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## Article

# A Relative Age Effect (RAE) analysis of top European football clubs segmented by ownership models

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## MANAGEMENT | RESEARCH ARTICLE

# A Relative Age Effect (RAE) analysis of top European football clubs segmented by ownership models

Benito Pérez-González<sup>1</sup>, Pablo Cardona-Soriano<sup>1</sup> and Jose Torres Pruñonosa<sup>1\*</sup>

**Abstract:** The aim of this paper is to analyse the Relative Age Effect (RAE) on European elite football teams segmented by type of ownership. The study presents the RAE incidence in the Academy of the UEFA top 10 ranking clubs near the conclusion of the 2020–21 season. The sample ( $n = 746$ ) comprises players aged 17 to 23 years of age. The frequency of the players' date of birth adjusting to a Poisson regression was used in order to confirm the presence of RAE. The existence of RAE in the whole sample was verified ( $p < 0.001$ ). By segmenting the sample, the existence of RAE in the analysed age range between U17–19 and U20–23 ( $p < 0.001$ ) was confirmed. Whereas listed clubs, clubs owned by private shareholders and clubs owned by members had a very significant RAE incidence ( $p < 0.001$ ), clubs owned by public organisations did not present RAE. Results suggest that the management of youth academies differs depending on the ownership model.

**Subjects:** NonProfit Management; Human Resource Management; Sports Administration; Sports Management; Quantitative methods in sport; Football;

**Keywords:** Relative Age Effect; youth academy; soccer; ownership; shareholders

## 1. Introduction

European football encompasses the clubs that generate the highest revenues worldwide (Deloitte, 2021). Nonetheless, unlike the franchises operating in the United States and Canada (Fort, 2019), different ownership models coexist in European football (Rohde & Breuer, 2018; Torres-Puñonosa et al., 2020). On the one hand, several clubs are still owned by their supporters (Gougnet & Primault, 2006). And we say “still” because their number has been decreasing over the last few years. For instance, whereas in the 1990s this was the most common ownership model among Spanish clubs, currently only four of the professional clubs retain this ownership structure: Futbol Club Barcelona, Real Madrid, Athletic Club and Club Atlético Osasuna. This ownership structure is not capital-based; in fact, these institutions do not have capital and, therefore, do not have shares and they are not allowed to distribute dividends to their members. The club's members can vote in the institution's bodies in order to decide who will be the president, as well as to make other important decisions, for instance, important investments such as building a new stadium and financing decisions. In these polls, the criteria followed is one member, one vote, which is totally different from the capital-based ownership models in which the rule is one share, one vote. On the other hand, currently, this second ownership model, based on capital, is the most common one in European football (Leach & Szymanski, 2015). Nevertheless, diverse typologies are included in this

group. Some football clubs are listed on secondary stock markets (Baur & McKeating, 2011). In fact, there was a stock index that encompassed all European football clubs with listed shares: STOXX Football Index (Benkraiem et al., 2011), which disappeared on 28 August 2020, formerly named the Dow Jones STOXX Football Index (Aglietta et al., 2008). Nonetheless, the majority of the European football clubs are not listed, since barely more than twenty are. A new ownership model has appeared among non-listed clubs, over the last few years. Even though the majority of non-listed clubs are in the hands of private shareholders, some European clubs have been acquired by foreign capital directly or indirectly provided by public institutions, mostly from the Middle East. For example, Manchester City was acquired by Abu Dhabi United Group in 2008, Paris Saint-Germain was acquired by Qatar Sports Investments in 2011 and recently, in 2021, Newcastle United Football Club was taken over by Public Investment Fund, the public wealth fund of Saudi Arabia. This private ownership model in the hands of public shareholders enabled the acquired clubs to obtain very high capital injections, which allowed them to achieve considerable improvements in terms of sporting performance. In fact, several clubs are unenthusiastic about this ownership model since, in their opinion, it makes the competition lopsided because these clubs have access to huge amounts of public funds to strengthen their sporting structures, in spite of the existence of financial Fair Play. In short, in Europe there are four football club ownership models: 1) ruled by members (hereinafter, members); 2) corporations in the hands of private shareholders (hereinafter, private shareholders); 3) corporations in the hands of shareholders which are public institutions (hereinafter, public shareholders); and 4) corporations listed in stock markets (hereinafter, listed). According to Dolles & Söderman (2013), different types of clubs can generate different value captures with respect to their players. Are there differences in the strategies used by these different ownership model clubs when it comes to managing one of their most important assets, the pool of young players? This paper aims to answer that question.

