all of the variables does not change under any of the standard error specifications, and therefore the results of these models were not included.

### ***Results***

The first test compares the foul differential at the end of the half with the expected foul differential under the assumption of independence. Figure 1 illustrates the empirical and expected differential. The mean and variance of the foul differential (home team fouls less visiting team fouls) for the 272 regular season games are -.960 and 7.40. Taking the number of foul calls as constant and assuming an equal probability of a foul call on each team, the expected mean and standard deviation of foul calls are 0 and 19.89. Using a chi-squared test to compare the ratio of the actual and expected variances, the variance of the actual foul distribution is lower than the expected [ $\chi^2$  (df, N=272) = 100.72, P<.001]. A T test is used to compare the sample mean of -.960 with the expected mean of zero. Consistent with a finding of home bias, the foul differential is significantly less than zero [T (N=272) = 5.819, P<.001] indicating that significantly more fouls are called on the visiting team.

**[Insert Figure 1 about here]**

These findings are consistent with the first hypothesis that the foul differential at the end of a set period is smaller than expected under statistical independence. The median foul differential is -1 (one more foul call on the visitor than the home), and in 63.2% of games the foul differential fell between a -3 and 1, compared to an expectation of 46.7% under the assumption of independence.

The second hypothesis states that the probability of a foul called on a team increases as the foul differential increases in that team's favor. Figure 2 shows the probability of a foul on the home team as a function of the foul differential. As hypothesized, the probability of a foul on the home team increases as the foul differential is in the home team's favor, and declines when the foul differential is in the visiting team's favor.

**[Insert Figure 2 about here]**

The results of the first logistic regression are presented in Table 1. As hypothesized, the coefficient for net fouls is negative and significant. The more fouls that the home team has relative to the visiting team, the less likely it is that the next foul will be called on the home team. The coefficient for the dummy variable for a home lead is positive and significant, but the net score variable is not significant. This suggests that the team with the lead is more likely to get the next foul call, but that the magnitude of the lead does not significantly influence this probability. The conference dummy variables have no significant effects.

**[Insert Table 1 about here]**

To understand the significance of the factors, it is useful to examine some of the marginal effects of the regression. For each additional foul against the home team, the probability that the next foul will be called against the home team drops by .0295.

Comparing the case where the home team has three fewer fouls called on it with the case when it has three more fouls called, the probability of the next foul being called on the home team declines from .571 to .396. A similar comparison shows that the home team having the lead increases the probability that the next foul will be called on them by .063.

The second logistic regression examines only neutral court games, with the results presented in Table 2. Again, the net fouls are significant and negative, indicating that foul differential has a significant impact on the probability of the next foul. The dummy variable for lead is significant; however, the net score variable is not significant, suggesting that the magnitude of the lead does not matter. Conference dummy variables are again not significant. Both regression models have a low pseudo  $R^2$  of less than .02.

**[Insert Table 2 about here]**

### ***Discussion***

The results show a clear pattern of an increased probability of a foul on the team with fewer fouls, the visiting team, and the team that is leading. Home advantage, including officiating bias, has been studied extensively in sport literature (Smith, 2005). Results in this study suggest that the probability of a foul being called on the visiting team is about 7% higher than on the home team under similar circumstances. It should be noted that in all of the games, the officials are assigned by the respective conferences or the NCAA, and therefore, should not have any allegiance to the home school.

The increased proportion of fouls called on the trailing team is a phenomenon that has only been recently identified in the literature (Thu et al, 2002). An interesting finding is that the magnitude of the lead had no significant bearing on the proportion of fouls called. When

the home team is leading, the probability of the next foul being called on them is about 6.3 percentage points higher than when the home team is trailing.

The finding that the foul differential significantly and dramatically impacts the proportion of fouls called against the two teams is an important result. This is evidence of officials actively tracking the foul differential and changing behavior to focus on equality of outcomes, rather than striving for objectivity. Such a clear and convincing pattern of behavior is likely to have a significant impact on the outcome of games, and therefore on the strategy that coaches and players employ during competition. However, it is important to note that the pseudo-R is low, indicating that the action on the court is the primary determinant of foul calls, while the significance of the other factors indicates a clear bias that underlies these decisions.

