Sabotage in Tournaments: Making the Beautiful Game a Bit Less Beautiful*

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Abstract

When effort is multidimensional and output may not be precisely observed, incentives can have perverse effects, especially if agents can engage in sabotage activities. Difficulties in observing these actions may explain why there is no evidence in the empirical agency theory literature documenting these dysfunctional consequences. In this paper we study a natural experiment which provides such evidence. We exploit an incentive change in professional soccer leagues explicitly aimed at encouraging more attacking and goal scoring to obtain evidence on the effect of stronger incentives on productive and destructive effort. Using as control the behavior of the *same* teams playing at the same time in a competition that experienced no changes in incentives, we provide differences-in-differences estimates of the effect of the incentive change on the behavior of teams. We find that, although teams increased offensive effort, they also increased sabotage activities ("dirty play") substantially, resulting in no net change in scoring. When ahead, teams became more conservative, increasing their defenders, scoring less goals, and allowing fewer attempts to score by their opponents. We also find that teams that engage more in sabotage activities depress the attendance at their rival's home stadiums, and that indeed attendance suffered as a result of the incentive change. Thus, teams responded to stronger incentives in this setting, but in a way undesired by the principal.

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1 Introduction

Strong incentives often have dysfunctional consequences. CIA field agents rewarded on the number of spies recruited fail to invest in developing high quality spies (WMD Commission Report, 2005, p. 159). Civil servants rewarded on outcomes in training programs screen out those who may most need the program (Anderson et al. (1993), Cragg (1997)). Training agencies manipulate the timing of their trainees' performance outcomes to maximize their incentive awards (Courty and Marschke, 2004). Teachers cheat when schools are rewarded on student test scores (Jacob and Levitt, 2003). A theoretical literature going back at least thirty years (see, for instance, Kerr (1975), Hölmstrom and Milgrom (1991), and Baker (1992)) has studied the possibility of dysfunctional responses to incentives in different settings. Essentially, as Baker (1992) carefully argues, when output is not clearly observed, what matters is the correlation, on the margin, between what is rewarded and the desired action.

Dysfunctional responses may occur not only in cases of individual incentive contracts but also in tournament settings where individuals compete with each other and are rewarded on a relative performance basis. In these settings, strong incentives can be particularly damaging if agents can devote resources not only to productive activities but also to depressing each other's output. As Lazear (1989) argues, when rewards depend only on their relative performance, agents may respond to stronger incentives by actively sabotaging their rivals, i.e. by undertaking actions that adversely affect others' output.[1]

While tournaments are pervasive in organizations, and anecdotal accounts of "back-stabbing," bad-mouthing and other sabotage activities are easy to find, there does not exist any systematic work documenting such responses. In particular, we are not aware of any empirical work on tournaments that involves the possibility of multiple activities, especially when some actions are aimed at reducing others' output. An obvious reason why such actions are usually impossible to document is that

[1]Tournaments where workers can allocate their time and attention only in the direction of productive activities where introduced by Lazear and Rosen (1981). See also Green and Stokey (1983), Rosen (1986), and Prendergast (1999) for a review. For empirical work on tournaments in a sports context with only productive activities see Ehrenberg and Bognanno (1990), and for experimental work see Bull, Schotter and Weigelt (1987). Theoretical work with multiple productive activities, such as individual and cooperative tasks, appears in Itoh (1991, 1992), and Rob and Zemsky (2002). Drago and Garvey (1998) use survey data to study helping others on the job.

workers who sabotage their fellow workers' performance typically go to great lengths to conceal their actions.

In this paper, however, we provide such empirical evidence. We do this by exploiting an incentive change in a natural setting where both productive and sabotage activities can be directly observed. Our setting is a sports context.[2] Soccer teams that engage in league competition (round-robin tournaments) have historically been rewarded with 2 points for winning a match, 1 point for tying, and no points for losing. In the run up to the soccer World Cup that was to take place in the US in 1994, the *Fédération Internationale de Football Association (FIFA)*, which is the governing body of the game, decided to change the reward for the winning team from 2 points to 3 points while leaving the reward for ties and losses unchanged. The objective of FIFA, worried about the possibility of empty stadiums in the US, was to "encourage attacking, high-scoring matches."[3] This change subsequently became part of the *Laws of the Game* and was applied after 1995 to all league competitions worldwide.[4] We use a detailed data set on soccer matches in Spain before and after the change to study the impact of this change in rewards along a number of dimensions. In this context, following Lazear (1989), we call *sabotage* any effort that is intended to reduce the performance of the rival in the tournament. In particular, we focus our analysis on all such actions that are perceived as "dirty play" and penalized in different ways in the *Laws of the Game*.

Our setting has two key advantages. First, sabotage is *observable*. We have information on the type of specialists in different actions (productive and destructive) that teams choose to field. More importantly, both productive actions aimed at in-

[2]In recent years, sports contexts have been succesfully studied in the literature to test a number of predictions about individual behavior. These include corruption, discrimination, the effects of police on crime, the Coase theorem, Nash equilibrium, social pressure and others. See, for instance, Chiappori et al (2003), Duggan and Levitt (2002), Garicano et al (2005), Kahn (2000), Palacios-Huerta (2003), Szymanski (2000), Walker and Wooders (2001) and other references therein.

[3]See, for example, "FIFA officials' goal: Encourage attacking, high-scoring matches," *USA Today* March 17, 1994, and "FIFA Approves scoring changes," *L.A. Times*, December 17, 1993. The *L.A. Times* reports: "An underlying reason for FIFA's action, and for World Cup Chairman Alan Rothenberg of the United States pushing hard for it, was the feeling that American fans, used to higher-scoring American games, would be much less tolerant and much more quickly turned off than a more traditional soccer audience by an early parade of 0-0 and 1-1 results." Citing experts of the game, *The New York Times* ("Avoid Scoreless Ties," January 4, 1994) commented on the decision: "A decision by FIFA last June to reward teams three points for a first-round victory instead of two has increased optimism that teams will emphasize offense and produce a scoring spectacle in the World Cup." See Brocas and Carrillo (2004) for a theoretical study of this decision in a two-period model reaching the basic conclusion in Lazear (1989).

[4]Professional soccer leagues in England had already implemented this change in the reward schedule in the 1982-83 season.

creasing one's own output and destructive actions aimed at decreasing the opponents' output are observed and routinely recorded in newspapers and box scores. Second, we can take advantage of an unusual control group: the very same teams that engage in league play were playing at the same time in a different tournament that experienced no changes in incentives. Using their behavior in this tournament, we can eliminate the effect of any changes in styles of play or other time trends unrelated to the incentive change.

The incentive change we study should lead teams to try harder to win. This may result in two types of actions, as Lazear's (1989) model predicts: teams may undertake more offensive actions, but they may also play "dirtier," as it now becomes more important to prevent the opposing team from scoring a goal. Stronger incentives may then lead to more sabotage. For example, tackling an opponent may reduce his likelihood of scoring, but also poses an important physical risk to both players. An increase in the value of winning may thus lead to an increase in this type of effort. Does then the amount of dirty play increase? And if so, is it possible to say this is "bad," and therefore unintended, as opposed to providing simply a more intense, and perhaps even more fun, game? Put differently, are stronger incentives detrimental to the objective of the principal?

