THE ECONOMICS OF MATCH-FIXING

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Abstract

The phenomenon of match-fixing does constitute a constant element of sport contests. This paper presents a simple formal model in order to explain it. The intuition behind is that an asymmetry in the evaluation of the stake is the key factor leading to match-fixing. In sum, this paper considers a partial equilibrium model of contest where two asymmetric, rational and risk-neutral opponents evaluate differently a contested stake. Differently from common contest models, agents have the option of choosing a second instrument to affect the outcome of the contest. The second instrument is assumed to capture positive investments in 'contest management' – namely efforts paving the way for a match-fixing. In particular, it will be demonstrated that, under some conditions, an asymmetry in the evaluation of the stake can lead to a concession from one agent to the other and then to a match-fixing. Eventually the intuitions and results of the model will be applied to make a comparison between the FIFA World Cup and the UEFA Champions League tournaments.

KEYWORDS: Contest, Football, Sport Contest, Contest Management, Match-Fixing, Asymmetry in evaluation, Concession, FIFA, UEFA, World Cup, Champions League.

JEL CODE: L83, D7, D73.

Introduction

Match-fixing in sport contests is a recurring and never-ending phenomenon. History of football provides several examples. In 1915 a match between Manchester United and Liverpool was fixed in Manchester's favour. The United won 2-0 and avoided the relegation. In 1979, in the last match of the Italian Serie A championship, Juventus and Avellino probably fixed a match in Avellino's favour. Avellino was in danger of relegation whilst Juventus was safely at the third place of the standing. Juventus was winning 3-0. Suddenly, Juventus's headcoach Giovanni Trapattoni substituted the legendary Dino Zoff - the most important goalkeeper at that time – with the unknown substitute goalkeeper called Giancarlo Alessandrelli. Then, Avellino scored three times in twenty minutes and avoided more quietly a possible relegation.

However, the most famous example is perhaps the match between West Germany and Austria in 1982 World Cup. They both qualified to the second round at the expense of Algeria which had surprisingly beaten West Germany. Under the rules of the tournament, Algeria played its last match the day before West Germany and Austria. Then, before playing the two german-speaking teams had the opportunity to know in advance the best outcome for both of them. If Germany had won by 1 or 2 goals both teams would have qualified. They did. West Germany won 1-0 and qualified. That result strongly affected the outcome of World Cup. Italy won the World Cup and West Germany was the runner-up.

The common element emerging in these examples is that match-fixing arose because of the tournament design. Of course, this is not a novel statement. In fact, match-fixing is considered somehow predictable in European-style leagues with promotion and relegation. At the end of the season whenever one team is in the mid-table and the opponent is in danger of relegation last matches appear to be naturally in favour of the latter. To the first team the match is meaningless whereas for the opponent it is worth one entire season. Preston and Szymanski (2003) already pointed out that: "*[…]Bribing opponents usually happens because the rewards for winning are highly asymmetric. This can happen in tournaments where one team has already qualified for a later stage of competition. In leagues with promotion and relegation there are often accusations of match fixing at the end of a season where one team in match is in danger of relegation[…]*"[p.618]. This is also in line with Duggan and Levitt (2002). In this study the authors find out a form of reciprocity in Japanese Sumo based upon – among other elements - the asymmetry in the evaluation of the stake in the final match of a tournament.

However, in the presence of a high asymmetry in the evaluation of the contested stake, it could be maintained that the boundary between match-fixing and an ordinary lack of commitment is often undistinguishable. The low-evaluation player could simply exert less efforts than a very motivated player. The aim of this paper is that of providing a simple formal model in order to explain the occurrence of match-fixing between teams retaining different evaluations of the stake. Moreover, the model presented also proposes a tentative differentiating feature between match-fixing and lack-of-commitment and how they could be linked. In order to do that, I enrich a traditional contest model and I shall consider the existence of a second kind of efforts that players have at their disposal. The intuition behind is quite simple. Football matches, as well as other sport contests, are rarely a simple exploitation of physical force and talent. Most sport contests and tournaments involve permanent communication and bargaining efforts between contenders. This can take different shapes and emerges in different occasions. Take the match. Players on the pitch speak each other. They also communicate through silent means. In fact, by means of a less intense commitment, players can simply 'signal' their willingness to exert less efforts and then to fix the result. Kicking aimlessly and lazily the ball around the pitch works in this respect.

However, in modern football, clubs meet and communicate very often. They also meet and interact frequently about transfers of players. At national level, they bargain almost everyday being involved in leagues which organize the tournaments. Moreover, what was traditionally common in domestic league is also becoming common at European level. This kind of situation finds its analog in management of conflicts in the realm of international interactions between nation-states. In fact, most conflicts involve remarkable bargaining and communication efforts between the antagonists. Beyond violence, as applied when sending actual or potential threats, agents apply other instruments to successfully end any struggle. During a war, for example, the exploitation of actual violence is often interlinked with diplomatic efforts. Diplomatic negotiations are often conducted while troops are deployed on the battlefield. In international interactions, the exploitation of potential or actual violence cannot be disentangled from partial openings and cooperative behaviours.

In general, the existence of this kind of behaviour suggests that players have at their disposal two kinds of efforts: (i) 'pure contest' and (ii) 'contest management' efforts. In a broader view, 'contest management efforts' can involve a wide spectrum of activities. For expository convenience, consider among others: (a) bargaining; (b) communication and strategic information transmission; (c) costly signaling. The two kinds of efforts are assumed to be complementary. Contestants are still rational utility-maximizers. Exerting less efforts may not correspond to 'giving up'. In fact, they would exert efforts in 'contest management' if and only if they can get a higher payoff. The existence of 'contest management' efforts paves the way for the occurrence of match-fixing. In such a view, in general terms the phenomenon of match-fixing is nothing but a case of cooperation between agents involved in a wasteful conflict. At the same time, match-fixing is a phenomenon of cooperation which involves necessarily an element of threat and reciprocity. Consider that the existence of 'pure contest' efforts do constitute a kind of 'credible threat'. Therefore, a mechanism of *strong* *reciprocity* works. In such a view, whenever one of the contestants violates a silent (implicit) or declared match-fixing agreement, the opponent can punish it by exerting more 'pure contest' efforts. The characteristic feature of strong reciprocity is that the threatened punishment must be costly. This is in line with definition of strong reciprocity given in Gintis (2000).

This paper links with different strands of literature. Traditional contest models are formally grounded on Tullock (1980) and found seminal explanations in O'Keeffe et al. (1984), Rosen (1986) and Dixit (1987). Szymanksi (2003a) and Szymanki (2003b) expounded the application of contest theory to sport contests.

In the theory of contest the use of a second instrument is not a novelty, although such approach has not been developed extensively. Consider among others the following studies. Baik and Shogran (1995) study a contest between players with unknown relative ability. Under the assumption of decreasing aversion to uncertain ability, agents are allowed to expend resources in order to reduce such uncertainty through spying. Konrad (2003) enriches a model of rent-seeking considering the interaction between two types of efforts: (i) the standard rent-seeking efforts to improve their own performance; (ii) a sabotaging effort in order to reduce the effectiveness of other agents' efforts. In this model, sabotage is targeted towards a particular rival group and reduces this group's performance. Through sabotage a group can increase its own probability of winning the prize as well as the other contestants'. Thus, the model predicts that sabotage disappears whenever the number of contestants becomes large. Caruso (2005) presents two different models of contest with two instruments. The analysis is applied to sport contests in order to consider the phenomena of match-fixing and doping. Arbatskaya and Mialon (2005) analyze in depth the equilibrium properties of a two-instrument contest model and compare the results to those attainable in standard one-instrument models. In particular, this paper is close to a model proposed by Epstein and

Hefeker (2003), who model a contest where, the use of a second instrument creates an advantage for the player with the higher stake.

