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RESEARCH ARTICLE

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To comply or not to comply? How a UEFA wage-to-revenue requirement might affect the sport and managerial performance of soccer clubs

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This paper evaluates the soccer clubs' compliance with a potential wage-to-revenue requirement by the Union of European Football Associations (UEFA) and studies the effect on sport achievements resulting from sports and managerial skills. The empirical analysis uses data on first division teams of the Premier League, La Liga, Serie A, and Ligue 1, from seasons 2009/2010 to 2018/2019. We measure the teams' quality through the annual wages and use the wage-to-revenue ratio as a proxy measure for financial responsibility. Our results reveal that a more prudent financial performance, which is generally linked to good management practices, implies better sport performance and higher chances of qualifying for UEFA competitions.

1 | MOTIVATION AND LITERATURE

The introduction of the Financial Fair Play (FFP) regulations by the governing body of the Union of European Football Associations (UEFA) is aimed to encourage the sustained financial stability of soccer clubs. An essential element of the FFP is the break-even requirement, calculated as the difference between what UEFA defines as "relevant revenue" and "relevant expenses." Under the break-even rule, the clubs' spending is constrained by the financial means available to them (e.g., their annual revenue); that is, the teams with higher income are thus allowed to spend larger amounts on salaries.[1] In practice, "break-even requirements" allow for an acceptable cumulative average loss of €30 million, computed over a 3-year period (UEFA, 2015). In April 2022, UEFA overhauled the FFP rules, introducing ceilings on the teams' wage bills to better control spending in players' wages and transfer fees. The new rules will come into force in 2025/2026, allowing clubs to incur losses—over 3 years—of 60 million euros, instead of the 30 million established previously. However, the rules will limit salary spending on player and staff, and on transfers and player agents' fees, to 70% of total revenue. Appendix A provides a detailed description.

This paper addresses the interconnectedness between financial responsibility, as part of a broader range of good managerial practices, and better sport performance. In particular, our paper empirically examines if the compliance with a wage-to-revenue ratio (WRR) requirement, as may be defined by UEFA within the context of FFP, might have a systematic positive influence on sport achievements, in addition to the improved financial stability of clubs. First, we investigate whether a more responsible financial performance, as captured by a lower WRR, indicates better managerial practices that lead to enhanced sport performance. For this purpose, we run a battery of ordinary least squares (OLS) regressions in line with the production equation proposed by Carmichael et al. (2011). Second, we inquire into the chances for qualifying to UEFA competitions, as we believe this additional analysis enables us to throw further light into the disparities across domestic leagues. For this endeavor, we rely on logit model estimation, which is extensively adopted in the context of general management—see Hoetker (2007), for instance—and also in sports—Green et al. (2015); Ahtiainen and Jarva (2020), among others.

Let us now briefly consider how our paper fits in with the sports literature regarding UEFA legislation, with special focus on FFP rules. Previous contributions addressed the implications of the regulations

on a number of aspects, such as the consolidation of dynasties associated to historical clubs (Vöpel, 2011), the cost efficiency of soccer clubs that face a trade-off between sport and economic outcomes (Ghio et al., 2019), the joint sporting and financial efficiency of soccer clubs (Gallagher & Quinn, 2020), the probability of clubs reporting losses (Ahtiainen & Jarva, 2020), and the impact of soccer clubs on their business model (Dimitropoulos & Scafarto, 2021). Other papers (Aguiar-Noury & Garcia-del-Barrio, 2022; Rohde & Breuer, 2016) offer evidence on financial achievements being explained by clubs' brand value as well as by their sport performance. Soccer clubs are bound to suffer from mismanagement as long as they overinvest in talent (Dietl et al., 2008)—something that is likely to happen when they prioritize sport success over economic returns.

A relevant aspect that has increasingly attracted the research efforts in the field is the impact of FFP regulations on the competitive balance of teams playing in European leagues. In recent years, there have been many papers addressing this issue: Franck (2014); Peeters and Szymanski (2014); Freestone and Manoli (2017); Scelles (2017); Plumley et al. (2018, 2019); Birkhäuser et al. (2019); Garcia-del-Barrio and Rossi (2020), Scelles et al. (2022), among others. Franck (2014) expresses concerns about the effects of FFP regulations, as the competitive balance is typically implemented through limits on wage spending (Peeters & Szymanski, 2014)—like salary caps in US professional leagues.[2] In principle, introducing salary caps in Europe is not possible, given that the member countries of UEFA must contend with European Union laws as well as national labor and competition laws. In any case, Dietl et al. (2009) argue that the introduction of salary caps (as a fixed proportion of the clubs' income) is ultimately equivalent to the break-even FFP rules imposed by UEFA.

Arguably, regulatory limits on the income received from external agents can affect weaker teams more decisively than top-performing teams, as the former group is thus impeded to reduce their wage gap relative to their better-to-do rivals. Peeters and Szymanski (2014), however, suggest the existence of spillover effects related to the drop in the cost of reaching a given level of sport talent and achievements. They argue that FFP regulations, in addition to restricting the clubs' wage spending, will also improve the competitive balance of teams as they reduce the competitive advantage of teams at the top. We believe that both arguments may actually be valid.

Freestone and Manoli (2017) found evidence for the English Premier League, suggesting that FFP regulations increase competitive balance beyond their original aim, thus preserving the future stability of clubs. On the other hand, Birkhäuser et al. (2019) warn that FFP might raise some barriers against newcomers, which would eventually lead to stiff hierarchies and competitive imbalance. Consistent with the latter, Plumley et al. (2018, 2019) found a statistically significant decline in competitive balance post-FFP across major soccer leagues in Europe, which hints at the possibility of unintended consequences stemming from such regulations. Garcia-del-Barrio and Rossi (2020) argue that, while commitment to FFP rules enforces greater financial stability (an effect that is only modest, according to Ahtiainen & Jarva, 2020), it can also diminish the quality of the competitions by undermining competitive balance. Moreover, these authors find evidence that WRRs have converged towards smaller figures in the main European soccer leagues and argue that break-even requirements limit the teams' chances to deviate from WRR values attached to low-financial-risk. Accordingly, weaker teams—that is, those facing the risk of relegation—are supposed to counterbalance their poor sports performance with greater financial instability. (Di Simone and Zanardi (2021) use the "Staff-to-Sales" (SS) ratio, which is the equivalent to our WRR variable).

The recent contribution by Scelles et al. (2022) delves deep into the determinants of competitive balance across a number of countries and picks up several idiosyncratic variables that focus on the structural layout, rather than the policy choices, made by countries and even certain local areas within those countries. They find evidence about the negative impact of "exogenous" FFP rules on the competitive balance of all big five European leagues. The authors claim that this result should not discourage the implementation of such rules, as a decline in competitive balance might still have been found without them—they mention the internationalization strategies pursued by the richest clubs as a potential factor behind such trend.

Our contribution departs from the previous references in that we examine how the introduction of the FFP rules—in the form of break-even requirements—affects soccer clubs' objectives beyond their economic outcomes, as we pay special attention to how WRRs relate to sport achievements. Notice that, even if the UEFA regulatory framework is only binding for clubs qualifying for UEFA competitions, all potential candidates will very likely try to meet the FFP regulations, since they would be sanctioned otherwise. In our empirical analysis, we will consider the implications of estimating the models with variables in levels as well as in deviations from the mean. The latter seems to be a more suitable strategy on two accounts: first, it is the relative strengths among teams that matters in the end (Sanderson, 2002), and second, models in deviations tend to enjoy better statistical properties. This approach is equivalent to using the share (of revenue, wages, etc.) that a team has within a league and season—previous research adopting this approach includes Carmichael et al. (2011) and Caporale and Collier (2015), for instance.

In this paper, we suggest that greater financial responsibility leads to better sport performances and a higher probability of participation in international competitions.

The structure of the paper is as follows. Section 2 includes the data description and a brief analysis on how the UEFA financial rules affect the WRRs, while distinguishing among the domestic leagues under examination. Section 3 describes the basic model and the econometric strategies to test our hypothesis. Section 4 reports the estimations obtained from the different models and offers a discussion on the main findings. In the concluding section, we summarize the results and venture a few areas for future research.

2 | DATA DESCRIPTION

The empirical analysis we develop here is based on data of teams playing in the first division category of four main European soccer