Our analysis proceeds in four steps, as follows. First, we start by describing the basic behavioral changes that took place after the rule change. We find that, consistent with what we might expect, the introduction of the new incentives was followed by a decrease in the number of ties. However, the number of matches decided by a large number of goals declined. Measures of offensive effort such as shot attempts on goal and corner kicks increased, while indicators of sabotage activity such as fouls and unsporting behavior punished with yellow cards also increased following the change. Of course, all of these results could follow simply from time trends and, hence, they are merely suggestive at this point.

Second, we proceed to use the control matches to estimate the effects due to the change in rewards. Most, but not all, of the changes we observe in the previous before-after analysis are still present in the differences-in-differences (DID) analysis we implement. We observe an increase on the order of 10 percent in the measures of attacking effort desired by the principal. We find, however, that the number of fouls increased significantly, by around 12.5 percent, as a result of the incentive change. The net result of these opposing forces is that the number of goals scored did not change.

We then try to understand the underlying mechanisms through which these changes

took place and the reason they neutralized each other in terms of goal scoring by examining the way the behavior of teams changed *during* the match. We expect teams that get ahead in the score by one goal to become more conservative, since allowing one goal causes them to drop two points rather than one point. On the other hand, the behavior of teams that get behind should not change a great deal, as the marginal value of one goal (tying) remains basically unchanged.[5] The evidence we find is consistent with this hypothesis: teams that get ahead become more conservative by significantly increasing the number of defenders they use. This change in the defensive stance has two consequences: the probability of scoring an additional goal by a team that is ahead significantly drops; moreover, by the end of the match, the losing team ends up making significantly fewer *attempts* on goal than before the incentive change. Hence, the winning team successfully manages to "freeze the score."

The fourth and final step is to actually show that this change represented *undesirable* sabotage rather than, say, desirable greater intensity in the games. That is, we try to understand the welfare consequences of the stronger incentives that are implemented. Public statements by FIFA officials indicated that, in the spirit of Kerr (1975), they were increasing the rewards for wins while hoping for more scoring; this we know, did not happen. Still, a more intense match could be more fun even without more goals, if the public likes the greater emphasis on defense. We find that this was not the case either. We exploit the lack of selection in the assignment of teams to stadiums given that all teams play in all stadiums and calculate the effect of playing at one's home stadium against a "dirtier" team, measured in several different ways. Controlling for team fixed effects, we find that attendance at any given stadium significantly *decreases* when being visited by teams that play dirtier. This result is important in that it confirms the idea that the significant increase in sabotage actions we find is, on the margin, undesired by the public. We finally show that, indeed, attendance at stadiums decreased as a result of the sabotage.

Overall, our study suggests, consistently with the broad empirical agency theory literature (see Gibbons (1998) and Prendergast (1999, 2002) for reviews) that soccer clubs reoptimized and changed their behavior in response to stronger incentives, but that they did this largely in a manner undesired by the principal: they engaged in more sabotage activities and managed to decrease the output desired by the principal. The beautiful game became a bit less beautiful.[6] Thus, we see our evidence as sup-

[5]On the one hand, now under the new incentive scheme the reward for a tie (one point) is a lower proportion of points per win. On the other hand, there is an increase in the value of scoring one goal on the way to scoring two, that is as the option it gives to winning the match.

[6]Despite its low popularity as an spectator sport in the US, this is how soccer is often referred

porting incentive models with multiple tasks, where the cost of increasing incentives is encouraging more effort of the "wrong" kind.

2 Data and Descriptive Statistics

The data come from the Spanish League competition *La Liga*, one of the main professional soccer leagues in the world. We use data from the 1994-95 full season (370 games), the last one with the 2-1-0 scheme, and from the 1998-99 full season (380 games) with the new 3-1-0 scheme. Using data that are four seasons apart is convenient because it does not require us to assume that teams were able to immediately adjust their behavior to the new situation. It also means that we will have to account for any possible year effects in the data. To do this, we use data from the Spanish Cup competition *La Copa* as controls in our analysis. This competition is an elimination tournament in which teams are randomly paired together, no points are awarded, and the winner survives to the next round. All changes in rules and regulations that took place during the period of analysis apply equally to League and Cup games except, of course, the change in rewards in League games. As a result, the behavior of the teams in the Cup tournament should be largely unaffected by the change in the reward scheme in the League tournament.[7]

The data come from MARCA, which is the best selling newspaper in Spain, and from *www.sportec.es*. They include detailed observations of multiple measures of actions, both sabotage and the desired attacking or offensive effort, along with the teams' choices of specialists:

1. PLAYER TYPES. In a soccer game each team lines up one goalkeeper and ten field players. Field players can be of three possible types: defenders, midfielders or attackers. *Defenders*, who play closest to their own goal, which they defend when it is under attack. This often requires stopping rival players through hard tackles or other types of dirty play. Thus, they are most likely to be involved in sabotage activities. *Attackers*, or Forwards, are the primary scorers who play closest to the other team's goal. They are players specialized in the type of effort (attacking actions) that FIFA

to in the rest of the world.

[7]If anything, this control group of games provides us with a *lower bound* on the effects of the change in incentives. The reason is that players may adapt their style of play to the new reward scheme in the league and as a result change how they play in *all* games. We use two years of cup data before and two years after the change (93-94 and 94-95 before and 97-98 and 98-99 after) to have a greater number of matches in our sample since in an elimination tournaments the number of total matches is smaller.

wants to increase.[8] Lastly, *Midfielders* play between defenders and attackers and their role is to support both of them.

We classify each of the players in every team that played in every match in the sample using the official classification of players' types published by MARCA and *www.sportec.es*. The data include information on the number of the different types of players at the beginning of each match and *during* each match. Although our main direct evidence will come from changes in observed actions, the information on player types is useful to study teams' defensive and attacking stances.

2. ACTIONS. For every match and for every team in the sample, the data set includes information on the number of productive and destructive actions

Destructive Actions:

Fouls. In the *Laws of the Game* (FIFA, 2000), the following actions are sanctioned as fouls: "Tripping or attempting to trip an opponent, charging into an opponent, striking or attempting to strike an opponent, pushing an opponent, jumping at an opponent in a careless or reckless manner or using excessive force, blatant holding or pulling an opponent, and impeding the progress of an opponent." These actions are penalized in different ways.[9]

In addition to fouls, there are two color "cards" which the referee will hold up to indicate hard fouls and behavior which won't be tolerated:

Yellow Cards. Indicate a formal "caution" for any form of "unsporting behavior," which includes especially "hard fouls, harassment, blatant cases of holding and pulling an opposing player, persistently breaking the rules," and other similar acts. In addition to being punished as a foul, a player who receives two yellow cards is given a Red Card and ejected from the game without being replaced by a teammate.