Thirdly, this paper can also be linked to the literature of contests with asymmetric evaluations. Hillman and Riley (1989), Nti (1999/2004) analyses the case of a contest where participants evaluate differently the 'prize' – namely the stake. The common results of this contributions show that agents retaining a higher evaluation of the stake exert more efforts in the contest than the low-evaluation participants. In particular, Hillman and Riley show that asymmetric evaluation deters participation by low-evaluation agents.

The remainder of the paper is organised as follows. In a first section a common contest model – allowing for different evaluation of the stake - is presented. In a second section the model is enriched in order to capture the existence of a second kind of effort. Then, through a classical mechanism of comparative statics the emergence of a *Match-Fixing Region* is explained. In a fourth section, a tentative calibration of the model is proposed. In particular, UEFA and FIFA tournament designs are analysed. A final section summarizes the results and discusses some policy implications.

The 'pure contest' model

Consider two risk-neutral teams, indexed by $i = 1,2$. they have different evaluations of the contested stake denoted by $x_i \in (0,\infty), i = 1,2$. Given the asymmetry in evaluation, it would be possible to write that $x_1 \neq x_2$ where the subscripts indicate the evaluation of team 1 and team 2 respectively. In particular, hereafter assume that team 1 has a higher evaluation than team 2, namely $x_1 > x_2$. Let $\delta \in (0,1)$ denote the degree of asymmetry between the stakes of the two teams, namely $\exists \delta \in (0,1)\, s.t. x_2 = \delta x_1$. For sake of notational simplicity, throughout the paper I shall use agent 1's evaluation as a kind of numeraire and it will be simply denoted by x. There is common knowledge about such hypotheses. Let a and b denote the abilities for team 1 and team 2 respectively. Following the prevailing literature the outcome of a sport contest is determined through a Contest Success Function (henceforth CSF for brevity). The probability of winning is given for team 1 and team 2 respectively by:

$$p_i(C_1, C_2, a, b) = \frac{aC_1}{aC_1 + bC_2} \tag{1}$$

$$p_2(C_1, C_2, a, b) = \frac{bC_2}{aC_1 + bC_2}. \tag{2}$$

Where C_1, C_2 denote the exerted efforts by team 1 and team 2 respectively. The probability of winning of each team is increasing in its own effort and decreasing in the effort of the opponent. The functional form of CSF adopted in equation does not allow for a draw. Of course, this is a very strict limiting assumption when considering football. Anyway the focus on wins or losses also provides interesting insights. The existence of a draw could be captured through a modified form of the CSF as axiomatized by Blavatskyy (2004). However, the extended model in the next section would not be solved analytically. Then, for expository convenience I have chosen to stick to the traditional form of CSF.

Because of the different evaluation of the stake the payoff functions for team 1 and team 2 are given respectively by:

$$\pi_1 = p(C_1, C_2)x - C_1; \tag{3}$$

$$\pi_2 = p(C_1, C_2)\delta x - C_2 \tag{4}$$

Following an ordinary maximization process the optimal choice of efforts in a match are given by:

$$C_1^* = \frac{ab}{(a + b\delta)^2}\delta x \tag{5}$$

$$C_2^* = \frac{ab}{(a + b\delta)^2}\delta^2 x \tag{6}$$

And the level of total effort of the match is:

$$TC = C_1^* + C_2^* = \frac{ab(\delta + 1)}{(a + b\delta)^2}\delta x \qquad (7)$$

The payoffs accruing to the teams are:

$$\pi_1 = \frac{a^2}{(a + b\delta)^2} x \qquad (8)$$

$$\pi_2 = \frac{b^2}{(a + b\delta)^2} \delta^3 x \qquad (9)$$

The winning probabilities are:

$$p_1(C_1, C_2) = \frac{a}{a + b\delta}; \qquad (10)$$

$$p_2(C_1, C_2) = \frac{b\delta}{a + b\delta}. \qquad (11)$$

It is simple to verify that $p_1 > p_2 \Leftrightarrow a > b\delta$. That is, in the extreme case of $\delta = 1$ (no asymmetry) only the abilities have an impact upon the outcome of the contest. The more talented team will be the favourite while the less talented team will be the underdog.

The extended model

Now consider an extended model where teams have the option of choosing also an optimal level of 'contest management' efforts. Let $F_i \in (0, \infty)$ with $i = 1,2$ denote the level of 'contest management' efforts of team 1 and team 2 respectively. The two kinds of effort are assumed to be complementary to each other. That is, the marginal payoff of an increase in 'pure contest' could be enhanced by a simultaneous increase in 'contest management'. Hereafter the superscript 'F' will denote the 'contest management' scenario for all variables. When both teams exert efforts to 'manage' the contest there is also room for match-fixing. Let me assume that the contest management scenario can be sustained by means of a transfer. Such a transfer is measured in the same unit of both the efforts and the contested stake. Then, suppose that such a transfer is worth a fraction of the optimal level of resources expended for contest management. Given no direct exchange, these transfers are assumed to take the shape of concessions. Let $s_1 \in (0,1)$ and $s_2 \in (0,1)$ denote the proportional concessions. They enter additively the payoff function of the contestants. A limited assumption is that the such reciprocal proportional concessions are treated as exogenously given. That is, I am not proposing any analytical explanation about the determination of them. I made this choice for analytical and expository convenience. In this setting, the CSF becomes:

$$p_1^F = \frac{aC_1(F_1+1)}{aC_1(F_1+1)+bC_2(F_2+1)} \tag{12}$$

$$p_2^F = \frac{bC_2(F_2+1)}{aC_1(F_1+1)+bC_2(F_2+1)} \tag{13}$$

Eventually, assuming linear cost functions for 'contest management' efforts, the payoffs function are:

$$\pi_1^F = p_1^F x - C_1 - F_1 + s_2 F_2 \tag{14}$$

$$\pi_2^F = p_2^F \delta x - C_2 - F_2 + s_1 F_1 \tag{15}$$

Note that a concession proportional to the value of 'contest management' efforts enter the payoff functions of both teams. The optimal choices for both 'pure contest' efforts and 'contest management' efforts are:

$$\begin{cases} C_1^{F*} = \dfrac{ab}{(a+b\delta^2)^2}\delta^2 x \,;\, F_1^* = C_1^{F*} - 1 \\ C_2^{F*} = \dfrac{ab}{(a+b\delta^2)^2}\delta^3 x \,;\, F_2^* = C_2^{F*} - 1 \end{cases} \tag{16}$$

Note that the optimal level of 'pure contest' is unambiguously positive $C_1^{F*} > 0, C_2^{F*} > 0$ whereas it is clear that $F_1^* > 0 \Leftrightarrow (a+b\delta^2)^2/(ab\delta^2)$ and $F_2^* > 0 \Leftrightarrow x > (a+b\delta^2)^2/(ab\delta^3)$. That is, in order to have positive efforts in contest management the value of the stake must be sufficiently large. Since $(a+b\delta^2)^2/(ab\delta^3) > (a+b\delta^2)^2/(ab\delta^2)$ for $\delta \neq 1$ considering only the positivity condition for team 2's contest management effort would suffice. Moreover, the team with the higher evaluation of the stake has a higher incentive to fix the result of the match. In fact $F_1^* > F_2^*$. The total level of 'pure contest' efforts is:

$$TC^F = C_1^{F*} + C_2^{F*} = \frac{ab\delta^2 x(\delta+1)}{(a+b\delta^2)^2} \tag{17}$$

