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Abstract

This paper examines the determinants of aggressiveness – proxied alternatively by the number of penalties issued by the referee and by a related measure- on the soccer pitch in 463 matches from FIFA (World Cup) and UEFA (Euro Cup) tournaments spanning from 1994 to 2012. We highlight the role of several measures of international rivalry between countries on the players' aggressive behaviour.

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1. Introduction

"*Serious sport has nothing to do with fair play. It is bound up with hatred, jealousy, boastfulness, disregard of all rules and sadistic pleasure in witnessing violence: in other words it is war minus the shooting*" (Orwell, 1945). This view is used to interpret the violence associated with soccer, especially from national teams taking part in major international tournaments. The recent focus has been the role that socio-political and economic factors play in determining player aggression. That violence is an innate part of sport is widely accepted such that soccer matches stylize and miniaturize war (Elias-Dunning, 1986). The basic nature of sport is one of competition, which can lead to aggressive behaviour, coercion and threats of violence (see Caruso, 2011), but is often an outlet of nationalistic tensions or as a political instrument for building trust between rival countries. Unfortunately, violence is viewed as a negative but ineluctable component of sport, both on and off the pitch. Miguel et al. (2008) demonstrated the strong relationship between civil conflict in a player's home provenance and the number of yellow/red cards awarded by referees, supporting the idea that culture and identity can influence player's aggressive behaviour. However, Cuesta-Bohórquez (2012) reached different conclusions from the Copa Libertadores, showing that the violent behaviour of players depended exclusively on soccer characteristics. This paper extends the previous empirical investigations proposed in Caruso and Di Domizio (2013), where differences in political, diplomatic, education and economic factors significantly affected the sanctions issued by referees. We examine additional factors that may better explain player aggression, such as the roles of: stadium atmosphere, prize money incentivisation and referees. This is achieved by generating two proxy variables for player aggressiveness: the weighted number of yellow/red cards issued and the number of fouls sanctioned by referees. Additionally, we attempt to control for the influence that referees' may impose on the match through fixed effects.

2. Dataset and empirical strategy

The dataset consists of 463 final phase matches from FIFA (World Cup) and UEFA (Euro Cup) tournaments spanning from 1994 to 2012 and includes 61 national teams. We investigate players' aggressiveness by means of two dependent variables: *(i)* ***WINT*** - a weighted measure of cards issued per match, *(ii)* ***FOULS*** - the count of sanctioned fouls. We utilize a Negative Binomial II regression model, as the dependent variables are count data. We include a set of control variables divided into three broad groups: **Tournament**, political-economic (**Politec**), and **Match** specific variables. Table 1 presents the summary statistics.

The dependent variable *WINT* is a weighted measure of the penalties issued on the pitch, calculated as follows:

$$WINT = (1st\ yellow\ card\ ) + 2 \times (2nd\ yellow\ card) + 3 \times (direct\ red\ card).$$

The weighting process distinguishes between a single direct red card (usually issued after an breach of the rules) and an indirect red card (issued as the sum of two lesser fouls). Eventually we also consider the count of fouls committed, *FOULS*. Additionally, we use the *absolute* difference of $\log_2$ in FIFA World ranking between teams at the date of the match to estimate relative team closeness (Krumer et al., 2014).

Table 1: Descriptive statistics

Variables	***Obs.***	***Mean***	***SD***	***Min***	***Max***
WINT	*463*	5.052	2.97	0	24
FOULS	*285*	34.6	8.39	13	62
Ranking Difference	*463*	1.648	1.264	0.046	6.714
Trade Imbalance	*462*	0.763	0.281	0	1
Power Imbalance	*463*	0.700	0.271	0	0.998
Attendance ('000)	*463*	46.984	16.638	16.002	94.194
Adjusted Prize Money (mln)	*463*	3.251	4.919	0	44.751
Dummies	***Obs.***		**0**	**1**	
Knockout Stage	*463*		348	115	
World Cup	*463*		155	308	
Hosting Country	*463*		400	63	
Over Time	*463*		425	38	
Penalty	*463*		382	81	

The remaining dummies capture match-specific information, such as *Knockout Stage*, the *Hosting Country*, *Over Time* finishes and matches with at least one *Penalty*. The second group of variables relates to imbalances from international trade and status. *Trade Imbalance* is calculated as:

$$Trade\ Imbalance = 1 - \frac{\min\left[\frac{Import\ A\ from\ B}{Import\ A}; \frac{Import\ B\ from\ A}{Import\ B}\right]}{\max\left[\frac{Import\ A\ from\ B}{Import\ A}; \frac{Import\ B\ from\ A}{Import\ B}\right]},$$

where *Import A from B* are the gross imports (c.i.f.) of country A from B (and vice versa), and *Import A* (*B*) are total imports (c.i.f.) of country *A* (*B*)[1]. The index range is such that at 0 countries have equal share of trade exchanges, but as the index approaches 1 there are asymmetric gains from trade in the bilateral relationship. *Power Imbalance,* based on the Composite Index of National Capability (CINC)[2], is defined as:

$$Power\ Imbalance = 1 - \left[\frac{\min CINC(A/B)}{\max CINC\ (A/B)}\right]$$

The index ranges between 0-1, where there is no recognized strength difference at 0 and at 1 they differ greatly on population, iron/steel production, energy consumption, military personnel/expenditure.