Before discussing the implications of these findings, it is acknowledged that several possible alternative explanations other than officiating bias exist for the phenomenon discussed in this paper. The most plausible alternate explanation is that teams and coaches react to foul calls by changing the behavior or strategy of the team. A team with few fouls may play more aggressively because it has not been penalized, while a team that has been called for several fouls may respond by playing less aggressively. McGuire et. al (1992) found that player behavior changes depending on the game situation. However, we are unaware of coaches or captains intentionally modifying their style of play or level of aggression during a game except in the case of an individual player having foul trouble. Therefore, this does not appear to provide a complete explanation for the documented phenomenon. One might expect the opposite effect, that experienced players would recognize that fewer fouls have been called on their team and know that their actions will be

more closely scrutinized going forward. Additionally, the fact that this pattern appears even when the foul differential is small makes it unlikely that it is due to players modifying their behavior during the game.

It is also interesting to ponder the underlying causes of the behavior patterns of the officials. It is possible that they are responding to external factors such as the crowd, the coaches, and the players. The practice of “working the officials” (lobbying or complaining in hopes of influencing future calls) is a common and accepted part of game strategy (Smith, 2005). Inherent in this strategy is the belief that external agents can influence officiating calls, in part based on reaction to previous calls. It is also likely that there are some internal processes affecting the way individuals perceive fairness of outcomes that influence the behavior of the referee. While the crowd may put pressure on the officials when the home team is at a disadvantage, we find that the sequence effects work against the home team as well. That is, when the home team has 3 or 4 fewer fouls than the visitor, the probability that the next foul will be on the home team is approximately 55%. It is unlikely that the home crowd influences the officials to an increased probability of making foul calls on the home team. In addition, Plessner & Betsch (2001) found that previous penalty kick calls have an effect on subsequent calls, even when the referees are watching calls on videotape.

Presumably, these are conditions in which subjects are responding to an internal desire for fairness rather than external agents such as coaches or fans. Unfortunately, it is beyond the scope of this paper to analyze all of these issues, and it is hoped that future researchers will provide greater insight to the causes of these behaviors.

The results of this study have strategic competitive implications for coaches and players. One may wonder whether this officiating pattern is harmless or even beneficial.

Coaches, players, fans, and officials may benefit from the perception that the game is being called fairly by having an approximately equal number of fouls called on each team.

However, this pattern of behavior has negative consequences, as well. The effect of the pattern is to mitigate the harm of a foul called. When a team commits a foul, it incurs a penalty in the form of lost possession or giving the other team foul shots. However, this penalty is mitigated if the referee is then more inclined to call a subsequent foul on the opposing team. Players determine their aggressiveness by balancing the harm of aggressive play (the expected probability of a foul times the level of the penalty) with the benefit of aggressive play (generally a lower probability that the opponent will score). An officiating pattern that reduces the penalty of a foul call will encourage teams to increase aggressive play. From a strategic perspective, each coach will want to have the more aggressive and physical team, as the benefits of physical play will tend to outweigh the cost of incurring one or two more fouls per half of play.

These theoretical results match up well with the observed behavior of NCAA basketball teams over the last 20 years. Play has become increasingly aggressive, and the NCAA has made fruitless efforts to reduce the level of aggression (NCAA, 2000; NCAA, 2004). The model addressed in this study suggests that the underlying problems may be greater than the NCAA appreciates. To truly reduce the level of aggression, the NCAA would have to enact policies and rule changes that reward teams that play less physically. This could include educating officials about officiating biases and encouraging them to call fouls without regard to foul differential, or to possibly increase the penalty for a foul.

This study uses only one sport, but the underlying phenomenon is generalizable not only to most sporting situations involving officials, but to other fields as well. There are



several conditions which can create an environment in which officials will likely be influenced by previous rulings. First, there must be sufficient subjectivity and ambiguity in the decision and decision-making process that the official can credibly side with either party without making a blatant error. For example, tennis is a sport with a very low level of subjectivity in the refereeing, and presumably there is no pattern of officiating that is predicated on prior calls. One of the appeals of using basketball for the basis of this study is precisely that many of the calls are very subjective. However, football (soccer), American football, and many other sports are sufficiently subjective to notice patterns. Second, there must be a sufficient number of decisions so that the referee may in fact exhibit a bias on subsequent decisions. Given these two officiating criteria, a pattern is likely to appear in which officials explicitly attempt to balance the outcome of an event rather than strictly adjudicating each event independently. This pattern can have harmful effects to the integrity of the process.

