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The impact of social pressures on referee's sanctions in professional soccer : a case study of penalty kicks in the MLS

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The Impact of Social Pressures on Referee's Sanctions in Professional Soccer: A Case Study of Penalty Kicks in the MLS

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Abstract

This paper examines referee bias in the Major League Soccer (MLS), particularly looking at referees' decisions regarding penalty kicks. After analyzing the 520 penalty kicks sanctioned since the inception of the MLS, this study ascertains that referees' display a considerable bias favoring the home team when awarding the initial penalty kick of a game. Additionally, this study demonstrates that in matches with more than one penalty kick, the penalties are disproportionately awarded to each team, suggesting that referees are compensating or atoning for their initial calls. Moreover, when sanctioning a second penalty kick, there is a bias effect of 5.4% in favor of the home team. This work also contributes to the literature of referee bias by determining that the sanctioning of a second penalty is independent of the outcome of the first penalty kick.

Introduction

The influence of social pressure on individual behavior plays a crucial role in many areas of society, drastically affecting the outcome of significant events. While a number of studies have investigated this phenomenon in areas like the workplace, politics, sports, and the judicial system (Dohmen 2005, Pieters 2005, Neale 1964, Carmichael and Thomas 2005), there have been no recent studies analyzing the effect of social pressure on referee bias in Major League Soccer (MLS), the top professional soccer league in the United States.

Existing studies have examined the effect of social pressure in other popular American sports such as football, or the NBA (Price, Wolfers 2007). Additionally, referee bias in soccer has already been explored, but only in well established leagues. For instance, Pettersson-Lidbom Per, and Priks Mikael (2007) looked at how social pressure affects the behavior of soccer referees in Italy by taking advantage of an exogenous change that recently took place. Due to a substantial increase in hooligan violence, the Italian government temporarily implemented a regulation that forced some soccer teams to provisionally play home matches in empty stadiums. The Pettersson and Priks study found that referees punished away players more harshly and home players more lightly when the games were played in front of spectators, compared to when they were not. Even though recent research has been performed studying referee behavior in professional soccer, this study will specifically examine referee behavior in the MLS, which may differ from most other professional soccer leagues for a number of reasons. Additionally, this study will take the current analyses of referee behavior one step further by examining matches in which two or more penalty kicks have been awarded. Specifically, this paper will test whether referees appear to compensate for awarding one team a penalty kick, by increasing the likelihood of awarding a second penalty to the other team.

There are numerous reasons that would support the hypothesis that Major League Soccer might not return similar results as previous studies. First, and most importantly, the influence of soccer in America has yet to reach a level of extreme fan loyalty. In various countries such as Argentina, Colombia, Italy, and Brazil amongst others, there are groups of hooligans such as "La Doce" that have been know for blackmailing referees or even committing crimes against players or other fans. Since this type of behavior is severely penalized, as well as socially unacceptable in the MLS, one would expect there to be more impartial referees. Similarly, the United States professional soccer leagues generally have lower attendance levels compared to some of the other major soccer leagues around the world, and thus the referees in MLS may be less influenced by crowd noise.

A second reason why the MLS might have less of a referee bias effect is that other studies have looked at corrupted leagues; while, the MLS appears thus far to be unblemished. For instance, Pettersson and Priks looked at the "Lega Calcio Serie A", best known as the professional Italian league. In this league, teams like Juventus, Fiorentina, and Lazio have been previously punished for bribing referees to throw off games (Baroncelli, Lago 2006). While corruption and bribery is rooted in many cultures around the world, American sports have remained fairly clean. Thus, it would be extremely surprising to find that the MLS has had any problems with their referees being bought by teams.

Finally, the technology used during the MLS soccer games might cause less of a referee bias. In foreign leagues such as the Bundesliga, it is common for stadiums to have a JumboTron that feeds the games while they are being played. In many instances, referees are able to see if they were correct in their sanctions because of replays on the stadium screens. Therefore,

referees might feel the need to remain impartial by making up their bad calls. In the MLS, there are strict rules against showing the games while they are being played; consequently, eliminating the retribution aspect of the bias.

On the other hand, there is ground for arguing that studying the MLS will in fact return similar empirical results as other leagues. First, referees are humans and as such they can be influenced by either eighty thousand people or simply by ten thousand. The pressure might not be exactly the same, but it might be sufficient for referees to favor the home team.

