The Italian Job.
Match Rigging and Career Concerns of Referees in Serie A

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Even though Juve committed more fouls than any club in the league, they received the least red cards, a statistical inconsistency that defies logical reckoning. [...] [G]ranted Juve a dubious penalty for a transparent piece of thespianism, where the cause of a player's flop to the ground could not be explained by any known law of physics.

Franklin Foer, *How Soccer explains the World*, Harper, 2004 (pp. 170 and 174)

Motivations & Contributions

- **Economics of Corruption** contribution:
  we investigate the relationship between
  - **Career concern**: promotion to international standing of a referee
    ⇕
  - **Corruption**: successful rigging of an event
    ⇕
- **Soccer Economics** contribution:
  - we analyse the allocation of referees to matches and their careers.
  - we investigate the grading of Italian referees in relation to home bias, competitive balance and match rigging.
- **Econometric** contribution:
  - we provide a method to identify potential episodes of corruption.
  - we introduce different econometric applications for studying team performance using a unique dataset on *Serie A*.

Preview of the Results

Principal results:

1. Involvement in mach rigging increases the chance to be assigned to the most important matches (important for the career of a referee)
2. Grading of referees did not penalize involvement in rigged matches and home bias
3. Evidence of corruption episodes well before (and after) *Calciopoli*

Outline

1. motivations & contributions
2. a *round* history of *Calciopoli*
3. promotion and grading the referees
4. a toy model on the allocation of "blackmail capital"
5. an econometric model to estimate the determinants of corruption during the 2004/2005 Championship
6. predictions of corruption episodes for the period before and after *Calciopoli*

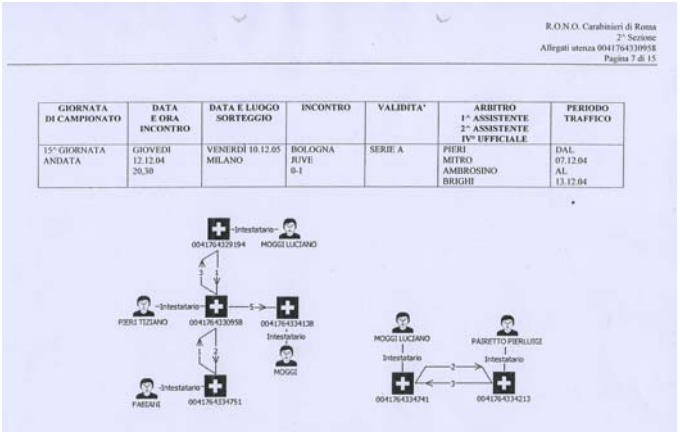
Round History of *Calciopoli* (1)

1. Corruption is not a new phenomenon:
   - 1927: bribery episode and championship revoked
   - 1982: gambling
2. 2004-2005 season: Juventus, Milan, Fiorentina, Lazio and Reggina involved with minor teams in rigging matches and manipulating news.
3. In May 2006 the scandal was uncovered by Italian prosecutors after tapping phone conversations in relation with an investigation on the use of doping at Juventus.
4. Sportive justice: Juventus has been relegated to the 2nd Division; point penalizations for the other teams.

Matches likely to have been rigged by Juventus before the Championship 2004/5 according to Garlando and Gilioli

Champ.	*M. Day*	*Match*	*Result*	*Rigged Episode*
1994/1995	18	Juventus-Brescia	2-1	Last minute irregular penalty
1996/1997	20	Juventus-Perugia	2-1	Perugia was denied penalty
1997/1998	3	Juventus-Brescia	4-0	Brescia was denied penalty
1997/1998	11	Juventus-Lazio	2-1	Penalty for Juventus
1997/1998	19	Juventus-Roma	3-1	Favors to Juventus
1997/1998	21	Juventus-Sampdoria	3-0	Inexistent goal for Juventus
1997/1998	25	Juventus-Napoli	2-2	Favors to Juventus
1997/1998	30	Empoli-Juventus	0-1	Empoli was denied goal
1997/1998	31	Juventus-Inter	1-0	Inter was denied penalty
1999/2000	33	Juventus-Parma	1-0	Parma was denied goal
2001/2002	3	Juventus-Chievo	3-2	Penalty for Juventus
2001/2002	14	A.C.Milan-Juventus	1-1	Penalty for Juventus
2001/2002	15	Inter-Chievo	1-2	Inter was denied penalty
2002/2003	17	Chievo-Juventus	1-4	2 penalties for Juventus
2002/2003	20	Juventus-Empoli	1-0	Penalty for Juventus
2002/2003	29	Juventus-Roma	2-1	Penalty for Juventus
2003/2004	10	Modena-Juventus	0-2	Favors to Juventus
2003/2004	16	Sampdoria-Juventus	1-2	Favors to Juventus
2003/2004	24	Brescia-Juventus	2-3	Favors to Juventus

Round History of *Calciopoli* (2)