TABLE 1 Descriptive statistics of the main variables

Variable	Obs.	Mean	Std. dev.	Min.	Max.
Annual wages (in,000)	797	78,088.6	78,719.0	7,648.0	541,920.0
Annual revenue (in,000)	796	126,609.6	138,442.4	13,426.0	836,730.0
Wage/revenue (WRR) %	796	64.5	17.8	20.7	223.4
Points in domestic league	800	52.1	16.8	16.0	102.0
WRR—Pooled sample					
Wage/rev ratio (in %)	**Obs.**	**Mean**	**Std. dev.**	**Min.**	**Max.**
Season 2009/2010	79	68.72	18.3566	34.95	144.34
Season 2010/2011	79	70.28	21.7254	34.56	177.86
Season 2011/2012	80	68.95	23.6512	35.87	223.41
Season 2012/2013	80	64.88	15.3859	34.86	128.68
Season 2013/2014	80	63.17	15.2610	37.61	148.81
Season 2014/2015	79	58.78	16.8792	20.77	94.51
Season 2015/2016	80	62.33	15.2123	32.62	106.81
Season 2016/2017	79	58.03	13.5237	29.37	106.17
Season 2017/2018	80	62.59	16.4738	34.34	126.61
Season 201820/2019	80	67.25	15.8001	36.32	131.77
TOTAL	*796*	*64.5053*	*17.8486*	*20.77*	*223.41*
WRR—Premier league					
Wage/rev ratio (in %)	**Obs.**	**Mean**	**Std. dev.**	**Min.**	**Max.**
Season 2009/2010	19	71.03	16.4174	45.98	106.60
Season 2010/2011	20	71.86	17.0041	46.14	113.57
Season 2011/2012	20	72.92	13.4922	49.27	94.18
Season 2012/2013	20	75.57	16.4522	50.37	128.69
Season 2013/2014	20	59.25	5.6966	50.61	74.41
Season 2014/2015	20	63.48	11.7231	37.11	84.91
Season 2015/2016	20	67.71	11.7958	46.80	87.74
Season 2016/2017	20	56.68	8.7759	41.50	77.34
Season 2017/2018	20	63.32	12.0177	39.05	84.66
Season 2018/2019	20	64.11	13.2126	39.00	85.11
TOTAL	*199*	*66.57*	*14.0854*	*37.11*	*128.69*
WRR—Spanish La Liga					
Wage/rev ratio (in %)	**Obs.**	**Mean**	**Std. dev.**	**Min.**	**Max.**
Season 2009/2010	20	71.52	24.0742	43.00	144.35
Season 2010/2011	19	78.31	30.8764	45.00	177.87
Season 2011/2012	20	73.58	37.1573	45.40	223.42
Season 2012/2013	20	59.40	15.9102	39.69	90.32
Season 2013/2014	20	63.88	22.7569	38.53	148.82
Season 2014/2015	20	60.82	12.9704	42.04	82.21
Season 2015/2016	20	56.50	10.6278	39.52	72.39
Season 2016/2017	20	55.58	12.1497	29.37	77.02
Season 2017/2018	20	62.41	10.5452	40.83	79.00
Season 2018/2019	20	61.50	12.1303	36.33	86.25
TOTAL	*199*	*64.2852*	*21.5897*	*29.37*	*223.42*
WRR—Italian Serie A					
Wage/rev ratio (in %)	**Obs.**	**Mean**	**Std. dev.**	**Min.**	**Max.**
Season 2009/2010	20	57.18	13.7992	34.95	84.93
Season 2010/2011	20	55.80	15.6538	34.56	86.01
Season 2011/2012	20	53.73	14.2781	35.87	88.65
Season 2012/2013	20	55.36	11.1847	34.86	79.14
Season 2013/2014	20	58.43	11.3961	37.61	83.76

(Continues)

TABLE 1 (Continued)

WRR—Italian Serie A					
Wage/rev ratio (in %)	**Obs.**	**Mean**	**Std. dev.**	**Min.**	**Max.**
Season 2014/2015	19	37.94	9.9304	20.77	59.95
Season 2015/2016	20	50.40	12.5503	32.62	78.80
Season 2016/2017	20	49.41	8.6579	31.12	63.69
Season 2017/2018	20	48.72	9.3164	34.34	69.69
Season 2018/2019	20	65.87	10.2013	41.43	80.96
TOTAL	*199*	*53.36*	*13.5547*	*20.77*	*88.65*
WRR—French Ligue 1					
Wage/rev ratio (in %)	**Obs.**	**Mean**	**Std. dev.**	**Min.**	**Max.**
Season 2009/2010	20	75.26	12.6144	53.50	99.66
Season 2010/2011	20	75.55	13.5404	55.05	104.44
Season 2011/2012	20	75.58	15.1714	52.76	116.53
Season 2012/2013	20	69.17	8.2895	54.96	82.21
Season 2013/2014	20	71.11	13.4672	50.53	96.74
Season 2014/2015	20	71.85	11.3542	50.28	94.51
Season 2015/2016	20	74.69	13.2554	53.91	106.81
Season 2016/2017	19	71.11	14.3017	43.68	106.17
Season 2017/2018	20	75.89	19.9194	39.75	126.62
Season 2018/2019	20	77.53	21.3013	37.23	131.78
TOTAL	*199*	*73.79*	*14.6676*	*37.11*	*131.78*

Abbreviation: WRR, wage-to-revenue ratio.
Source: Deloitte ARFF (2000–2019), Deloitte FML (1997–2019), and authors' own collection from club's accounts and databases such as SABI, Aida, Amadeus, and Hoovers.

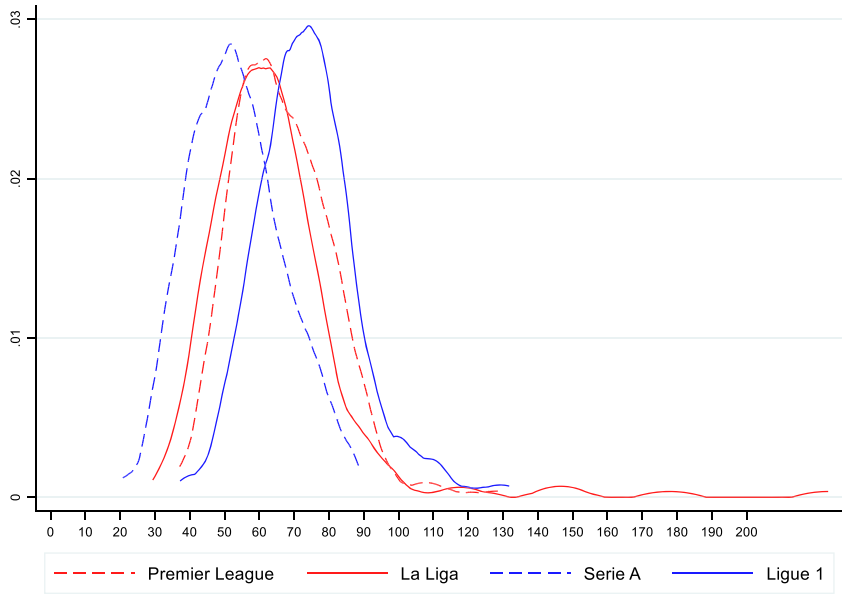

FIGURE 1 Kernel density functions—Wage-to-revenue ratios (*x*-axis) by domestic leagues [Color figure can be viewed at wileyonlinelibrary.com]

leagues: England, Spain, Italy, and France (data for Germany were not available). The dataset comprises 800 observations: 20 observations per league and season over a period of 10 years (from 2009/2010 to 2018/2019). Due to four missing values, regressions were run on 796 observations.[3]

For the majority of clubs, data on financial variables—for example, annual revenue (R_{it}) and annual wages (W_{it})—were obtained from Deloitte (Football Money League, FML and Annual Report of Football Finance, ARFF) or from databases such as SABI, Aida, Amadeus, and Hoovers. In some cases, especially for Spanish and

French clubs, the information was directly obtained from the clubs' official accounts.

Table 1 reports descriptive statistics of the main variables. The information on the WRR variable, given its relevance for our analysis, is further decomposed by seasons (pooled sample) and by league and season.

Before addressing the main topic of this paper, Figure 1 displays for the whole sample the estimated Kernel probability density functions of the WRRs, one for each of the four leagues considered. This preliminary analysis reveals significant discrepancies in the patterns of WRRs across leagues. It seems that wage inflation affects the French Ligue 1 more intensively, with Serie A falling on the other end of the scale.

Our empirical analysis will focus on three main variables: (i) number of points in domestic leagues, (ii) annual wages, and (iii) the WRR. To test whether or not financial negligence leads to poorer sport performance in soccer clubs, we will run a set of "sport performance" equations. In particular, we will regress the number of points at the end of the domestic league on the wages (in quadratic form), our WRR variable, and a set of controls.

On the one hand, if the estimated coefficients on WRR turn out to be negative and statistically significant—even when accounting for the squad quality as captured by the annual wage bill—then a growing share in WRR would mean fewer points in the league and, thus, poorer sport performance. On the other hand, if the WRR coefficients happen to be positive and statistically significant, we should conclude that overspending in talent provokes an additional positive impact on sport performance. Finally, if these coefficients are not significant, we should simply acknowledge no systematic link between the clubs' financial management and sport performance.

The WRR requirements are thought of as a strategy by UEFA to promote the clubs' financial discipline and stability, which prevents them from overspending with respect to their actual revenue. To ensure that the clubs' accounts are balanced, UEFA adopted, in 2013, the break-even requirements, which limit the annual wage spending depending on their annual revenue. The conditions regarding the compliance with break-even requirements were only effective since the 2014/2015 season.[4] In particular, it was not until May 2014, during the 2014/2015 season, that UEFA imposed the first sanctions to clubs failing to fulfill the break-even requirements, which allowed clubs to spend up to €5 million beyond the income earned during a 3-year assessment period.[5]

The approach and empirical strategy we adopt in this paper does also implicitly relate to the impact that the introduction of the UEFA FFP rules may have had on the clubs' WRR, since there seem to exist discrepancies before and after their implementation. Figure 2 illustrates this point.

According to UEFA, by setting the acceptable deficits in absolute figures, instead of relative percentage terms, they are less restrictive to smaller and medium-sized clubs. Nevertheless, the new set of FFP rules that UEFA has announced to foster the clubs' financial stability in the future are precisely defined as a percent threshold of annual wages over operating revenue.

At any rate, the empirical analyses carried out in this paper will rely on WRRs. (Appendix A describes how the break-even requirements are actually structured, and how they differ from our WRR variable). The following section lays out our model and describes how it fits in with the literature.