Whenever teams spend efforts to manage the contest the level of total efforts is lower than in the pure contest scenario. That is, $TC > TC^F$. The winning probabilities are:

$$p_1^F = \frac{a}{a+b\delta^2};\, p_2^F = \frac{b\delta^2}{a+b\delta}. \tag{18}$$

where $p_1^F > p_3^F \Leftrightarrow \delta < (a^{1/2}/b^{1/2})$. The payoff of team 1 is given by:

$$\pi_1^F = (1-s_2) + \frac{ax[a+b\delta^2(\delta s_2 - 1)]}{(a+b\delta^2)^2} \tag{19}$$

Note that:

$$\pi_1^{F*} > 0 \Leftrightarrow s_2 > (b\delta^2 - a)/(b\delta^3). \tag{19.1}$$

In the extreme case of $s_2 = 0$, the condition becomes $a - b\delta^2 > 0$.

Payoff for team 2 is given by:

$$\pi_2^F = (1-s_1) + \frac{b\delta^2 x[b\delta^3 - a(\delta - s_1)]}{(a+b\delta^2)^2} \tag{20}$$

At the same time note that

$$\pi_2^{F*} > 0 \Leftrightarrow b\delta^3 + a(s_1 - \delta) > 0. \tag{20.1}$$

If $s_1 = 0$ the (20.1) condition becomes $a - b\delta^2 < 0$. Considering (19.1) and (20.1) It would be trivial to underline that if $s_1 = s_2 = 0$ there cannot be positive payoffs for both teams.

Comparative statics

As noted above, the second scenario has to be incentive-compatible. Then both teams have to get higher payoffs. More formally $\pi_1^F > \pi_1$ and $\pi_2^F > \pi_2$. Recall (8), (9), (19) and (20) and use $a = kb$, to write:

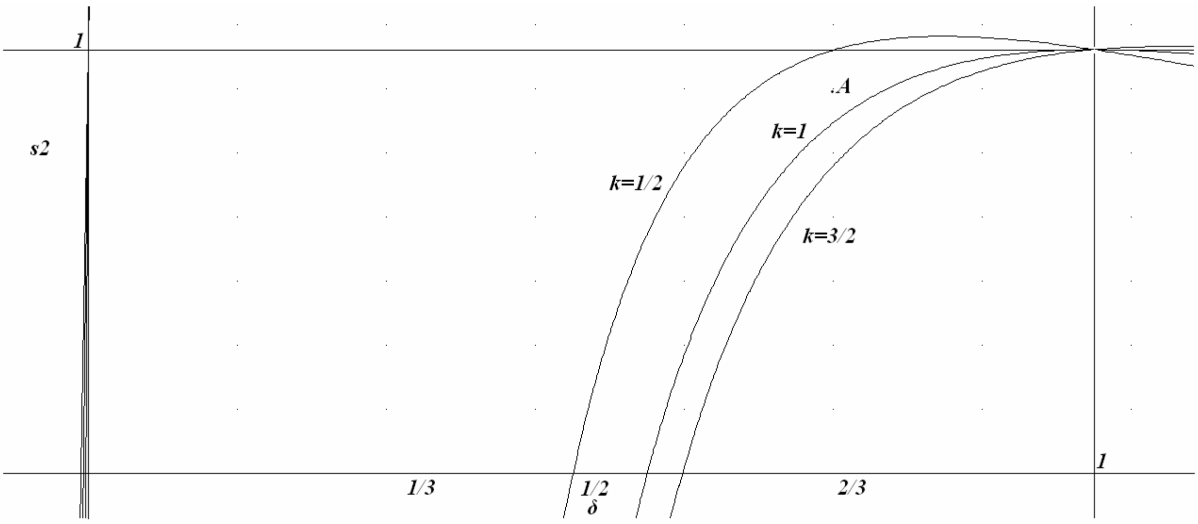
$$\pi_1^F > \pi_1 \Leftrightarrow \frac{kx(\delta^3 s_2 - \delta^2 + k)}{(\delta^2 + k)^2} + (1 - s_2) > \frac{k^2 x}{(\delta + k)^2} \tag{22}$$

and

$$\pi_2^F > \pi_2 \Leftrightarrow \frac{\delta^2 x(\delta^3 - \delta k + ks_1)}{(\delta^2 + k)^2} + (1 - s_1) > \frac{\delta^3 x}{(\delta + k)^2} \tag{23}$$

For sake of simplicity, hereafter I set an arbitrary value for the stake, $x = 100$. Then consider first team 1 and look at the parameter space (δ, s_2) plotted below.

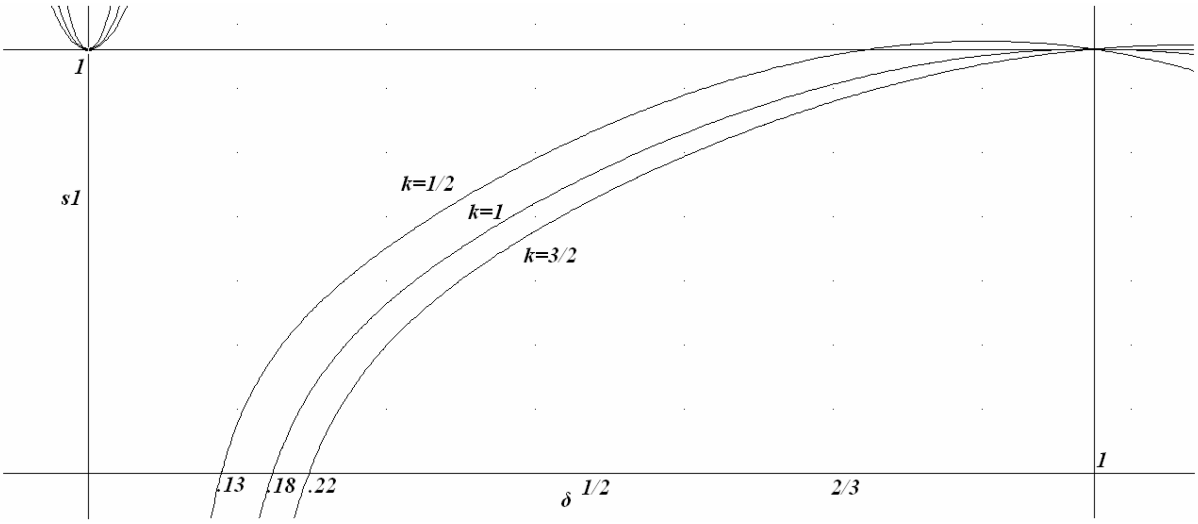
FIGURE 1- RATIONALITY OF CONTEST MANAGEMENT FOR TEAM 1 ($x = 100$)



All the points on the left of each curve represent the set of possible combinations of δ and s_2 that make team 1 willing to manage the contest. It is clear that in the extreme case of $s_2 = 0$, the boundary of the set would be represented by a vertical line denoting $\delta = .48$, $\delta = .56$ and $\delta = .59$ respectively for $k = 1/2$, $k = 1$, $k = 3/2$. That is, in general for $s_2 = 0$ and a fixed value of k, there is a critical level $\tilde{\delta}$ such that for $\delta > \tilde{\delta}$ team 1's willingness to fix the match vanishes. However such willingness to manage the contest vanishes unless team

2 doe not provide the opponent with a sufficient proportional concession. In sum, the plot reports the boundary of a rationality condition. Figure 2 below reports the same for team 2.