Red Cards. These are given after a second yellow card as well as for behavior that is clearly beyond the bounds of the game such as "violent conduct, spitting at an opponent, using offensive or threatening language, and use of excessive force or brutality against an opponent."

It seems apparent that these three types of actions are aimed at reducing the rivals' output. Empirically, around 85-90 percent of all such sabotage activities are fouls where players are not booked with a card, 10-15 percent are fouls where a yellow

[8]Data from Marca (2005) shows that indeed sabotage actions are committed mainly by *defenders* and attacking actions mainly by *attackers* (e.g., over 2/3 of all fouls and yellow cards are given to defenders while attackers represent over 70 percent of the players that score at least one goal).

[9]Depending on the action and its severity, they are punished with either a direct free kick or an indirect free kick. If they take place inside the penalty box they are punished with a penalty kick. See Law 12 on Fouls and Misconduct in FIFA (2000).

card is given, and typically less than 1 percent are actions punished with a red card. For the most part we will focus our attention on fouls and yellow cards.

Productive Actions:

With regard to actions aimed at scoring we have data on *Shots*, which are attempts on goal that ended up aimed incorrectly at the opponent's goal, and *Shots on Goal*, which are those that were correctly aimed at the opponent's goal. The data also include *Corner Kicks*, an action that is a consequence of attacking behavior: if when a team attacks, the ball goes out of bounds over the end line and was last touched by the defending team (e.g., a shot that was deflected by a defender), the attacking team inbounds it from the nearest corner by kicking it in from the corner arc.

3. Other Variables. We also have data on the date of the game, the stage of the season (game number), the winning record of each team at the time of the match, stadiums' capacities, attendance at each match, and the operating budgets of each team, a proxy for the strength of a team. Lastly, our data set includes the number of goals by each team and their timing, as well as information on:

Extra time. Soccer games have two 45-minute halves, at the end of which the referee may, at his discretion, award what is often referred to as "extra time" or "injury time." Law 7 in the Official Laws of the Game states that "allowance for injury time is made in either period of play for all time lost through substitutions, assessment of injury to players, removal of injured players for treatment, wasting time, or any other cause. Allowance for time lost is at the discretion of the referee" (FIFA, 2000, p. 37). Information on the amount of extra time that referees add on may thus be valuable as indirect, additional evidence on the amount of destructive actions that took place.

Player Substitutions. Players may be replaced by a substitute at any time during the match. Teams may use up to a maximum of three substitutes. We have information on the timing at which substitutions take place.

We begin in Figure 1 by presenting the probability distribution of score margins before and after the change. The percentage of all matches that ended in a tie decreases from 29.7 to 25.5 percent, while the number of matches decided by a single goal (whether in favor of the home or visiting team) experiences a large increase from 31 to 40 percent. In absolute terms, the number of tied games decreased from 110 to 97, the number of matches that finished with a 1-goal difference increased from 115 to 153, and those that finished with a difference of two goals or more decreased from

145 to 130. Statistically, the before and after distributions are significantly different (Pearson $\chi^2(6) = 17.28$; p-value: 0.008).[10] This first look of the data, therefore, suggests a clear non-monotonic pattern in the outcomes: teams are less likely to tie, but they are also less likely to win by a "useless" (but possibly quite entertaining) large number of goals.

Table 1 presents some descriptive statistics before and after the change. This table does not account for possible year effects, as it only reports changes in means, but it gives an idea of the main patterns observable in the data. It also shows that the effects that we will find in the next section result, as we might expect, from changes in the "treatment group." We find, for instance, that there were statistically significant and large increases in regular fouls, yellow card fouls, shots on goal, and corner kicks. With respect to match outcomes we see the drop in the proportion of ties referred to before, as well as an increase in extra time and a decrease in attendance. As indicated earlier, these results, while suggestive, could simply reflect other trends in the way soccer is being played. We proceed in the next section to study the relations of these changes to the changes in incentives, by comparing them with the changes that took place in the Spanish Cup.

3 Responses to the Incentive Change

As mentioned earlier, we will consider player types as an indication of the teams' defensive and attacking stances. Changing the composition of player types, therefore, may be taken just as suggestive evidence of how teams may respond in their choices of productive and destructive effort.[11] Direct evidence will come from changes in actions. With respect to actions, the stated purpose of the change was to encourage attacking and scoring, so attacking actions are desired by the principal per se, especially if they lead to more scoring. On the destructive side, hindering the opponent's ability to compete by injuring opposing players and other forms of dirty play punished with fouls and yellow cards players seem unquestionable sabotage activities.

For each outcome variable, we first present the simple differences-in-differences estimator, which is the difference of the difference in means. The effect of the incentive change is then the interaction between league (non-cup) and year. Then, we

[10] We omitted margins above 3 games to conform to the practice of limiting the Pearson analysis to bins for which the expected number of observations is greater than 5.

[11] Moreover, the theoretical literature treats agents as individuals, not as teams of different types, and hence yields implications only for the *actions* that agents take as a response to incentives.

repeat the analysis controlling for the strength of the teams in the match using their operating budgets, and lastly we add team fixed effects.

Offensive Behavior. Table 2 presents our main evidence on the increase in attacking play. We have four proxies for attacking behavior:

i. Player Types. First, we find that there is a large and significant increase in the number of attackers as a result of the change, estimated at 0.41. Considering that 2.08 forwards were used on average before the change, this estimated 20% increase is in fact sizable. Controlling for the budgets of the teams (column II) or team's fixed effects (column III) reduces the coefficient estimates to about 0.28. The evidence from these three specifications is nevertheless unambiguous: teams significantly increase, by roughly between 0.28 and 0.41 players per team, the number of attackers they use as a result of the new reward scheme.

ii. Attacking Actions. We construct a proxy of offensive or "good" effort using the first principal component of three variables: corner kicks, shots, and shots on goal. The results are reported in columns IV, V and VI. We see a clear increase in offensive effort, suggesting that the incentive change resulted in an increase in the number of shots, shots on goals, and corner kicks. We also calculated the effects for the individual components of the index and, although not separately statistically significant, they all showed increases of around 10%.

Sabotage. Table 3 reports the impact of the incentive changes on sabotage activities. We study three measures of sabotage:

i. Player Types. We find in columns I, II and III that the number of specialist in defense *increases* from 0.10 to 0.25 depending on the specification. Given that the average pre-change number of defenders is 4, these changes represent an increase of about 2% to 6%. Note that this is one instance where the differences-in-differences estimates reverse the before-after findings.

ii. Fouls. The second panel, columns IV, V and VI in Table 3, performs the same analysis for regular fouls. Recall that this type of fouls represents the large majority of all sabotage activities. The result here is quite conclusive: the incentive change produced a precisely estimated increase in the number of fouls of about 2. Given the pre-change mean of 16.2, the estimate represents approximately a 12.5% increase in the number of fouls as a consequence of the incentive change.

iii. Yellow Cards. Because referees are subject to an upper limit on the number of yellow cards they can give per player (because two yellow cards to the same player

in a game causes that player to be expelled), yellow cards may be less sensitive than other measures of sabotage. All the estimates we obtain in columns VII, VIII and IX are positive and of comparable magnitudes. They suggest that yellow cards increase by around 10% as a result of the incentive change, although in this case our estimates are somewhat imprecise.