3 | DESCRIPTION OF THE BASELINE MODEL

Soccer players contribute to their clubs by collaborating in the achievement of sport success and also by generating economic returns (broadcasting rights, merchandising contracts, etc.) through

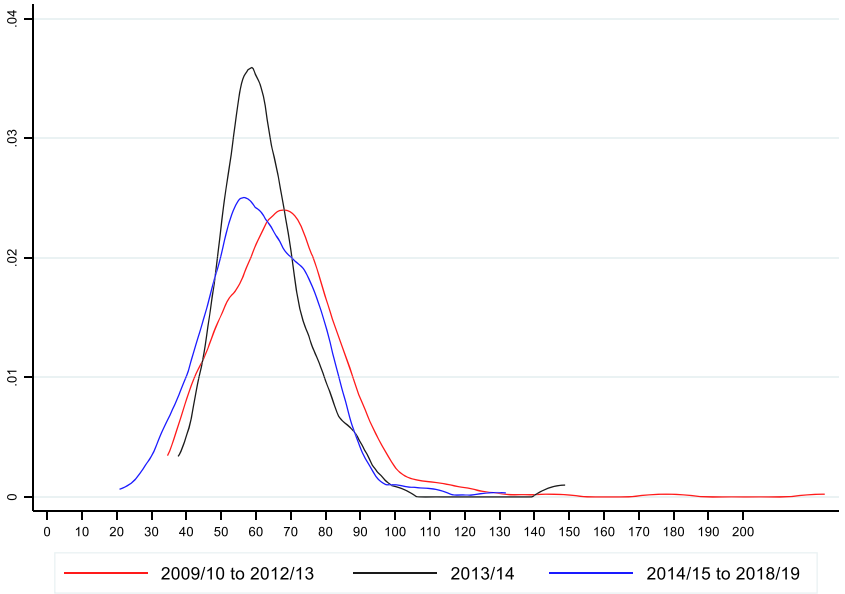

FIGURE 2 Kernel density functions—Wage-to-revenue ratios (*x*-axis) before and after the FFP rules [Color figure can be viewed at wileyonlinelibrary.com]

their media appeal. This paper focusses on the former type of contribution by linking the players' sporting skills and teams' managerial abilities with sports performance (e.g., points at the end of the season). We argue that soccer clubs' performances, and thus sports achievements, depend on the team rosters' sporting talent and also on the quality of the coaching staff and other managerial abilities related to good governance.[6] Accordingly, the empirical analysis is developed using a production function with both types of skills: We measure the team rosters' sporting talent by the clubs' annual wages, and we proxy the coaching and other managerial abilities by the WRRs.

Our approach is of an empirical nature, but there is an implicit theoretical framework behind. Here we consider a Cobb Douglas production function, where the outcome is the number of points scored in the domestic league by team i in season t, P_{it}, which results from the combination of the sporting (S_{it}) and managerial (M_{it}) inputs mentioned above:

$$P_{it} = f(S_{it}, M_{it}) = A \cdot S_{it}^{\alpha} \cdot M_{it}^{\beta} = A \cdot S_{it} \cdot M_{it} \quad (1)$$

Notice that by imposing $\alpha = \beta = 1$, we are assuming *increasing* returns to scale[7] (instead of constant or decreasing), as the output is likely to increase more than proportionally to the joint changes in the use of inputs. This assumption may find support, among other reasons, in the fact that every victory is rewarded with two more points than a draw, whereas losing a game means just one point less. In our context, increasing the combined skills by a certain proportion leads to a higher probability of winning, which involves a more than proportional outcome in terms of domestic points.

With the aim of estimating the effects of both sports and managerial skills on sports performance, we turn our attention to some theoretical extensions of the model. First, we define the two main sources of performance as (i) sports skills and (ii) managerial skills, which we model as linear functions of their respective compensations: salaries and economic returns, respectively.

$$\text{Sports skills (S)}: \; S_{it} = a + b \cdot W_{it} \quad (2)$$

$$\text{Managerial skills (M)}: \; M_{it} = c + d \cdot \frac{R_{it}}{W_{it}} \quad (3)$$

where W_{it} is the clubs' annual wages, R_{it} the annual revenue, and $\frac{R_{it}}{W_{it}}$ the revenue-to-wage ratio.

Given that our focus is placed on financial responsibility, we use the WRR, which is assumed to be a broad measure of managerial mismanagement.[8] Hence, we redefine M_{it} above as follows:

$$M_{it} = \alpha - \beta \cdot \frac{W_{it}}{R_{it}} \quad (4)$$

where the expected value of the parameter for the slope is negative, as suggested by the theoretical specification right above. Plugging S_{it} and M_{it} in our production function yields

$$P_{it} = A \cdot S_{it} \cdot M_{it} = A \cdot (a + b \cdot W_{it}) \cdot \left(\alpha - \beta \cdot \frac{W_{it}}{R_{it}}\right)$$
$$= A \cdot a \cdot \alpha + A \cdot b \cdot \alpha \cdot W_{it} - A \cdot a \cdot \beta \cdot \frac{W_{it}}{R_{it}} - A \cdot b \cdot \beta \cdot \frac{{W_{it}}^2}{R_{it}}$$

Or also $P_{it} = A \cdot S_{it} \cdot M_{it} = A \cdot a \cdot \alpha + A \cdot b \cdot \alpha \cdot W_{it} - A \cdot b \cdot \beta \cdot {W_{it}}^2 - A \cdot a \cdot \beta \cdot \frac{W_{it}}{R_{it}} - A \cdot b \cdot \beta \cdot \frac{1}{R_{it}}$

Which after some renaming: $\delta_0 = A \cdot a \cdot \alpha$; $\delta_1 = A \cdot b \cdot \alpha$; $\delta_2 = A \cdot a \cdot \beta$ and $\delta_3 = A \cdot b \cdot \beta$; allows estimation, by constrained OLS, of the following reduced form

$$P_{it} = \delta_0 + \delta_1 \cdot W_{it} - \delta_2 \cdot \frac{W_{it}}{R_{it}} - \delta_3 \cdot {W_{it}}^2 - \delta_3 \cdot \frac{1}{R_{it}} + \varepsilon_{it} \quad (5)$$

where the estimated coefficient of squared wages, ${W_{it}}^2$, is constrained to be equal to the coefficient of the reciprocal of revenue. The empirical analysis will be carried out on this final expression, where two interesting features emerge. First, the model delivers the usual quadratic form typically associated with salaries (in determining output). Second, the model accounts for the market size of the teams using revenue as proxy, although the variable entertained in the estimation is its reciprocal, whose estimated coefficient is therefore expected to be negative.[9] Thus, the number of points scored in the domestic league at the end of the season is regressed on annual wages, its quadratic form,[10] the WRR, the multiplicative inverse of annual revenue, and a set of controls (e.g., year and league dummies and, in fixed effects [FE] models, team dummies). As the following section shows, our empirical analysis adheres to the usual positive correlation found between the teams' amount of talent (as measured by annual wages) and sport achievements (Barajas & Rodriguez, 2010; Forrest & Simmons, 2002 and Szymanski & Smith, 1997).

The clubs' annual wage bill is meant to capture the amount of talent in the teams' rosters, so we expect a positive and statistically significant coefficient for δ_1, but a negative and significant coefficient for $-\delta_3$; the latter not only accounts for diminishing returns in wages but also relates to potential overinvestment in sport talent. (See Dietl et al. (2008) or Garcia-del-Barrio and Tena-Horrillo (2019), for instance).

Our attention will however be focused on coefficient $-\delta_2$, by assessing the extent to which the clubs' financial responsibility affects sport performance. Hence, higher WRRs beyond a certain threshold would arguably make the financial situation of soccer clubs more unmanageable, resulting in poor sport performance. A negative and significant coefficient would thus imply that economic mismanagement leads to poorer sport achievements—a feature that will also be illustrated below by breaking down the contribution of the WRR variable into different threshold levels.

A few remarks follow on the estimation methodology. In a panel estimation framework, heterogeneity bias usually implies the inclusion of either FE or random effects (RE), which can capture the differences among cross-sections better than a pooled OLS estimation. For this reason, and as another robustness check, in the next section, both the

pooled and FE estimations are shown. If the teams with higher levels of wages and/or WRRs are the same all over the sample, then FE can conveniently pick up these elements of individual heterogeneity and add explanatory power to the model.[11]

4 | EMPIRICAL ANALYSIS

This section presents the results of a variety of empirical approaches based on the simple model described in Equation (5). Section 4.1 reports the estimations of models where sport performance is measured by the number of points the teams accumulate at the end of the league season. Section 4.2 performs a more refined analysis by distinguishing the distinctive patterns observed in each of the four domestic leagues under analysis. Finally, Section 4.3 examines the probability to reach the UEFA Europa or Champions league using Logit estimation models.

For the sake of robustness, we estimate the models for the main variables (points, wages, revenue, and WRR) both in levels as well as in deviations from the mean, where the means are computed for each league and season. Besides, we use a collection of control dummies to account for the peculiarities of the domestic leagues (where the Serie A remains as the reference group) and a set of temporal dummies to control for seasons. The latter are crucial for the case in which the main variables are in levels and become almost irrelevant when expressed in deviations from the mean.