FIGURE 2 – RATIONALITY OF CONTEST MANAGEMENT FOR TEAM 2



As noted above for team 1, for $s_1 = 0$ and a fixed value of k, there is a critical level $\tilde{\delta}$ such that for $\delta > \tilde{\delta}$ team 2's willingness to fix the match vanishes. However such willingness to manage the contest vanishes unless team 1 does not provide the opponent with a sufficient proportional concession. The interesting point is that, for a fixed value of k, critical values of δ allowing for a contest management scenario are lower than those of team 1. That is, the team with a higher evaluation of the stake has to influence team 2's behaviour by means of a positive concession.

As noted above, a match-fixing region is attainable if and only if $F_1^* > 0, F_2^* > 0, \pi_1^{F*} > 0, \pi_2^{F*} > 0, \pi_1^F > \pi_1, \pi_2^{F*} > \pi_2$. Then recall (19.1), (20.1), (22) and (23), and set again an arbitrary value both for x and k.

FIGURE 3 – MATCH-FIXING REGION (MFR) AND ASYMMETRY IN EVALUATION

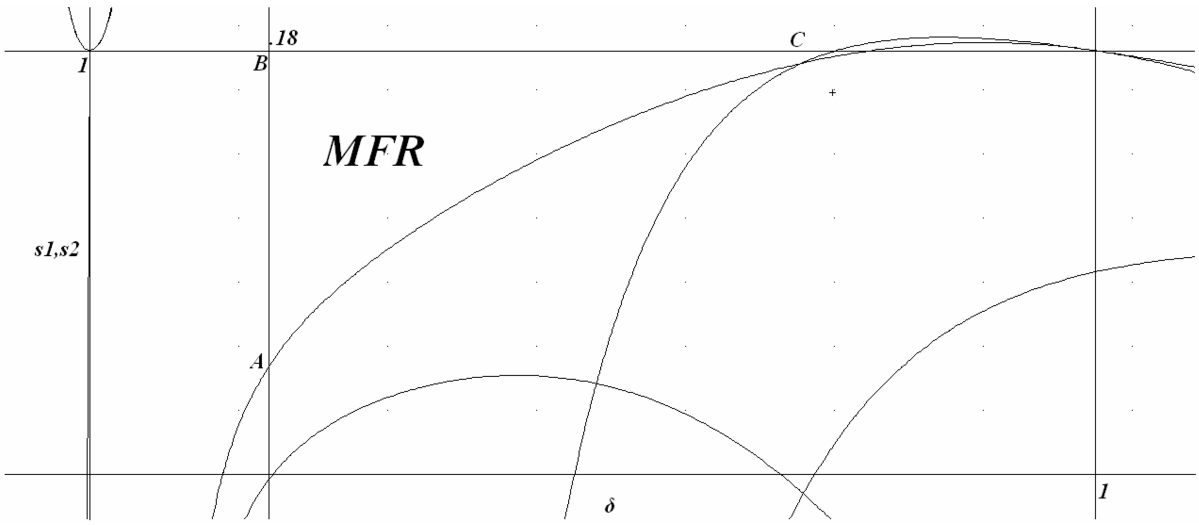


Figure 3 show the MFR for $x = 100$ and $k = 1/2$. The MFR is the area delimited by ABC. That is, team 1, namely the team with a higher evaluation of the stake has also lower abilities. The vertical line indicating $\delta = 0.18$ represents the condition $F_2^* > 0$, namely $x > (a + b\delta^2)^2 / (ab\delta^3)$, for $x = 100$ and $a/b = k = 1/2$. All the points on the right of line fulfill the condition.

The MFR contains all the possible values for both s_1 and s_2 that – for a given value of δ - allow for contest management. The contest management scenario paves the way for match-fixing. In such a case, both teams will prefer the contest management scenario to the pure contest scenario. It does appear clear that as the asymmetry in the evaluation of the stake decreases (namely as $\delta \to 1$) the value of the proportional concessions needed to establish a MFR increase. To better understand the graph consider also an arbitrarily-fixed value as $\delta = .25$. In such a case, in order to have a MFR, $s_1 \geq .44$ and $s_2 \geq -17.49$ respectively. Since $s_2 \in (0,1)$ this would mean that team 2 – namely the team with a lower evaluation of the stake – is not going to reward the opponent. That is, only the high-evaluation team is willing to make a positive transfer to the opponent. This would suffice to influence team2's behaviour towards manage the contest – that is to fix the match. The table 1 below presents a simple numerical example.

TABLE 1
Numerical Example $x = 100, k = 1/2$

$x = 100$			
δ	s_1	s_2	MFR
0.15	0.12	0	◊
0.25	0.44	0	●
0.35	0.65	0	●
0.5	0.80	.18	●
0.75	0.99	1	◊
1	1	1	◊

Therefore, there is a region where both teams are willing to manage the contest and perhaps to fix the match. As noted above, albeit the willingness to make a positive concession, for $k = 1/2$ if $\delta < .18$ team 1 is not able to influence team 2's behaviour. The remarkable point of interest is that there is a region where team 1 can be better off under the contest management scenario even if team 2 is not going to concede. The intuition behind appears to be simple. Since team 1 has a higher incentive to contest, it has also a higher willingness to settle whenever it is able to get a higher payoff. Then team 1 can influence team 2's behaviour. Moreover, consider also that team 1 is weaker than the opponent ($k = 1/2$). As the asymmetry decreases a MFR is feasible if and only if both teams concede to the opponent. In the case presented above, only reciprocal concessions can create a MFR when $\delta > .48$.

In practical terms, team 1 can tempt to fix the match through a transfer(concession) to team 2. Such a concession needs not to be a contextual monetary transfer (as in the case of corruption). In the presence of reciprocity concessions can be measured in different ways. Consider that in modern football teams meet, communicate and bargain very often. They are involved in leagues which organize tournaments and negotiate TV revenues redistribution.

They also meet and interact frequently about transfers of players. Then a concession can take different shapes. It can take the shape of a permanent collusive and cooperative behaviour between teams. Recall the story of Juventus and Avellino in 1979 last match of Italian serie A. This is exactly the case of a weaker team (Avellino) willing to concede to a stronger team (Juventus). The weaker team has a higher evaluation of the stake because is under the threat of a relegation. In the following years, the existence of friendly relationships between the two teams, was confirmed by transfers of Avellino's best young talents to Juventus.

However, it is also interesting the case of the high-evaluation team as the stronger team. This does fit with the story of West Germany and Austria in 1982 World Cup.

TABLE 2
Numerical Example $x = 100, k = 3/2$

$x = 100$			
δ	s_1	s_2	MFR
0.15	.12	0	◊
0.25	.15	0	●
0.35	.42	0	●
0.5	.64	0	●
0.75	.88	.74	●
1	1	1	◊

Whenever the high-evaluation team is also the better endowed in talent ($k > 1$) the room for a MFR for a grounded upon an unilateral concession seems to enlarge. However, consider first that the lower bound of the MFR is higher. A stronger team would rely to a larger extent on its own talent and ability. Then, it is willing to 'manage the contest' if and only if the degree of asymmetry reaches a reasonable level.