Player training is one of the key aspects in sporting development and, for this reason, most professional teams have a competitive structure in lower age categories. In football academies, future professional players are trained under the supervision of both the technical teams and the minors' families (Bonal et al., 2020). Football academies are talent generators that may allow football clubs to have players for their first team without paying huge amounts of money to other clubs to secure their federative rights. Indeed, in 2018 alone, European team transfer fees amounted to 4,555 billion euros (UEFA, 2018). Therefore, to avoid constant signings that imply huge amounts of money, which may deteriorate the clubs' financial situation, it is essential for them to develop and foster talent in youth academies.

With the aim of fostering fair competition among players in the training stage, competitions are organised by age group (Castillo et al., 2019), which results in different categories organised on the basis of the year of birth, up to the senior category where age groups do not exist. Nonetheless, football talent development in youth football is affected by the Relative Age Effect (RAE), which means that there is a lower presence of players born during the last few months before the cut-off date, after which a new age category is classified.

The aim of this paper is to analyse whether RAE varies depending on the football clubs' ownership model, being the first paper in which such an analysis is carried out. Therefore, this is our contribution to the field of knowledge. To this end, we used as a sample the youth academies of the ten European clubs with the highest UEFA coefficient, which measures their sporting performance over the last years. Among the ten clubs analysed we can find examples of each of the four ownership structures previously described. Finally, RAE has been estimated for all the players of the youth academies, segmented by the ownership model of the club they belong to.

This paper, which focuses only on male players, is structured as follows. Section 2 provides an overview of the RAE theoretical and conceptual framework. In section 3, the methodology is described, as well as the sample. In section 4, the results are shown. And in section 4 the results are discussed, and conclusions are set out.

## 2. Theoretical framework

RAE occurs in different areas and is more evident in sports and school. In the case of football, the first study published was conducted by Barnsley et al. (1992). Copley et al. (2009) pointed out that RAE is more likely to occur in the case of male athletes—between 15 and 18 years old—competing in the most popular sports. For instance, Lupo et al. (2019) study the presence of RAE in basketball, rugby, football, volleyball and water polo. Whereas RAE was present in all early phase subgroups, it was only present in football in the late phase subgroups. In summary, the more popular the sport is, the more likely that RAE will exist in the elite category. Likewise, confirming the findings of Copley et al. (2009), Delorme et al. (2009) found no significant RAEs in female elite sports in France.

Wattie et al. (2014) developed an explanatory model of RAE in sport based on (Newell, 1986) “Development System Theory”. This model states that there are three types of constraints in the optimisation of coordination and control in a particular area—in our case, specific sporting practice. These possible constraints are as follows: 1) Individual; 2) Task; 3) Environmental. Wattie et al. (2014) consider that there is a relationship between the three constraints, which needs to be taken into account when analysing the RAE on each sport.

Another interesting model that explains the RAE on sport was developed by Hancock et al. (2013). This model describes the three most relevant social agents involved in youth and professional sport, and their influence on RAE. Namely, they recommend parents to influence RAE by means of the Matthew Effect, coaches by means of the Pygmalion Effect and athletes by means of the Galatea Effect. By integrating these three theories, Hancock et al. (2013) propose a theoretical model that explains RAE by means of these social agents, which allows researchers to understand, explain and, finally, create policies designed to limit the negative effects of RAE on sport.

Salinero et al. (2014) conducted a study on RAE in football for the period 2000 to 2011. This study confirms the occurrence of the effect both in the first category and in youth football, as well as in the positions of defender and mid-fielder in the Spanish first competition. There is a specific study on the 2009–10 season (Lesma et al., 2011) that confirms the occurrence of the effect in the Spanish first category and another one (Salinero et al., 2013a) that shows its evolution from youth football academies up to the elite first division. This effect is stronger in the youth categories than in the older ones, in which it is still present but at a lower level, confirming the “underdog hypothesis” (Brustio et al., 2023; Kelly et al., 2020).

Later studies show similar results: whereas around 60% of the Spanish highest category players were born during the first quarter of the year, in the youth academies the rate of players born during the first six months of the year has grown from 75% to 80% (Pérez-González et al., 2018).