TABLE 2 Sports performance production function—**Dep.Var.:** Points in league (in levels)

Models	WRR (2.1) OLS	WRR (segments) (2.2) OLS	WRR (2.3) FE	WRR (segments) (2.4) FE
salaries	0.3716*** (0.019)	0.3701*** (0.019)	0.2663*** (0.030)	0.2563*** (0.031)
salaries_2	−0.0006*** (0.000)	−0.0006*** (0.000)	−0.0004*** (0.000)	−0.0004*** (0.000)
WRR	−0.1127*** (0.026)		−0.1120*** (0.028)	
WRR < 50		3.1030 (4.718)		−0.0494 (4.979)
WRR_60		0.9300 (4.668)		−0.8922 (4.998)
WRR_70		−0.7772 (4.683)		−3.2779 (5.002)
WRR_80		−0.6414 (4.711)		−3.5458 (5.054)
WRR_90		−1.7354 (4.783)		−5.1424 (5.136)
WRR > 90		−5.7992 (4.908)		−8.3965 (5.343)
Premier L	−13.4195*** (1.185)	−13.1950*** (1.198)		
La Liga	3.5986*** (1.043)	3.5930*** (1.046)		
Ligue 1	5.7241*** (1.143)	5.8395*** (1.165)		
s2010_11	−0.4594 (1.457)	−0.3682 (1.453)	−1.1399 (1.490)	−1.0286 (1.496)
s2011_12	−2.0358 (1.580)	−2.0410 (1.562)	−2.5476* (1.498)	−2.5639* (1.506)
s2012_13	−2.0111 (1.569)	−1.9382 (1.579)	−2.5375* (1.514)	−2.4884 (1.520)
s2013_14	−2.8129* (1.627)	−2.6442 (1.652)	−3.8795** (1.528)	−3.8659** (1.542)
s2014_15	−3.5016** (1.565)	−3.3914** (1.568)	−4.2969*** (1.574)	−4.1719*** (1.580)
s2015_16	−6.1690*** (1.655)	−6.2085*** (1.672)	−6.9872*** (1.620)	−6.8717*** (1.627)
s2016_17	−7.0239*** (1.737)	−6.8176*** (1.754)	−7.0742*** (1.687)	−6.8639*** (1.699)
s2017_18	−8.4980*** (1.639)	−8.4473*** (1.651)	−8.3527*** (1.758)	−8.0978*** (1.758)
s2018_19	−9.9510*** (1.675)	−9.8445*** (1.696)	−10.1405*** (1.807)	−9.7900*** (1.809)
Constant	42.9538*** (2.039)	35.5678*** (4.938)	48.2098*** (2.355)	44.0558*** (5.294)
Fixed effects	–	–	Yes	Yes
N. obs.	796	796	796	796
N. teams			145	145
R^2	0.6509	0.6513	0.5027	0.5028
Adj. R^2	0.6442	0.6423		
AIC	5939.96	5949.20	5610.13	5617.79

Note: Robust standard errors in parentheses|fixed effect (FE) models, R^2 denotes the overall R-squared.
Abbreviation: WRR, wage-to-revenue ratio.
***$p < 0.01$. **$p < 0.05$. *$p < 0.1$.

4.1 | Estimations of the baseline model

Table 2 exhibits the estimated coefficients of the sports production function (where points in league are used as dependent variable) on the pooled sample in specification (2.1) and with FE in (2.3). Notice that the alternative versions in (2.2) and (2.4) break down the WRR variable into dummies representing different intervals (WRR segments): below 50%, 50% to 60%, 60% to 70%, 70% to 80%, 80% to 90%, and finally, above 90%. By offering several related estimations not only do we achieve greater robustness but we are also able to reach more nuanced conclusions about the topic at hand. Precisely, the different WRR segments could be considered as potential salary caps, where a WRR of 60% or 70% is the usual threshold established in American team sport leagues.

The results are straightforward and indicate that greater financial responsibility, which is associated to lower WRR, comes along with better sport performances. This conclusion holds for different models, as the statistical significance of the WRR coefficient in models (2.1) and (2.3), and the d_WRR coefficients in models (3.1) and (3.3) clearly indicate. The latter two correspond to the specifications where the main variables (points, wages, and WRR) are expressed in deviations from their means, calculated for every season and domestic league.[12]

Moreover, the estimation of FE models—like (2.3) and (3.3)—reinforce our results, since the significance levels attached to WRR and d_WRR still hold even when we account for potential elements of individual heterogeneity among the teams. The results for models (2.2) and (3.2) convey additional information: The negative impact on sport performance becomes increasingly large (the size of coefficients is increasingly negative) as the WRR percentage grows bigger, even if the effect appears to be statistically significant only when WRR exceeds 90%, in model (3.2). The breakdown of WRR into six variables reveals that sport performance deteriorates along with financial mismanagement only progressively, although there is a jump for segment 80%–90% and an even greater jump (statistically significant) for WRR beyond 90%.

Table 3 reports the estimations of models with the variables expressed in mean deviations; as expected, the results are essentially similar to the ones in Table 2, indicating that they are robust to a variety of model specifications.

We also explore the dynamics behind our main specifications by introducing one lag of the dependent variable in (2.1), (2.2), (3.1), and (3.2). The results in all these cases show little changes in terms of explanatory power (the estimations are available on request).

The issue of reverse causality is always a matter of concern. Nevertheless, we discard here that sporting success in a domestic

TABLE 3 Sports performance production function—**Dep.Var.:** Points in league (mean deviations)

	WRR_dev (3.1) OLS	WRR_dev (segments) (3.2) OLS	WRR_dev (3.3) FE	WRR_dev (segments) (3.4) FE
d_salaries	0.2735*** (0.010)	0.2737*** (0.010)	0.2215*** (0.024)	0.2126*** (0.024)
d_ salaries^2	−0.0006*** (0.000)	−0.0006*** (0.000)	−0.0004*** (0.000)	−0.0004*** (0.000)
d_WRR	−0.1172*** (0.026)		−0.1249*** (0.029)	
WRR < 50		−0.3805 (3.508)		−0.0035 (4.943)
WRR_60		−1.6345 (3.461)		0.1130 (4.963)
WRR_70		−3.5715 (3.505)		−2.4893 (4.967)
WRR_80		−3.0018 (3.522)		−2.5436 (5.018)
WRR_90		−4.6176 (3.616)		−4.4169 (5.097)
WRR > 90		−9.9788*** (3.778)		−8.6841 (5.302)
Premier L	1.3778 (1.056)	2.8378** (1.157)		
La Liga	2.9976*** (1.032)	4.1609*** (1.080)		
Ligue 1	−0.0619 (1.011)	2.1808* (1.143)		
Constant	0.6961 (1.296)	2.7652 (3.675)	3.0861*** (1.095)	5.4179 (5.046)
Season dummies	Yes	Yes	Yes	Yes
Fixed effects	–	–	Yes	Yes
N. obs.	796	796	796	796
N. teams			145	145
R^2	0.6465	0.6482	0.6359	0.6330
Adj. R^2	0.6397	0.6391		
AIC	5,949.02	5,955.13	5,598.70	5,605.71

Note: Robust standard errors in parentheses|in fixed effect (FE) models, R^2 denotes the overall R-squared.
Abbreviation: WRR, wage-to-revenue ratio.
***$p < 0.01$. **$p < 0.05$. *$p < 0.1$.

league causes greater wage spending in a direct way. On the one hand, performance bonuses in domestic competitions tend to be relatively small as compared with fixed wages when contracting the best players. On the other hand, previous empirical studies rejected the hypothesis of reverse causation in soccer (Hall et al., 2002).[13]

4.2 | A refined analysis by leagues

In this section, we carry out a more detailed analysis by estimating the models separately, by domestic leagues. This approach permits exploring distinct patterns or peculiarities of each competition that may be statistically significant. Table 4 gathers the OLS estimations.[14]

These results confirm our previous analyses since the coefficients of the WRR variable are always negative. The coefficients are large and strongly significant for the Premier League and the Italian Calcio and, to a lesser extent, for the French Ligue 1.

Another robustness check was implemented by estimating a pooled model while defining different WRR variables for each of the domestic leagues under consideration. The results are relegated to Appendix B (Table B1) and show again negative and statistically significant coefficients for the Premier League, Serie A, and Ligue 1 (all but the Spanish league). Finally, we also estimate the dynamic versions of the specifications in Table 4, by including one lag of the dependent variable as regressor. The estimation results reveal this coefficient to be statistically significant again in the English, Italian, and French leagues. Overall, we find no major differences with the static versions of those specifications (the estimations are available on request).

4.3 | Estimation of logit models: Probability to reach UEFA leagues

The implementation of break-even requirements was introduced by UEFA to foster soccer clubs' financial responsibility and to lower their risk to face a financial failure. European teams have to comply with these rules should they want to be granted the license authorizing them to participate in European competitions (UEFA, 2015).

Interestingly, the empirical analyses of Sections 4.1 and 4.2 reveal that compliance with the break-even restrictions also implies better sport performances of European soccer teams. This result holds systematically and is robust to different model specifications. We now turn our attention to the teams' probabilities to qualify for the UEFA Europa League and UEFA Champions League.

In this section, we focus specifically on the probability of the teams to qualify for UEFA competitions, which must be considered as a reward in terms of sporting opportunities, reputation, and economic returns. We are especially interested in the WRR variable, since the preceding sections provided the evidence for improved sport performances in soccer teams as a result of financial responsibility. We venture that this finding points towards a more general premise, namely, that good financial management (in organizations) is usually

TABLE 4 Sports production function—Domestic points models (by domestic leagues)

Leagues Models	Premier L (4.1) OLS	La Liga (4.2) OLS	Serie A (4.3) OLS	Ligue 1 (4.4) OLS
Salaries	0.4106*** (0.037)	0.3517*** (0.023)	0.4900*** (0.050)	0.4264*** (0.039)
Salaries^2	−0.0006*** (0.000)	−0.0005*** (0.000)	−0.0010*** (0.000)	−0.0008*** (0.000)
WRR	−0.3437*** (0.046)	−0.0026 (0.026)	−0.2813*** (0.067)	−0.1568** (0.062)
2010_11	−1.8139 (2.255)	0.4444 (2.210)	0.1324 (3.223)	−1.5802 (3.287)
2011_12	−3.7571 (2.702)	−0.6079 (2.356)	−2.1668 (3.257)	−2.8168 (3.658)
2012_13	−4.4880* (2.424)	0.6930 (2.731)	−1.4987 (3.564)	−1.8767 (3.233)
2013_14	−10.6784*** (2.984)	0.0346 (2.848)	−1.0771 (3.522)	−2.6479 (3.311)
2014_15	−14.7846*** (2.630)	−1.3760 (2.891)	−1.2632 (3.477)	−1.1661 (3.234)
2015_16	−17.6277*** (3.734)	−4.1365 (2.532)	−2.6101 (3.050)	−2.1048 (3.375)
s2016_17	−18.9299*** (2.932)	−6.1293** (3.055)	−4.7184 (3.649)	−2.9427 (3.505)
s2017_18	−20.3187*** (2.613)	−7.2476** (3.287)	−6.2811** (3.139)	−4.2919 (3.117)
s2018_19	−19.7079*** (3.020)	−9.4170*** (2.627)	−5.4524 (3.471)	−5.6471 (3.782)
Constant	48.6610*** (4.151)	38.5708*** (2.482)	45.7251*** (4.018)	48.8563*** (6.023)
N. obs.	199	199	199	199
R^2	0.7261	0.7428	0.6552	0.6067
Adj. R^2	0.7084	0.7262	0.6329	0.5813
AIC	1,469.65	1,462.55	1,506.08	1,478.69

Note: Robust standard errors in parentheses.
Abbreviation: WRR, wage-to-revenue ratio.
***$p < 0.01$. **$p < 0.05$. *$p < 0.1$.

embedded in a broader mindset of good general managerial practices. According to our results, lack of financial discipline in soccer appears to be correlated with poorer sport performances.