R.O.N.O. Carabinieri di Roma
2^ Sezione
Allegati utenza 0041764330958
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GIORNATA DI CAMPIONATO	DATA E ORA INCONTRO	DATA E LUOGO SORTEGGIO	INCONTRO	VALIDITA'	ARBITRO 1^ ASSISTENTE 2^ ASSISTENTE IV^ UFFICIALE	PERIODO TRAFFICO
15^ GIORNATA ANDATA	GIOVEDI 12.12.04 20,30	VENERDI 10.12.05 MILANO	BOLOGNA JUVE 0-1	SERIE A	PIERI MITRO AMBROSINO BRIGHI	DAL 07.12.04 AL 13.12.04

Round History of *Calciopoli* (3)

COMUNICATO STAMPA

Roma, 19 maggio 2005

SORTEGGIO DEL 19 MAGGIO 2005
18^ GIORNATA DI RITORNO DEL CAMPIONATO DI SERIE A – TIM
18^ GIORNATA DI RITORNO DEL CAMPIONATO DI SERIE B – TIM

GRIGLIA A

ATALANTA – ROMA	**(preclusi Collina – De Santis – Rodomonti)**
BRESCIA – MESSINA	
CHIEVO VR – BOLOGNA	**(precluso Paparesta – Rosetti)**
LAZIO – FIORENTINA	**(preclusi Collina – De Santis – Rodomonti)**
PARMA – SIENA	**(preclusi Paparesta – Rosetti)**
REGGINA – LECCE	

ARBITRI:
BERTINI – COLLINA – DE SANTIS – PAPARESTA – RODOMONTI – ROSETTI

GRIGLIA B

CAGLIARI – UDINESE	**(precluso Messina)**
LIVORNO – JUVENTUS	
MILAN – PALERMO	**(precluso Trefoloni)**
SAMPDORIA – INTER	
EMPOLI – GENOA	
VICENZA – VERONA	

ARBITRI:
DONDARINI – FARINA – MESSINA – RACALBUTO – TOMBOLINI – TREFOLONI

Team owners and Media (Championship 2004/5)

Team	*Owner*	*Main Activities*	*Media Control (direct)*	*Media Control (indirect)*
Atalanta	Ivan Ruggeri	Real Estate	*Giornale di BG*	no
Bologna	Alfredo Cazzola	Exposition	no	no
Brescia	Luigi Corioni	Manifacturing	no	no
Cagliari	Massimo Cellino	Chemicals	no	no
Chievo	Luca Campedelli	Food	no	no
Fiorentina	Diego Della Valle	Textile, Media	*RCS*	no
Inter	Moratti-Pirelli	Oil, TLC, Tyres, Media	*RCS* and *la 7*	yes
Juventus	Agnelli's Family	Auto, Ins., Media	*La Stampa*	yes
Lazio	Claudio Lotito	Real Estate	no	yes
Lecce	Giovanni Semeraro	Bank	Lecce News	no
Livorno	Franco Spinelli	Transport	no	no
Messina	Pietro Franza	Transportation	no	no
A.C. Milan	Silvio Berlusconi	Media	*Mediaset*	yes
Palermo	Maurizio Zamparini	Real Estate	no	no
Parma	under judicial control	Food	no	no
Reggina	Pasquale Foti	n.a.	no	no
Roma	Francesco Sensi	Transportation	no	yes
Sampdoria	Garrone	Oil	no	no
Siena	Paolo de Luca	Transportation	no	no
Udinese	Giampaolo Pozzo	Manifacturing	no	no

Referees' Grading System

- behavioral assessment: number and importance of yellow/red cards
- not influenced by spectators/players and no (*home bias*)
- fitness and promptness: number of fouls whistled, understanding of fake penalties
- preventing fouls

Home Bias? Favoritism under Social Pressure

Several psychological studies and Garicano, Palacios-Huerta and Prendergast (2005):

- referees systematically favor home teams
- presence of an athletic track reduces home bias
- number of spectators increases deferential attitudes vis a vis home team

Home Bias in Italian Soccer

Country	Championship	Win	Draws	Loss	Goal Home	Goal Away
England	1982-1990	48.40	26.30	25.30	1.58	1.07
	1991-1999	45.70	28.50	25.80	1.52	1.09
	Δ%	-5.58	8.37	1.98	-3.80	1.87
France	1991-1994	51.70	31.70	16.60	1.45	0.76
	1995-1999	49.20	31.00	19.80	1.47	0.87
	Δ%	-4.84	-2.21	19.28	1.38	14.47
Germany	1991-1995	45.20	31.20	23.40	1.76	1.19
	1996-1999	44.90	29.30	25.80	1.73	1.22
	Δ%	-0.66	-6.09	10.26	-1.70	2.52
Italy	1992-1995	55.00	19.00	26.00	99.25	60.50
	1996-1999	61.50	15.50	23.00	95.31	52.63
	Δ%	**11.82**	**-18.42**	**-11.54**	**-3.97**	**-13.02**
Spain	1991-1994	50.40	28.40	21.20	1.51	0.94
	1995-1999	47.90	27.10	25.00	1.60	1.09
	Δ%	-4.96	-4.58	17.92	5.96	15.96

