BEAUTIFUL GAME THEORY

How Soccer Can Help Economics

IGNACIO PALACIOS-HUERTA

PRINCETON UNIVERSITY PRESS
Princeton, NJ

CONTENTS

8

MAKING THE BEAUTIFUL GAME A BIT LESS BEAUTIFUL

(with Luis Garicano)

> I do not, however, deny that I planned sabotage. I did not plan it in a spirit of recklessness, nor because I have any love of violence. I planned it as a result of calm and sober assessment.
>
> —Nelson Mandela's statement at the opening of the defense case in the Rivonia Trial (Pretoria Supreme Court, April 20, 1964)

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; and 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 30 years (for instance, Kerr 1975; Holmstrom 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 settings where individuals compete with each other and are rewarded on the basis of relative performance. In these settings, strong incentives may be particularly damaging if agents can devote resources not only to productive activities but also to depressing each other's output.

However, whereas anecdotal accounts of "back-stabbing," badmouthing, and other sabotage activities are easy to find, there does not exist any systematic work documenting such responses. An obvious reason why such actions are usually *impossible* to document is that workers who sabotage their fellow workers' performance typically go to great lengths to conceal their actions.

Viewed from this perspective, this chapter studies an incentive change in a natural setting where both productive and sabotage activities can be directly observed. Our setting is a sports context, and the sport we are concerned with is, again, the most popular in the world: soccer.

Football 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 football World Cup that was to take place in the United States in 1994, the governing body of the game, FIFA, 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 United States, was to raise the incentive to attack in games, with a view to driving up the number of goals and overall excitement levels (for example, *USA Today* 1994). The *Los Angeles Times* (Dwyre 1993) 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* (Yannis 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."

This change subsequently became part of the *Laws of the Game* (FIFA 2012) and was applied after 1995 to all league competitions worldwide.[1] Interestingly, little if any intellectual analysis about the potential effects of the rule change was done along the way.

We use a detailed data set on football matches in Spain before and after the change to study the effect of this change in rewards along a number of dimensions. In this context, we call "sabotage" any effort that is intended to reduce the performance of the rival in the match. In particular, we focus our analysis on all such destructive actions that are perceived as "dirty play" or "negative play" and penalized in different ways in the *Laws of the Game* (FIFA 2012).

Our setting has two key advantages. First, negative activities are *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 increasing 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 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 change to the three-point rule that we study should lead teams to try harder to win. This attempt to win may result in two types of actions: Teams may undertake more offensive actions, but they may also play "dirtier" (unsporting behavior punished in different ways) because it now becomes more important to prevent the opposing team from scoring a goal. Stronger incentives may then lead to more negative play. For example, tackling an opponent may reduce his or her 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 that 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 FIFA?

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

1 Professional soccer leagues in England had already introduced this change in the reward schedule in 1981, that is, beginning in the 1981–82 season.

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 after 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 caused by 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% in the measures of attacking effort desired by FIFA. We find, however, that the number of fouls increased significantly, by around 12.5%, 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 by one goal to become more conservative, since conceding one goal from this position would cause them now 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 because the marginal value of one goal (tying) remains basically unchanged.[2]

The evidence we find is consistent with this hypothesis: Teams that get ahead become more conservative by increasing significantly 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 drops significantly; 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 actually to 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 result, we know, did not happen. Still, a more intense match could be more fun

2 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, in terms of the option it gives on winning the match.

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 *decreases* significantly when the stadium is 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.

We conclude this chapter with a brief discussion of the potential relevance our findings have for agency problems and the tournaments literature. Based on our findings, we also discuss how teams might respond to recent proposals to change other rules. Thus far, rule changes have been discussed and decided on with little data and even less data analysis. From this perspective, our relatively speculative analysis may represent a contribution to this discussion. Overall, the evidence 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. Thus, we see our evidence as supporting incentive models with multiple tasks, where the cost of increasing incentives is encouraging more effort of the "wrong" kind.