Overall, we take these results as indicating that teams unambiguously increased the amount of sabotage.

Net Effects of Increasing Offensive Effort and Sabotage on Outcomes. We have found that due to the incentive change, while offensive effort increases so does sabotage. In principle, it is not clear whether these changes may lead to more goals, fewer goals, or to no significant change. Interestingly, we find in columns I-III in Table 4 that there is no change in the number of goals after the change in incentives in any of the specifications. Hence, the increase in attacking play was not enough, given the increase in sabotage, to increase goals. The effect is quite precisely estimated at around zero.

Columns IV-XII in this table present results for some other outcome measures of interest:

(a) The proportion of ties did not decrease, even though such a decrease would be Pareto preferred by both teams;[12]

(b) Extra time, which is awarded at the discretion of the referees to compensate for interruptions in play, does *increase* as a result of the incentive change. Since most interruptions are due to fouls and yellow cards, especially those that cause injuries, this is further, indirect evidence of sabotage;

(c) Finally, there still is the question of whether the public preferred the increase in more physical play. Attendance measures this margin. Our findings suggest that the incentive change actually *decreased* attendance. Note that the most complete specification, which controls for the popularity of the teams using a full set of home and visiting team fixed effects, is the one that gives the clearest result. In section 5, we will return to this issue and examine which actions may have led to lower attendance, that is to reducing welfare as perceived by the principal FIFA. We first try to get a better understanding of why goals did not change after the change in incentives by investigating the dynamic strategic mechanism underlying the changes in behavior we have documented.

[12]Increasing attackers and defenders, therefore, does not increase the risk of the outcome except for the case of scoreless ties (not shown) which do decrease.

4 Competition Dynamics: Why Did Sabotage Keep Goals from Increasing?

We study here the dynamics of the competition using the variables for which there exists information on their timing during the match: player substitutions and goals.

Player Substitutions During the Game. Figures 2A and 2B present graphically the DID estimates of the changes in the number of defenders and attackers by game score. Although any player can defend and attack, changes in strategies during the game are better implemented by substituting in new specialists. Using the evidence on player substitutions during the game, we find that more defenders are monotonically used the more a team gets ahead in the score, and more attackers are monotonically used the more a team gets behind.

Figure 2A, which shows the impact of the change in the number of defenders by goal score (where the number is measured relative to the number used in a tie) clarifies how teams are adapting their strategy to the new situation. After the incentive change, teams that get ahead in the score by one or two goals increase significantly their deployment of defenders relative to what such deployment was before the rule change. For 1 goal ahead, the test statistic for the equality of the number of defenders is $F(1,\ 858) = 5.64$, p-value: 0.017; while for 2 goals ahead it is $F(1,\ 858) = 4.26$, with p-value: 0.039. That is, when a team is ahead it deploys a strategy aiming at conserving the score relative to the possibility of scoring more goals. Moreover, recall that teams were already using more defenders in the initial line-up. Hence, the change relative to the old reward scheme is even more significant.

Figure 2B shows the change in the deployment of the number of attackers by game score, again relative to the number used in a tie. The change goes in the same direction of more conservatism when ahead, and has a similar size. After the incentive change, the team that is ahead deploys .1 fewer attackers than when it is tied, although the drop is not statistically significant (for 1 goal the p-value is 0.310, and for 2 goals it is 0.416).

Likelihood of Scoring and Goal Attempts During the Game. Figures 3A and 3B report the estimated coefficients of two different regressions of goals and shots aimed at the opponent's goal.

Figure 3A presents the DID estimates of the probability of scoring in a game by game score. Consistent with its increasing defensive stance, the team ahead was less

likely to score a goal after the rule change. This change is statistically significant (for 1 goal ahead, the test on the equality of the scoring probablity is $\chi^2(1) = 5.46$, p-value: 0.019; for 2 goals ahead, $\chi^2(1) = 4.09$, and p-value: 0.043). Since the probability that the team behind scores a goal in any particular minute is very small, the team that is behind suffers only a tiny decrease in the probability of scoring as a result of the increasingly aggressive defensive stance of the team ahead. Yet, the change is transparent.[13]

Figure 3B presents additional, indirect evidence on this drop. Since no records exist of shots per minute, the figure shows the number of shots over the entire match. The behavior is U-shaped: teams take more shots both in matches where they end up behind and in matches where they end up ahead. After the incentive change, the total number of shots taken by a team that ends up losing decreases significantly (for 2 goals, $F(1, 797) = 5.42$, with p-value: 0.020; for 1 goal $F(1, 797) = 7.51$, with p-value: 0.006), while there is no change for the team that ends up winning. Although, of course, the match outcome is endogenous to the number of shots, we find that this evidence complements that in the previous figure.

To summarize, teams ahead use fewer forwards and more defenders after the incentive change, score fewer goals and allow, overall, a smaller number of shots by their opponents.

5 Dysfunctional Response vs. Desirable Intensity

It seems reasonable to conclude from the evidence obtained that as a result of the incentive change effort increased, teams engaged in a more intense and physical type of play, and more "dirty" actions took place. Yet, sabotage activities need not be detrimental to the game. That is, it is unclear whether or not this is "bad" from the perspective of the principal. Contrary to the provision of incentives in firms and other organizations where any amount of sabotage is undesirable by the principal, in a sports context some strong physical play may be desirable. For instance, it is often argued that physical play and brawls are desired by the public in ice hockey. This, despite FIFA's stated purpose for the incentive change, could also be the case in soccer.

Here we study the extent to which the public dislikes the increase in dirty play after the incentive change. To do this, we exploit a useful feature of league play: all teams are allocated to all stadiums, until they each play in every other team's home

[13]The estimate for a team behind by 1 goal decreases from 0.002 to 0.00015.

stadium. This feature allows us to tease out the effect of playing against a dirtier rival, i.e., one which undertakes more sabotage actions, on attendance.

Table 5 studies the effect of playing against a dirtier team at one's home stadium, that is the response of fans to the expected dirtiness of the visiting team. We proxy for this using the average number of fouls, yellow cards and red cards by the visitor during the season in question. We also compute an index of sabotage propensity by a team using a factor analysis on the matrix of these three variables and picking the first principal component. The results show a significant decrease in attendance when being visited by dirtier teams, even after controlling for the losing or winning record of the teams in the match and other variables.[14]

This finding, together with the result in Table 4 showing how the audience declined as a result of the incentive change, allows us to conclude that stronger incentives to win led to dirtier play which turned off the audience. As such, these strong incentives did have dysfunctional consequences.