Probability of Being Selected as a Referee

Ordered Probit. Dep.Var. 0=out, 1=griglia B, 2= griglia A						
	(1)	(2)	(3)	(4)	(5)	(6)
	β/s.e.	β/s.e.	β/s.e.	β/s.e.	β/s.e.	β/s.e.
rigged	1.929***	1.853***	1.802***			
	(0.198)	(0.186)	(0.157)			
match day	-0.048***	-0.080***	-0.072***	-0.062***	-0.059***	-0.063***
	(0.013)	(0.015)	(0.015)	(0.017)	(0.017)	(0.011)
match day^2	0.001***	0.002***	0.001***	0.001*	0.001*	0.001**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
lagvotoarb		2.065***	1.207***	1.963***	1.715***	0.849***
		(0.400)	(0.336)	(0.343)	(0.328)	(0.200)
age			-0.011		0.028	-0.010
			(0.028)		(0.023)	(0.016)
new			-0.987***			-0.560**
			(0.292)			(0.217)
experience			-0.220			-0.029
			(0.226)			(0.132)
international			0.478*			0.176
			(0.193)			(0.115)
prev. rigged				0.510**	0.465*	0.241*
				(0.177)	(0.185)	(0.110)
laggrigliaa						0.080***
						(0.014)
N	1,292	1,017	1,017	1,017	932	932

Dependent Variable: Referees' Official Evaluation							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	β/s.e.	β/s.e.	β/s.e.	β/s.e.	β/s.e.	β/s.e.	β/s.e.
rigged	-0.036	-0.033	-0.033	-0.027	0.000	-0.032	-0.058
	(0.019)	(0.016)	(0.016)	(0.016)	(0.000)	(0.022)	(0.046)
grigliaa	0.021	0.011	0.010	0.011	0.011	0.018	0.006
	(0.021)	(0.021)	(0.020)	(0.015)	(0.015)	(0.016)	(0.022)
friends	0.079*	0.072*	0.071*	0.073*	0.072*	0.063	0.026
	(0.036)	(0.033)	(0.031)	(0.031)	(0.033)	(0.031)	(0.044)
enemies	-0.014	-0.011	-0.012	-0.038	-0.038	-0.026	-0.021
	(0.039)	(0.037)	(0.037)	(0.041)	(0.041)	(0.037)	(0.027)
track	-0.037	-0.039	-0.037	0.000	0.000	0.000	0.000
	(0.021)	(0.021)	(0.021)	(0.000)	(0.000)	(0.000)	(0.000)
dif comp.	-1.225**	-1.167**	-1.153**	-0.779	-0.785	-0.745*	-0.835**
	(0.377)	(0.369)	(0.360)	(0.385)	(0.394)	(0.331)	(0.302)
log spect	0.005	0.002	0.001	-0.008	-0.008	-0.011	-0.018
	(0.018)	(0.018)	(0.018)	(0.015)	(0.015)	(0.014)	(0.014)
ivs	-0.276	-0.210	-0.168	-0.452	-0.436	-0.309	-0.042
	(0.484)	(0.487)	(0.473)	(0.554)	(0.540)	(0.494)	(0.459)
match day	-0.014*	-0.014*	-0.014*	-0.016*	-0.016*	-0.014	-0.014*
	(0.006)	(0.006)	(0.006)	(0.007)	(0.008)	(0.007)	(0.007)
match day^2	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
lagevaluation	0.038	-0.007	-0.007	0.010	0.011	0.011	-0.032
	(0.070)	(0.064)	(0.068)	(0.060)	(0.062)	(0.059)	(0.053)
new	-0.060	-0.075	-0.072	-0.054	-0.060	-0.045	0.000
	(0.043)	(0.048)	(0.052)	(0.051)	(0.057)	(0.052)	(0.000)
elite	8.594***	21.370***	21.150**	16.408**	16.648**	13.104*	0.000
	(0.633)	(5.342)	(5.733)	(5.123)	(5.333)	(5.198)	(0.000)
experience	-0.039	-0.056**	-0.057**	-0.061**	-0.064**	-0.050*	0.000
	(0.024)	(0.018)	(0.019)	(0.017)	(0.022)	(0.022)	(0.000)