The third group refers to match-specific variables: *Attendance*, used to control for external source of aggression, in line with Savage and Torgler (2013). Additionally, we test the relevance of economic factors in determining player aggression, by including the monetary stakes awarded by UEFA and FIFA.[3] We control for top league players, as their

[1] Data are drawn from IMF - *Direction of Trade Statistics Quarterly - June 2013.*
[2] See http://www.correlatesofwar.org/ and Singer et al. (1972).
[3] See FIFA World Cup Statistical Kit 6 (2012) and thanks to Sara Williams (National Association Development) for data on UEFA competitions.

monetary incentives may differ, by generating an index of the proportion of players coming teams in the top five European leagues on national rosters. We then convert monetary prizes into Swiss Francs (CHF) at 2012 constant prices and divide this amount by the index to obtain *Adjusted Prize Money*. We build a set of model estimations by adding variable blocks one at a time, beginning with *Tournament* (1), then successively add *Politec* (2), *Match* (3) *Interactions* (4) and finally a *Referee Fixed Effect* (5) model. Given the subjectivity of referees issuing cards or recognizing fouls, we control for the referee role in determining/limiting players' aggressive attitude.

3. **Results**

Findings are presented in table 2 below. The results of the Wald test confirm that the sport variables are not exhaustive in explaining the aggressive attitude of players (via WINT and Fouls), while the *Politec* variables are significant both in the case of WINT and FOULS. We observe that an increase of one standard deviation of *Trade Imbalance* results in an increase of 0.207 (WINT) and 0.517 (Fouls) and we observe a similar increase of 0.249 (WINT) and 0.451 (Fouls) for *Power Imbalance*. The introduction of the *Match* and *Interaction* variables has a minor impact in the size of the *Politec* variables but they remain significant in the WINT regressions, but we observe that *Power Imbalance* becomes insignificant in the FOULS (9). Furthermore, we see the effect of *Attendance* and *Adjusted Prize Money* meets with our hypothesis, such that both are significant and positive supporting the idea that stadium atmosphere and expected monetary stakes may influence players' behaviour.

As a robustness check we have included iteraction terms for *Adjusted Prize Money* × *Attendance* and *Adjusted Prize Money* × *Ranking Difference* and *Adjusted Prize Money Square*d to check for non-linearity. The results suggest that the prize money effect on aggression reduces when attendance and ranking difference increase. This is reasonable since the ranking difference and the crowd effect may have a strong influence on players. However, the interactions between dependent variables can be read in the opposite direction. The significance and negative sign of *Adjusted prize money* × *Ranking Difference* and *Adjusted prize money* × *Attendance* indicate that the ranking difference and the attendance effects are mitigated when prize money increases. The (significant) negative sign of the coefficient associated to *Adjusted Prize Money Squared* also supports that hypothesis. Finally, we include the Referee FFX modelling (5 & 10) in order to evaluate their impact on the game. We observe that virtually all significance vanishes from the *Politec* and *Matches* variable sets, only *Knockout Stage* and *Penalty* remain significant in WINT (5) and *Over Time* and *Hosting Country* in the Fouls (10) model. These results demonstrate the crucial role that the referees play in controlling "potential" player aggression.

4. **Conclusions**

This paper demonstrates that trade and power gaps are significant determinants of players' aggressive behaviour proxied by sanctions and fouls recorded during high-level international tournaments. We show that larger crowds can influence players' aggression and that prize money can significantly affect players' decision-making and behaviour. Additionally, we validate the role of referees in controlling player on field behaviour with the Referee Fixed Effects model. The inclusion of the fixed effects removes nearly all the political, economic, tournament and match variable significance, supporting the role of referees as match controllers.