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Figure 1 - End of Half Foul Differential

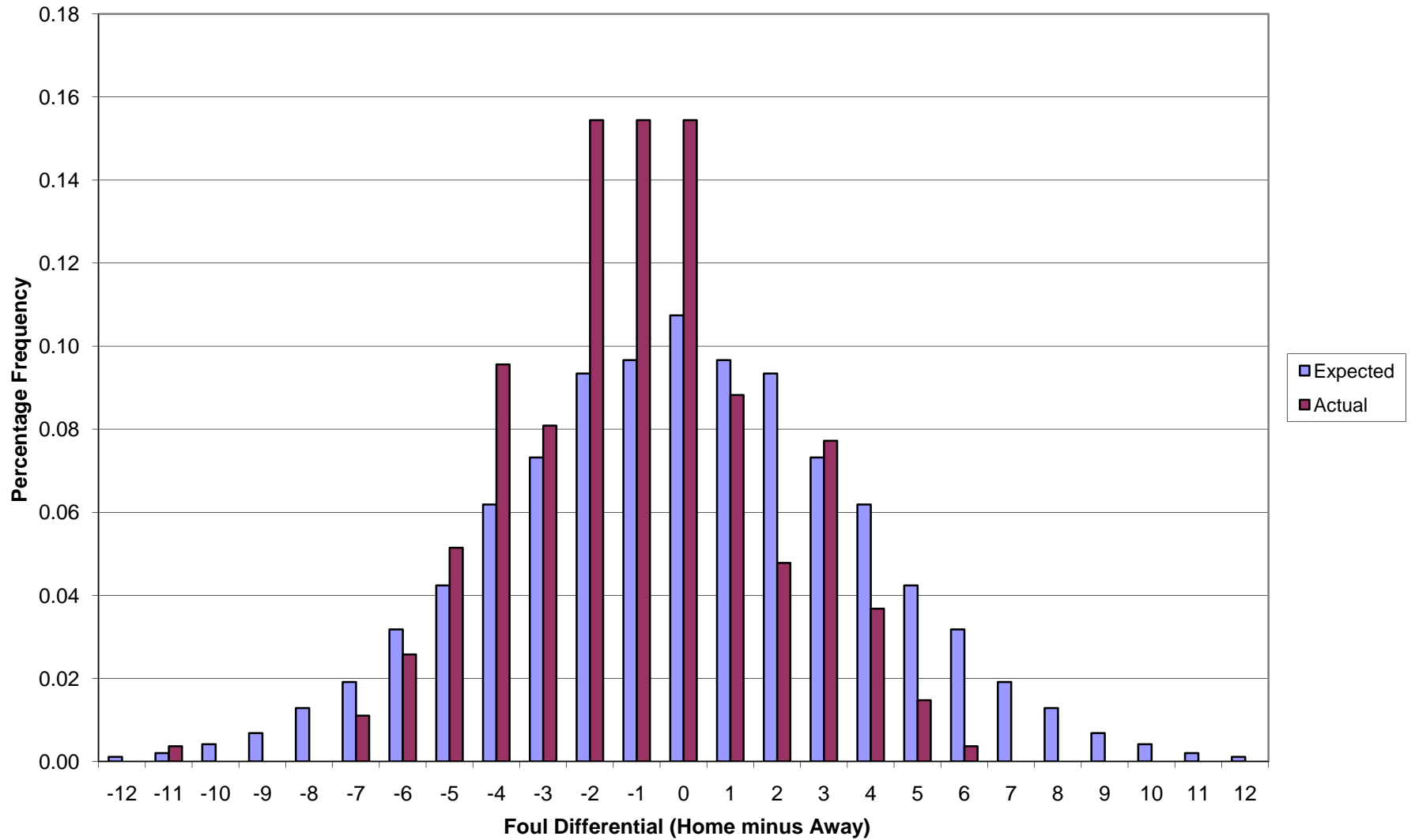
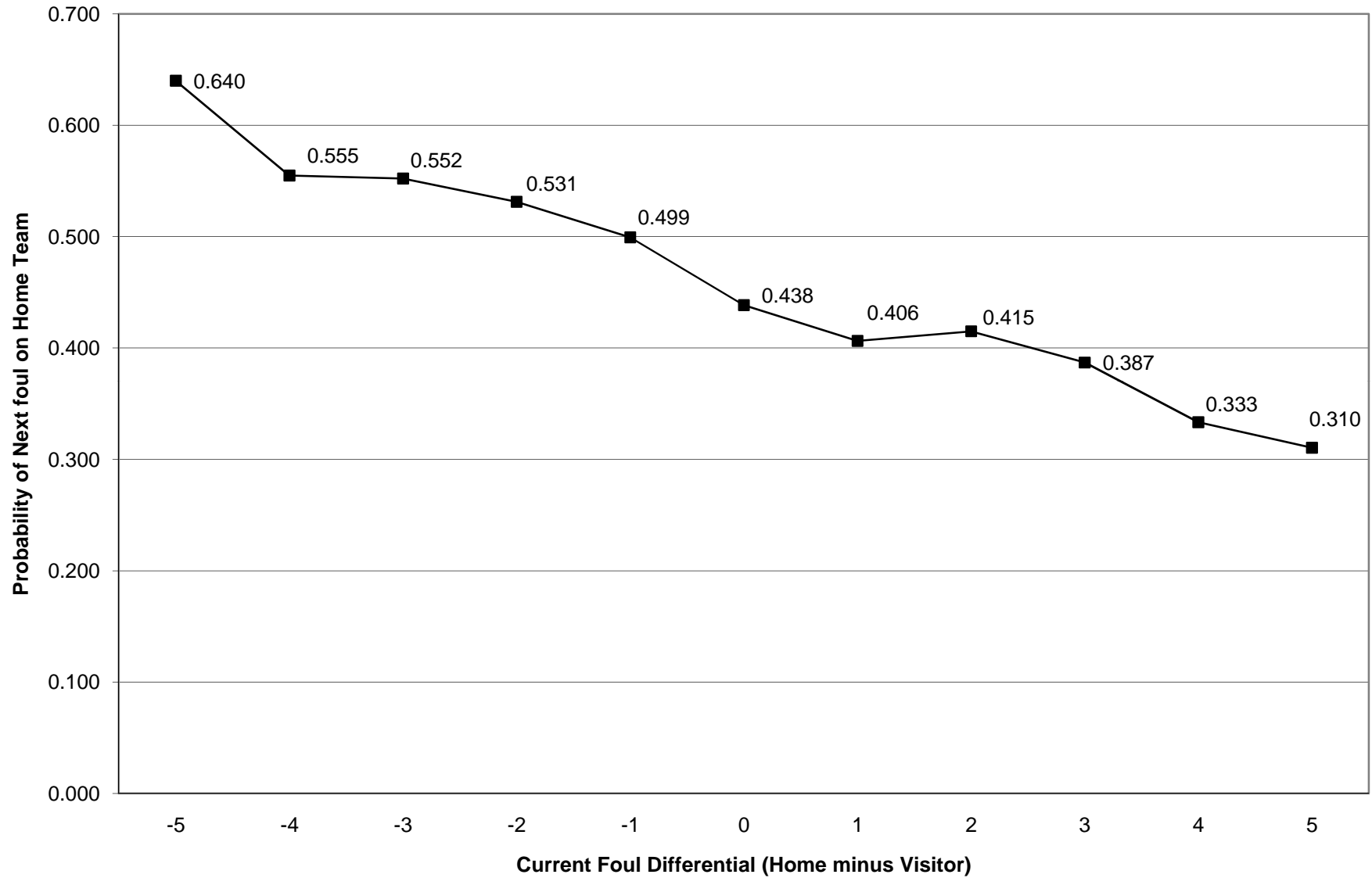