Aside from being vulnerable to smaller crowds, American referees might not have the international experience some of the other referees have. Therefore, American referees might not be as stern with their decisions and in consequence more easily affected by the players or crowds. Lastly, referee bias could be much more psychologically driven than economically; therefore, lack of corruption and bribes in the MLS might not have a strong effect on the way referees behave.

In light of these competing theories concerning the extent of referee bias in the MLS compared to other professional soccer leagues, this study will empirically measure the effect of referee bias in the MLS. This paper will utilize a data set from the MLS organization which provides all the penalties sanctioned since the leagues inception. By meticulously analyzing the most important sanction in the game and how home field advantage might affect this call, this paper will show to what extent there truly is referee bias in American soccer. Furthermore, this study will examine the propensity of referees to compensate or atone for awarding one team a penalty kick by disproportionately awarding a second penalty kick to the other team.

Background Information on the MLS

Major League Soccer is the top-flight professional soccer league in the United States. It was founded in 1993, prior to the 1994 FIFA World Cup that was hosted in the United States; however, the first season was not played until 1996. Originally the league was composed of ten teams, and throughout the years four more teams have joined. Since 1998, MLS has been experiencing on and off periods of growth highlighted by expansion, the construction of soccer-specific stadiums, and the addition of new investors. Unlike other leagues around the world, the MLS has only one season per calendar year and it's comprised of thirty games (twenty six during the regular season and four during the post-season playoffs).

The MLS also differs from more established leagues around the world since it constantly changes the rules of the game to spark more interest in the American public. For instance, since its inception, the MLS has experimented with countdown clocks. Initially, referees were allowed to stop the clock throughout the game, but they were not allowed to allocate extra time once the clock hit the zero mark. Another change the MLS implemented in its early years was the definition of tied games through shootouts; while, whenever a tie occurs in other leagues each team is given one point. Also, for a period of time the MLS allowed four substitutes instead of the standard three substitutes per game. Lastly, since its inception the MLS has experimented with different ways to add time at the end of the official 90 minutes in playoffs games. From the year 2000 until early in 2005, a ten minute golden goal was used to break tied games. Since late 2005, the league has conformed to the rules used by most other professional leagues by establishing regular extra time, or two 15 minute periods with a 5 minute break in between. Under this new rule, during these 30 minutes of extra play, the first team to score is considered to

be the victor.

Aside from experimenting with rule changes throughout the years, the MLS has continued to become a more recognized league as new programs such as "Game First" were introduced. "Game First", established in 2007, created youth teams that served as feeders for the professional teams. In addition, this program created an anthem for the sport and hired full time professional referees for the first time. The MLS has also been able to continually increase its recognition and reputation by signing famous players from around the world, such as: David Beckham, Guillermo Barros Schelotto, Juan Pablo Angel, and Cuauhtemoc Blanco.

Even though the MLS is not yet as established and reputable as other leagues, its continuous efforts to expand and become more professional have already made a difference. In the years to come two more teams are projected to join the league, and another soccer-specific stadium is already being built. As the efforts and resources allocated to the MLS continue to increase so does the attention the league receives. While this study serves as another illustration of the interest the league has sparked, it also serves as a study of referee bias in a rising but not yet fully established league.

Literature Review

There are a numerous studies that have meticulously examined how external forces influence the decisions referees make during professional games. These studies primarily focus only on a few of the external forces that influence the decisions that referees' sanction. Although it is indisputable that the external environment has an impact on referees' sanctions, we are not precisely certain if the variables affect referees across the world in the same manner. The

following is a brief overview of the most pertinent literature addressing referee bias experienced in professional soccer leagues around the world. In addition to addressing the referee bias in soccer, the following overview will reference recent works that present referee bias in other sports.

A number of current studies focus on delineating the effects that cause referees to be biased. For instance, Pettersson-Lidbom Per, Priks Mikael (2007) looked at how social pressure affects the behavior of soccer referees by taking advantage of an exogenous change that took place in Italy. Due to recent hooligan violence, the Italian government implemented a regulation that forced some soccer teams to temporarily play home matches in empty stadiums.