The imbalance is even greater if we compare the number of players born during the first quarter with those born during the last quarter of the year. In 2009/10, 34% of the first division league’s players were born between January and March, whereas only 18% were born between October and December. In 2017/18 the difference is 31% –20% and 19 teams out of the total of 20 show an imbalance towards the first semester. Moreover, the bibliography shows that the phenomenon has the same effect on the 5 European major leagues (The Premiere League, Serie A, Bundesliga, LaLiga and Ligue 1) where a higher percentage of players born during the first semester has been detected. A study confirms the RAE effect on the 2009–10 season in the Italian, Spanish and French leagues (Salinero et al., 2013b), González-Villora et al. (2015) confirm the occurrence of the effect in a sample of 841 professional players that participated in UEFA international competitions. Yagüe et al. (2018) expand the study on RAE to the most important European leagues in the season 2016/17 ( $n = 5,201$ ) confirming RAE in all of them, with the exception of the Belgian league. These authors also confirm RAE in all the field positions, being particularly high in the case of mid-fielders and more reduced, although still present, in the position of striker. The effect also occurs in the Italian league, as noted by Brustio et al. (2018). Recent studies show the effect in the Japanese professional league (Yamamoto et al., 2021) and in the German Bundesliga (Götze & Hoppe, 2021).

Likewise, a recent study shows that the new generation of professional football players, represented by players participating in the last World, European and American Cups, is significantly affected by RAE (Pérez-González et al., 2021). In 2019, numerous championships of youth category national football teams were held. The occurrence of RAE was analysed in four major male championships that, due to their importance and the participating teams, brought together the bulk of players who will dominate professional football in the next decade. Participants were professional and amateur young male football players who participated in the last international championships: UEFA European Under-21 Championship (2017–2019); UEFA European Under-19 Championship (2019); South American Youth Football Championship (also known as Conmebol U-20) (2019); and FIFA U-20 World Cup (2019), with 823 players.

But RAE does not only affect first division football professional teams; it also affects lower category professional teams that compete in the second divisions of the top-5 European competitions (Rađa et al., 2018). This study, which uses data from the 2014/15 season, shows that there are no second chances (to return to the team that fired the player) with RAE, even to play in lower category professional teams, such as those competing in second division. In their study, Rađa et al. (2018) compile solutions proposed by several authors that are often difficult to implement: the first one, based on Gerdin et al. (2018), entails removing classifications from the competitions until after the youth stage is over. A different proposal is based on the study carried out by Lagestad et al. (2018), which suggests that at least 40% of players in training teams should be born in the second half of the year. And, finally, the idea of Barnsley & Thompson (1988) is included, which suggested reducing the relative age range in the categories as much as possible, for instance, organising competitions by semesters.

The accumulation of this effect over the years in different countries means that a significant number of players born during the last months of the years did not have the opportunity to play in the professional category, in spite of deserving it. This poorly selected talent has an impact on several areas: economic, ethical, football (the higher the average level, the greater the game's evolution), among others.

Take the example of the ethical area. RAE has implications for the staff of football clubs, not only at management level, but also at academy level. Brown et al. (2005) define ethical leadership as *“the demonstration of normatively appropriate conduct through personal actions and interpersonal relationships, and the promotion of such conduct to followers through two-way communication, reinforcement, and decision-making”* (p. 120) and suggested it should be exercised through knowledge of RAE bias with the aim of reducing it. Therefore, coaches, trainers and academy directors of football clubs must have ethical leadership (Ruiz et al., 2011; Ruiz-Palomino et al., 2013; Zoghbi-Manrique de Lara, 2019) that allows equal opportunities for players based on their talent and ability.

To conclude this section, it has been confirmed that the greatest sport talents are not affected by RAE; namely, there are not more high value players who were born during the first few months of the years (Pérez-González et al., 2020). Therefore, having more talent (value) in sport is not correlated with the month of birth.

### 3. Methodology

In the European football organisational pyramid, UEFA represents the ultimate administrative body, and it manages the most important football club competition in the world: UEFA Champions League. Teams are classified in a ranking established by UEFA according to the scores accumulated by the teams' participation in the international competitions organised by this institution (UEFA, 2021).