international	0.090***	0.076***	0.076***	0.064***	0.062***	0.054***	0.000
	(0.023)	(0.019)	(0.019)	(0.012)	(0.013)	(0.013)	(0.000)
tot fouls	-0.003*	-0.004*	-0.003*				
	(0.001)	(0.001)	(0.001)				
ratio fouls	0.007	0.008					
	(0.019)	(0.019)					
tenure		-0.006*	-0.006*	-0.005*	-0.005*	-0.004	0.000
		(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	(0.000)
yellow h			-0.006				
			(0.009)				
yellow v			0.034				
			(0.042)				
fouls h				-0.003	-0.003	-0.003	-0.003
				(0.002)	(0.002)	(0.002)	(0.002)
fouls v				-0.003	-0.003	-0.003	-0.002
				(0.002)	(0.002)	(0.002)	(0.002)
red h				-0.206*	-0.206*	-0.176*	-0.183**
				(0.087)	(0.090)	(0.080)	(0.064)
red v				-0.043	-0.046	-0.052	-0.077
				(0.069)	(0.072)	(0.059)	(0.069)
red last man h				0.068	0.069	0.081	0.064
				(0.052)	(0.053)	(0.047)	(0.044)
red last man v				0.025	0.027	0.032	0.013
				(0.039)	(0.038)	(0.035)	(0.055)
yellow protest h				-0.013	-0.012	-0.011	-0.014
				(0.012)	(0.012)	(0.014)	(0.020)
yellow protest v				-0.015	-0.015	-0.010	0.003
				(0.016)	(0.016)	(0.015)	(0.018)
lineman 1				0.211*	0.212*	0.208*	0.226***
				(0.098)	(0.099)	(0.090)	(0.066)
lineman 2				0.125	0.122	0.098	0.067
				(0.076)	(0.077)	(0.065)	(0.065)

extra time 1^{st}				0.002	0.002	0.005	0.008
				(0.007)	(0.007)	(0.006)	(0.009)
extra 2^{nd}				-0.004	-0.004	-0.004	-0.002
				(0.008)	(0.007)	(0.007)	(0.008)
module 3vs.3				0.022	0.020	0.019	0.007
				(0.092)	(0.093)	(0.086)	(0.059)
module 3vs.4				0.010	0.010	0.013	0.006
				(0.022)	(0.022)	(0.021)	(0.026)
module 3vs.5				0.166	0.165	0.150	0.173
				(0.097)	(0.099)	(0.102)	(0.098)
module 4vs.4				0.405***	0.407***	0.336***	0.315*
				(0.063)	(0.062)	(0.057)	(0.138)
module 5vs.5				0.000	0.000	0.000	0.000
				(0.000)	(0.000)	(0.000)	(0.000)
corner home				0.003	0.003	0.003	0.001
				(0.003)	(0.003)	(0.003)	(0.003)
corner visitor				0.004	0.004	0.003	-0.001
				(0.004)	(0.004)	(0.004)	(0.004)
new referee*rigged					0.023		
					(0.064)		
experienced referee*rigged					0.013	0.008	0.022
					(0.041)	(0.032)	(0.056)
elite referee*rigged					-0.037	0.000	0.000
					(0.029)	(0.000)	(0.000)
grade gazzetta						0.047***	0.052***
						(0.011)	(0.012)
constant							6.219***
							(0.818)
N	270	260	259	246	246	242	242
R^2	0.99	0.99	0.99	0.99	0.99	0.99	0.469

The Model of Corruption (1): Assumptions

Managers:

1. no principal-agent problem: owner=manager (and different from coaches), who is risk neutral and profit maximizer s.t. a budget constraint
2. allocates corruption fees across games or *blackmail capital* (maximum level of pressures using media power)
3. moreover,
   - ▷ there is a maximum number of matches to be rigged
   - ▷ each manager can at most rig one match per day of the tournament.

Theoretical Model (a)

We model the cost of rigging/making pressure as increasing and convex

$$C_{ij} = 2\int_{\pi_{ij}^W}^{\overset{\frown}{\pi}_{ij}^W} (\overset{\frown}{\pi}_{ij}^W - \pi_{ij}^W) d\overset{\frown}{\pi}_{ij}^W = (\overset{\frown}{\pi}_{ij}^W - \pi_{ij}^W)^2 \tag{1}$$

with π^W win probability in fair match and $\widetilde{\pi}$ the odd in rigged matches, thus increasing in the deviation from the fair outcome.

Theoretical Model (b)

The payoff from rigging a match is

$$W^W \overset{\frown}{\pi}_{ij}^W + (1 - \overset{\frown}{\pi}_{ij}^W)\ W^L - \Delta_{ij}^2 \tag{2}$$

The expected payoff from a fair match is insted given by

$$W^W \pi_{ij}^W + (1 - \pi_{ij}^W)\ W^L \tag{3}$$

Thus a necessary condition for match rigging is that

$$\Delta_{ij}(\Delta W - \Delta_{ij}) > 0 \tag{4}$$

with

$$\Delta_{ij} = (\overset{\frown}{\pi}_{ij}^W - \pi_{ij}^W)$$

$\Rightarrow$ **Target matches: crucial and rather balanced games**

Theoretical Model (c)