*

The data were obtained from *Marca*, which is the best-selling newspaper in Spain, and from www.sportec.es. The setting concerns the Spanish League competition La Liga, and 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, as in the previous chapter, it does not require us to assume that teams 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 *Copa del Rey* 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.[3]

We have obtained detailed observations of multiple measures of actions, both sabotage and the desired attacking or offensive effort, along with the teams' choices of specialists. They are described as follows.

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, defend it when it is under attack. This play 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 wants to increase.[4] Lastly, midfielders play between defenders and attackers, and their role is to support both of these types of players.

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 comes from changes in observed actions, the information on player types is useful to study teams' defensive and attacking stances.

ACTIONS

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

3 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 *both* league and cup games. We use two years of cup data before and two years after the change (1993–94 and 1994–95 before and 1997–98 and 1998–99 after) to have a greater number of matches in our sample since in an elimination tournaments the number of total matches is smaller. We have also checked that the chosen years are not outliers in terms of average goals scored, fouls, and other variables in league matches relative to cup matches.

4 Data from *Marca* (2012) show that indeed sabotage actions are committed mainly by defenders and attacking actions mainly by attackers (e.g., more than two-thirds of all fouls and yellow cards are given to defenders, and attackers represent more than 70% of the players who score at least one goal).

Destructive Actions

Fouls

In the *Laws of the Game* (FIFA 2012), 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.[5]

In addition to fouls, there are two color "cards" that the referee holds up to indicate hard fouls and behavior that will not be tolerated: yellow cards and red cards.

Yellow Cards

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 (FIFA 2012). 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

Red cards are given after a second yellow card is given in the same match, 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 destructive actions (fouls, yellow cards, and red cards) are aimed at reducing the rivals' output. Empirically, around 85–90% of all such sabotage activities are fouls where players are not booked with a card, 10–15% are fouls where a yellow card is given, and typically less than 1% are actions punished with a red card. For the most part, we 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 the opposition team's goal that missed the target, and shots on goal, which are those that did not miss the target. The data also include corner kicks, an action that is a consequence of attacking

5 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 (2012).

behavior: If during an attack 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.

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 or injury time and player substitutions:

Extra Time or Injury Time

Soccer games have two 45-minute halves, at the end of which the referee may, at his or her 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 2012). 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 8.1 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%, and 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%. 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).[6]

6 We omitted margins above three games to conform to the practice of limiting the Pearson analysis to bins for which the expected number of observations is at least five.

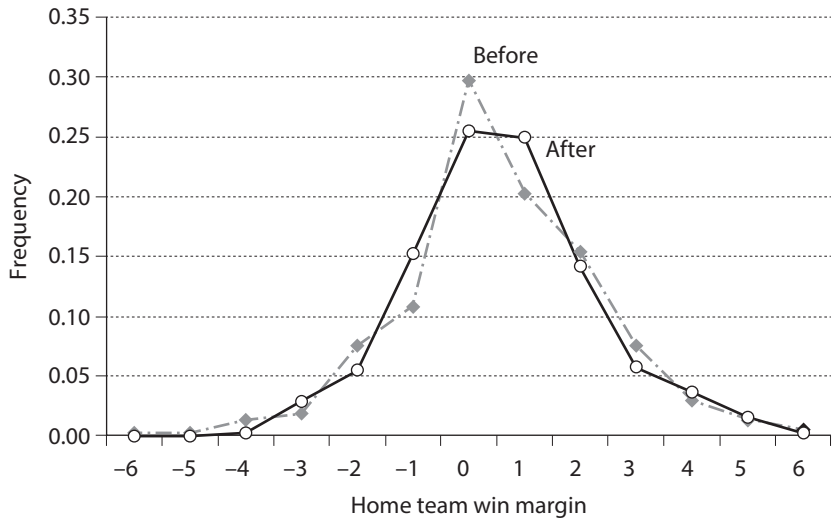


Figure 8.1. Distribution of score margins before and after incentive change.

This first look at the data, therefore, suggests a clear, nonmonotonic pattern in the outcomes: Teams are less likely to tie, but they are also less likely to win by a typically "useless," but possibly quite entertaining, large number of goals.

