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Impact of Market Value, Roster Size, Arrivals and Departures on Performance in Iranian Men's Football

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Abstract: This research aims to study the effect of the sustainable management of human resources on performance. It examines the impact of market value, roster size, arrivals and departures on team performance in football. Regressions are tested based on data from clubs in the Persian Gulf Pro League—the first tier in Iranian men's football—over 2009–2022 ($n = 216$ observations). The results show that market value has a significant positive impact on team performance roster size and arrivals a significant negative impact, and departures no significant impact. When distinguishing departures between teams with a roster size below 33 players vs. 33 players and more, departures for roster size below 33 players have a significant positive impact vs. no impact for 33 players and more. To the best of the authors' knowledge, this study is the first to distinguish arrivals and departures when looking at staff turnover in football. It informs the need for a sustainable roster (not too many arrivals) and roster size (not too high) to perform on the pitch. The article highlights that departures can help reach a more sustainable roster size (if too high) and a better team performance, while also contributing to a sustainable financial management.

Keywords: sports performance; player value; firm size; staff turnover; Persian Gulf Pro League; performance management

1. Introduction

Football is a popular sport but also a big business [1]. Players are the most critical investments in professional football from both a sporting and a business perspective [2]. Relatedly, the most important decisions of football team managers are related to player transfers [1]. The money exchanged between clubs for the transfer of professional football players has grown considerably over time, with the current transfer fee record being GBP 199.8 m, set in 2017 when Paris Saint-Germain paid Barcelona for the transfer of Neymar. Therefore, the problem of estimating transfer fees has drawn the attention of economists, statisticians and operational researchers alike [3].

In parallel to this interest in players' transfer fees, researchers have paid increased attention to players' market values [4]. A player's market value can be seen as an estimate of the amount for which a team can sell the player's contract to another team [5]. However, Quansah et al. [6] considered that a player's market value is a theoretical construct that aims at approximating the current market price for releasing that player from an existing contract, irrespective of its remaining length or status. At the player level, Velema [7] stated that each extra move up leads to an additional increase in market value, and the negative impact of downward mobility decreases when players take up more important roles on their new team. Players' market values and the subsequent club market values are widely estimated by the German website Transfermarkt. Despite some limitations [1,8], these estimations benefit from a certain level of selectivity [9]. They have been used and shown

as a powerful predictor of team performance in previous literature [10,11], suggesting the relevance of including them in any attempt to explain team performance.

Another advantage of Transfermarkt is that it provides other information relevant to the potential sporting quality of a team and subsequent performance on the pitch that relates to the sustainable management of human resources. This includes roster size (i.e., the number of players in the squad) and staff turnover (i.e., the numbers of arrivals and departures). Roster size needs to be managed in a sustainable way in the sense that a size too small may lead to players too often fielded on the pitch and becoming tired as the season progresses, with a negative impact on performance, whereas a size too high may lead to players considering that they are not sufficiently regularly fielded on the pitch and becoming unhappy as the season progresses, with a negative impact on the overall level of happiness in the team and, subsequently, on performance. Coincidentally, staff turnover also needs to be sustainably managed, as too many changes may generate a lack of shared experience and understanding among players, with a negative impact on performance. Contrasting results have been found about the impact of roster size on team performance in previous football literature, with some authors finding a significantly negative impact [12,13] and other authors finding no significant impact [14,15]. This literature has used roster size mainly as a control rather than a key variable and has not carefully considered the reason for the results found, thus highlighting a gap in knowledge. This means that further development is needed for a better understanding and discussion of the impact of roster size on team performance. Moreover, previous football literature tends to find a negative impact of staff turnover on team performance [16–19]. However, it does not distinguish between arrivals and departures. In other words, there is a gap in knowledge around whether both arrivals and departures explain the negative impact of staff turnover on team performance, or only one of the two variables—or maybe even one of the two variables tends to compensate for the negative impact of the other variable. In line with the two gaps identified that relate to the specific research issues addressed in the study, the main aim of the present paper is to examine the effect of sustainable management of human resources (i.e., roster size, arrivals and departures) on performance. Accordingly, and given the relevance of also including market value, the first and main research objective and contribution of the present study is to test the impact of market value, roster size, arrivals and departures on team performance.