Notice that the current UEFA Champions League draws heavily on the previous pre-1992 competition, the "European Cup", where domestic soccer league winners competed in a knockout tournament. The current structure of the Champions League involves a qualifying stage, a divisional round-robin phase, and a final knockout stage. The attempt to create a closed *'Superleague'* in European soccer has been a matter of serious consideration since the 1990s. The issue is controversial, as it involves legal demands against historic top-European soccer clubs. In this context, Green et al. (2015) give some insights:

> "*UEFA has rejected (implicitly or explicitly) two alternative competition formats. One is an end of season playoff competition akin to playoffs in North American leagues. This would not be feasible due to the sheer number of domestic leagues in Europe. The second, more feasible, design is a breakaway European* 'superleague' *where elite teams detach themselves from their domestic leagues to form a separate competition, either closed or open with promotion or relegation. (…) The established Champions' League competition design has games scheduled in midweek to avoid conflicts with the weekend fixtures in domestic league competitions facilitating coexistence with domestic leagues.*"

The purpose of this section is to measure the extent to which a change in the teams' WRR—as a measure of the degree of the clubs' financial responsibility—affects the team's probability to reach UEFA competitions. Given the probabilistic nature of this exercise, we rely on Logit estimation models, whose nonlinearity makes for a more difficult interpretation of the estimated coefficients.[15] For this reason, and as suggested by the literature, we will report the marginal effects to assess how our explanatory variables can change the probability of reaching the targeted outcome (Hoetker, 2007).

The estimated coefficients of a Logit model measure the effects of the explanatory variables on the log-odds of the outcome, instead of the effects on the probability, which is what we are interested in. On the one hand, odds ratios are often misinterpreted by considering them as relative probabilities. On the other hand, marginal effects convey the information as differences in probabilities, thereby being more appropriate than odds ratios and relative probabilities. Marginal effects are therefore better suited to see the effects of an explanatory variable on a binary (0 or 1) dependent variable (Norton & Dowd, 2018). Also, notice that marginal (e.g., incremental) effects are derivatives, and in the case of a continuous variable—and when the model is nonlinear—it applies to a small change in the explanatory variable. The interpretation is more intuitive for dummy variables, as the change goes from 0 to 1. In the tables below, we will present the marginal effects at the mean, that is to say, assuming that the other covariates take their average value.[16]

In line with the previous comments, Table 5 shows the results of estimating chances of reaching the UEFA Europa League for the four specifications that result from combining two pair of alternatives: (i) estimations with variables in levels (models 5.1 and 5.2) or in deviations from the mean, calculated for each season and domestic league (models 5.3 and 5.4), and (ii) models including a continuous WRR as regressor (models 5.1 and 5.3) or a collection of dummies by intervals (models 5.2 and 5.4). Along with the estimated coefficients, we provide the corresponding marginal effects (dy/dx) of the main variables at the bottom of the tables.

To evaluate the models' predictive power, we rely on the pseudo R-squared statistic, which—even if it does not measure the proportion of the variance explained by the regressors, as with the R^2—is still valid to compare among models that use the same dataset and dependent variable (Yatchew & Griliches, 1985).

Models in Tables 5 and 6 confirm yet again that the teams' annual wages capture the quality of the squads and can thus be considered as a major driver of the teams' chances to reach European competitions. The fact that the two coefficients defining the quadratic functional form of the baseline model (salaries and squared salaries) are statistically significant reveals that there are diminishing returns to scale in the salaries. This is certainly a robust result, given that the estimators are statistically significant in all four models.

In reporting the marginal effects, we want to highlight both the qualitative and quantitative conclusions. These marginal effects indicate the real changes in the predicted probability; that is, by what degree the probability of qualifying for a UEFA competition will change when allowing for a unit change in the WRR. Remember that the WRR is expressed as the percentage of the annual wage spending with respect to annual revenue. Notice also that the magnitude of the marginal effects varies across observations, along with the values of the other regressors. Therefore, average marginal effects can differ for subgroups, which could lead to deliver, in a different context, policy recommendations quite different and that depend on the respective subgroup (Norton & Dowd, 2018).

According to the marginal effects in models (5.1) and (5.3), the probability to reach the UEFA Europa League decreases by 0.64% or 0.62%, when there is a 1% increase in the WRR variable in levels and in deviations from the mean, respectively. Note that this is equivalent to a 6.2% and 6.2% increase, respectively, if we were to consider a 10% increase in WRR.

Table 6 shows the results for the UEFA Champions League; the interpretation of models (6.1) and (6.2), as well as models (6.3) and (6.4), is then equivalent, in all aspects, to their counterparts in Table 5.

The marginal effects reported in models (6.1) and (6.3) show a drop in the probability to play the UEFA Champions League of about 0.31% or 0.25%, with each 1% increase in WRR. The results in specifications (5.2) and (5.4)—in Table 5—as well as (6.2) and (6.4)—in Table 6—are even more informative, as they show the intervals for the WRR variable.

Table 7 summarizes the findings of the previous two tables. It exhibits, along with the marginal effects, the difference, in percentage, of each group (e.g., interval) with respect to the marginal effect of the

TABLE 5 Logit models—Probability to qualify for the UEFA Europa league

Dep.Var. Models	EuropeL (5.1) logit	EuropeL (seg) (5.2) logit	EuropeLDev (5.3) logit	EuropeLDev (seg) (5.4) logit
Salaries	0.0813*** (0.008)	0.0822*** (0.008)		
Salaries^2	−0.0001*** (0.000)	−0.0001*** (0.000)		
WRR	−0.0310*** (0.008)			
d_salaries			0.0594*** (0.006)	0.0601*** (0.007)
d_ salaries^2			−0.0001*** (0.000)	−0.0001*** (0.000)
d_WRR			−0.0299*** (0.008)	
WRR < 50		4.1690*** (0.884)		3.0765*** (0.879)
WRR_60		4.0665*** (0.900)		3.3021*** (0.927)
WRR_70		4.2902*** (0.881)		3.5375*** (0.899)
WRR_80		3.2579*** (0.862)		2.6172*** (0.868)
WRR_90		2.7957*** (0.869)		2.1024** (0.866)
WRR > 90		2.1367** (0.946)		1.1518 (0.966)
Premier L	−2.7778*** (0.539)	−2.9480*** (0.561)	0.5163 (0.451)	0.6875 (0.472)
La Liga	1.6033*** (0.338)	1.4219*** (0.348)	1.2957*** (0.314)	1.3713*** (0.338)
Ligue 1	1.2373*** (0.416)	1.1771*** (0.415)	−0.1816 (0.327)	0.1913 (0.381)
Constant	−2.5728*** (0.553)	−8.2456*** (1.094)	−0.8230** (0.410)	−3.8068*** (0.920)
Season dummies	Yes	Yes	Yes	Yes
N. obs.	796	796	796	796
Pseudo R^2	0.4911	0.4992	0.4871	0.4975
AIC	538.44	540.45	542.47	542.08
Marginal effects	(5.1)	(5.2)	(5.3)	(5.4)
Salaries	0.0167***	0.0167***		
Salaries^2	−0.0000***	−0.0000***		
WRR	−0.0064***			
d_Salaries			0.0123***	0.0123***
d_Salaries^2			−0.0000***	0.0000***
d_WRR			−0.0062***	
WRR < 50		0.8504***		0.6334***
WRR_60		0.8295***		0.6798***
WRR_70		0.8751***		0.7283***
WRR_80		0.6645***		0.5388***
WRR_90		0.5702***		0.4328**
WRR > 90		0.4358***		0.2371
Premier L	−0.5739***	−0.6013***	0.1076	0.1415
La Liga	0.3312***	0.2900***	0.2700***	0.2823***
Ligue 1	0.2556***	0.2401***	−0.0378	0.0393

Note: Robust standard errors in parentheses.
Abbreviations: UEFA, Union of European Football Associations; WRR, wage-to-revenue ratio.
***$p < 0.01$. **$p < 0.05$. *$p < 0.1$.

reference group: WRR smaller than 50%. The calculations of these changes, with respect to WRR < 50, are useful to recognize discrepancies across the intervals.