The participants in this study are players in the academies of the top 10 first teams in UEFAs Ranking (in March 2021) in the 2020/21 Season (see Table 1). We collected all the open access

**Table 1. Categories analysed by club**

Clubs	Categories analyzed
Atlético de Madrid	U23, U19, U17
Bayern München	U23, U19, U17
FC Barcelona	U23, U19, U17
Juventus	U23, U19
Liverpool	U23, U19, U18
Manchester City	U23, U19, U18
Manchester United	U23, U19
Paris Saint Germain	U23, U19
Real Madrid	U23, U19, U17
Sevilla CF	U23, U19, U17

**Table 2. Ownership models**

Members	Private shareholders	Public shareholders	Listed
FC Barcelona	Atlético de Madrid	Manchester City	Juventus
Bayern Munich	Sevilla FC	Paris Saint Germain	Manchester United
Real Madrid	Liverpool		

information available about academy players (from U17 to U23). We obtained the information from the web pages of the clubs concerned and the specialised platform, Transfermarkt (2021). The Spanish clubs included in this study provide information about their youth academy from U8, showing greater information transparency, whereas non-Spanish clubs do not offer this information for any of their categories on their corporate websites; which is why we obtained it from the aforementioned specialised platform. The ten clubs were classified according to their ownership model into the categories included in Table 2.

The RAE was analysed by means of Poisson regressions (Doyle et al., 2018, 2019). The Poisson regression formula  $y = e^{(b_0 + b_1x)}$  is used to explain the frequency count of an event ( $y$ ) by an explanatory variable  $x$ . The data used for Poisson regression were week of birth ( $W_B$ ) whereby the first week in January was designated  $W_B^1$ , and time period of birth ( $t_B$ ) describing how far from the beginning of the year a player was born. This last index ranging between 0 and 1 was calculated as  $t_B = (W_B - 0.5)/52$ . In the Poisson regression, the event ( $y$ ) was the frequency of birth in a given week and the explanatory variable ( $x$ ) was  $t_B$ . We also calculated the index of discrimination (ID) according to Doyle et al. (2019) as  $e^{-b_1}$ . This index measures the relative odds of a player born on day 1 versus day 365 of the selected competition year. The likelihood ratio McFadden's pseudo R-square was calculated as one minus the ratio that shows the full-model log-likelihood divided by the intercept-only log-likelihood (McFadden, 1974). All statistical tests, including descriptive analysis, were performed using the software package R (version 4.0.2). Significance was set at  $p < 0.05$ .

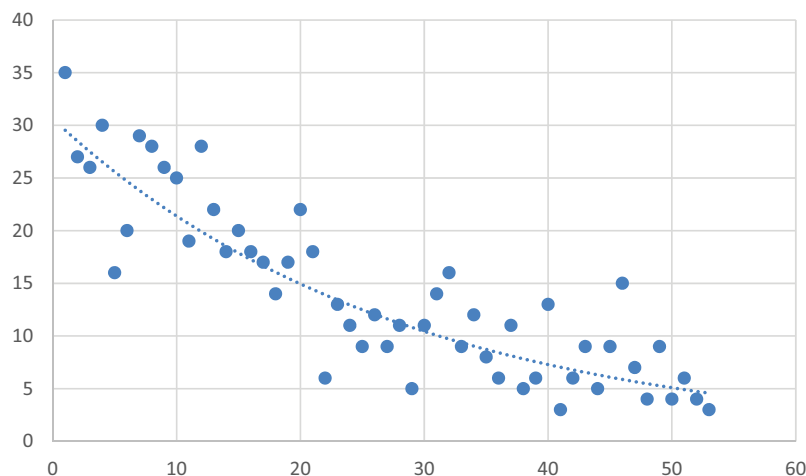
Our hypothesis is that there will be statistically significant differences depending on the ownership model of the football team.

#### 4. Results

Figure 1 shows the frequency of week of birth for all players analysed in the sample. A higher frequency of players born in the first weeks of the year is noted with a lower presence of those born at the end of it. Later we will check that these differences are statistically significant and, therefore, there is an RAE on the sample as a whole ( $n = 746$ ).