To test whether referees were biased due to social pressure they used the following set up: $Yij = \alpha i + \beta no\_spectatorsij + vij$,. Here, *Y*ij denoted referee *i*'s behavior in game *j* (fouls, yellow cards, and red cards) and they used *no_spectators* as an indicator variable for the games in which the teams were forced to play without any spectators. Then they estimated the effect of having no spectators on the referee's behavior by running a regression. It's also worth noting that αi is a referee fixed effect. The parameter β measures the effect of having no spectators on the behavior of the referee. It is also important to note that the parameter β is identified *only* by the within referee variation since they included fixed referee effects. In other words, they compared the behavior of the *same* referee when he is a referee in a game with no spectators compared to a game with many thousands of spectators. In order to be able to test whether the referee is biased, they separated the behavioral response of a referee towards both the home team and the away team in games with many or with no spectators.

Pettersson-Lidbom Per, Priks Mikael revealed that referees punished away players more harshly and home players more lightly when the games were played in front of spectators, compared to when they were not. Specifically, 2.6 fewer fouls were called against the away team when there was no crowd; while, 1.7 more fouls were called against the home team. Thus, referee bias was 4.3 fouls in favor of the home team (results were statistically significant at the 5% level). Lastly, they found *s*ignificant bias, once again favoring the home team, in terms of yellow and red cards (results were statistically significant at the 5% level).

Other studies like the ones conducted by Nevill, Balmer, and Williams (2002) investigated whether the presence or absence of crowd noise influenced qualified referees when assessing various challenges recorded on videotape. During their study they showed a tape with forty seven tackles from an English Premier League game to forty professional referees of mixed ages. They were then asked to classify the tackle as legal or illegal. Those viewing the challenges with background crowd noise were more uncertain in their decision making and awarded significantly fewer fouls (15.5%) against the home team, compared with those watching in silence. It is worth noting that the decisions made by the referees hearing the crowd were almost perfectly lined up with the decisions made by the officials of the actual game. Ultimately, utilizing binary logistic regression, Nevill, Balmer, and Williams were able to demonstrate that the presence of crowd noise has a dramatic effect on the decisions referees make.

Another study that analyzed referee bias in soccer was conducted by Sutter Matthias, and Kocher Martin G (2002). Mathias and Martin investigated the "home bias effect" in the Bundesliga (Germany's professional league). In their study they analyzed referee bias in

awarding penalties. In order to determine if there was bias in the penalties given to home teams, they performed a chi-squared test which demonstrated that the distribution of the frequencies were significantly different between the home and away team. Still, Mathias and Martin decided that this distributional difference was not sufficient evidence to support a claim of bias in favor of the home team. In consequence, they determined if each call was indeed correct or incorrect. Of the 55 penalties awarded to the home team only 5 were classified as incorrect calls. Their investigation also showed 12 instances where a penalty kick was not sanctioned and it should have been. For the visiting team, only 1 out of 21 penalties were classified as incorrect, yielding 20 legal calls. However, in 19 instances referees did not award a penalty kick when they should have. Hence, in 50 out of 62 cases, or 81% of the time, the home team was awarded a penalty kick correctly; while, visiting teams were awarded a correct penalty kick in 20 out of 39 cases, or 51% of the time. The difference they found was highly significant indicating a clear home bias effect with regards to referees' sanctions of penalties.

Peter Dawson (2007) contributed to the literature of referee bias by presenting a statistical analysis of patterns in the incidence of disciplinary sanctions, such as yellow and red cards, that were called against players in the English Premier League, over the period 1996–2003. In his paper, he reported estimates of the unconditional and conditional expectations of the incidence of disciplinary sanctions against footballers in English Premier League matches. His empirical analysis suggested that the tendency for away teams to incur more disciplinary points than home teams can't be explained solely by the home advantage effect. Dawson also found evidence that home team bias was different between referees, and this variation contributes to the overall pattern of inconsistency in refereeing. Lastly, Dawson claimed that the extent to which

corrective action, or taking action to make up for previous bad calls, is also likely to vary between officials.

In addition to the preceding studies, Garicano Luis, Palacios-Huerta Ignacio, and Prendergast Canice's (2005) National Bureau of Economic Research working paper offers empirical evidence that corroborates what the other studies had already found. They showed that in the Spanish football league, referees favored home teams in order to satisfy the crowds in the stadium. In order to test this, they examined the amount of extra time referees added after the official ninety minutes were over, taking into consideration the score of the game and the composition of the crowd attending the game. Controlling for "objective reasons" to add extra time, such as the number of yellow cards, red card, or the number of substitutions, they still found referees systematically favored home teams by shortening close games where the home team was ahead, and lengthening close games where the home team was behind.