We find that teams that overspend in salaries tend to show an increasing drop in the probability to reach UEFA competitions. Whenever the teams' WRR goes beyond the 70% threshold—which is precisely the salary cap usually applied in American team sport leagues—teams experience a sharp reduction in their chances to reach both the UEFA Europa and Champions leagues. Moreover, our results suggest a larger reduction in the teams'

TABLE 6 Logit models—Probability to qualify for the UEFA champions league

Dep.Var. Models	ChampL (6.1) logit	ChampL (seg) (6.2) logit	ChampLDev (6.3) logit	ChampLDev (seg) (6.4) logit
Salaries	0.0775*** (0.007)	0.0789*** (0.007)		
Salaries^2	−0.0001*** (0.000)	−0.0001*** (0.000)		
WRR	−0.0551*** (0.014)			
d_salaries			0.0552*** (0.005)	0.0558*** (0.005)
d_ salaries^2			−0.0001*** (0.000)	−0.0001*** (0.000)
d_WRR			−0.0486*** (0.013)	
WRR < 50		3.2553*** (0.984)		1.9584** (0.867)
WRR_60		2.4868*** (0.868)		1.4130* (0.843)
WRR_70		2.1522** (0.890)		1.1436 (0.874)
WRR_80		0.8703 (0.915)		0.1051 (0.881)
WRR_90		−0.1047 (0.937)		−0.9383 (0.889)
WRR > 90		0.5155 (1.042)		−0.5594 (1.044)
Premier L	−2.5377*** (0.526)	−2.7009*** (0.553)	−0.7288 (0.539)	−0.2046 (0.595)
La Liga	2.3242*** (0.545)	2.2829*** (0.576)	1.4918*** (0.487)	1.9727*** (0.531)
Ligue 1	2.2071*** (0.629)	2.2070*** (0.654)	0.2925 (0.455)	1.2165** (0.533)
Constant	−3.0183*** (0.880)	−8.4821*** (1.287)	−2.4196*** (0.487)	−3.5635*** (0.982)
Season dummies	Yes	Yes	Yes	Yes
N. obs.	796	796	796	796
Pseudo R^2	0.5977	0.6097	0.5816	0.5906
AIC	337.21	338.08	349.44	352.59
Marginal effects	(6.1)	(6.2)	(6.3)	(6.4)
Salaries	0.0043***			
Salaries^2	0.0000***			
WRR	−0.0031***			
d_Salaries		0.0040***	0.0029***	0.0027***
d_Salaries^2		0.0000***	0.0000***	0.0000***
d_WRR			−0.0025***	
WRR < 50		0.1682***		0.0971**
WRR_60		0.1285***		0.0701
WRR_70		0.1112**		0.0567
WRR_80		0.0449		0.0052
WRR_90		−0.0054		−0.0465
WRR > 90		0.0266		−0.0277
Premier L	−0.1414***	−0.1396***	−0.0384	−0.0101
La Liga	0.1295***	0.1180***	0.0787**	0.0978***
Ligue 1	0.1230***	0.1140***	0.0154	0.0603**

Note: Standard errors in parentheses.
Abbreviations: UEFA, Union of European Football Associations; WRR, wage-to-revenue ratio.
***$p < 0.01$. **$p < 0.05$. *$p < 0.1$.

chances as they further deviate to 80% and 90% and beyond. For instance, teams with wages representing more than 90% of their revenue are about 48.75% or 62.57% (depending on the model) less likely to reach the Europa League than the reference group. These results are generally bigger in magnitude for the UEFA Champions League than for the Europa League.

We also ran Logit regressions with FE, but the loss of data was substantial and the gains trivial. (See Appendix C for the results of the FE model estimations). To further illustrate the previous analysis and facilitate the interpretation of the role played by the WRR variable, Figure 3 displays the range of probabilities to qualify for UEFA competitions, which is in line with our previous results.

TABLE 7 Logit models—Probability of qualifying for the UEFA Europa league and champions league

	Europa league—marginal effects				Champions league—marginal effects			
Model	(5.2) (dy/dx)	Change wrt WRR < 50	(5.4) (dy/dx)	Change wrt WRR < 50	(6.2) (dy/dx)	Change wrt WRR < 50	(6.4) (dy/dx)	Change wrt WRR < 50
WRR < 50	0.85040		0.63340		0.16820		0.09710	
WRR_60	0.82950	−2.46%	0.67980	7.33%	0.12850	−23.60%	0.07010	−27.81%
WRR_70	0.87510	2.90%	0.72830	14.98%	0.11120	−33.89%	0.05670	−41.61%
WRR_80	0.66450	−21.86%	0.53880	−14.94%	0.04490	−73.31%	0.00520	−94.64%
WRR_90	0.57020	−32.95%	0.43280	−31.67%	−0.00540	−103.21%	−0.04650	−147.89%
WRR > 90	0.43580	−48.75%	0.23710	−62.57%	0.02660	−84.19%	−0.02770	−128.53%

Abbreviations: UEFA, Union of European Football Associations; WRR, wage-to-revenue ratio.
Source: Authors' own calculations.

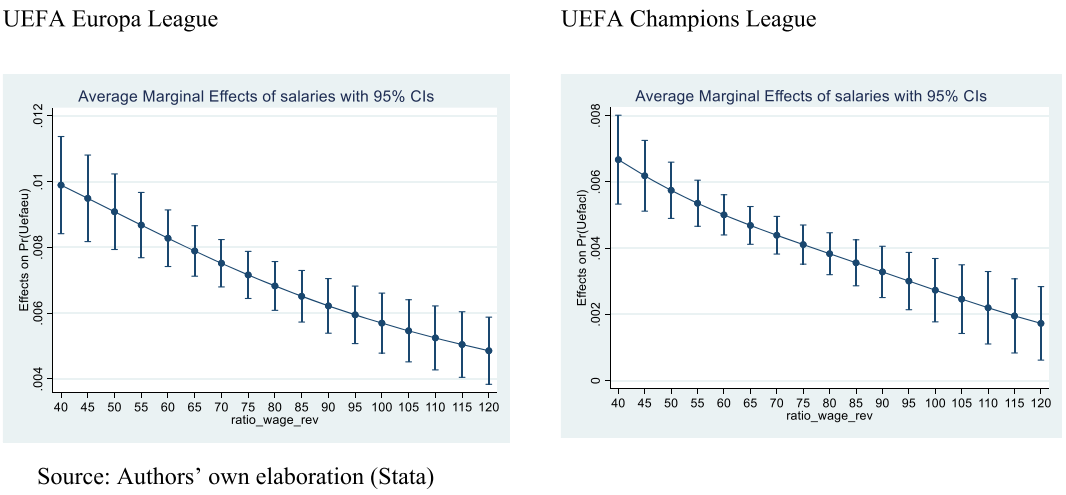

FIGURE 3 Effects on the probability to qualify for the Union of European Football Associations (UEFA) Europa and champions leagues [Color figure can be viewed at wileyonlinelibrary.com]

Similar results (just for UEFA Champions League) are found by Di Simone and Zanardi (2021), who distinguish between compliance with FFP rules and the salary to sales ratio (SS), which results from the ratio between staff costs and sales (equivalent to our WRR variable).[17]

The interpretation of the figures is clear. The Logit models predict a positive probability of qualifying for the UEFA Europa and Champions leagues as the clubs' wage bill grows bigger. This result applies all along the range of values of the WRR variable. However, the positive correlation between the teams' salaries and the probability of reaching a UEFA-qualifying position becomes smaller as the WRR covariate increases. This result is consistent with a corollary of our analysis, namely, that financial mismanagement seems to be associated with poor management in other areas of business practices, which may negatively affect sport performance.

5 | CONCLUSIONS

Our empirical analyses on four main European soccer leagues reveal that greater financial responsibility leads to better sport performance and higher chances to qualify for the Champions and Europa Leagues. Our results are in line with the premise that financial responsibility, as encouraged by UEFA, has a positive financial effect on clubs and even reach beyond the intended scope of such responsibility, as they also seem to benefit the teams' sport performance and achievements.

We have examined the behavior of four major domestic European soccer leagues through the lens of a sports production function and found, across several specifications, that the smaller the WRR, the better the clubs' performance. This effect seems to be further aggravated when WRR goes beyond the 70% benchmark. In addition to this, we have applied Logit regression analysis to study the impact of WRR on the clubs' probability to reach greater sport achievements, such as qualifying for the UEFA competitions. Our results suggest an increase in the probability of reaching UEFA's Europa and Champions leagues of roughly 6% and 3%, respectively, with a 10% drop in the WRR.

In summary, this paper has applied different econometric strategies that yield consistent results in support of financial stability—as embedded in UEFA's FFP rules—as a driver of improved sport performance. Moreover, we venture that a healthy financial position is

usually embedded in a broader managerial mindset of good practices, which eventually make their way back in the form of higher productivity levels and better performance in teams. In principle, the introduction of break-even requirements to foster greater financial responsibility is expected to lower the risk of financial failure of soccer clubs. Interestingly, these same break-even limits also help teams to perform better in the playing field, a result that holds consistently while controlling for the quality of the teams' rosters.

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DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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ENDNOTES

[1] Ahtiainen and Jarva (2020) offer a description of the FFP regulations "*unanimously approved by UEFA's Executive Committee in September 2009. In June 2010, the first set of FFP regulations were introduced, and they have been updated three times since (UEFA, 2012, 2015, 2018). However, the key requirements of FFP have remained largely unchanged: (i) it highlights transparency and credibility by setting minimum disclosure requirements for clubs' financial statements; (ii) it requires clubs to prove that they do not have overdue payables to other clubs, their players, and social/tax authorities throughout the season; and (iii) it requires clubs to comply with the break-even requirement. Specifically, FFP's break-even rule states that relevant incomes and expenses essentially match over the reporting periods, and any difference must be above a predetermined threshold. Failure to comply with the FFP requirements can invoke various penalties ranging from warnings and fines to disqualification/exclusion from UEFA's competitions* (i.e., *the Champions League or Europa League)*". The official UEFA Financial Fair Play regulations (Edition 2018) can be retrieved online (https://documents.uefa.com/v/u/MFxeqLNKelkYyh5JSafuhg)

[2] Ghio et al. (2019) offer an empirical analysis for Italian clubs to assess the trade-off between sporting and economic outcomes. Their findings imply that FFPs do not improve the average efficiency of Italian first division teams. Gallagher and Quinn (2020), in turn, look into the effect of break-even financial constraints on the joint sporting and financial efficiency of 60 English football clubs for the period 2003/2004 to 2016/2017. They find that break-even rules bring about reductions in the clubs' efficiency (on average), and that UEFA financial regulations may force clubs to give attention to financial achievements while weakening the competitive intensity in the Premier League. To clarify the difference between competitive balance and competitive intensity, see: Scelles et al. (2013), Andreff and Scelles (2015), Scelles (2017), Andreff and Scelles (2021), Scelles and Andreff (2021).