Table 8.1 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 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.[7]

As indicated earlier, these results, though 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

7 Consistent with conventional wisdom, clubs play more defensively in away games. The squad composition measured by, say, Number of defenders – Number of forwards, is +1.05 (away games minus home games). This home–away difference is also affected by the three-point rule: This difference becomes +1.17, more than a 10% increase. Furthermore, there is also an induced increase in defensiveness in protection of a lead that is more pronounced at away games after the three-point rule.

Table 8.1. Before-After Estimates

	Before	After	Difference
Offensive Play			
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			
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			
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)
	$N = 370$	$N = 380$	

Notes: 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; then, 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 parentheses, have been adjusted for clustering on match. *** denotes significant at the two-tailed 1% level.

incentives, by comparing them with the changes that took place in the Copa del Rey.

RESPONSES TO THE THREE-POINT RULE

As mentioned earlier, we 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.[8]

Direct evidence comes 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 seem unquestionable sabotage activities.

For each outcome variable, we first present the simple DID 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 repeat the analysis controlling for the strength of the teams in the match using their operating budgets, and lastly we add team fixed effects.

Attacking Play

Table 8.2 presents our main evidence on these types of actions. We have a number of proxies for attacking behavior:

1. 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.
2. Attacking Actions. We construct a proxy of offensive or "good" effort using the first principal component of three variables: corner

8 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.

Table 8.2. 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 parentheses. * denotes significance at the 10% level, ** at the 5% level, and *** at the 1% level.

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%.

Negative Play

Table 8.3 reports the effect of the incentive changes on sabotage activities. We study three measures of sabotage:

1. Player Types. We find in columns I, II, and III that the number of specialists in defense *increases* from 0.10 to 0.25 depending on the specification. Given that the average prechange number of defenders is 4, these amounts 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.
2. Fouls. The second panel, columns IV, V, and VI in the table, 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 prechange mean of 16.2, the estimate represents approximately a 12.5% increase in the number of fouls as a consequence of the incentive change.
3. 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. Consistent with this intuition, 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 Attacking Play and Negative Play on Outcomes.

We have found that because of the incentive change, whereas offensive effort increases, so does sabotage. In principle, it is not clear whether

Table 8.3. 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 cup tournaments to league play. Standard errors clustered on matches are reported in parentheses. * denotes significant at the 10% level, ** at the 5% level, and *** at the 1% level.

these changes may lead to more goals, fewer goals, or to no change in the number of goals. Interestingly, we find in columns I–III in table 8.4 that there is no significant 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:

1. The proportion of ties did not decrease, even though such a decrease would be Pareto preferred by both teams.[9]
2. 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. Because most interruptions are caused by fouls and yellow cards, especially those that cause injuries, this increase is further, indirect evidence of sabotage.
3. 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 to the stadium. 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. We will return later to this issue and examine which actions may have led to lower attendance, that is, to reducing welfare as perceived by 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.

COMPETITION DYNAMICS: HOW 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 8.2A and 8.2B 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

9 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.