We can also consider the option value of waiting comparing the reward for rigging the match at the last but one game:

$$\tilde{\pi}_{ij}^{W} \Delta W_i - C_{ij} + (1 - \tilde{\pi}_{ij}^{W}) \pi_{ij}^{W} \Delta W_i \tag{5}$$

and the last game

$$\pi_{ij}^{W} \Delta W_i + (1 - \pi_{ij}^{W})(\tilde{\pi}_{ij}^{W} \Delta W_i - C_{ij}) \tag{6}$$

$\Rightarrow$ **waiting may not be optimal strategy. Match rigging concentrated around the middle of the tournament**

Theoretical Model (d)

Consider now the case in which there are two managers of competing team with media power endowed with an equal stock of blackmail capital, sufficient to rig just one match per manager:

- competition only in media power does not necessarily make corruption more costly
- the costs of match rigging increase together with competition on both media power and competitive power

The Model of Corruption (2): Empirical Implications

1. *Prediction 1: concentration & corruption*: Match rigging is larger the more concentrated is media power.
2. *Prediction 2: marginal teams*: Conditioning on a given distribution of media power, match rigging involves teams close to attaining their target.
3. *Prediction 3: the timing of corruption*: Match rigging should preferably involve the central days of the tournament.
4. *Prediction 4: the nature of rigged matches*: Matches targeted for corruption should be rather balanced.

Detecting Rigged Matches

We proceed in 3 steps:

1. **Probit regression model (binary dependent variable: rigged matches) of the determinants of corruption using the theoretical model.**
2. Outliers from an ordered probit
   - ▷ 2004/5: Outliers ⇔ matches under investigation?
   - ▷ 1997/8-2003/4 2005/6: Monte Carlo simulations
3. Detection of potentially rigged episodes during the previous championships based on results from 1 and 2

The Determinants of Match Rigging (1)

We estimate the probability of match rigging based on the following probit model:

$$CORRUPTION_{ijt} = \beta_1 CR_{t-1} + \beta_2 MATCH\_DAY_t + \beta_3 MEDIA\_POWER_{ijt} +$$

$$\beta_4 PRECLUSIONS\_GRID\_ijt + \beta_5 EXP\_REFEREE_t + \beta_6 ELITE\_REFEREE_t + \epsilon_{ijt}$$

where $CR_{t-1} = \frac{POINTS}{TOTALPOINTS}$.

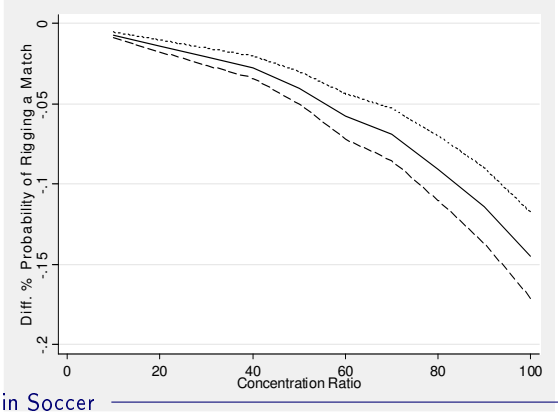
Estimation technique: stacked probit with separate intercepts (time & team)=discrete-time proportional hazards.

The Determinants of Match Rigging (2)

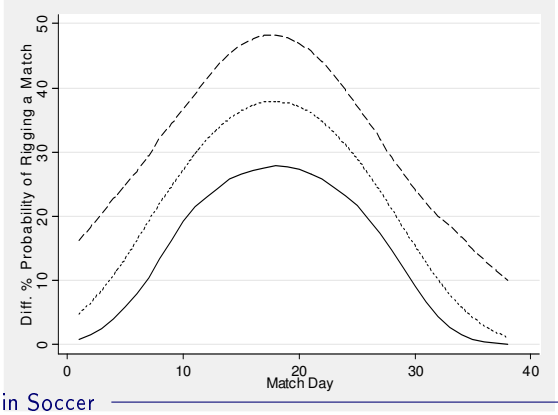
	(1)	(2)	(3)	(4)*	(5)*	(6)*
CR_JUVENTUS	-0.028**	-0.024*	-0.024*	-2.246*	-2.541**	-2.272**
	(0.009)	(0.011)	(0.011)	(0.905)	(0.517)	(0.447)
CR_MILAN	0.704	0.696	0.541	-1.098		
	(1.542)	(1.524)	(1.577)	(1.371)		
CR_INTER		-0.904	-0.623	1.280		
		(1.657)	(1.682)	(1.850)		
WEAK_JUVENTUS			0.738*	0.771*		0.735*
			(0.362)	(0.351)		(0.357)
MATCH_DAY	0.157**	0.167*	0.169*	0.180***	0.152**	0.166**
	(0.057)	(0.066)	(0.068)	(0.053)	(0.050)	(0.043)
$MATCH\_DAY^2$	-0.005***	-0.005***	-0.005**	-0.005***	-0.005**	-0.005**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
EXP_REFEREE					0.062*	
					(0.030)	
ELITE_REFEREE					-0.558*	
					(0.240)	
PRECLUSIONS_GRID					0.523**	
					(0.145)	
N. Obs. 380	380	380	380	370	370	370
Log pseudold.	-171.41	-171.32	-169.90	-170.14	-159.28	-170.56
χ^2	105.677	116.479	112.176	98.85	195.789	87.17
$*p < 0.05, **p < 0.01, ***p < 0.001$						