[3] UEFA regulations are meant to improve the financial responsibility (and stability) of many other football teams, both from other divisions and countries, potentially involving around 700 clubs. Our sample focusses on just the 20 clubs competing in the top division of the mentioned leagues. Despite the sample bias, we consider that our dataset is appropriate for addressing our goal, namely, to assess the chances of teams to reach the main UEFA competitions.

[4] Even though UEFA implemented the FFP rules in 2011, their actual application started later. In particular, and to prevent exclusion from UEFA competitions, the clubs' accounts in 2011/2012 and 2012/2013 had to follow the FFP rules. Since then, UEFA has imposed economic penalizations, warnings, transfer bans, points' deductions, limits on registering players, and so on. As stated in the preamble to the UEFA FFP rules, these measures are meant to increase discipline and rationality in managing the club finances (UEFA, 2015). See Appendix A for details on the FFP rules.

[5] This "three-year assessment period" is congruent with the evidence that holds that, as wage spending (relative to income) increases, the clubs' financial balance sheet deteriorates and leads to a greater probability of insolvency. The football clubs' insolvency status is a relatively common event in the lower divisions of English football, which is arguably the result of its promotion and relegation mechanism (Szymanski, 2017).

[6] In the literature, the appraisal of football players' valuations is often based on estimated transfer fees (cf.: Dobson & Gerrard, 1999; Garcia-del-Barrio & Pujol, 2021; Mourao, 2016; Müller et al., 2017; Ruijg & van Ophem, 2015, among others) or, more generally, on market values (cf.: Franck & Nüesch, 2012; Herm et al., 2014; Korzynski & Paniagua, 2016, for instance). On the one hand, a significant part of the cost of hiring a new player derives from the transfer fee's payment, whose amortization is made over the contract period, at a certain yearly depreciation. On the other hand, the wage agreed between the player and the new team does depend on the actual transfer fee paid. Previous studies highlight the close correlation between annual salaries and transfer costs (Garcia-del-Barrio & Szymanski, 2009). In hiring players, football clubs spend significant amounts to pay the transfer fees. However, unlike the strong correlation found between sport performance and annual wage spending, the clubs' net transfer spending is usually poorly correlated with sporting success, given its character of a long-term investment in talent.

[7] The usual Cobb Douglas specification seems well suited as opposed to an additive relationship in the production function, as the latter would downplay the reinforcing effects the two inputs might have. Notice also that we are assuming constant returns to inputs when considered individually.

[8] We are aware that, strictly speaking, a ratio that would be consistent with the FFP break-even rule should include other expenses beyond wages, and we are thankful to one of the referees for such an insightful comment. These data are however not easily available and might introduce further heterogeneity among clubs. We will thus stick to our humbler measure of financial responsibility as defined above, which can also be seen as a salary cap.

[9] The coefficient of the reciprocal of the revenue is in all the cases negative and statistically significant, but we do not report its values in the tables as they are of course identical to the ones of the squared wages.

[10] The introduction of wages in a quadratic form is in line with the studies on production functions and is consistent with the law of diminishing marginal returns and, moreover, delivers the best results.

[11] The conventional procedure to discriminate between the FE and RE estimations consists of relying on the Hausman test (Hausman, 1978). For the models with variables in levels, the test indicates that the differences in the coefficients are systematic, but they are not systematic for the models in deviations. Anyway, even though the RE estimators are

consistent and efficient, we choose reporting the FE estimators for a theoretical reason: The idiosyncratic elements of heterogeneity are not expected to change in such a short period.

[12] The approach used in models of Table 3 is the preferred strategy in some papers that model performance equations—where clubs' annual wages are related to sport performances—by using the teams' relative positions in their respective leagues (Torgler & Schmidt, 2007; Caporale & Collier, 2015; Garcia-del-Barrio & Tena-Horrillo, 2019, among others).

[13] Even if one recognized the existence of a reverse causality process, it would be predetermined: The driven factors to determine current sporting performance are past revenue (rather than current revenue), and the same idea applies to the role of past performances in explaining the clubs' current wages (Garcia-del-Barrio & Szymanski, 2009).

[14] Given that we performed the estimations for each league separately, there are no differences between the results for the variables in levels and in mean deviations. We also estimated pooled OLS models with four WRR coefficients, one for each league. The results, reported in Appendix B, yield nearly identical significance and lead to similar conclusions.

[15] Although the Logit and Probit estimations are similar in binary studies, the former model is preferred for samples with short time periods due to problems of incidental parameters observed in FE Probit estimations (Greene, 2004). We only report the marginal effects for pooled models, as Logit models do not provide the marginal effects for FE estimations.

[16] We neglect the discussion on whether the average marginal effect or the marginal effect at the mean is better (Williams, 2012)—in calculating marginal effects, it does not matter at which value we hold the other covariates constant, because we are taking differences in the effects.

[17] Concerning the "Salary to Sales" (SS) ratio, Di Simone and Zanardi (2021) find that a 1% drop in SS implies and improvement in the Champions League rank of about 0.68, implying that a team would be able to reach beyond the initial phase, thus qualifying for the quarter-finals, with a reduction of 4% points of SS. They use other ratios too, such as the "Player purchase on revenue" (PPR), aiming at capturing the cost structure of clubs, and the ratio between the difference of sold and purchased players over the revenue (SPR), which is intended to measure the skill to handle the soccer market. More importantly, they adopt a different approach to ours in evaluating the fulfillment of the FFP rules, as they define a dummy variable (FFP) that takes the value 1 when three conditions are fulfilled (and 0 otherwise): (i) financial leverage less than 0.7, (ii) staff costs over sales less than 0.7, and (iii) equity value greater than zero.

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APPENDIX A

A.1 | The UEFA FFP guidelines and break-even requirements

Information retrieved from online (https://www.uefa.com/insideuefa/protecting-the-game/financial-fair-play)

This appendix summarizes the content of the FFP regulations and justify the reason why our empirical analysis is based on models where we use the WRR variable, instead of the difference between "relevant income" and "relevant expenses"—which, according to the definition of UEFA Club Licensing and FFP Regulations in force in the current time, is the club's break-even result for a reporting period.

A club fulfills the financial requirement insofar as its aggregate break-even result is not negative; otherwise, the club has an aggregate deficit, which the rules find tolerable expenses those in excess to revenue by an amount smaller than €5 m. Moreover, the regulations allow clubs to accumulate more than €5 m deficit if the entire deviation is paid by contributions from equity participants or related parties. More specifically, the FFP regulations allow clubs to spend €5 million beyond the amount of income they generate in a 3-year assessment period. However, if the owners cover the losses, this restriction may become €30 million (it was originally €45 million).

With minor changes over the years, the fundamental principles and objectives described by UEFA (2019) have remained essentially the same:

• to improve the economic and financial the capacity of the clubs, increasing their transparency and credibility;• to place the necessary importance on the protection of creditors and to ensure that clubs settle their liabilities with employees, social/tax authorities and other clubs punctually;• to introduce more discipline and rationality in club football finances;• to encourage clubs to operate on the basis of their own revenue;• to encourage responsible spending for the long-term benefit of football;• to protect the long-term viability and sustainability of European club football.

These regulations are detailed in full in the UEFA Club Licensing and Financial Fair Play Regulations (and the Addendum). They are developed around two main areas: the commitment for clubs, over a

TABLE A1 Sport performance and WRR requirement (measured through "revenue net of wages")

	Points (r-w) (2.1′) OLS	d_Points (r-w) (3.1′) OLS	Points (r-w) (2.3′) FE	d_Points (r-w) (3.1′) FE
salaries	0.3217*** (0.021)		0.2111*** (0.030)	
salaries_2	−0.0005*** (0.000)		−0.0003*** (0.000)	
revenue net of wages	0.0517*** (0.013)		0.0579*** (0.012)	
d_salaries		0.2278*** (0.014)		0.1654*** (0.024)
d_salaries_2		−0.0005*** (0.000)		−0.0003*** (0.000)
d_profits		0.0543*** (0.014)		0.0644*** (0.013)
premier_l	−13.4813*** (1.163)	1.2848 (1.053)		
la_liga	2.7444*** (1.003)	2.7936*** (1.019)		
ligue_1	4.3973*** (1.054)	−0.0654 (1.012)		
s2010_11	−0.5480 (1.432)	−0.1315 (1.397)	−1.2354 (1.483)	−0.8611 (1.473)
s2011_12	−2.0888 (1.559)	−0.3716 (1.523)	−2.6115* (1.492)	−1.2575 (1.478)
s2012_13	−1.7288 (1.561)	−0.1980 (1.543)	−2.3761 (1.504)	−1.3122 (1.488)
s2013_14	−2.6553 (1.626)	0.0502 (1.625)	−4.0080*** (1.523)	−2.2015 (1.490)
s2014_15	−3.1111** (1.548)	0.8546 (1.530)	−4.2918*** (1.560)	−1.2320 (1.514)
s2015_16	−5.8259*** (1.626)	1.0035 (1.706)	−7.0536*** (1.610)	−2.0572 (1.528)
s2016_17	−6.7284*** (1.722)	1.6990 (1.712)	−7.3514*** (1.683)	−1.3651 (1.541)
s2017_18	−8.1119*** (1.618)	2.6134 (1.602)	−8.5016*** (1.750)	−1.1020 (1.581)
s2018_19	−9.5144*** (1.653)	3.5244** (1.690)	−10.2573*** (1.800)	−1.2031 (1.591)
Constant	36.8331*** (1.500)	0.6821 (1.278)	41.7904*** (1.774)	3.0524*** (1.092)
Fixed effects	-	-	Yes	Yes
N. obs.	796	796	796	796
R^2	0.6514	0.6471	0.5205	0.6342
Adj. R^2	0.6447	0.6403		
AIC	5939.11	5955.13	5603.86	5593.22

Note: Robust standard errors in parentheses|in fixed effect (FE) models, R^2 denotes the overall R-squared.
Abbreviation: WRR, wage-to-revenue ratio.
***$p < 0.01$. **$p < 0.05$. *$p < 0.1$.

period, to balance their books (first assessed in the 2013/14 season) and the obligation for clubs to meet all their transfer and employee payment obligations at all times (first assessed in 2011).