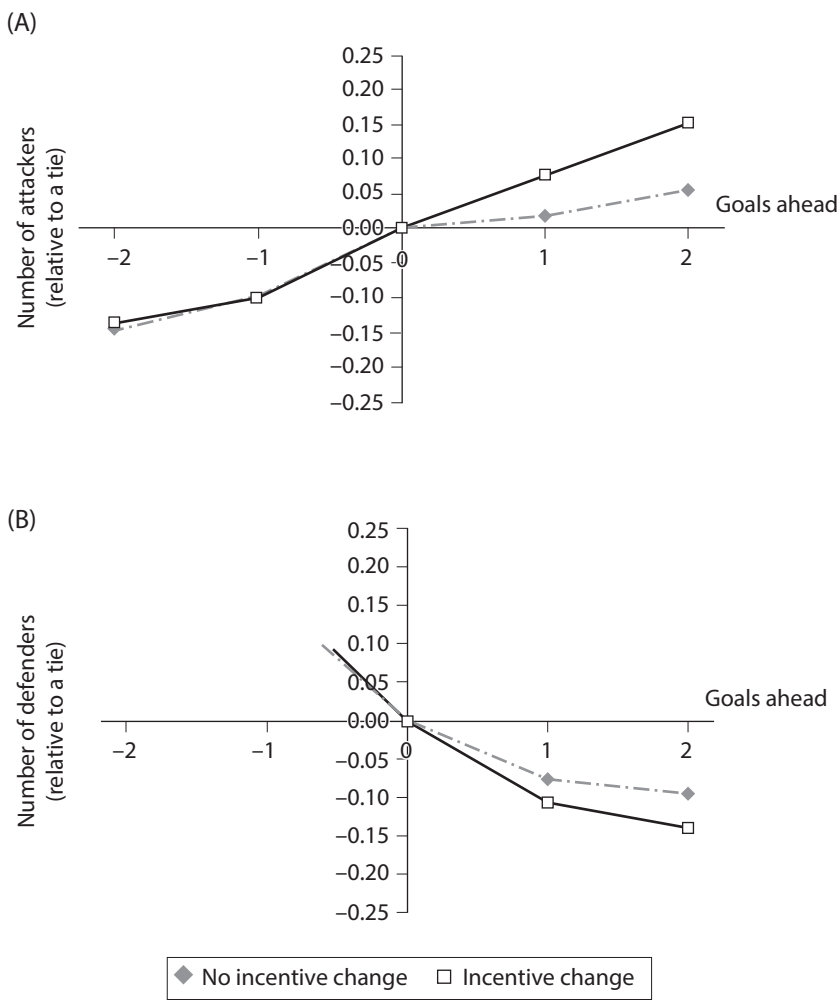
Table 8.4. Net Effects of Incentive Change on Goals and Other Outcome Variables

	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	−0.0088	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
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 parentheses. The unit of observation is the team in the match in the first three columns and the match in the remaining columns. * 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.

during the game are better implemented by substituting in new specialists. Using the evidence on player substitutions during the game, we find that the number of defenders used by a team in the lead increases monotonically with the size of the goal difference. Conversely, teams use more attackers the further behind they fall, and this relationship is also monotonic.

Figure 8.2A, which shows the effect 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 such deployment before the rule change. For 1 goal ahead, the test statistic for the equality of the number of defenders is $F(1, 858) = 5.64$, and p-value is 0.017, whereas for 2 goals ahead, it is $F(1, 858) = 4.26$, and p-value is 0.039. That is, when a team is ahead, it deploys a strategy that aims at conserving the score relative to the possibility of scoring more goals.

Moreover, recall that teams were already using more defenders in the initial lineup. Hence, the change relative to the old reward scheme is even more significant.

Figure 8.2B 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 it has a similar size.