Table 2 – Results

	WINT					FOULS				
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**
Ranking Difference	**0.535*** **	**0.085*** **	0.035	**0.057** **	0.005	**2.081*** **	**0.338*** **	**0.119*** **	**0.125*** **	0.0007
	(0.029)	(0.024)	(0.025)	(0.028)	(0.024)	(0.107)	(0.042)	(0.035)	(0.038)	(0.012)
Knockout Stage	**0.648*** **	**0.274*** **	0.032	0.059	**0.149** **	**1.242*** **	**0.556*** **	**-0.219***	-0.132	-0.003
	(0.121)	(0.086)	(0.103)	(0.093)	(0.072)	(0.304)	(0.146)	(0.128)	(0.124)	(0.037)
Penalty	**0.783*** **	**0.305*** **	**0.245** **	**0.215*** **	**0.183*** **	**1.209*** **	**0.775*** **	**0.390*** **	**0.318*** **	0.013
	(0.116)	(0.082)	(0.079)	(0.077)	(0.066)	(0.319)	(0.154)	(0.118)	(0.106)	(0.033)
Overtime	0.140	0.194	0.137	0.108	0.002	0.516	0.529	**0.455** **	0.282	**0.241*** **
	(0.199)	(0.135)	(0.129)	(0.120)	(0.100)	(0.526)	(0.243)	(0.186)	(0.171)	(0.049)
Hosting Country	**0.628*** **	**0.201** **	-0.031	-0.025	0.104	**1.634*** **	**0.574** **	-0.113	-0.081	**0.096*** **
	(0.124)	(0.101)	(0.094)	(0.081)	(0.076)	(0.124)	(0.158)	(0.129)	(0.116)	(0.035)
Trade Imbalance		**0.737*** **	**0.396*** **	**0.350*** **	-0.170		**1.907*** **	**1.038*** **	**0.916*** **	0.033
		(0.102)	(0.130)	(0.116)	(0.101)		(0.137)	(0.130)	(0.123)	(0.053)
Power Imbalance		**0.918*** **	**0.655** **	**0.517*** **	0.081		**1.664*** **	**0.938** **	0.769	-0.010
		(0.109)	(1.168)	(0.128)	(0.098)		(0.142)	(0.132)	(0.125)	(0.047)
Attendance (‘000)			**0.013*** **	**0.014*** **	-0.001			**0.038*** **	**0.041*** **	-0.001
			(0.002)	(0.002)	(0.002)			(0.003)	(0.003)	(0.001)
Adj. Prize Money			**0.019** **	**0.153*** **	0.018			**0.033** **	**0.259*** **	0.009
			(0.007)	(0.026)	(0.021)			(0.010)	(0.026)	(0.009)
Adj. Prize Money Squared				**-0.002*** **	-0.0005				**-0.003*** **	0.0001
				(0.000)	(0.0004)				(0.000)	(0.0001)
Adj. Prize Money X Attendance				**-0.002*** **	-0.000				**-0.003*** **	0.0001
				(0.000)	(0.0003)				(0.000)	(0.0001)
Adj. Prize Money X Rank				**-0.014** **	-0.008				**-0.016** **	-0.001
				(0.006)	(0.005)				(0.007)	(0.002)
Referee FE	NO	NO	NO	NO	YES	NO	NO	NO	NO	YES

Standard Errors	7.796	3.516	3.407	3.306	2.820	74047.7	59.26	44.67	36.64	Na
Akaike Info. Criterion	6.138	5.25	5.114	5.045	4.974	12.34	10.11	9.43	9.18	Na
Log-pseudolikelihood	-1414.95	-1205.90	-1171.44	-1152.48	-998.68	-1752.17	-1427.28	-1329.30	-1290.72	-887.08
Likelihood ratio test χ^2	817.54***	205.16***	163.20***	134.13***	0.63	1.08e04***	4081.34***	3150.34***	2633.8***	4.4e-236
Wald χ^2	806.84***	520,42***	70.97***	36.17***	na	623.80***	1049.85***	220.54***	98.35***	na
Alpha	0.766***	0.261***	0.214***	0.186***	0.009	0.766***	0.827***	0.474***	0.370***	1.29e-08
Observations	463	462	462	462	462	285	285	285	285	285

References

Caruso, R. (2011), "Crime and Sport Participation, Evidence from Italian regions over the period 1997-2003" *Journal of Socio-Economics*: **40**,455-463.

Caruso, R and M. Di Domizio (2013) "International hostility and aggressiveness on the soccer pitch: evidence from European Championships and World Cups for the period 2000-2012" *International Area Studies Review* **16,** 262-273.

Cuesta J and Bohórquez C (2012), Soccer and national culture: estimating the impact of violence on 22 lads after a ball. *Applied Economics* **44**, 147-161.

Elias N and Dunning E (1986), *Quest for Excitement: Sport and Leisure in the Civilizing Process*. Oxford (UK): Basil Blackwell.

Krumer A., Rosenboim M., Shapir O.M., (2014), Gender, Competitiveness, and Physical Characteristics: Evidence From Professional Tennis, *Journal of Sports Economics,* DOI: 10.1177/1527002514528516

Miguel E, Satyanath S, Saiegh SM (2008), *National cultures and soccer violence*. Cambridge (USA): NBER Working Paper 13968.

Orwell G (1945), The sporting spirit. *The collected essays, journalism and letters of George Orwell*, *4*, 1945-50.

Savage D and Torgler B (2013), Nerves of Steel? Stress, work performance and elite athletes. *Applied Economics* **44**, 2423-2435.

Singer JD, Bremer S, Stuckey J (1972), Capability Distribution, Uncertainty, and Major Power War, 1820-1965 in Bruce Russett (ed) *Peace, War, and Numbers*, Beverly Hills: Sage, 19-48.