**Figure 1. Frequency of week of birth ( $W_B$ ) for all players.**



**Table 3. Birth date distributions according to their quartile (Q) or semester (S) of birth by age ranges**

		Q1	Q2	Q3	Q4	S1	S2
All Players	n	331	195	123	97	526	220
	%	44.4	26.1	16.5	13.0	70.5	29.5
U20–23	n	103	76	48	40	179	88
	%	38.5	28.5	18.0	15.0	67.0	33.0
U17–19	n	228	119	75	57	347	132
	%	47.6	24.8	15.7	11.9	72.4	27.6

Table 3 shows the distribution of players by quarters and semester, segmenting them also according to their age category, namely between 20 and 23 years old (U20–23) and between 17 and 19 years old (U17–19). 70.5% of players were born during the first semester of the year. Segmenting it by age group, 67% of players from 20 to 23 years old were born during the first semester, as were 72.4% of players from 17 to 20 years old.

Figure 2 shows the relative frequencies (in percentage) for both age groups per ownership model, where some important differences are shown. Additionally, given that the ownership model is a categorical variable (qualitative) that cannot be transformed into a quantitative one, a Chi-squared test has been carried out, obtaining a p-value of 0.0026 that confirms the significant correlation between the variables.

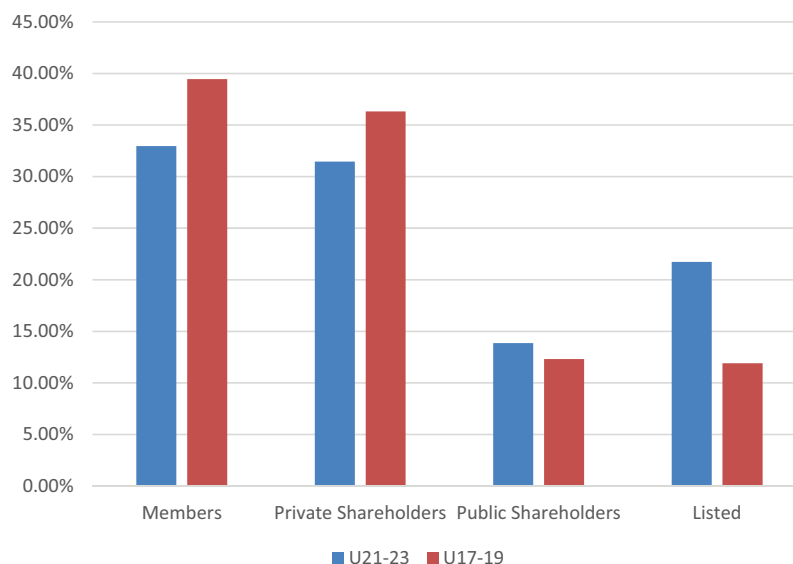
The Poisson regression by frequency analysis revealed the presence of a significant overall RAE in players of academies of all the 10 first teams in UEFA's Ranking. Analysed by age group (Table 4), the effect was significant ( $p < 0.001$ ) in all categories.

Table 5 shows the sample segmentation by ownership model. In clubs owned by members, 75.8% of players were born during the first semester; in clubs owned by private shareholders 72.4%; 64.4% in listed clubs; and finally, 59.2% in clubs owned by public shareholders. Table 6 shows whether the differences are statistically significant or not.

Analysing the Poisson regressions by type of ownership (Table 5), the RAE was also significant ( $p < 0.001$ ) in all the ownership models, with the exception of clubs owned by public shareholders ( $p = 0.0734$ ). The implications of these results will be discussed along with the conclusions in the next section.



**Figure 2. Relative frequencies of players according to their age category and the ownership model.**



**Table 4. Poisson regression analysis of RAE by frequency for all youth players by age groups**

Overall (n=746)	W <sub>B</sub>	17 ± 14
	t <sub>B</sub>	0.32 ± 0.26
	b <sub>0</sub>	3.42
	b <sub>1</sub>	-1.80
	ID	6.05
	Pseudo R <sup>2</sup> (McFadden)	0.76
	P value	<b>&lt;0.001</b>
U20-23 (n=267)	W <sub>B</sub>	21 ± 14
	t <sub>B</sub>	0.39 ± 0.26
	b <sub>0</sub>	0.20
	b <sub>1</sub>	-0.29
	ID	1.34
	Pseudo R <sup>2</sup> (McFadden)	0.47
	P value	<b>&lt;0.001</b>
U17-19 (n=479)	W <sub>B</sub>	18 ± 14
	t <sub>B</sub>	0.34 ± 0.26
	b <sub>0</sub>	3.06
	b <sub>1</sub>	-2.02
	ID	7.54
	Pseudo R <sup>2</sup> (McFadden)	0.70
	P value	<b>&lt;0.001</b>

WB:week of birth; tB: time of birth; ID: index of discrimination.