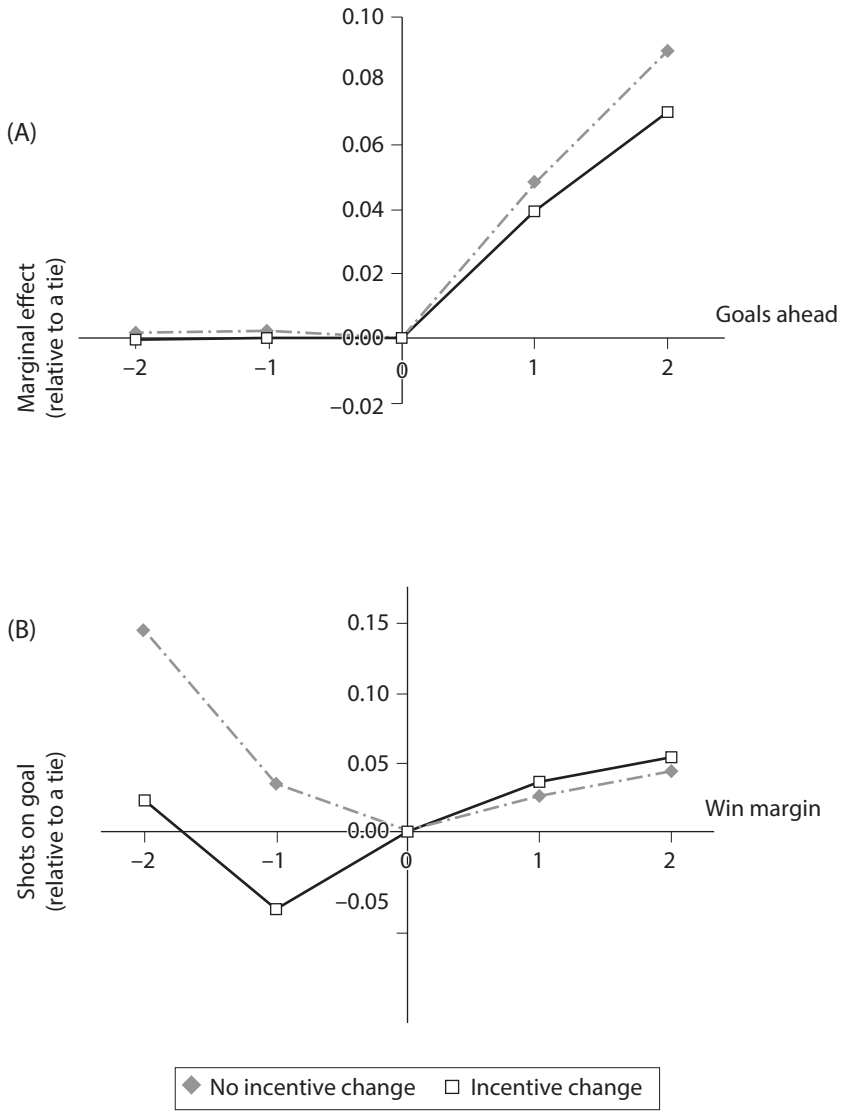
After the incentive change, a team deploys 0.1 fewer attackers when it is ahead than when it is tied, although the drop is not statistically significant (for 1 goal, the p-value is 0.310, and for 2 goals it is 0.416).

Likelihood of Scoring and Goal Attempts during the Game

Figures 8.3A and 8.3B report the estimated coefficients of two different regressions of goals and shots aimed at the opponent's goal.

Figure 8.3A presents the DID estimates of the probability of scoring by game score. Consistent with its increasing defensive stance, the team

Figure 8.2. A. Deployment of defenders by game score. B. Deployment of attackers by game score. These figures report the estimated coefficients from a regression of the number of defenders (A) and attackers (B) 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 (for A) and 0.228 (for B). The reported coefficients are relative to the number of defenders (A) or attackers (B) used during a tie. For instance, the point (1, 0.077) on "Incentive Change" in figure 8.2A means that after the change, teams on average had 0.077 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 8.2B, 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 0.05% level in figure 8.2A but not statistically different in figure 8.2B.



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 probability is $\chi^2(1) = 5.46$, and p-value is 0.019; for 2 goals ahead, $\chi^2(1) = 4.09$, and p-value is 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

Figure 8.3. A. Probability of scoring one additional goal by game score. This figure reports the estimated coefficients from probit regressions of an indicator equal to 1 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, 0.048) 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 0.05% level. B. Number of shots on goal by final score. 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, win margin, 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 0.108. The reported coefficients are relative to the number of 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.

result of the increasingly aggressive defensive stance of the team ahead. Yet, the change is transparent.[10]

Figure 8.3B presents additional, indirect evidence on this drop. Because no records exist of shots per minute in the data set, 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, $F(1, 797) = 5.42$, and p-value is 0.020; for 1 goal, $F(1, 797) = 7.51$, and p-value is 0.006), and 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

10 The estimate for a team behind by 1 goal decreases from 0.002 to 0.00015.

smaller number of shots by their opponents. Does this change contribute to making the beautiful game more or less beautiful?

DYSFUNCTIONAL RESPONSE OR DESIRABLE INTENSITY?

It seems reasonable to conclude from the evidence 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 behavior by the agents 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 for 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 stadium. This feature allows us to tease out the effect of playing against a dirtier rival—that is, one that undertakes more sabotage actions—on attendance at the stadium and on TV audiences.

Table 8.5 studies the effect of playing against a dirtier team at one's home stadium, that is, the response of fans attending at the stadium 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. Table 8.6 reports the net effect of the incentive change on TV audiences and, using the same principal component, also the effect of dirtier games on these audiences.