Additional research objectives and contributions of the current research relate to the specific case studied. Data about team performance, (club) market value, roster size, arrivals and departures are available for a large range of football leagues internationally on Transfermarkt, including leagues academically less studied such as the Persian Gulf Pro League, the highest tier in Iranian men's football. The Persian Gulf Pro League is one of the most competitive men's football leagues in Asia, as demonstrated by Iran being ranked fourth in the 2021 Asian Football Confederation (AFC) Club Competitions Ranking behind Saudi Arabia, South Korea and Japan, but ahead of Qatar, Uzbekistan and China. Two of its clubs (Esteghlal and Persepolis) are among the best in Asia [20]. Bahramfard et al. [17] and Hosseini Keshtan et al. [18] have found a negative impact of staff turnover on team performance in the Persian Gulf Pro League. However, they have neither distinguished between arrivals and departures, nor controlled for other variables such as roster size. Yet, the Persian Gulf Pro League has specific rules and regulations for transfers and player lists (described later in the paper) that can affect these variables and their subsequent impact on team performance, but also clubs' financial performance, hence making their examination relevant in its context. In line with this, the second research objective and contribution of the present study is to test the impact of market value, roster size, arrivals and departures on team performance in the Persian Gulf Pro League, thus adding to knowledge about a league overlooked so far in the literature.

Subsequently, the third research objective and contribution of the present study is to provide some managerial and policy recommendations relevant to the sustainability

of the Persian Gulf Pro League and its clubs from sporting competitiveness and financial perspectives, with the potential to be replicable in other leagues internationally.

The rest of the article is organised as follows. Section 2 provides the theoretical foundation of the research and reviews the literature on the impact of market value, roster size and staff turnover on team performance. Section 3 presents an overview of the Persian Gulf Pro League. Section 4 describes the method in terms of model, variables and data. Section 5 develops the results, including the estimation approach. Section 6 discusses the findings. Last, Section 7 concludes.

2. Theoretical Review and Hypothesis Development

2.1. Theoretical Review

The theoretical foundation providing support for the study's model comes from previous football literature using regression analyses to explain the determinants of team performance, with specific attention to the models developed by Gerhards and Mutz [10] and Gasparetto and Barajas [13]. Gerhards and Mutz [10] suggested that market value is a key factor to explain team performance. This is because teams fielding players with higher market value are supposed to be more skilled and, therefore, expected to perform better on the pitch. However, Gerhards and Mutz [10] assumed that market value is not the sole factor that should be considered, as variables related to team composition can also affect team performance. Specifically, factors related to homogeneity vs. heterogeneity between players (e.g., in terms of skills and culture) and staff stability vs. turnover can affect team performance, with the assumption that homogeneity and stability favour team performance. Accordingly, the theoretical foundation used in Gerhards and Mutz [10] relied on the distinction market value vs. team composition. Our own theoretical foundation also comes from this distinction, although our team composition variables are inspired not only by Gerhards and Mutz [10] but also by Gasparetto and Barajas [13]. These authors used roster size as a control variable, following Franck and Nüesch [12], who operated in a similar fashion and found a negative impact of this variable on team performance, a result confirmed by Gasparetto and Barajas [13]. In our study, roster size is considered a key rather than a control variable.