6 Conclusions

While traditionally most of the literature on incentives has emphasized the trade-off between risks and incentives, empirical evidence for the importance of such trade-off is tenuous (Prendergast, 2002). A more modern view (e.g., Lazear, 1989, Hölmstrom and Milgrom, 1991, 1994, Baker, 1992) emphasizes the limits placed on the strength of incentives by the difficulty in measuring output correctly and the costs that may be incurred when, as a reaction to stronger incentives, agents re-optimize away from the principal's objective.

We see our paper as providing a strong empirical endorsement for this view. We find that an increase in the reward for winning increased, counter to FIFA's intentions, the amount of sabotage effort undertaken by teams. Although there appears to be some increase in attacking effort, no actual changes take place in the variable where change was intended, goals scored. The mechanism underlying these patterns is increasing conservatism: teams try to preserve their lead by freezing the game. The decrease in attendance we find means that stronger incentives turn out to be detrimental to the game.

[14]The results are strong for every variable except for red cards, which exhibit high standard errors. These represent, however, a very small proportion of all sabotage activites (less than 1 percent) and are to a large extent random and unplanned, in that they involve behavior (e.g., insulting, spitting) that is clearly beyond the bounds of the game.

Although theoretical research warns about the possible detrimental incentive effects of increasing the spread of rewards in a tournament when workers can engage in sabotage, the theory has remained untested in the literature. Workers engaged in promotion tournaments may indeed bad-mouth their colleagues and actively prevent them from achieving good results by withholding information and other means. But they will typically do their best to conceal their efforts. For this reason, evidence on sabotage activities is, by its nature, at best anecdotal. In the natural setting we have studied, however, both productive and destructive actions can be observed. Moreover, we can study the effects of a change in incentives using a control group to eliminate any effects unrelated to the incentive change. These elements allow us to provide the first explicit empirical test of worker-incentive problems in a natural multi-task setting, where tasks can be productive and destructive.

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Table 1 - Before-After Estimates

This table reports differences in offensive and defensive effort and selected match-level statistics in league soccer matches before and after the FIFA incentive change. For the offensive and defensive measures the unit of observation is a team within a match. For the match outcomes the unit of observation is a match except for goals that it is a team within a match. Attendance is measured as the fraction of available seating that was occupied. Where appropriate standard errors, reported in parenthesis, have been adjusted for clustering on match. * denotes significant at the two-tailed 10% level, ** at 5%, and *** at 1%.

Offensive Play

	Before	After	Difference
Attackers	2.08	2.35	0.274***
	(0.0244)	(0.0256)	(0.0353)
	N = 740	*N* = 760	
Shots	6.19	6.80	0.619***
	(0.124)	(0.101)	(0.16)
	N = 734	*N* = 760	
Shots on Goal	4.12	4.75	0.626***
	(0.0882)	(0.0775)	(0.117)
	N = 760	*N* = 760	
Corner Kicks	5.29	5.94	0.649***
	(0.101)	(0.0885)	(0.134)
	N = 734	*N* = 760	

Sabotage Play

	Before	After	Difference
Defenders	4.05	3.93	-0.122***
	(0.0286)	(0.03)	(0.0415)
	N = 740	*N* = 760	
Fouls	16.20	17.49	1.290***
	(0.191)	(0.151)	(0.243)
	N = 734	*N* = 760	
Yellow Cards	2.33	2.67	0.338***
	(0.0549)	(0.0614)	(0.0823)
	N = 734	*N* = 760	

Match Outcomes

	Before	After	Difference
Goals Scored	1.25	1.32	0.064
	(0.0443)	(0.0432)	(0.0618)
	N = 740	*N* = 760	
Tied Matches	0.297	0.255	-0.042
	(0.0238)	(0.0224)	(0.0327)
	N = 370	*N* = 380	
Extra Time	3.46	3.97	0.506***
	(0.0647)	(0.0593)	(0.0878)
	N = 370	*N* = 380	
Attendance	0.755	0.719	-0.035***
	(0.00845)	(0.00949)	(0.0127)
	N = 370	*N* = 380	

Table 2 - Changes in Desired Offensive Effort

	Attackers			Offensive Index		
Explanatory Variable	**(I)**	**(II)**	**(III)**	**(IV)**	**(V)**	**(VI)**
Incentive Change	0.413***	0.286*	0.276***	0.287**	0.239	0.256*
	(0.098)	(0.148)	(0.0887)	(0.133)	(0.151)	(0.142)
Cup Dummy	0.12	0.00345	0.104*	-0.371***	-0.43***	-0.388***
	(0.0759)	(0.121)	(0.0622)	(0.0937)	(0.107)	(0.104)
Year Effect	-0.139	-0.0401	-0.216***	0.135	0.0647	0.139
	(0.0914)	(0.144)	(0.0835)	(0.12)	(0.142)	(0.132)
Visitor Dummy		-0.183***	-0.189***		-0.478***	-0.473***
		(0.0347)	(0.0293)		(0.0479)	(0.0472)
Own Budget		1.922E-5***			1.99E-5**	
		(6.116E-6)			(8.699E-6)	
Opponent's Budget		-8.74E-6			2.304E-5***	
		(5.997E-6)			(8.643E-6)	
Intercept	2.08***	2.15***	2.28***	-0.182***	-0.0252	0.0691
	(0.0244)	(0.0337)	(0.0275)	(0.042)	(0.0591)	(0.0522)
Include team fixed effects?	No	No	Yes	No	No	Yes
N	1698	1574	1698	1596	1568	1596
R^2	0.036	0.062	0.280	0.050	0.103	0.134

Note: This table reports differences-in-differences estimates of the effect of a change in scoring incentives on the number of attackers initially deployed by a team and an offensive index. The offensive index is the first principal component of the number of shots, shots on goal, and corner kicks made by a team. The unit of observation is a team within a match. The first difference compares matches in seasons before and after the incentive change and the second difference compares matches in the cup tournament to league play. Standard errors clustered on matches are reported in parenthesis. * denotes significance at the 10% level, ** at the 5% level, and *** at the 1% level.