Table 1: Estimation results : Robust Cluster Probit. Corruption as dependent variable.* = $CR\_$ at $t-1$

The Determinants of Match Rigging (3): Competitive Power



The Determinants of Match Rigging (4): Match Day



Detecting Rigged Matches

We proceed in 3 steps:

1. Probit regression model (binary dependent variable: rigged matches) of the determinants of corruption using the theoretical model.
2. **Outliers from an ordered probit**
   - ▷ **2004/5: Outliers ⇔ matches under investigation?**
   - ▷ **1997/8-2003/4 & 2005/6: Monte Carlo simulations**
3. Detection of potentially rigged episodes during the previous championships based on results from 1 and 2

Predicting Fair Outcomes in 2004/5 Championship

We propose different specifications based on soccer economics contributions:

- König (2000) and Dobson and Goddard (2001): *ordered probit*
- Karlis and Ntzoufras (2003): *poisson model* with numbers of goals scored as dependent variable
- *random effect unbalanced ordered logit*
- our contribution: *2sls ordered probit*:
  1. First step: poisson model
  2. Second step: ordered probit

Main Regressors

We can use several series from our dataset:

- Concentration ratio $\frac{POINTS}{TOTALPOINTS}$
- last results with different lags
- match day
- coaches
- quality index: *Indice di Valutazione di Squadra*

Estimation Models: Horse Races

Estimation Method	Matches Forecasted	Outliers which are Rigged
Ordered Probit	68%	38%
Poisson Model	62%	37%
RE Unb. ordered logit	54%	56%
2sls ordered probit	73%	41%

Estimation results : Poisson

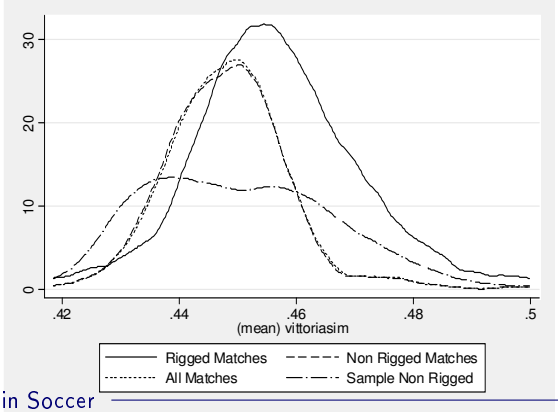
Dependent Variable:	(1) GOALH	(2) GOALV	(3) GOALH	(4) GOALV
$MATCH\_DAY$	-0.014*	-0.010**	-0.013*	-0.008
	(0.006)	(0.004)	(0.006)	(0.004)
$FRIENDS$	-0.387	-0.111	-0.380	-0.083
	(0.227)	(0.148)	(0.230)	(0.144)
$ENEMIES$	-0.167	-0.123	-0.154	-0.079
	(0.157)	(0.069)	(0.160)	(0.067)
$VISITOR$	-0.024**		-0.021**	
	(0.008)		(0.007)	
$AVERAGEP\_HOME_{2004,t-1}$	-0.935*	-0.121	-0.896	0.160
	(0.473)	(0.381)	(0.472)	(0.398)
$AVERAGEP\_VISITOR_{2004,t-1}$	-0.361		-0.402	
	(0.677)		(0.686)	
$GOAL\_HOME_{2004,t-2}$	0.552***	-0.387***	0.626**	-0.118
	(0.080)	(0.055)	(0.205)	(0.147)
$GOAL\_VISITOR_{2004,t-2}$	0.229***	0.658***	0.235***	0.671***
	(0.031)	(0.036)	(0.035)	(0.038)
$NEW\_COACH\_HOME_{2004,t}$	0.156**	0.114*	0.157**	0.120*
	(0.057)	(0.057)	(0.057)	(0.056)
$NEW\_COACH\_VISITOR_{2004,t}$	0.065	0.069	0.060	0.060
	(0.064)	(0.070)	(0.061)	(0.071)
$HOME$		-0.018***		-0.015***
		(0.004)		(0.004)
$AVERAGEP\_VISITOR_{2004,t-1}$		-0.048		0.381
		(0.530)		(0.537)
IVS_HOME			-0.003	-0.009*
			(0.007)	(0.005)
N.obs	320	320	320	320
% Non Rigged Matches Forecasted	63 %		62 %	
% Outliers which are Rigged	37 %		37 %	