This seems to fit the case of West Germany and Austria in World Cup 1982. Despite the loss suffered with Algeria, West Germany was still the higher-ability team. It had won the European Championship two years before, and West Germany was also the higher-evaluation team because it was under the threat of being eliminated from the World Cup. However the evaluation was not extremely asymmetric. Austria could have been eliminated if West Germany had won with more than 2 goals. A spontaneous match-fixing seemed to emerge. It was based upon reciprocal concessions. What did the Austrians concede? Fixing the match in favour of West Germany they renounced to compete for the first place in group. What did the germans concede? They actually renounced to put the maximum effort in the match. Given the higher ability they could have won also with more than 2 goals. Once Hrubesch scored, - forgive the joke with words - German and Austrian commitment to match-fixing was entirely devoted to the lack-of-commitment.

To sum up, the analysis demonstrated in a very simple way that a MFR is attainable when there is an asymmetry in the evaluation of the stake and in particular that:

1. there is a critical interval $(0, {}_*\delta)$ where a large asymmetry in the evaluation of the stake does not allow for any MFR. The high-evaluation team is not willing to make any concession to the opponent. A MFR would not be a incentive-compatible scenario. Both teams get higher payoff under a 'pure contest', but the low-evaluation team would exert a very low level of efforts. The stronger is the high-evaluation team the larger is this interval, namely the higher the value of ${}_*\delta$. I would define this *Lack-of-Commitment Region (LCR)*.

2. there is a critical interval $[{}_*\delta, \delta^*]$ such that for $\delta \in [{}_*\delta, \delta^*]$ a MFR is attainable even if $s_2 = 0$. In such a case the team with the higher evaluation of the stake retains a higher willingness to cooperate. I would call this *Match-fixing under Unilateral commitment*.

3. There is a critical interval $(\delta^*, 1)$ such that for $\delta \in (\delta^*, 1)$ a MFR is attainable only in the presence of positive reciprocal concessions.

In terms of policy implications, it is reasonable to think that different rules-of-the-game can modify the occurrence of match-fixing as an implicit collusive behaviour. This appears to be feasible when considering different reward systems. In particular, through them, tournament organizers can narrow the range of the match-fixing region based upon unilateral commitment.

FIFA and UEFA tournaments

In this section I present a simple analysis of FIFA World Cup and UEFA Champions League tournaments. This would allow to verify whether the design of the tournament can lead to the mergence of a Match-Fixing scenario. The analysis will focus mainly on the possible emergence of match-fixing in the final stage of group phase in Champions League and World Cup respectively. To do this, I shall compute the bounds of a feasible match-fixing region under unilateral commitment, which will be denoted as MFRUC henceforth. Eventually, some proposals will be made in order to avoid the emergence of a match-fixing scenario.

The FIFA World Cup Design

In the FIFA World Cup at the group stage, the 32 teams are drawn into eight groups of four. In the group stage three points are awarded for a win, one for a draw and no points for a defeat. Consider also the sequence of the matches. The top-seed team will play the final match against the bottom-seed team of the group. Monetary rewards are extremely asymmetric. Each team receives CHF 2m per match in the group stage. That is, there is no performance bonus. Teams which qualify to the first knock-out round will receive CHF 8,5m each. In such a case, whenever in the final match the stronger team has to qualify could play against an opponent with no incentive. The match simply evolves into a contest with two prizes. Theory of contests is clear in this respect. The high-evaluation player gets the higher prize whereas the underdog gets the second prize.

As example consider group G of World Cup 2006. The standings before the final matches are reproduced in the table below:

TABLE 3 – WORLD CUP 2006, GROUP G, STANDINGS BEFORE LAST MATCHDAY

Team	W	D	L	GF	GA	GD	Pts
Switzerland	1	1	0	2	0	2	6
South Korea	1	1	0	3	2	1	4
France	0	2	0	1	1	0	2
Togo	0	0	2	1	4	-3	0

W=wins; D=draws; L=lost; GS=Goals Scored; GA=Goals Against; GD=Goal Difference. Pts=points

France was the top seed team. In the final matchday, France played against Togo the bottom-seed team which has no possibility to qualify. It is clear that there was an extreme asymmetry in incentives between the two teams. The stake for France was worth CHF 8,5m whilst for Togo it was close to nothing.

Consider also that FIFA changed the ranking rule. The ranking of each team in each group is determined taking into account: (i) greatest number of points; (ii) goal difference in all group matches; (iii) greatest number of goals scored in all group matches. If two or more teams are equal on the basis of the foregoing criteria then they are ranked according to (iv) greatest number of points obtained in the group matches between the teams concerned; (v) goal difference resulting from the group matches between the teams concerned; (vi) greater number of goals scored in all group matches between the teams concerned; (vii) lottery. That is, FIFA changed the rule which assigned higher priority to head-to-head results when resolving ties during the group phase of the tournament. A superior reliance on number of goals probably favours the high-abilities teams which in the last match against a weaker team can try to fill a gap in the final standings. The design of the group phase seems to favour the top-seed teams. Albeit the 1982 scandal, top-seed teams have still an advantage in world cup tournaments. As anecdotal evidence consider that in world cup 2006 no top-seed team failed the qualification.

I present hereafter a tentative application of the model to FIFA world cup. Table 4 below reports the results of the model for the last match of group phase. Some remarks are needed to explain the values used in the estimated model. The abilities have been computed through the FIFA ranking released in May 2006. In particular it had been augmented in order to consider some peculiarities. Recall that in December 2005 FIFA itself did not apply exactly the FIFA rankings to create the groups for the draw. Then I slightly modified the FIFA rankings in order to capture the impact of 'experience' and history in world cups as well as a 'bonus' for team which already won the world cup in the past. In order to capture the impact of experience and history I added the points each team obtained in the foregoing world cups plus one. To teams which had not obtained any point in foregoing world cups I (arbitrarily) assigned 1 point. Data on points obtained in the foregoing editions of world cup have been extracted from Torgler (2006). Moreover, an arbitrary bonus of 25 points has been assigned for every world cup and a bonus of 5 points to European teams. These latter points has been attributed because of the anecdotal evidence that no South American team has won a world cup organised in Europe. Then, the FIFA ranking becomes: $R_i = FIFA_i + Pts_i + WS_i + E$. For instance, Brazil, leader in FIFA ranking with 827 points, had received a bonus of 100 points for past wins as well as 142 additional points. The interesting point is that – with the exception of Mexico – the top-seed teams chosen by FIFA in December 2005 stand in the first seven places of this augmented ranking.

To evaluate the stake of the match recall that each team receives CHF 2m per match in the group stage. Teams which qualify to the first knock-out round receives CHF 8.5m each. That is, a match for a team which has to qualify is worth CHF 8.5m. The stake is worth almost zero for teams which already qualified or cannot qualify. However, it must be considered that teams attach an individual value to the stake because of national cash-incentive. This kind of bonus-schemes widely differ. In general players of top teams are promised a large cash-amount based upon performance, but the bonus scheme does not start until the quarter-finals of the competition. There could be also different mechanisms of internal redistribution within teams. For example the Czech Republic and Croatia announced to redistribute prize money promised by FIFA to the countries' football associations, in an 80:20 split between players and coaches. Many countries keep the precise details of world cup bonuses a secret. Being unable to collect these data I attach an arbitrary value of CHF 500,000 per match to teams having a stake equal to zero according to FIFA reward system.