Table 3 - Changes in Sabotage Measures

	Defenders			Fouls			Yellow Cards		
Explanatory Variable	**(I)**	**(II)**	**(III)**	**(IV)**	**(V)**	**(VI)**	**(VII)**	**(VIII)**	**(IX)**
Incentive Change	0.169*	0.105	0.249***	1.99**	2.1*	2.2**	0.23	0.421	0.217
	(0.095)	(0.17)	(0.0965)	(0.93)	(1.2)	(0.989)	(0.282)	(0.459)	(0.276)
Cup Dummy	0.23***	0.285**	0.274***	1.17	1.42	1.48	0.33	0.741**	0.462**
	(0.069)	(0.13)	(0.0713)	(0.856)	(1.13)	(0.908)	(0.202)	(0.294)	(0.191)
Year Effect	-0.291***	-0.171	-0.205**	-0.707	-0.363	-0.462	0.107	-0.159	0.125
	(0.0855)	(0.168)	(0.0913)	(0.897)	(1.18)	(0.96)	(0.27)	(0.455)	(0.267)
Visitor Dummy		0.0725*	0.0793**		0.166	0.168		0.411***	0.405***
		(0.0423)	(0.0329)		(0.211)	(0.209)		(0.069)	(0.0662)
Own Budget (000s)		-0.0363***			-0.0545			-0.0124	
		(0.00682)			(0.0376)			(0.0135)	
Opponent's Budget (000s)		0.016**			-0.108***			0.0399***	
		(0.00706)			(0.0369)			(0.0135)	
Intercept	4.05***	4.05***	3.93***	16.2***	16.4***	15.9***	2.33***	2.07***	2.11***
	(0.0286)	(0.0388)	(0.0324)	(0.191)	(0.236)	(0.229)	(0.0549)	(0.0768)	(0.0671)
Include team fixed effects?	No	No	Yes	No	No	Yes	No	No	Yes
N	1698	1574	1698	1596	1568	1596	1716	1572	1716
R^2	0.012	0.031	0.352	0.020	0.026	0.046	0.013	0.042	0.077

Note: This table reports differences-in-differences estimates of the effect of the change in incentives on the number of defenders initially deployed by a team, the number of fouls committed by the team, and the number of yellow cards received by the team. The unit of observation is a team within a match. The first difference compares matches in seasons before and after the rule change and the second difference compares matches in the cup tournament to league play. Standard errors clustered on matches are reported in parenthesis.
* denotes significant at the 10% level, ** at the 5% level, and *** at the 1% level.

Table 4 - Net Effects of Incentive Change on Goals and other Outcome Variables

	Goals Scored			Tie Indicator			Extra Time			Attendance		
Explanatory Variable	**(I)**	**(II)**	**(III)**	**(IV)**	**(V)**	**(VI)**	**(VII)**	**(VIII)**	**(IX)**	**(X)**	**(XI)**	**(XII)**
Incentive Change	-0.0202	0.00187	0.011	0.0435	-0.0534	0.00213	0.471**	0.491**	0.503*	-0.0104	-0.0711*	-0.103***
	(0.169)	(0.272)	(0.177)	(0.0859)	(0.143)	(0.0952)	(0.234)	(0.241)	(0.259)	(0.0279)	(0.0373)	(0.0367)
Cup Dummy	6.629E-4	-0.126	-0.0169	-0.0331	-0.0504	-0.0402	-0.382**	-0.419**	-0.436**	0.195***	0.148***	0.0837*
	(0.11)	(0.149)	(0.119)	(0.0652)	(0.104)	(0.073)	(0.163)	(0.177)	(0.201)	(0.0182)	(0.026)	(0.0429)
Year Effect	0.0846	-0.154	0.108	-0.0856	0.0635	-0.00875	0.0354	0.0077	-0.0378	-0.025	0.0397	0.0386
	(0.158)	(0.266)	(0.17)	(0.0795)	(0.14)	(0.0898)	(0.217)	(0.226)	(0.248)	(0.0249)	(0.0368)	(0.0467)
Intercept	1.25***	1.37***	1.5***	0.297***	0.334***	1.71***	3.46***	3.4***	4.37***	0.755***	0.362***	1.24***
	(0.0443)	(0.063)	(0.0598)	(0.0238)	(0.0282)	(0.21)	(0.0648)	(0.127)	(0.204)	(0.00846)	(0.0636)	(0.0579)
Additional Controls:		Home and visitor budgets, visitor dummy	Visitor dummy		Home and visitor budgets				Stadium capacity, home and visitor budgets		Home and visitor goals, yellow cards, and red cards	Home and visitor goals, yellow cards, and red cards
Additional Fixed Effects:			Team			Home and visiting team		Home and visiting team	Home and visiting team			Home team
Unit of Observation:		Team in match			Match			Match			Match	
N	1718	1574	1718	859	787	859	801	800	800	801	801	787
R^2	0.001	0.102	0.125	0.005	0.010	0.074	0.057	0.085	0.121	0.085	0.689	0.692

Note: This table reports differences-in-differences estimates of the effect of the incentive change on the number of goals scored by a team, the probability of a tie match, the number of extra minutes added to the match by referees, and match attendance. Attendance is measured as the proportion of the available seats in the stadium that were occupied. The first difference compares matches in seasons before and after the rule change and the second difference compares matches in the cup tournament to league play. Standard errors clustered on matches are reported in parenthesis. * denotes significant at the 10% level, ** at the 5% level, and *** at the 1% level. For columns IV-VI, estimation using a probit model generates comparable results.

Table 5 - Attendance and Sabotage

Explanatory Variable	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)
Measures of Visitor's Dirty Play								
• Fouls	-0.00836**	-0.00693*						
	(0.00424)	(0.00369)						
• Yellow Cards			-0.0191*	-0.0202*				
			(0.0108)	(0.0103)				
• Red Cards					-0.0484	0.0949		
					(0.0934)	(0.0916)		
• Dirtiness Index							-0.0435***	-0.0345**
							(0.0158)	(0.0141)
Home Team Wins		0.00243		0.00213		0.00219		0.00235
		(0.00241)		(0.00241)		(0.00241)		(0.00242)
Visitor Wins		0.0149***		0.0151***		0.0153***		0.0148***
		(0.00157)		(0.00157)		(0.00166)		(0.00155)
Season Indicator		-0.00893		-0.00913		-0.0132		-0.00597
		(0.0115)		(0.0117)		(0.0114)		(0.0119)
Stadium Capacity		-0.0121***		-0.0121***		-0.0121***		-0.0121***
		(0.0037)		(0.00369)		(0.0037)		(0.00368)
Day of Season		-0.00592***		-0.00588***		-0.00598***		-0.00585***
		(0.00103)		(0.00103)		(0.00105)		(0.00102)
Intercept	0.879***	1.32***	0.789***	1.26***	0.741***	1.2***	0.737***	1.2***
	(0.0724)	(0.159)	(0.0306)	(0.143)	(0.00853)	(0.141)	(0.00458)	(0.141)
N	750	750	750	750	750	750	750	750
R^2	0.503	0.565	0.501	0.565	0.499	0.563	0.505	0.566

Note: This table reports regression estimates of the effect of the visiting team's dirty play on attendance. The unit of observation is a match and the sample is restricted to league matches. Each of the measures of the visitor's dirty play is constructed as averages over the season in which the match took place. The "Dirtiness Index" is the first principal component of fouls, yellow cards, and red cards. "Home Team Wins" and "Visitor Wins" are the number wins by each team in the match within the same season prior to the game in question. "Stadium Capacity" is measured in number of seats. "Day of Season" is the game number in the season. All specifications include home-team fixed effects. * denotes significant at the 10% level, ** at the 5% level, and *** at the 1% level.