Estimation Method	(1a) Ordered Probit	(1a) Ordered Probit	(2) Ordered Probit	(2a) Ordered Probit
DEPENDENT VARIABLE	POINTS	POINTS	POINTS	POINTS
	β/se	β/se	β/se	β/se
$AVERAGEP\_HOME_{2004,t-1}$	-1.240	-1.657	-4.629*	-4.994*
	(1.807)	(2.100)	(2.071)	(2.134)
$AVERAGEP\_VIS_{2004,t-1}$	-4.936**	-4.759*	0.743	0.753
	(1.844)	(2.015)	(2.489)	(2.628)
$AVERAGEP\_HOME_{2003,t-1}$	-0.955	-2.076	-3.314	-3.856
	(2.253)	(2.058)	(2.629)	(2.160)
$AVERAGEP\_VIS_{2003,t-1}$	-2.060	-1.340	2.249	2.391
	(2.341)	(2.042)	(2.091)	(2.512)
$AVERAGEP\_HOME_{2002,t-1}$	6.450*	9.041**	5.088	6.652
	(3.010)	(3.272)	(3.620)	(3.726)
$AVERAGEP\_VIS_{2002,t-1}$	-2.316	-6.163	-2.591	-6.238
	(3.412)	(3.411)	(2.655)	(3.951)
$POINTS\_HOME_{2004,t-1}$	0.085	-0.038	-0.029	-0.180
	(0.195)	(0.167)	(0.139)	(0.201)
$POINTS\_VISITOR_{2004,t-1}$	-0.155	-0.184	-0.093	-0.105
	(0.155)	(0.147)	(0.150)	(0.175)
$\widehat{GOAL}\_HOME_{2004,t-1}$	-0.284	-0.198	-0.458*	-0.409*
	(0.192)	(0.177)	(0.192)	(0.181)
$\widehat{GOAL}\_VISITOR_{2004,t-1}$	-0.011	0.148	-0.324	-0.209
	(0.220)	(0.179)	(0.188)	(0.220)
$\widehat{GOAL}\_HOME_{2004,t}$	0.422**	0.505***	-0.677***	-0.699***
	(0.156)	(0.130)	(0.173)	(0.129)
IVS_HOME			0.139***	0.142***
			(0.017)	(0.012)
$CORRUPTION\_HOME_{2004,t}$		0.951***		1.012***
		(0.214)		(0.289)
$CORRUPTION\_VISITOR_{2004,t}$		-1.238***		-1.076***
		(0.217)		(0.260)
N. obs	310	310	310	310
Log-likelihood	-307.222	-281.329	-199.616	-181.908

Dependent Variable:	
	$POINTS$
	$\beta / s.e.$
$AVERAGEP\_HOME_{2003,t-1}$	1.317***
	(0.261)
$AVERAGEP\_VISITOR_{2003,t-1}$	-1.433***
	(0.205)
$AVERAGEP\_HOME_{2002,t-1}$	1.077***
	(0.180)
$AVERAGEP\_VISITOR_{2002,t-1}$	-0.973***
	(0.170)
$AVERAGEP\_HOME_{2001,t-1}$	2.075***
	(0.464)
$AVERAGEP\_VISITOR_{2001,t-1}$	-2.059***
	(0.381)
$AVERAGEP\_HOME_{2000,t-1}$	1.518***
	(0.431)
$AVERAGEP\_VISITOR_{2000,t-1}$	-1.548***
	(0.396)
$AVERAGEP\_HOME_{1999,t-1}$	1.956***
	(0.471)
$AVERAGEP\_VISITOR_{1999,t-1}$	1.558***
	(0.355)
$AVERAGEP\_HOME_{1998,t-1}$	1.390***
	(0.293)
$AVERAGEP\_VISITOR_{1999,t-1}$	-1.690***
	(0.452)
$AVERAGEP\_HOME_{1997,t-1}$	-0.925**
	(0.350)
$AVERAGEP\_VISITOR_{1997,t-1}$	-1.374***
	(0.334)
$\widehat{GOAL}\_HOME_{t-1}$	0.012
	(0.029)
χ^2	1101.707
N	1,925

$*p < 0.05, **p < 0.01, ***p < 0.001$

Estimation Models: Monte Carlo Simulations 2004/5



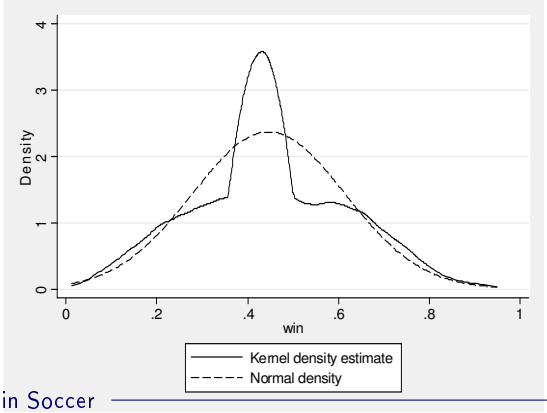
Type I Error: Matches under Investigation & Non Outliers