## 5. Discussion and conclusions

This paper confirms the occurrence of RAE in the whole sample analysed, as well as in all age groups. It has been confirmed that youth football players born during the first months of the year have greater opportunities because of a valuation bias that multiplies its effects in the different agents involved in the selection process (Hancock et al., 2013). Hill and Sotiriadou (2016) believe that RAE could be alleviated in two ways. Firstly, by means of increasing the training of coaches,

**Table 5. Birth date distributions according to their quartile (Q) or semester (S) of birth by ownership model**

		Q1	Q2	Q3	Q4	S1	S2
All Players	n	331	195	123	97	526	220
	%	44.4	26.1	16.5	13.0	70.5	29.5
Members (n=264)	n	129	71	39	25	200	64
	%	48.9	26.9	14.8	9.4	75.8	24.2
Private shareholders (n=269)	n	130	64	40	35	194	75
	%	48.3	23.8	14.9	13.0	72.1	27.9
Public shareholders (n=88)	n	30	28	18	22	58	30
	%	30.6	28.6	18.4	22.4	59.2	40.8
Listed (n=115)	n	42	32	26	15	74	41
	%	36.6	27.8	22.6	13.0	64.4	35.6

teachers and, in general, everyone in charge of making decisions about children in youth categories so that they can take this effect into account and may reduce it with more flexibility and observation skills. Secondly, they suggest rotating the cut-off date over the years so that RAE does not always affect the same players—normally, those born during the last months of the year.

RAE is confirmed in the whole sample analysed, in all the age categories and in almost all the ownership models, with the exception of public shareholders. This could indicate a different management of youth academies in these clubs. In line with Pérez-González et al. (2020), who demonstrated that top football players are not affected by RAE, results may indicate that clubs run by public shareholders use the academies just to create top players, whereas youth football training is not among their objectives. This model is very different from others, such as Futbol Club Barcelona, whose aim is the comprehensive training of young players, not only with regard to football, but also at an intellectual level, training the home-grown player as a person and aligning them with the club's values (Lleó & Cardona, 2011). This circumstance is made evident by the fact that clubs run by public shareholders purchase players from other academies so as to obtain talent, without having to train it; taking advantage of the training carried out by other clubs. The younger categories of these clubs do not stand out in the field of sport, since their objective is not for their young players to win titles for their institution, but to obtain new top players to nourish the first team. Conversely, we see that RAE has a high impact on clubs owned by members, specifically 75.8% of players were born during the first semester of the year. This percentage is the highest of all the ownership models, not only in the first team, but in all the age categories, since there is a greater emotional attachment with the teams, regardless of the age group.

The implications of the results obtained have to do with the sociocultural aspects of these different football teams. The clubs that are governed by their members (FC Barcelona, Bayern Munich and Real Madrid) aim to win not only in the elite categories but in each and every of them, including the younger categories. Take the example of the UEFA Youth League: clubs governed by members have won it three times, when this competition has been only played 10 times. No other football team analysed in this paper, the 10 with the highest score according to UEFA, has won this title. This is just evidence that clubs governed by members have a special attachment, not only to the elite professional team, but also to the youth categories, feeling proud of their successes as much as in the elite category, which makes them unique from a sociocultural point of view. It is no surprise, then, that this group is the most affected by the RAE, given that this group is more oriented towards obtaining good sporting results, not only at a professional level but also in youth categories. Therefore, the youth academies of clubs governed by members should strategically try to soften their aim to win in the youth categories in order to be less affected by the RAE. Otherwise, the results will not change, and the impact of RAE will continue to be very high, making them less