TABLE 4 - WORLD CUP 2006, LAST MATCHDAY, GROUP PHASE

		x_1	x_2	δ	a	b	k	MFRUC bounds		PMF
(Monetary stakes are expressed in Thousands of CHF)										
Poland	Costa Rica	500	500	1	717	605	1.19			◊
Germany	Ecuador	500	500	1	900	634	1.42			◊
Paraguay	Trinidad & Tobago	8500	500	0.06	672	605	1.11	0.05	0.55	●
England	Sweden	8500	500	0.06	833	757	1.10	0.05	0.55	●
Angola	Iran	500	500	1	582	690	0.84			◊
Portugal	Mexico	500	500	1	771	792	0.97			◊
Argentina	Holland	500	500	1	919	811	1.13			◊
Ivory Coast	Serbia	500	500	1	671	656	1.02			◊
Italy	Czech Republic	8500	8500	1	905	805	1.12			◊
Ghana	USA	8500	8500	1	601	773	0.78			◊
Croatia	Australia	8500	8500	1	705	613	1.15			◊
Brazil	Japan	500	500	1	1069	713	1.50			◊
Spain	Saudi Arabia	500	500	1	816	657	1.24			◊
Ucraine	Tunisia	8500	8500	1	615	699	0.88			◊
Switzerland	South Korea	8500	500	0,06	671	695	0.97	0.05	0.54	●
France	Togo	8500	500	0,06	829	570	1.45	0.055	0.57	●

In the last matchday four out of sixteen matches are susceptible of match-fixing. In particular, the table presents lower and upper bounds (critical values of δ) of a potential MFR with unilateral commitment (MFRUC). Bold notations denote the feasible emergence of match-fixing. Of course the results are sensitive to the arbitrary value chosen. However, given the extreme asymmetry in evaluations of the stake, it is clear that if no arbitrary value is attributed, there would be a Lack-of-commitment region. Consider also that even if there is no asymmetry ($\delta = 1$) the design of the competition seems to favour high seed teams. According to (10) and (11) in the presence of equal evaluation the probability of winning will depend upon only the level of abilities. At the same time the lower is the stake the lower is the level of efforts expended in a match by both teams. Then, the absence of performances bonuses and an extreme asymmetry in the evaluation of the stake can lead to lack of commitment and match-fixing.

Consider an alternative mechanism. First recall that the total prize money to be awarded by FIFA for each group amounts to CHF 45 million. Imagine that each team receives CHF 1 m for each match played plus a performance bonus of CHF 2m for each win (CHF 1m for a draw). Imagine also that teams qualifying for the round of sixteen will each earn CHF 3,5 million. The total prize money would be slightly lower (43m). The table would become:

TABLE 5 - WORLD CUP 2006, LAST MATCHDAY, GROUP PHASE, A PROPOSED DESIGN

		x_1	x_2	δ	a	b	k	**MFRUC bounds**		**PMF**
(Monetary stakes are expressed in Thousands of CHF)										
Poland	Costa Rica	2000	2000	1	717	605	1.19			◊
Germany	Ecuador	2000	2000	1	900	634	1.42			◊
Paraguay	Trinidad & Tobago	3500	2000	0.6	672	605	1.11	0.05	0.55	◊
England	Sweden	3500	2000	0.6	833	757	1.10	0.05	0.55	◊
Angola	Iran	2000	2000	1	582	690	0.84			◊
Portugal	Mexico	2000	2000	1	771	792	0.97			◊
Argentina	Holland	2000	2000	1	919	811	1.13			◊
Ivory Coast	Serbia	2000	2000	1	671	656	1.02			◊
Italy	Czech Republic	3500	3500	1	905	805	1.12			◊
Ghana	USA	3500	3500	1	601	773	0.78			◊
Croatia	Australia	3500	3500	1	705	613	1.15			◊
Brazil	Japan	2000	2000	1	1069	713	1.50			◊
Spain	Saudi Arabia	2000	2000	1	816	657	1.24			◊
Ucraine	Tunisia	3500	3500	1	615	699	0.88			◊
Switzerland	South Korea	3500	2000	0.6	671	695	0.97	0.05	0.54	◊
France	Togo	3500	2000	0.6	829	570	1.45	0.055	0.57	◊

As it is clear, the room for an unilateral commitment match-fixing disappears. Moreover, given the existence of a performance bonus the total amount of efforts expended would be higher. Then, for FIFA World Cup, re-allocating resources from participation bonuses to performance bonuses appears to be a desirable policy.

The UEFA Champions League Design

Champions League is the top football tournament in Europe. At the group stage, the 32 clubs are drawn into eight groups of four. These groups are formed by means of a draw. For the purpose of the draw, the 32 clubs are divided into four groups of eight. Such a division is based upon the existing rankings of teams before the start of competition. In fact, each team is ranked by means of a combination of 33% of the value of the respective national association's coefficient for the five years before the start of competition and the team individual performances in UEFA club competitions during the same period. Then clubs are divided into four groups of eights in accordance with their rankings. Therefore, there are eight top-seed clubs.

Each club plays one home and one away match against each other club. The sequence of the matches is really a remarkable point. In fact, the top seed club in thee final match will play away against the second-seed club of the group. Consider 2005/2006 tournament. Liverpool, as title-holder, was the top-seed of its group. Then it played the last match of the group stage against Chelsea which was the second seed of the group.

In the group stage three points are awarded for a win, one for a draw and no points for a defeat. If two or more teams are equal on points the final rankings will be determined according (i) the higher number of points obtained in the matches played among the teams in question; (ii) superior goal difference in the matches played among the teams in question; (iii) higher number of goals scored away in the aforementioned matches; (iv) superior goal difference from all group matches played; (v) higher number of goals scored. There are also monetary rewards. In particular, teams receive CHF 500,000 for a win and CHF 250,000 for a draw. Teams which qualify for the first knock-out round receive CHF 2.5m each.

As example consider again the 2005/2006 tournament. In the group D the standings before the final matches are reproduced in the table below:

TABLE 6 – CHAMPIONS LEAGUE 2005/ 2006, GROUP D, STANDINGS BEFORE LAST MATCHDAY

	W	D	L	GS	GA	GD	PTS.
Villareal	1	4	0	2	1	1	7
Lille	1	2	2	3	4	-1	6
Manchester United	1	3	1	1	2	-1	6
Benfica	1	3	1	2	3	-1	5

W=wins; D=draws; L=lost; GS=Goals Scored; GA=Goals Against; GD=Goal Difference. PTS=points

The final matches were Villareal-Lille and Benfica-Manchester United. Please note that the top-seed club of the group was Manchester United. It went to play the final match in Portugal. In such a situation, it is clear that all teams can qualify. Then, all clubs contested a stake worth CHF 3m. In such a case, there is no room for unilateral match-fixing.

Consider now a tentative application of the model to the UEFA Champions League. In such a case, The UEFA team ranking of previous season have been used as proxy to determine the abilities of teams involved. Of course, this also sounds as arbitrary. UEFA points are computed upon results of the previous season. Abilities of teams change through transfers of players and then they differ with respect to the previous season. However, it would be quite impossible to find a measure of abilities for all teams involved in Champions League. At the same time – especially for top seed teams – abilities do not change dramatically and ‘history matters’. The more experienced teams have also at their disposal the more experienced players. And this is a factor that makes the rankings quite stable across years for top seed teams. The tables below present the matches of the last round-up in the group phase in 2005/2006 and 2006/2007 respectively.