Figure 2 - Proportion of Fouls on Home Team



**Table 1 - Logistic Regression results for Regular Season Games**

	Coefficient	Std. Error	P	Marg. Effect
Net fouls	-0.1180	0.0153	0.000 **	-0.0295
Lead home	0.2543	0.0957	0.008 **	0.0634
Score net	0.0093	0.0064	0.151	0.0023
Big Ten	0.0212	0.0798	0.790	0.0053
ACC	-0.0144	0.0753	0.848	-0.0036
Constant	-0.3333	0.0722	0.000 **	

N 4142

Likelihood Ratio  $\chi^2$  96.03

Pseudo R<sup>2</sup> 0.0168

\*Significant at 5% level

\*\*Significant at 1% level

**Table 2 - Logistic Regression results for Neutral Court Games**

	Coefficient	Std. Error	P	Marg. Effect
Net fouls	-0.1469	0.0281	0.000 **	-0.0366
Lead seed	0.4506	0.1735	0.009 **	0.1051
Score net	-0.0141	0.0126	0.262	-0.0035
Big Ten	0.1898	0.1901	0.185	0.0467
ACC	-0.2241	0.1691	0.318	-0.0559
Big East	0.0539	0.1899	0.777	0.0134
Constant	-0.2657	0.1088	0.015 *	
N	1386			
Likelihood Ratio $\chi^2$	38.19			
Pseudo R <sup>2</sup>	0.0199			

\*Significant at 5% level

\*\*Significant at 1% level