Another contribution to the literature of referee bias in professional soccer was done by Greenberg, Mark, and Lehman (1985) at the University of Pennsylvania. Their study reviewed three forms of justice in sports: distributive, retributive, and procedural. Distributive justice is accomplished by apportioning rewards in accordance to the outcome of the competition, or in other words, winners receive more than losers. Retributive justice occurs when violators are penalized in a manner which provides advantages to their opponents in order to discourage future violations. The third form of justice, procedural justice, involves the fairness of the rules by which rewards and punishments are determined. For the most part, this work presented numerous illustrations to display how much justice can drastically affect the outcome of sports.

Aside from the studies that focused on statistically evaluating whether there is bias in the way referees behave in soccer, there is also an abundant amount of literature which focuses on referee bias in other sports. Joseph Price and Justin Wolfers (2007) performed a study in the NBA to determine if there was bias based on race. They found that more personal fouls were called against players when they were officiated by an opposite-race refereeing crew than when officiated by an own-race crew. Specifically, Price and Wolfers found that players earn up to 4% fewer fouls and score up to 2½% more points on nights in which their race matches that of the refereeing crew. In turn, their study concluded that the bias in foul calling was sufficiently large that the probability of a team winning was noticeably affected by the racial composition of the refereeing crew assigned to the game. Another study developed by Vergin Roger and Sosik John (1999) analyzed referee bias in the NFL and found that from 1981 to 1996 home teams won 58% of their games. Additionally, they demonstrated that away teams were more severely punished by looking at historical trends in fouls. From these trends they perceived that not only were away teams punished more often, but also that these reprimands were also harsher; subsequently, leading them to ratify referee bias in the NFL in favor of the home team.

As clearly depicted above, referees seem to be biased in their decisions; thus, affecting the outcome of games across disciplines. The brief review presented illustrates that there are several influential factors that directly affect how referees' act. Factors such as crowd size, violence in the stadium, score close to the end of the game, or stadium noise may significantly affect the calls referees make. The existing soccer literature is primarily focused on European leagues where all these factors play a great role; however, there is not much literature addressing how referees are influenced in the MLS. This paper will fill this void in the literature by

examining the degree of home team advantage in the awarding of penalty kicks in the MLS. Furthermore, this study will extend the current literature by investigating whether referees in the MLS appear to compensate for their decisions by disproportionately awarding each team a penalty kick, in those games where two or more penalty kicks are awarded.

Data Analysis

To empirically measure the effects of social pressure on referee bias in Major League Soccer (MLS), this study looks at every single penalty kick that has been sanctioned since 1999 until the present. The data utilized in this work was obtained from the official website of the Major League Soccer (www.mlsnet.com). In the process of looking at every penalty kick sanctioned, this study focuses on identifying not only if there is a home bias effect, but also if there is a compensation effect on behalf of the referees.

A scan of every penalty kick awarded and the proportion given to the home team is essential in order to determine if there is a home bias. From doing this, we recognize that in fact the majority of the penalty kicks were awarded to the home team. Out of 520 penalty kicks, 63% or 328 penalties were called in favor of the home team (table 1). Similarly, looking at games with only one penalty kick, 64% of the time, or 240 out of 374 occasions, the home team was favored (table 1). The year with the lowest percentage of calls in favor of the home team was 2004 with a 59% rate; while, the year with the highest percentage of sanctions in favor of the home team was in 2005 with a 71% rate.

Further analysis displays that the vast majority of games with more than one penalty kick truly favored the local team. Since the establishment of the league there were a total of 71 games in which more than one penalty kick was called. In only three instances the away team received

the majority of the penalty kicks for a given game. From the remaining 68 games, 20 illustrated once again a home advantage, while 48 remained neutral.

After noticing that a significant majority of the games with more than one penalty favored the home team, this study focused on the independence of events. Basically, this study questioned whether the occurrence of one penalty kick affected the probability of the next penalty kick occurring. To address this question, a Chi-Square test was performed, analyzing all games that had more than one penalty kick but less than three (table 2). As depicted on table two, there are basically four possibilities in terms of distribution of penalties in games with two penalty kicks. The options go as follows: Home then Home; Home then Away; Away then Home; and Away then Away. Prior to running the Chi-Square test, expectations with regards to the percentages for each of the above options were formulated. The first option, Home then Home, was expected to occur 40.96% of the time or (.64) (.64); assuming that the home team had a 64% penalty kick advantage and the second penalty is independent from who is awarded the first one. The Home then Away, or Away then Home combination was expected to occur 23.04% of the time or (.64) (.36); following the above assumptions. The remaining option Away then Away was predicted to take place 12.96% of the time, or (.36) (.36); again assuming that the away team had a 36% change of receiving a penalty and also assuming that the second penalty is independent from who is awarded the first.