**Table 6. Poisson regression analysis of RAE by ownership model**

Overall (n=746)	W <sub>B</sub>	17 ± 14
	t <sub>B</sub>	0.32 ± 0.26
	b <sub>0</sub>	3.42
	b <sub>1</sub>	-1.80
	ID	6.04
	Pseudo R <sup>2</sup> (McFadden)	0.76
	P value	<b>&lt;0.001</b>
Members (n=115)	W <sub>B</sub>	17 ± 13
	t <sub>B</sub>	0.32 ± 0.24
	b <sub>0</sub>	2.56
	b <sub>1</sub>	-2.3
	ID	9.97
	Pseudo R <sup>2</sup> (McFadden)	0.65
	P value	<b>&lt;0.001</b>
Private shareholders (n=269)	W <sub>B</sub>	17 ± 13
	t <sub>B</sub>	0.32 ± 0.24
	b <sub>0</sub>	2.48
	b <sub>1</sub>	-2.04
	ID	7.69
	Pseudo R <sup>2</sup> (McFadden)	0.51
	P value	<b>&lt;0.001</b>
Public shareholders (n=236)	W <sub>B</sub>	18 ± 14
	t <sub>B</sub>	0.34 ± 0.26
	b <sub>0</sub>	0.91
	b <sub>1</sub>	-0.62
	ID	1.85
	Pseudo R <sup>2</sup> (McFadden)	0.038
	P value	<b>0.0734</b>
Listed (n=115)	W <sub>B</sub>	18 ± 14
	t <sub>B</sub>	0.34 ± 0.26
	b <sub>0</sub>	1.35
	b <sub>1</sub>	-1.26
	ID	3.54
	Pseudo R <sup>2</sup> (McFadden)	0.30
	P value	<b>&lt;0.001</b>

WB:week of birth; tB: time of birth; ID: index of discrimination

inclusive (Barba-Sánchez et al., 2021; Calderón-Milán et al., 2020) and losing the chance to capture more talent available to them.

On the other hand, the football teams that are governed by shareholders, no matter if they are private shareholders or listed companies, are also affected by the RAE, due to the fact that their aim is to increase profitability, since they are profit-driven companies. It is quite usual for these teams to sell one of their best players in order to make gains and reverse losses in a season, if necessary. This is something that has been admitted and accepted by their supporters, in a sociocultural sense, given that it is understood by their members that decisions are made by shareholders and not by supporters. For this reason, it makes sense that RAE is affecting the

management of youth academies, given that they aim to find the new young player that could be sold to revert losses, particularly because if the player sold is trained through the youth academy and not purchased from another team, the price of the player sold can be almost equal to the profits obtained.

Finally, it is reasonable to assume that, in a sociocultural sense, supporters who accept and even celebrate that their football team is going to be governed by public shareholders, will accept the new mission of the owner, which aims to win titles mainly in the elite divisions. For this reason, it is reasonable to assume that their academies are not affected by RAE in contrast with the other ownership models. Ultimately, their aim—or obsession even—usually is not only about winning national competitions but the European Champions League, like Manchester City eventually won during 2022/2023 season. Given that their financial resources are less limited, particularly in comparison with clubs governed by their members when they are financially stressed, youth academies have been managed in a completely different way than the other football teams. The authors understand that this is why public shareholders football teams are the only ones not affected by RAE, for the time being.

As far as the “underdog effect”, some studies demonstrate that the RAE is mitigated in the older categories (Brustio et al., 2023; Kelly et al., 2020). Although this might improve the management of youth academies, the initial bias created by the RAE is still present, and this is why it should be taken into account in the youth categories.

With regard to the limitations of the study, the sample is limited to only 10 clubs. This is therefore proposed as a starting point to be explored in the future, repeating the analysis with a larger sample. Another limitation has to do with the lack of information about players belonging to categories under U-17, with the exception of the Spanish clubs, even though it has not been included so as to have a homogeneous sample. This work could be repeated with all the age categories in Spain, even though in this country there are no football clubs listed or owned by public shareholders. For this reason, an analysis of RAE in Spain should be delimited to a comparison among football clubs—owned by members—and Sport Stock Corporations (*Sociedades Anónimas Deportivas*), owned by stakeholders. Finally, a third limitation has to do with the fact that the sample used has been taken at a specific moment, and its evolution over time has not been taken into account. In this regard, future research lines could analyse the evolution over time of clubs with public shareholders, such as PSG or Manchester City, in the years before and after the takeover, and in the future, the evolution of some clubs recently acquired with public funds, such as Newcastle, with regard to their youth academies.

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#### Data availability statement

Data is available under request to the corresponding author.

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