Match Day	Match	Final Result	Probability to be outliers (%)
14	Juventus-Lazio	2-1	0
23	A.C. Milan-Lazio	1-0	0

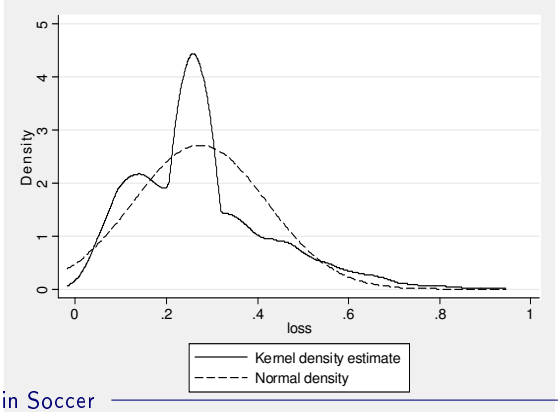
Type II Error: Matches not under Investigation & Outliers

Match Day	Match	Final Resul	Probability to be outliers (%)	Potential Rigged Events
9	Inter-Lazio	1-1	100	Referee favorable to Lazio Mancini quarrels with the referee
10	Atalanta-Sampdoria	0-0	100	Penalties refused to both the teams
10	Lecce-Udinese	3-4	100	-
11	Inter-Bologna	2-2	100	-
12	Fiorentina-Livorno	1-1	100	-
14	Juventus-Lazio	2-1	100	Penalties refused to both the teams
17	Chievo-Siena	1-3	100	-
23	A.C. Milan-Lazio	2-1	100	-
25	Messina-Juventus	0-0	100	-
27	Udinese-Bologna	0-1	100	-
29	Messina-Bologna	0-0	100	*entente cordiale* between the teams
32	Juventus-Inter	0-1	100	-

Estimation Models: Monte Carlo Simulations 1997/8-2003/4 & 2005/6



Estimation Models: Monte Carlo Simulations 1997/8-2003/4 & 2005/6



Detecting Rigged Matches

We proceed in 3 steps:

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2. Outliers from an ordered probit
   - ▷ 2004-2005: Outliers ⇔ matches under investigation?
   - ▷ 1997-2003: Monte Carlo simulations
3. **Detection of potentially rigged episodes during the previous (and following) Championships based on results from 1 and 2**

Rigged Matches According to 3 Criteria:

1. The characteristics of these matches (in terms of timing, competitive power of the first two teams) should involve a corruption probability higher than 80% according to the coefficients estimated in the probit model. (Step 1)
2. win/loss probabilities in the region where the Monte Carlo simulation deviates from the normal distribution: the difference between the estimated density and the normal one should exceed the 90% percentile for the win probabilities of the home team and be lower than 90 % percentile for the loss probabilities of the visitor. (Step 2)
3. The matches belong to grid A, meaning that they are important for the career prospects of the referees.

Rigged Matches According to the 3 Criteria (2):

Ch.	Home	Visitor			Match Day	Referee	Total number of preclusions	Potential Rigged Episode
99/00	Lecce	Udinese	1	0	9	Paparesta	2	Irregular goal for Lecce
03/04	Modena	Juventus	0	2	6	Gabriele	8	Favors to Juventus
05/06	Chievo	Udinese	2	0	16	Banti	0	Favors to Chievo
05/06	Juventus	Siena	2	0	17	De Santis	0	6 Siena players owned by Juventus do not defend

Prova Toyota Rav4 anche il sabato
TOYOTA

Corriere dello Sport
STADIO

edizione NAZIONALE anno 80 - N. 317

domenica 23 novembre 2003

€ 0,90* in Italia

In palio 25 weekend per 2 persone a Folgaria, con corso di guida sicura sulla neve.
TOYOTA

Gli anticipi tra grandi polemiche e goleade

Tiro a segno Inter: 6-0

Reggina: via Colomba?

Vieri litiga con i tifosi poi fa gol

Juve, così è troppo

Gabriele arbitra a senso unico e convalida l'1-0 irregolare di Trezeguet

E oggi Milan e Roma debbono rispondere ai Campioni

Figure 6: *Corriere dello Sport* (November 23rd, 2003) on Modena-Juventus

Summary of Our Findings

Main findings:

1. Useful method for detecting potentially rigged matches (evidence that corruption predates Calciopoli)
2. Evidence that career concerns of referees play a role in match rigging (correlation match rigging – selection in top matches and involvement of "'experienced"' referees in documented rigged episodes.
3. Grading system does not seem to penalize involvement in rigged matches and home bias.

Policy Implications

Implications:

1. More transparent selection of referees and grading system
2. Reduce their discretion (replay?)
3. Reward linemen