In addition to generating expectations in terms of the percentage of time each combination should occur, expectations regarding the number of games with each option were also formulated. The actual percentages for each alternative combined with the actual number of games for each option allowed the generation of expected number of games for each combination. For instance, the Home then Home combination actually occurred 25.37% of the

time, or in 17 games. Already having an expectation of 40.96%, or (.64) (.64) enables us to find the number of expected games by simply performing the following: [(40.96) (17)]/(25.37). The results for each of the expected number of games for each combination are all displayed on table 2; and, they were all obtained in the same manner as the Home then Home alternative displayed above.

This Chi-Square test clearly illustrated that none of the possibilities yielded what we expected. The first option, Home then Home was expected to come up 40.96% of the time, when in reality it only occurred 25.37%; thus, the actual number of games with this combination fell short by 10 from our expected 27. The second, Home then Away occurred more often than expected with a 38.81% occurrence rate versus an expected 23.04% rate. In this case, our estimations were actually less than the actual number of games by approximately 10 games, displaying almost an opposite result from the previous case. Similarly, the Away then Home case took place more than expected with an actual rate of 32.84%, while the expected rate was merely 23.04%. This alternative took place 7 more times than expected. On the contrary, the Away then Away possibility happened less than expected with a 2.97% occurrence rate and a predicted 12.96% rate; hence, presenting an overestimation of approximately 7 games. To simplify the expected versus actual results, we expected both the away team as well as the home team to have more games where they received both sanctions in their favor. Instead, we obtained a much higher than expected combined split of sanctions with an actual rate of 71.65% while the expected rate was much lower at 46.08 %. Noticing that actual values differed from expected leads to the next step in the Chi-Square test, which was to figure out the Chi-Square statistic and its p-value. The statistic obtained was 19.13 and the p-value was .000256. At this point, with

such a low p-value, we can reject the null hypothesis at the 1% level and claim that the event of a second penalty kick taking place is not independent of the first one occurring.

In games with 3 penalty kicks awarded (table 3), a Chi-Square test was not suitable since we did not have enough observations. However, the data obtained in these games is still relevant to the study. In games with three penalties we have the following possible scenarios: Home, Home, Home; Home, Home, Away; Away, Away, Home; and lastly Away, Away, Away. After looking at the four cases in which three penalties took place, we notice that neither team ever received all of the sanctions in their favor. However, consistent with the idea of home bias, the home team received the majority of the penalties in their favor; specifically, 75% of the time, or in 3 out of the 4 instances.

The above test concludes that who is awarded the second penalty kick is not independent from who is awarded the first. The following tests, depicted on tabled 4 and 5, will attempt to determine if there appears to be a compensation effect on the referees' behalf. These tables illustrate the percentage of second penalty kicks' distributions based on who gets the first penalty kick. While table 4 looks at the scenarios where the home team was awarded the first penalty, table 5 focuses on the instances where the away team was awarded the first penalty. Looking at table 4 we can discern that whenever the home team is awarded a penalty kick first, either during the first 45 or 60 minutes, there is usually only a 1 in 4 chance that referees' will sanction another penalty. However, if the case is that referees' do sanction another penalty, the majority of the time, or approximately 60% of the time, it will be in favor of the Away team. Going back the summary measures shown on table 1, the away team received 37% of the overall penalty kicks. However, as just shown, in instances where there is a penalty in favor of the home team, and a second penalty is called, 60% of the time it is given to the away team. Furthermore, in

these occasions, the home team only received a second penalty 33.3% of the time versus an overall 63%. Thus, we can conclude that referees' do tend to level the playing field whenever they sanction more than one penalty given that the initial one was given to the home team.