Figure 1. Distribution of Score Margins Before and After Incentive Change

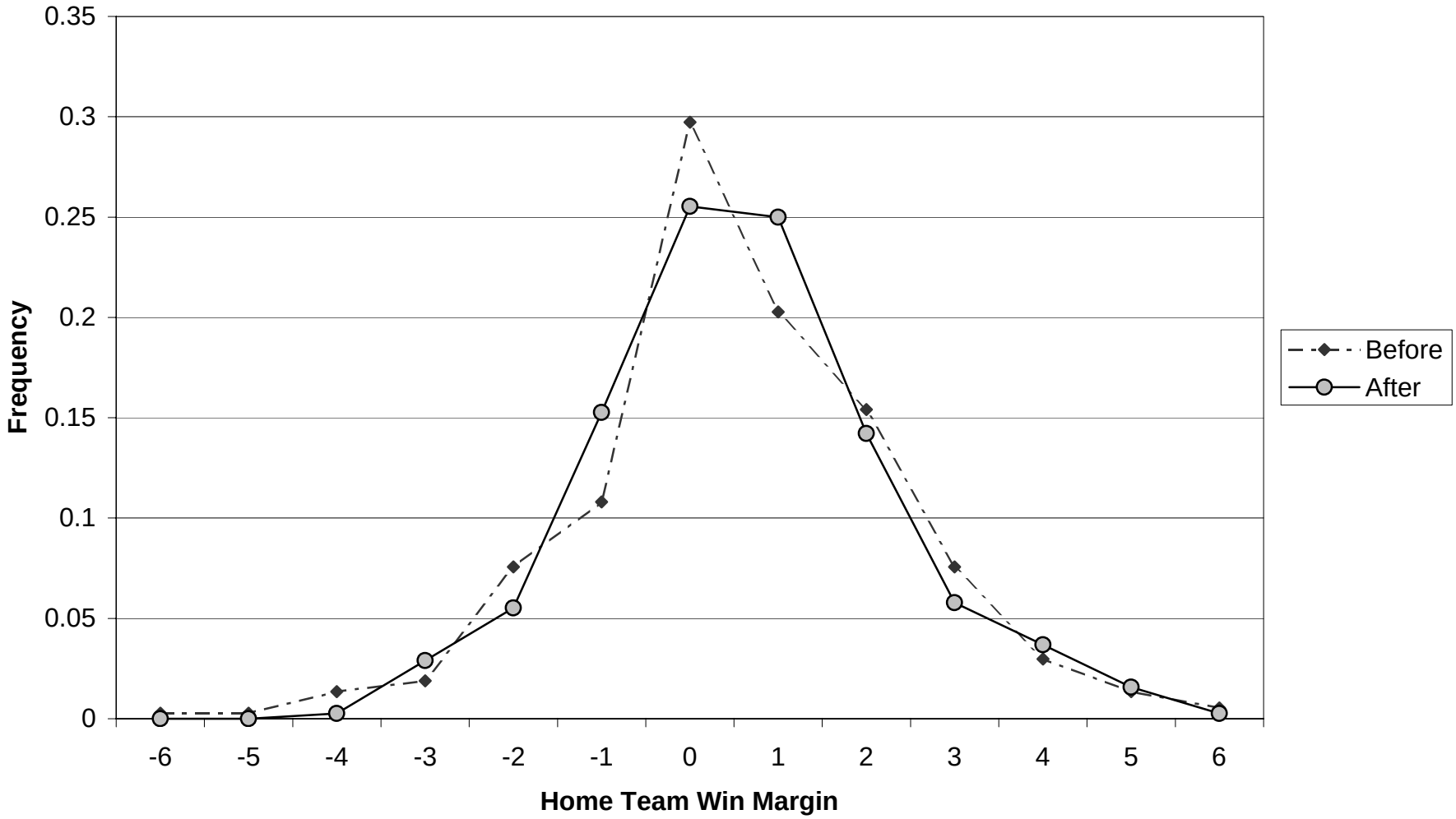


Figure 2A – Deployment of Defenders by Game Score

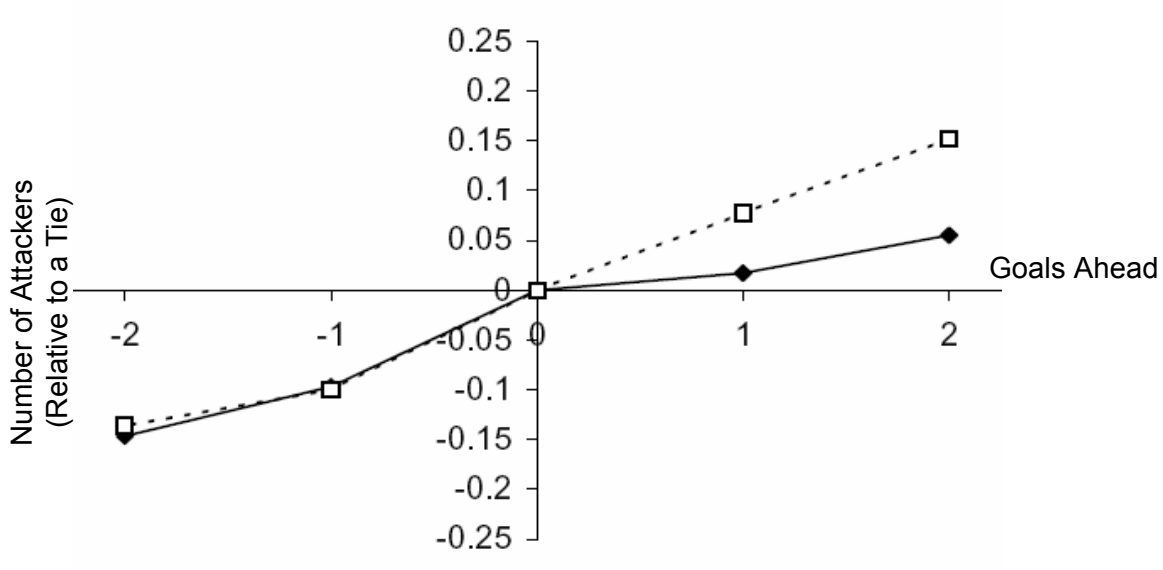
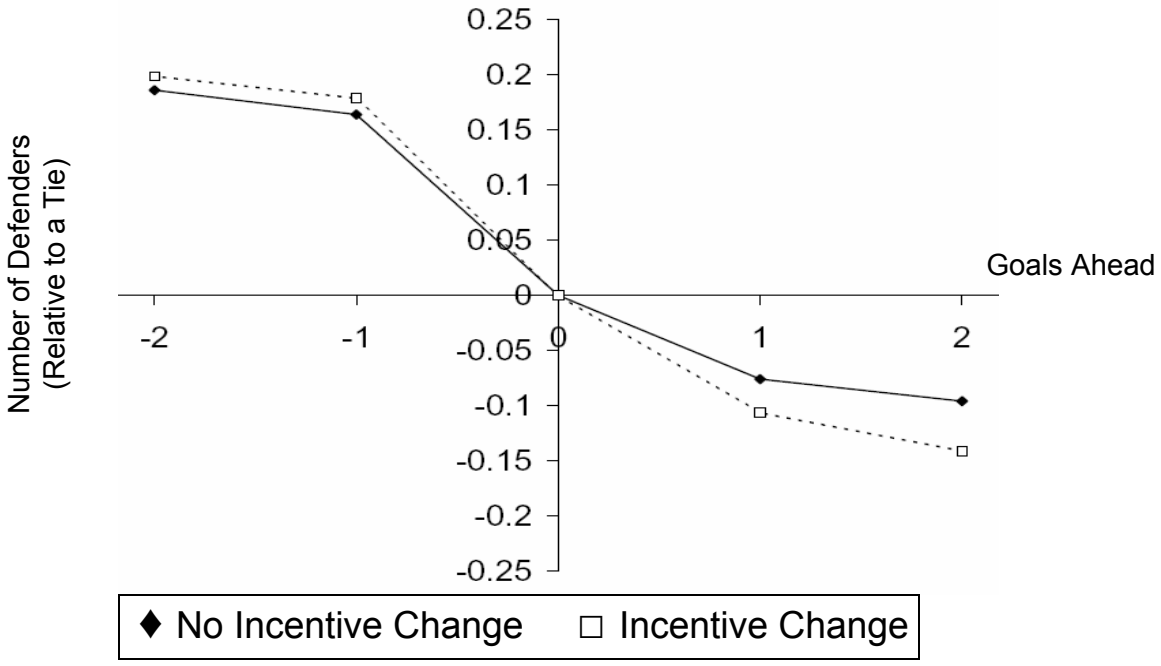
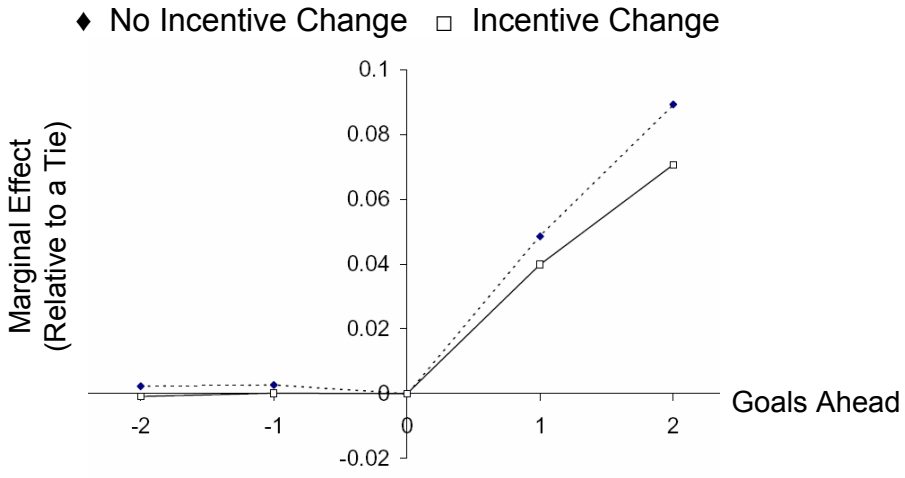