TABLE 7- CHAMPIONS LEAGUE 2005/2006 LAST MATCHDAY, GROUP PHASE

(Monetary stakes are expressed in Thousands of CHF)

		x_1	x_2	δ	a	b	k	MFRUC bounds		PMF
AC Milan*	Schalke	3000	3000	1	31,62	13,49	2.34			◊
PSV*	Fenerbhance	3000	500	0.2	24,96	10,77	2.32	0.091	0.6	●
Juventus FC	Rapid Vienna*	500	500	1	23,62	3,52	6.72			◊
Bayern	Brugge*	500	500	1	19,49	10,02	1.94			◊
Arsenal*	Ajax	500	500	1	19,14	11,96	1.60			◊
Villareal	Lille	3000	3000	1	22,10	16,77	1.32			◊
Manchester United	Benfica*	3000	3000	1	17,14	13,70	1.25			◊
Lyon*	Rosenborg	500	500	1	23,77	6,16	3.86			◊
Olympiakos*	Real Madrid	500	500	1	16,04	18,10	0.89			◊
Real Betis*	Anderlecht	500	500	1	4,10	5,02	0.82			◊
Chelsea*	Liverpool	500	500	1	25,14	30,14	0.83			◊
Rangers*	Inter	3000	500	0.2	7,57	22,62	0.33	0.048	0.425	●
Porto	Artmedia*	3000	3000	1	13,70	1,44	9.51			◊
Udinese*	Barcelona	3000	500	0.2	6,62	17,10	0.39	0.05	0.44	●
Werder Bremen*	Panathinaikos	3000	500	0.2	16,49	14,04	1.17	0.073	0.56	●
Notes: * Home Team										

TABLE 8- CHAMPIONS LEAGUE 2006/2007 LAST MATCHDAY, GROUP PHASE

(Monetary stakes are expressed in Thousands of CHF)

		x_1	x_2	δ	a		k	MFRUC bounds		PMF
Chelsea*	Sofia	500	500	1	17,76	17,89	0,99			◊
Liverpool	Galatasaray*	500	500	1	17,76	2,32	7,66			◊
PSV*	Bordauex	500	500	1	13,50	3,57	3,78			◊
Barcelona*	Werder Bremen	3000	3000	1	34,16	14,44	2,37			◊
Bayern*	Inter	500	500	1	17,44	24,07	0,72			◊
Shaktar Donestz	Olympiakos*	3000	500	0.2	12,90	5,16	2,50	0.09	0.61	●
Roma*	Valencia	3000	500	0.2	19,07	5,16	3,69	0.11	0.62	●
Sporting Lisbon*	Spartak Moscow	500	500	1	3,82	3,30	1,16			◊
Dinamo Kiev*	Real Madrid	500	500	1	1,90	17,16	0,11			◊
Lyon*	Steaua Bucuresti	500	500	1	24,57	26,56	0,93			◊
Lille	Ac Milan*	3000	500	0.2	16,57	26,08	0,64	0.06	0.5	●
Celtic	FC Copenaghen*	500	500	1	1,40	2,16	0,65			◊
FC Porto*	Arsenal	3000	500	0.2	8,82	31,76	0,28	0,04	0.4	●
CSKA Moscow	Hamburger SV*	3000	500	0.2	10,30	16,44	0,63	0.06	0.5	●
Manchester United*	Benefica	3000	3000	1	12,76	17,82	0,72			◊
AEK Athens	SC Anderlecht*	3000	500	0.2	2,10	6,82	0,31	0.05	0.42	●
Notes: * Home Team										

Monetary stakes are based upon UEFA 2005/2006 reward system. Teams which had to qualify for the first knock-out round have a stake of KCHF 2500 (minimum value for qualification) + KCHF 500 (performance bonus). Also in this case some matches are at risk of match-fixing.

Then, also in this case, a tentative proposal could involve a superior reliance on performance bonus. According to the UEFA financial report 2005/2006, 176,000 KCHF have been distributed as participation bonus and match bonus (KCHF 80,000+KCHF

96,000). The amount of performance bonus was 48,000 KCHF. Imagine now to devote most resources to performance bonuses, namely match bonuses. Rewarding a 1800 KCHF for a win (900 KCHF for a draw) the total amount to be distributed in the group phase (in 96 matches) would be 172,800 KCHF. In particular, imagine also a reduction of prize for clubs qualifying for the first knock-out round from 2500 KCHF to 2000 KCHF. Then, teams which have to qualify for the first knock-out round would have a stake of KCHF 2000 (minimum value for qualification) + KCHF 1800 (performance bonus), whereas teams competing only for the last match performance bonus would consider only the latter prize. In formal terms, the value of δ would move towards the unity, namely at a lower degree of asymmetry in the evaluation between contestants. As showed in the modified tables, also in this case the number of matches at risk of match-fixing would decrease. At the same time a higher stake would increase the level of total efforts exerted in the match. Eventually, teams which have to qualify are also able to get a higher payoff because their stake increases from 3000 KCHF to 3800 KCHF.

TABLE 9- CHAMPIONS LEAGUE 2005/2006 LAST MATCHDAY, GROUP PHASE, AN ALTERNATIVE DESIGN

(Monetary stakes are expressed in Thousands of CHF)

		x_1	x_2	δ	a	b	k	MFRUC bounds		PMF
AC Milan*	Schalke	3800	3800	1	31.62	13.49	2.34			◊
PSV*	Fenerbhance	3800	1800	0.47	24.96	10.77	2.32	0.091	0.6	●
Juventus FC	Rapid Vienna*	1800	1800	1	23.62	3.52	6.72			◊
Bayern	Brugge*	1800	1800	1	19.49	10.02	1.94			◊
Arsenal*	Ajax	1800	1800	1	19.14	11.96	1.60			◊
Villareal	Lille	3800	3800	1	22.10	16.77	1.32			◊
Manchester United	Benfica*	3800	3800	1	17.14	13.70	1.25			◊
Lyon*	Rosenborg	1800	1800	1	23.77	6.16	3.86			◊
Olympiakos*	Real Madrid	1800	1800	1	16.04	18.10	0.89			◊
Real Betis*	Anderlecht	1800	1800	1	4.10	5.02	0.82			◊
Chelsea*	Liverpool	1800	1800	1	25.14	30.14	0.83			◊
Rangers*	Inter	3800	1800	0.47	7.57	22.62	0.33	0.048	0.425	◊
Porto	Artmedia*	3800	3800	1	13.70	1.44	9.51			◊
Udinese*	Barcelona	3800	1800	0.47	6.62	17.10	0.39	0.05	0.44	◊
Werder Bremen*	Panathinaikos	3800	1800	0.47	16.49	14.04	1.17	0.073	0.56	●

Notes: * Home Team

TABLE 10- CHAMPIONS LEAGUE 2005/2006 LAST MATCHDAY, GROUP PHASE, AN ALTERNATIVE DESIGN

(Monetary stakes are expressed in Thousands of CHF)

		x_1	x_2	δ	a	b	k	MFRUC bounds		PMF
Chelsea*	Sofia	1800	1800	1	17.76	17.89	0.99			◊
Liverpool	Galatasaray*	1800	1800	1	17.76	2.32	7.66			◊
PSV*	Bordauex	1800	1800	1	13.50	3.57	3.78			◊
Barcelona*	Werder Bremen	3800	3800	1	34.16	14.44	2.37			◊
Bayern*	Inter	1800	1800	1	17.44	24.07	0.72			◊
Shaktar Donestz	Olympiakos*	3800	1800	0.47	12.90	5.16	2.50	0.09	0,61	●
Roma*	Valencia	3800	1800	0.47	19.07	5.16	3.69	0.11	0,62	●
Sporting Lisbon*	Spartak Moscow	1800	1800	1	3.82	3.30	1.16			◊
Dinamo Kiev*	Real Madrid	1800	1800	1	1.90	17.16	0.11			◊
Lyon*	Steaua Bucuresti	1800	1800	1	24.57	26.56	0.93			◊
Lille	Ac Milan*	3800	1800	0.47	16.57	26.08	0.64	0.06	0,5	●
Celtic	FC Copenaghen*	1800	1800	1	1.40	2.16	0.65			◊
FC Porto*	Arsenal	3800	1800	0.47	8.82	31.76	0.28	0.04	0,4	◊
CSKA Moscow	Hamburger SV*	3800	1800	0.47	10.30	16.44	0.63	0.06	0,5	●
Manchester United*	Benfica	3800	3800	1	12.76	17.82	0.72			◊
AEK Athens	SC Anderlecht*	3800	1800	0.47	2.10	6.82	0.31	0.05	0,42	◊