The results show that both stadium and TV audiences declined as a result of dirtier play, even after controlling for the losing or winning record of the teams in the match and other variables.[11] These findings,

11 The results are strong for every variable except for red cards, which exhibit high standard errors. Red cards, however, represent a small proportion of all sabotage activities (less than 1%) and are to a large extent random and unplanned, in that they involve unusual behavior (e.g., insulting, spitting) that is clearly beyond the bounds of the game. We have also put budget control variables in regressions X, XI, and XII of table 8.4 and in the regressions of table 8.5 and found no significant differences from the results without these controls.

Table 8.5. Stadium 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 of wins by each team in the match within the same season before 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.

Table 8.6. TV Audience and Sabotage

Panel A		
Constant	0.880***	1.251***
	(0.127)	(0.111)
Incentive Change	–0.202***	–0.217***
	(0.057)	(0.040)
Cup Dummy	0.152***	0.097**
	(0.045)	(0.040)
R^2	0.532	0.571
N	801	707
Panel B		
Constant	0.828***	1.332***
	(0.112)	(0.234)
Dirtiness Index	–0.062***	–0.079***
	(0.019)	(0.023)
Home Team Wins		0.003
		(0.165)
Visiting Team Wins		0.014***
		(0.003)
Season Indicator		–0.001
		(0.002)
Stadium Capacity		–0.012**
		(0.004)
Day of Season		–0.000
		(0.002)
R^2	0.352	0.397
N	297	297

Notes: This table reports regression estimates of the effect of the incentive change (panel A) and dirty play (panel B) on TV audience. Panel A includes controls for home and visitor goals and yellow and red cards in the first column, and in the second, in addition, home team fixed effects. In panel B, the "Dirtiness Index" is the first principal component of fouls, yellow cards, and red cards for both teams. "Home Team Wins" and "Visiting Team Wins" are the number of wins by each team in the same season up 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. Standard errors are clustered. ** denotes significant at the 5% level, and *** at the 1% level.

together with the result in table 8.4 showing how stadium attendance declined as a result of the incentive change, allow us to conclude that stronger incentives to win led to dirtier play, which turned off stadium attendances and TV audiences. As such, these strong incentives did have dysfunctional consequences. Rough back-of-the-envelope calculations suggest, for instance, that the amount of fans who would not go

to the stadium at the average league match because of the estimated increase in "dirtiness" induced by the three-point rule was about 6% to 8%. Similarly, the decrease in TV audiences as a result of the incentive change can be estimated to be in the range of 2% to 4% on average. There is no easy way to gauge the overall economic effect, but roughly, these findings suggest that the league may have become around 5% poorer as a result of the incentive change. Of course, this estimate does not take into account the subsequent cumulative effects that this change may have had in future seasons. No doubt this is an important question for future research.

*

Although 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 (Lazear 1989; Holmstrom and Milgrom 1991, 1994; and 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 reoptimize away from the principal's objective.

We see this chapter 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 change took 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 stadium attendance and TV audience we find means that stronger incentives turn out to be detrimental to the game.

Although theoretical research warns about the possible detrimental effects of increasing incentives when workers can engage in sabotage, the theory has remained untested in the literature until the results in this chapter were presented at various academic conferences and seminars (see Chowdhury and Gürtler 2013 for an excellent survey). Workers may indeed bad-mouth their colleagues and actively prevent them from achieving good results by withholding information and other means. However, they 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, a critical advantage is that we can study the effects of a change in incentives using a control group to eliminate any effects unrelated to the incentive change.

Viewed from this perspective, the analysis may be interpreted as providing the first explicit empirical test of worker-incentive problems in a natural multitask setting, where tasks can be productive and destructive. It is unclear, however, whether the evidence can be interpreted as a test of the standard tournament model with both productive and destructive actions, as in Lazear (1989). The purpose of the rules and their enforcement in professional sports is to make that single-minded pursuit of winning entertaining for the viewers. The tournament, in this sense, more than the compensation mechanism, is simply the product.[12] Put differently, using sporting rules to reward teams based on their level of entertainment rather than on their winning may in fact defeat the purpose of the product.