Table 5 tests the same concept but when the away team receives the first penalty. In these cases, we also note that there is usually only a 1 in 4 chance that another penalty will be awarded. Nevertheless, in cases where there is another penalty kick awarded, it is almost certain that it will go to the home team. Within the 60 minute period, the away team received only in one occasion, or 6% of the time, a second penalty kick; while, the home team received 14, or 82.4% of the time. Going back to the summary measures from table 1, the home team received 63% of all the penalties awarded while the away team received 37% of all penalties. As just shown, whenever there are two penalties awarded and the first one is given to the away team, the probability that the second penalty is given to the home team is much larger than before (82.4% versus 63% of the time). Also, the probability that the away team will receive another penalty is as low as 6% compared to an overall 37%. This again illustrates that when giving a second penalty kick, referees do tend to level the playing field.

Having established that referees' do tend to level the playing field whenever they sanction more than one penalty, it is vital to now identify if they compensate both teams equally as much, or if there is bias in favor of the home team. To do this, this study measured the overall effect in favor of the away team when the home team was awarded the first penalty kick, and the overall effect in favor of the home team when the initial kick was given to the away team. In the first case, the probability that a second kick was also given to the home team was 35.7 %, when overall the home team receives 63%. In other words, there is a 27.3% reduction in the probability that the home team will receive a second penalty given that they received the first

one. However, given that the home team is given the first penalty, the away team increases their chances of getting a penalty from an overall 37% to a 54.8%. The overall effect in favor of the away team is then 45.1% (27.3%+17.8%).

In the scenario where the away team receives the first penalty and a second one is called, the home team increases their chances of receiving a penalty from 63% to 82.4% (or a 19.4% increase). Additionally, the away team having already received a penalty reduces their chances of getting the second one to 5.9% from 37% (or a 31.1% decrease). The overall effect in favor of the home team is then 50.5% (19.4%+31.1%). Consequently, we can not only attest that referees' do tend to level the playing field whenever they sanction more than one penalty, but we can also claim that in sanctioning a second penalty kick there is a bias effect of 5.4% in favor of the home team.

The preceding tests portray the extent to which referees' display a compensation effect; additionally, they show that referees' are more biased in favor of the home during these interactions. To ratify these claims, a couple Chi-squared tests, on table 6 and 7, were performed. These two tests helped determine whether who gets the first penalty is statistically significant in explaining who gets second one. The first of the two tests, displayed on table 6, focused on the first 45 minutes of the game; while, the second one, on table 7, focuses on the later part of the game (up to 60 minutes). The initial test returned a Chi-Square statistic of 13.948 and a p-value of .0009. In consequence, we can reject the null hypothesis at 1 % level of significance and conclude that the variables are associated. The second Chi-Square test for independence returned a Chi-Square statistic of 12.714 with a p-value of .0023. Again, these results support at the 1% level of significance the idea of association between the variables; thus, supporting the claim that the first penalty is statistically significant in explaining who gets the

second penalty.

To further shed light on referee bias, and their compensation effect, it is essential to test whether the result of a penalty kick (made or miss) affects the decision of awarding a second penalty kick, and the recipient of it. To find out if the outcome of a penalty matters, table 8, 9, 10, and 11 were created.

Table 8 displays the instances in which the home team was awarded a penalty kick first, and it illustrates how the two options, made and miss, affect the sanctioning of another kick. When a penalty is sanctioned in favor of the home team, and a goal is converted, no additional kicks are awarded almost 80% of the time. In the cases where another penalty is awarded, 55.6% of the time the away team receives it, while 38.9% of the time the home team gets it. When the outcome of a penalty kick is a miss, the rate of no additional calls is lowered to 61%, and the away team receives the second kick 66.7% of the time versus an allocation of 25% of the time in favor of the home team. Again, these numbers corroborate the idea that referees tend to compensate the playing field whenever two penalties are called, and they also display that whenever the outcome of the first home penalty is a goal instead of a miss, the probability that a second penalty will take place is lowered by approximately 20%.

Table 9 illustrates the cases in which the away team was awarded a penalty kick first, and shows how the outcome, made or miss, affects the sanctioning of another kick. When a penalty kick is sanctioned, and a goal is converted, no additional violations are called 71% of the time. On the other hand, when the result is a miss, 86% of the time there is no other kick. It is crucial to point out that the number of observations for this second case is only 7, which does not provide for very reliable results. When a second violation is indeed called, the home team received the second penalty a lot more often (84.6% for a goal, and 100% for a miss).