Notes: * Home Team

However, proposing a different reward system for UEFA Champions League could be also useless. In fact, UEFA through its reward system redistributes only half of the monetary amount available. According to UEFA financial report, in 2005/2006 edition the net amount of CHF 677m available to the clubs has been split into a fixed amount of CHF 338,5m (starting bonuses, performance bonuses, match bonuses) and a variable amount of CHF 338,5m (market pool). The market pool balance is to be distributed according to the value of each TV market represented by clubs taking part in UEFA champions league and split among the number of teams. Such a split has been done according to (i) the performance in the previous domestic league championship; (ii) the number of matches played by each team in 2005/2006 champions league. The table reports the revenues of teams involved in Champions League 2005/2006.

TABLE 11 - TOTAL REVENUES FOR TEAMS IN CHAMPIONS LEAGUE 2005/2006

	Total Revenue	Market Pool	%market Pool
(data expressed in thousands of CHF)			
Chelsea	38662	28084	72.64
Lille	24995	17667	70.68
Schalke	23097	15519	67.19
Manchester United*	21689	14361	66,21

Bayern*	31104	20276	65.19
Lyon*	39490	25162	63.72
Liverpool*	27742	16914	60.97
Werder Bremen	23874	14046	58,83
Real Madrid*	24610	14282	58,03
Arsenal*	54327	29999	55.22
Real Betis	15919	8591	53,97
Juventus FC*	29460	15382	52,21
Rangers	20006	9928	49.63
Udinese	14469	7141	49.35
Fenerbhace	13010	6182	47,52
AC Milan*	31862	14284	44.83
Villareal	30518	12940	42.40
Barcelona*	49061	20733	42.26
Inter*	23411	9583	40.93
Olympiakos	11533	4705	40,80
PSV*	17411	7083	40.68
Panathinaikos	11085	4257	38,40
Ajax*	16987	6409	37.73
Rosenborg	10448	3620	34,65
Rapid Vienna	7964	1886	23,68
Anderlecht	8425	1847	21,92
Brugge	9369	2041	21.78
Porto*	8309	1231	14.82
Benfica	14831	1753	11.82
Artmedia	7526	198	2.63

Source: UEFA Financial Report 2005/2006; * member of G14

The figures show unambiguously how the share of TV revenues is extremely significant for some clubs. However, this reward system clearly favours the most important teams. Domestic champions get the ‘lion’s share’ of TV revenues. At the moment, reforming such a mechanism does not seem simple. Recall that leading clubs in Europe founded in 2000 a pressure group called G14. Ten out of top-15 earners in 2005/2006 are members of this pressure group. In general, the evaluation each team attaches to the stake can be really different from the monetary performance bonuses rewarded by UEFA. In fact, since a share of TV revenues are redistributed in proportion to the number of matches played, qualification to the first knock-out round can be more valued.

Conclusions and Policy Implications

To sum up, the theoretical model demonstrated in a very simple way that a MFR is attainable in the presence of an asymmetry in the evaluation of the stake and in particular that: (i) there is a critical interval $(0,{}_*\delta)$ where a large asymmetry in the evaluation of the stake does not allow for any MFR. The high-evaluation team is not willing to make any concession to the opponent. They both prefer the 'pure contest' scenario, but the low-evaluation team would exert a very low level of efforts. I defined this *Lack-of-Commitment Region (LCR)*; (ii) there is a critical interval $[{}_*\delta,\delta^*]$ such that for $\delta \in [{}_*\delta,\delta^*]$ a MFR is attainable even if $s_2 = 0$, that is even if the low-evaluation team does not concede. In such a case the team with the higher evaluation of the stake retains a higher willingness to collude and fix the match. I would call this *Match-fixing under Unilateral commitment*. **(**iii**)**There is a critical interval $(\delta^*,1)$ such that for $\delta \in (\delta^*,1)$ a MFR is attainable only in the presence of positive reciprocal concessions. The model suggests that reducing the asymmetry in the evaluation of the stake could be a desirable policy. Incentives to collude (to fix the matches) should be lower.

Then, the model has been applied to assess UEFA and FIFA tournaments. In order to reduce the asymmetry in the evaluation of stake, a wider reliance on performance bonuses has been proposed. The proposed redistribution of monetary prizes confirms this idea. In both tournaments, the number of matches at risk of match-fixing decreases. In general, it could be maintained that a system more focused on performance bonuses would work in favour of a high uncertainty of outcome. Therefore, re-allocating financial resources to monetary prizes as performance bonuses would be the key to avoid (or reduce) the emergence of match-fixing. Another desirable benign impact could be a higher level of total efforts. That is, a system more focused on performance bonuses would also lead to a higher level of exerted efforts which are increasing in the level of the stake.

In the absence of a performance bonus – as in the FIFA design – a football match is akin to a contest with two prizes. In fact, a participation bonus with no performance bonus lead weaker team to exert less efforts. Then, even if FIFA tournament design seems to be less prone to match-fixing, it is more prone to a widespread lack-of-commitment in the last matchday. Moreover, apart from the asymmetry in monetary rewards, this is also due to the scheduling of the matches. As noted above, in the FIFA system the schedule of matches also works in favour of top-seed teams. Even if FIFA changed the rules after the 1982 West Germany – Austria scandal, it remained biased in favour of top-seed teams. The example of France - Togo in 2006 World Cup is clear in this respect. The combination of a high asymmetry in the evaluation of the stake and the scheduling of the matches is highly distortionary. It leads the low-seed teams to exert less efforts. Instead, the Champions League tournament is not biased in this sense. In fact, the top seed club in the final match will play away against the second-seed club of the group.

However, UEFA Champions League is still biased in favour of top-seed teams because of the 'lion's share' of most important teams in redistribution of TV revenues. This of course, strongly modify evaluations of participating teams.

The analysis focused on a match-fixing region under unilateral commitment. Of course this is also questionable. Also in the presence of a very similar evaluation teams can collude. But this seems to work only in the presence of reciprocal concessions. In such a case, it would be close to the occurrence and sustaining of collusion in repeated play games. And this appears to be simply feasible in a domestic league. By contrast, for both FIFA and UEFA tournaments where teams may meet only once in several years, narrowing the asymmetry in the evaluation by means of different rules-of-the-game seems to be a desirable policy.

However, a crucial point – which could be the object of a future research - is related to the redistribution of monetary prizes within teams. The implicit assumption behind this paper was that all players agree on an evaluation of the stake. This clearly occurs when the team managers redistribute entirely the monetary prizes to the players. With no redistribution, efforts exerted by players can change dramatically.

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