Figure 2B – Deployment of Attackers by Game Score



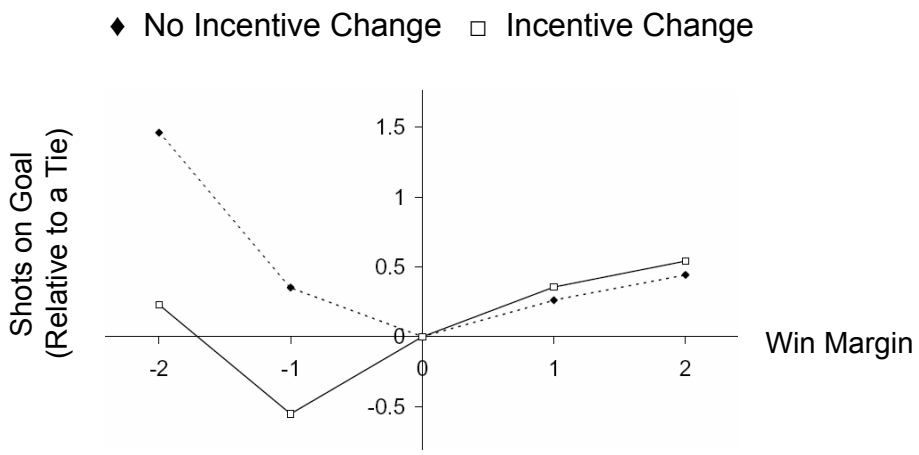
Note: These figures report the estimated coefficients from a regression of the number of defenders (Figure 2A) and attackers (Figure 2B) on an indicator variable for the incentive change interacted with indicators for the number of goals ahead or behind as well as team, minute, year, cup game, and match fixed effects. The unit of observation is one minute of play by a team in a match. The regressions contain 154,620 observations with an R^2 of 0.226 (Figure 2A) and 0.228 (Figure 2B). The reported coefficients are relative to the number of defenders (Figure 2A) or attackers (Figure 2B) employed during a tie. For instance, the point (1,.077) on "Incentive Change" in Figure 2A means that after the change teams on average had .077 more attackers on the field during minutes when they were ahead in the score than during minutes when the game was tied. Similarly for Figure 2B. When teams are 1 or 2 goals behind, *F*-tests using standard errors clustered on match fail to reject the equality of coefficients pre- and post-rule change in either figure. When teams are 1 or 2 goals ahead, the pre- and post-rule change coefficients are statistically different at the .05 percent level in Figure 2A but not statistically different in Figure 2B.

Figure 3A – Probability of Scoring One Additional Goal by Game Score



Note: This figure reports the estimated coefficients from probit regressions of an indicator equal to one in minutes in which a team scored on an indicator variable for the incentive change interacted with indicators for the number of goals ahead or behind as well as team, minute, year, and cup game fixed effects. The unit of observation is one minute of play by a team in a match. The regression contains 153,959 observations. The probit coefficients have been transformed to marginal effects at the mean of each indicator and are reported relative to ties. The point (1,.048) on "No Incentive Change," for example, means that before the incentive change teams on average were 4.8% more likely to score a goal during minutes when they were ahead than during minutes when the game was tied. When teams are 1 or 2 goals behind, *F*-tests using standard errors clustered on match fail to reject the equality of coefficients pre- and post-rule change. When teams are 1 or 2 goals ahead, the pre- and post-rule change coefficients are statistically different at the .05 percent level.

Figure 3B – Number of Shots on Goal by Final Score



Note: This figure reports the estimated coefficients from regressions of the number of shots on goal on an indicator variable for the incentive change interacted with indicators for the margin of victory as well as team, year, and cup game fixed effects. The unit of observation is a team in a match. The regression contains 1,596 observations with an R^2 of .108. The reported coefficients are relative to the number shots on goal made in games that were tied. For win margins of 1 and 2 goals, *F*-tests using standard errors clustered on match fail to reject the equality of coefficients pre- and post-rule change. For loss margins of 1 and 2 goals, the equality of coefficients can be rejected at the 5% level.