Table 10 further helps determine the effect that the outcome of a penalty has on the probability of another one being sanctioned (this table is actually broken down to 10-A and 10-B). 10-A shows a chi- square test for independence when the first penalty is given to the home team and it is indeed turned into a goal. 10-B performs the same test but for a miss instead of a goal. From these tables we obtain a Chi-Square statistic of 4.5766 and a p-value of .2056. These results are not significant and therefore we cannot reject the null hypothesis; subsequently, we can claim that whatever happens after a first penalty kick is called is independent of the result of the first penalty. In other words, referees are not more likely to compensate for a penalty that is scored versus for one that is missed.

Since there were not enough observations where the away team was given the first penalty and they did not score, this study was not able to perform a Chi-Square test for independence in this case. However, it incorporated the results from the games where the away team received the first penalty into table 11-A and 11-B. These tables combined both the results from the away and home teams to create an overall picture. More precisely, 11-A performed a Chi-Square test testing for independence when the first penalty's outcome was goal; while 11-B did the same but for a miss. The Chi-Square statistic obtained from this test was 5.6712 and the p-value was .1288. Once again, we cannot reject the null hypothesis; thus, we can conclude that overall any penalty sanctioned after the initial one is independent of the outcome, goal or miss, of the original penalty.

Conclusion and Policy Implications

After analyzing every penalty kick sanctioned since the inception of the MLS, this study ascertained that referees' display a considerable bias favoring the home team when awarding the

initial penalty kick of a game. In addition, it also demonstrates that in matches with more than one penalty kick, the penalties are disproportionately awarded to each team, suggesting that referees are compensating or atoning for their initial calls. Moreover, when sanctioning a second penalty kick, there is a bias effect of 5.4% in favor of the home team. Lastly, this study also contributed to the literature of referee bias by determining that the sanctioning of a second penalty is independent of the outcome of the first penalty kick.

Having established that there is referee bias in favor of the home team in the MLS, the next question to ask is: what can we do to eliminate this bias? Amongst many alternatives, some of the most viable are the following. First, the MLS might want to change the training methodologies they utilize on their referees to better suit them for their high stress job. Aside from training, the MLS might want to think of other alternatives such as allowing big screens on stadiums so that the assistant referees can help the main official more adequately. In addition to having a direct impact on referee training and the tools they are given to perform their jobs, this study might act as a catalyst to a reform in the pay structure of referees in the MLS. Rather than being paid by years of experience, the MLS might want to consider compensating more generously those officials who display less or no bias.

This study and its findings will not only expand the literature of referee bias in professional sports; but, outside of the soccer world, it will also serve as another illustration of compensatory behavior arising from high social pressures from the external environment.

Table 1

Proportion of PK's awarded to the home team

		z-stat	p-value	N	Percentage
All Penalty Kick's	63 %	5.928912	3.04948E-09	520	100%
Games with 1 PK	64 %	5.414942	6.13085E-08	374	72%

Table 2

Chi-Square Test for independence

(Games with more than one but less than 3 PK's awarded)

	Expected	Actual	Actual Number of Games with	Expected Number of Games with	Chi-sq stat
Home/ Home	40.96 %	25.37 %	17	27.4432	
Home/ Away	23.04 %	38.81 %	26	15.4368	
Away/ Home	23.04 %	32.84 %	22	15.4368	
Away/ Away	12.96 %	2.97 %	2	8.6832	
Total	100 %	100 %	67		19.13661
p-value					0.000256

Table 3

(Games with 3 PK's awarded)

	Expected	Actual	Actual Number of Games with
Home/ Home/ Home	26.21 %	0.0 %	0
Home/ Home/ Away	44.24 %	75 %	3
Away/ Away/ Home	24.88 %	25 %	1
Away/ Away/ Away	4.67 %	0.0 %	0
Total **p-value**	100 %	100 %	4

Table 4

Compensating Effects (Home Team Awarded a PK First)

	45 Minutes			60 Minutes		
No additional Pk's awarded	87	74.4 %		131	75.7 %	
Home team awarded another	10	8.5 %	33.3%	15	8.7 %	35.7 %
Away team awarded a Pk	18	15.4 %	60 %	23	13.3 %	54.8 %
2 Additional Pk's awarded	2	1.7%	6.7 %	4	2.3 %	9.8 %
Total	117		30	173		42

Table 5

Compensating Effects (Away Team Awarded a PK First)

	45 Minutes			60 Minutes		
No additional Pk's awarded	38	73.1 %		61	79.3 %	
Away team awarded another PK	0	0.0 %	0.0 %	1	1.2 %	5.9 %
Home team awarded a Pk	12	23.1 %	85. 7 %	14	17.1 %	82.4 %
2 Additional Pk's awarded	2	3.8%	14. 3 %	2	2.4 %	11.8 %
Total	52		14	82		17