Lastly, these findings are useful to make an educated guess as to how teams would respond to future potential changes in rules. For instance, take the proposal at the English Premier League annual meeting in 2005 that 4 points be awarded for *away* wins, rather than 3. The mechanisms for potential unintended consequences that our analyses have uncovered suggest that this is probably a bad idea, and one should proceed with caution. Overall, to the extent that rule changes have been discussed and decided on with very little data and even less analysis, the study in this chapter represents a contribution to the discussion.

*

Major forms of sabotage activities are often illegal and hard, if not impossible, to document even in the setting we have studied. Two anecdotes from World Cup games testify about the difficulties of obtaining such data.

The first one comes from Relaño (2010) and involves two of the greatest players ever. One of the many things that Diego Armando Maradona did after retiring from football was a quite successful TV program, *La Noche del 10*, in Argentina. To give prominence to the first program, he invited Pelé for an interview. The two players never had a great relationship (they still do not), always jealous of each other and disputing who was better than whom in soccer history. Pelé was paid 48,000 euros for

12 Tournaments where workers can allocate their time and attention only in the direction of productive activities were 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 et al. (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.

attending the program (Maradona charged 40,000 per program, and so Pelé demanded 20% more).

The interview started. After a lengthy exchange of compliments and courtesies that sounded pretty fake, Pelé suddenly changed the game. "I have a question, and I hope you will be honest with me: Did you put sleeping pills in the water bottle for Branco?" (Pelé referred to a known issue. In the Argentina–Brazil game of the World Cup in Italy on June 24, 1990, when the Argentine masseur Galíndez went off the bench to assist his player Troglio, he also used the opportunity to give intoxicated water to Branco, the Brazil captain. Galíndez had bottles of water with two types of caps: Blue (good water) and yellow (water with sleeping pills), which should be given to the Brazilians if they asked for water. And so it happened. Branco asked for water and was given a bottle with a yellow cap. He felt bad during the rest of the game. Branco then later recalled that he was somewhat surprised when an Argentinian player took a bottle of water and a teammate told him, "No, not from that one." A few months before that program, on another TV program (*Mar de Fondo*), Maradona confirmed the suspicions: "Someone put Rophynol in the water and everything came apart. . . . Branco did not greet me any more after drinking from that bottle.")

Coming back to the interview, Maradona was visibly taken aback by Pelé's question. Either he denied the accusation and was a liar, or he recognized a major form of sabotage from Argentina to Brazil. "I was not there . . . yes, something happened. . . ." Pelé insisted, and Maradona kept dribbling. "We acknowledge the sin but do not report the sinner. . . ." Until he found a sentence that allowed him to escape on top: "I never had to put to sleep anyone to win a game." It broke the biggest applause of the night. Argentina won the match with a lone goal by Claudio Caniggia in a famous play in which the entire Brazilian defense went chasing Maradona, who took the opportunity to pass to his teammate entirely unmarked.

The second one involves what is probably the biggest shock in the history of the World Cup: In 1966, North Korea beat Italy, eliminating it from that year's World Cup tournament in England.

Italy was one of soccer's most successful teams since winning back to back World Cups in the 1930s. Little was known about the Asian team before the tournament, but few expected them to provide much opposition to an Italian side featuring A.C. Milan star Gianni Rivera (a future European player of the year), Sandro Mazzola (son of Valentino Mazzola, the former Italian team captain) and Giacinto Facchetti (the F.C. Internationale Milano, or Inter Milan, icon). On July 19, 1966, however, in front of 18,000 spectators crammed into Middlesbrough's Ayresome Park, Italy lost to World Cup debutants North Korea. This was the first

time that a nation from outside Europe or the Americas had progressed from the first stage of a World Cup to the next round. The reasons for this shock remain unclear. No substitutes were allowed in the tournament, so when Giacomo Bulgarelli was stretchered off after 30 minutes after a knee injury, the Italian team had to manage with just 10 men for more than an hour of play. One would think that this fact might have played an important role. But, interestingly, it was never even mentioned as an excuse for the defeat. Instead, back in Italy some players reported to the media that they suspected (but could not prove) the most creative form of sabotage: It seemed to them that at halftime North Korea had replaced all 11 of their players in the lineup!