Concerning our empirical strategies, even if the difference between revenue and wages (that we denote as "revenue net of wages") seems to more faithfully reflect the FFP regulations, we chose the WRR approach because it avoids potential distortions produced by the inflation (as it would affect equally revenue and wages) and, furthermore, conveys more intuitive interpretations, while capturing the essence of the break-even requirements.

In April 2022, UEFA approved a new FFP regulation, which will come into force in 2025/2026. The new rules include, on the one hand, a limit on spending on players and staff and transfer costs and fees to agents, which together may not exceed 70% of total income. On the other hand, clubs will be allowed to incur losses—over 3 years—of 60 million euros, instead of the 30 million previously established.

Precisely, in Table A1, we replicate a selection of models where the "revenue net of wages" variable substitutes WRR as a regressor. As expected, the positive and statistically significant levels of the estimated coefficients for "revenue net of wages" prove our previous results that a greater financial responsibility leads to better sport performance.

Then, a similar analysis is shown in Table A2, for regressions estimated separately by domestic soccer leagues. The results yield identical conclusions as those we achieved and discussed in Section 4.2.

These results are not surprising, since the condition that the relevant income minus relevant expenses, as defined in the UEFA, must be not negative (for the clubs to fulfill the break-even requirements) is basically similar to imposing that WRR must be smaller than 1. That is to say:

$$R - W > 0 \text{ is equivalent to the condition that : } WRR = W/R < 1.$$

To prove the fact that these two inequalities are equivalent is straightforward, we know that $W = R \cdot WRR$; then, the break-even condition requires that: $R - W = R - R \cdot WRR = R \cdot (1 - WRR) > 0$. For the last expression to hold, we only need that $WRR < 1$. Hence, each of the two conditions implies the other.

Notice, as was mentioned above, that the actual rules allow the clubs to deviate from zero ($R - W > -T$) and, more importantly, that the fulfillment of the break-even requirements (to prevent clubs to accumulate financial deficits) applies to 3-year periods.

TABLE A2 Sport performance and WRR requirement ("revenue net of wages") by domestic leagues

Leagues Models	Premier L Points (r-w) (4.1′) OLS	La Liga Points (r-w) (4.2′) OLS	Serie A Points (r-w) (4.3′) OLS	Ligue 1 Points (r-w) (4.4′) OLS
ralaries	0.3508*** (0.037)	0.3991*** (0.038)	0.3638*** (0.050)	0.3765*** (0.052)
salaries_2	−0.0006*** (0.000)	−0.0005*** (0.000)	−0.0008*** (0.000)	−0.0008*** (0.000)
revenue net of wages	0.0790*** (0.018)	−0.0402 (0.026)	0.1010*** (0.022)	0.0735* (0.045)
s2010_11	−1.7765 (2.134)	0.2654 (2.196)	0.3550 (3.164)	−1.5705 (3.249)
s2011_12	−3.8918 (2.821)	−0.5415 (2.419)	−2.0316 (3.185)	−2.7963 (3.664)
s2012_13	−5.2165* (2.647)	1.1396 (2.781)	−1.6286 (3.527)	−1.3325 (3.156)
s2013_14	−8.3962*** (3.031)	0.3029 (2.819)	−1.6401 (3.418)	−2.4727 (3.299)
s2014_15	−13.0882*** (2.633)	−1.2101 (2.858)	−0.3738 (3.334)	−0.8246 (3.222)
s2015_16	−16.7864*** (3.828)	−3.9996 (2.524)	−3.1581 (3.074)	−2.0173 (3.296)
s2016_17	−17.1346*** (2.951)	−6.1745** (3.022)	−5.3352 (3.653)	−2.7056 (3.565)
s2017_18	−19.1048*** (2.580)	−7.8650** (3.302)	−6.7226** (3.154)	−4.0959 (3.155)
s2018_19	−17.9650*** (3.037)	−9.7819*** (2.689)	−6.6442** (3.319)	−5.6519 (3.713)
Constant	25.9997*** (2.813)	37.6726*** (1.958)	32.1518*** (2.557)	37.9125*** (3.143)
N. obs.	199	199	199	199
R^2	0.7043	0.7468	0.6565	0.5976
Adj. R^2	0.6852	0.7304	0.6343	0.5716
AIC	1484.874	1459.41	1505.32	1483.24

Note: Robust standard errors in parentheses|in fixed effect (FE) models, R^2 denotes the overall R-squared.
Abbreviation: WRR, wage-to-revenue ratio.
***$p < 0.01$. **$p < 0.05$. *$p < 0.1$.

APPENDIX B

The following results reinforce those of Table 4. Notice that models (A.2.1) and (A.2.3) are taken from Tables 2 and 3, and (A.2.2) and (A.2.4) shed new evidence on the impact of WRR on sport performance.

TABLE B1 OLS sports production function—Domestic points models (different WRR slope by leagues)

	Points (A.2.1) = (2.1)	Points' (A.2.2)	PointsDev. (A.2.3) = (3.1)	PointsDev.' (A.2.4)
Salaries	0.3716*** (0.019)	0.3778*** (0.019)		
salaries_2	−0.0006*** (0.000)	−0.0006*** (0.000)		
WRR	−0.1127*** (0.026)			
d_salaries			0.2735*** (0.010)	0.2731*** (0.010)
d_ salaries^2			−0.0006*** (0.000)	−0.0006*** (0.000)
d_WRR			−0.1172*** (0.026)	
idleague#c.WRR				
WRR_Premier L		−0.2463*** (0.051)		
WRR_La Liga		−0.0094 (0.024)		
WRR_Serie A		−0.2402*** (0.058)		
WRR_Ligue 1		−0.1207* (0.063)		
idleague#c.d_WRR				
d_WRR_Premier L				−0.2913*** (0.049)
d_WRR_La Liga				−0.0201 (0.026)
d_WRR_Serie A				−0.1677** (0.067)
d_WRR_Ligue 1				−0.1412** (0.060)
Premier L	−13.4195*** (1.185)	−11.4821** (4.685)	1.3778 (1.056)	1.3768 (1.045)
La Liga	3.5986*** (1.043)	−9.7682*** (3.584)	2.9976*** (1.032)	2.9955*** (1.025)
Ligue 1	5.7241*** (1.143)	−0.4308 (5.664)	−0.0619 (1.011)	−0.0619 (1.013)
Constant	42.9538*** (2.039)	49.5781*** (3.266)	0.6961 (1.296)	0.6959 (1.292)
Season dummies	Yes	Yes	Yes	Yes
N. obs.	796	796	796	796
R^2	0.6510	0.6608	0.6465	0.6547
Adj. R^2	0.6443	0.6530	0.6397	0.6467
AIC	5939.96	5923.19	5949.02	5936.15

Note: Robust standard errors in parentheses.
Abbreviation: WRR, wage-to-revenue ratio.
***$p < 0.01$. **$p < 0.05$. *$p < 0.1$.

APPENDIX C

The results of Table C1 complement the ones shown in Tables 5 and 6.

TABLE C1 FE logit models—Probability to qualify for the UEFA leagues

	EuropaL (A.3.1) FE	EuropaLDev (A.3.2) FE	ChampL (A.3.3) FE	ChampLDev. (A.3.4) FE
Salaries	0.1054*** (0.017)		0.1430*** (0.023)	
Salaries^2	−0.0002*** (0.000)		−0.0002*** (0.000)	
WRR	−0.0456*** (0.013)		−0.1005*** (0.021)	
d_salaries		0.0939*** (0.015)		0.1019*** (0.017)
d_ salaries^2		−0.0002*** (0.000)		−0.0002*** (0.000)
d_WRR		−0.0467*** (0.013)		−0.0763*** (0.017)
2010_11	−0.2999 (0.523)	−0.2747 (0.513)	0.1989 (0.703)	0.0359 (0.655)
2011_12	−0.6131 (0.572)	−0.3409 (0.548)	−0.4077 (0.751)	−0.1878 (0.680)
2012_13	−0.7933 (0.565)	−0.2842 (0.543)	−1.1706 (0.747)	−0.4336 (0.683)
2013_14	−1.4241** (0.585)	−0.5020 (0.561)	−1.7751** (0.834)	−0.6739 (0.724)
2014_15	−1.3913** (0.601)	−0.2201 (0.573)	−2.0439** (0.848)	−0.6072 (0.722)
2015_16	−2.0260*** (0.634)	−0.0712 (0.582)	−2.9105*** (0.887)	−0.8583 (0.782)
2016_17	−3.3352*** (0.744)	−0.8049 (0.612)	−4.3076*** (1.032)	−0.8900 (0.787)
2017_18	−3.2981*** (0.789)	−0.0333 (0.651)	−4.7662*** (1.088)	−1.2221 (0.819)
2018_19	−3.5769*** (0.832)	0.0586 (0.688)	−4.6613*** (1.180)	−1.4575* (0.878)
Fixed effects	Yes	Yes	Yes	Yes
N. obs.	444	444	299	299
N. teams	52	52	32	32
Pseudo R^2	0.2216	0.2512	0.4306	0.3806
AIC	271.37	261.94	160.28	172.23

Note: Standard errors in parentheses.
Abbreviation: WRR, wage-to-revenue ratio.
***$p < 0.01$. **$p < 0.05$. *$p < 0.1$.