Table 6

Chi-Square Test for independence
(1st PK in first 45 Minutes)

			Total	Test Statistic	P-Value	DF
No additional Pk's	87	38	125	13.948	.0009	2
Home team Awarded another PK	10	12	22			
Away team awarded a PK	18	0	18			
Total	115	50	165			
Expected Calls						
	1	**2**				
No additional Pk's	87.1	37.9				
Home Team Awarded another PK	15.3	6.67				
Away team awarded a PK	12.5	5.45				

Table 7

Chi-Square Test for independence
(1st PK in first 60 Minutes)

			Total	Test Statistic	P-Value	DF
No additional Pk's	131	61	192	12.174	.0023	2
Home team Awarded another PK	15	14	29			
Away team awarded a PK	23	1	24			
Total	169	76	245			
Expected Calls						
	1	**2**				
No additional Pk's	132	59.6				
Home Team Awarded another PK	20	9				
Away team awarded a PK	16.6	7.44				

Table 8

Compensating Effects (Home Team Awarded a PK First)
Conditional on outcome of initial PK

	Goal			No Goal		
No additional Pk's awarded	68	79.1 %		19	61.3 %	
Home team awarded another	7	8.1 %	38.9 %	3	9.7 %	25.0 %
Away team awarded a Pk	10	11.6 %	55.6 %	8	25.8 %	66.7 %
2 Additional Pk's awarded	1	1.2 %	5.6 %	1	3.8 %	8.3 %
Total	86		18	31		12

Table 9

Compensating Effects (Away Team Awarded a PK First)
Conditional on outcome of initial PK

	Goal			No Goal		
No additional Pk's awarded	32	71.1 %		6	86 %	
Home team awarded another	11	24.4 %	84.6 %	1	14 %	100 %
Away team awarded a Pk	0	0.0 %	0.0 %	0	0.0 %	0.0 %
2 Additional Pk's awarded	2	4.4 %	15.4 %	0	0.0 %	0.0 %
Total	45		18	7		1

Table 10 A

Chi-Square Test for independence when the Home team is awarded a Penalty first

	With A Goal				
	Expected	**Actual**	**Actual Number of Games with**	**Expected Number of Games with**	**Chi-sq stat**
No additional Pk's awarded	74.80%	79.1%	68	64.3	
Home team awarded Another	8.55%	8.1 %	7	7.39	
Away team awarded a Pk	15.43%	11.6 %	10	13.3	
2 additional Pk's	1.76%	1.2%	1	1.47	
Total	100 %	100 %	86		4.5766
p-value					0.2056

Table 10 B

Chi-Square Test for independence when the Home team is awarded a Penalty first

	With A Miss				
	Expected	**Actual**	**Actual Number of Games with**	**Expected Number of Games with**	**Chi-sq stat**
No additional Pk's awarded	74.53%	61.3%	19	23.1	
Home team awarded Another	8.57%	9.7 %	3	2.65	
Away team awarded a Pk	15.38%	25.8 %	8	4.77	
2 additional Pk's	2.01%	3.8%	1	0.53	
Total	100 %	100 %	31		4.5766
p-value					0.2056

Table 11 A

Chi-Square Test for independence for both teams

	With A Goal				
	Expected	**Actual**	**Actual Number of Games with**	**Expected Number of Games with**	**Chi-sq stat**
No additional Pk's awarded	73.93%	76.3%	100	96.9	
Home team awarded Another	13.01%	13.7 %	18	17.1	
Away team awarded a Pk	10.64%	7.6 %	10	14	
2 additional Pk's	2.38%	2.3 %	3	3.1	
Total	100 %	100 %	131		5.6712
p-value					.1288

Table 11 B

Chi-Square Test for independence for both teams

	With A Miss				
	Expected	**Actual**	**Actual Number of Games with**	**Expected Number of Games with**	**Chi-sq stat**
No additional Pk's awarded	73.96%	65.8%	25	28.1	
Home team awarded Another	12.99%	10.5 %	4	4.95	
Away team awarded a Pk	10.68%	21.1 %	8	4.05	
2 additional Pk's	2.34%	2.6 %	1	0.9	
Total	100 %	100 %	38		5.6712
p-value					.1288

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