Gerhards and Mutz [10] explained team performance by market value, inequality within the team (i.e., differences in the market values of individual players), cultural diversity and team fluctuation (i.e., staff turnover), as well as the squares for each of the four variables. They found a significant positive impact of market value and cultural diversity, a significant negative impact of staff turnover and the squares of market value and cultural diversity, and no significant impact of the square of staff turnover as well as inequality within the team and its square. Gasparetto and Barajas [13] explained team performance by payroll, wage dispersion and its square, payroll moderated by wage dispersion and its square, age and its square, and number of players (i.e., roster size). They found a significant positive impact of payroll as well as the squares of wage dispersion and age, a significant negative impact of dispersion, payroll moderated by wage dispersion, age and roster size.

Both studies by Gerhards and Mutz [10] and Gasparetto and Barajas [13] found a significant positive impact of either market value or payroll. Since payroll is not available in the case studied in this paper (i.e., the Persian Gulf Pro League), we will include market value in our model. Gerhards and Mutz [10] found a significant negative impact of staff turnover, whereas Gasparetto and Barajas [13] found a significant negative impact of roster size. We will include these two variables in our model, adding a distinction between arrivals and departures for staff turnover, based on the rationale provided in the introduction aiming to address a gap in the literature. Gerhards and Mutz [10] found a significant positive impact of cultural diversity and a significant negative impact of its square. As control variables proxying cultural diversity, we will include the number of foreign players and its square in our model. Gasparetto and Barajas [13] found a significant negative impact of

age and a significant positive impact of its square. We will include both of them as control variables in our model.

2.2. Football Players' Market Value and Team Performance

Teams often have incomplete information about a player's statistics. Although some teams review players' sports performance on match-day, there is still considerable uncertainty about the specific contribution individual players make to the performance of their teammates and the team [7]. Therefore, evaluating a player's talent, skills and qualities is a time-consuming and expensive search process to collect information [21]. Over the last decade, it was identified that, even though some football clubs had begun to analyse data for training aims and making decisions about line-ups, only a few had identified the data's economic potential [22]. This number may have increased in the leagues generating the highest revenue worldwide; however, it is likely that in leagues generating less revenue such as the Persian Gulf Pro League, the use of data analytics is still in its infancy.

Transfermarkt can help clubs access valuable information about themselves, their opponents and their players that could potentially add something to their squad. This website started to collect data from teams and players statistics in Germany in 2000, before extending its international reach both in terms of leagues analysed and languages available [9]. As mentioned by Frick et al. [9] (p. 4), Transfermarkt is "a crowd-driven online platform whose registered users discuss and express their opinions about, among other things, the market values of players in designated forums". One of the most important statistics that this website collects is data about players' market values. These market values give valuable information to potential selling and buying clubs, even for those players whose contracts have not been sold recently. While transfer fees offer actual prices paid on the market, market values provide estimates of transfer fees; therefore, they can play an important role in transfer negotiations [1]. If the assumption holds that the market value of a player reflects his athletic ability, then the most expensive players, i.e., those for whom the highest transfer fees are paid, should be the best players [10].

Some researchers have emphasized players' market values as determined by human capital indicators and prior performance measures [5,23]. Other studies have analysed the impact of mobility on players' market value [7,24]. Furthermore, some scholars have studied the effect of club market value (i.e., the sum of their players' market value) on team performance and competitive balance [11], which is directly relevant to the present study. For example, Gerhards and Mutz [10] stated that success in national football championships is highly predictable. They found that the market value of a team is by far the most important single predictor. Accordingly, in our study, Hypothesis 1 is:

Hypothesis 1. *Players' market value has a significant positive impact on team performance in Iranian men's football.*

2.3. Roster Size and Team Performance

Previous research has measured firm size in different ways. In traditional industries, three main metrics are often employed: number of employees, total assets and total revenue. Gasparetto and Barajas [13] argued that total revenue would be an appropriate metric for measuring firm size on football. Based on the win maximization hypothesis according to which football clubs aim to win on the pitch rather than to make profit [25], Gasparetto and Barajas [13] considered that payroll can replace total revenue (since clubs tend to spend all their available financial resources on playing talent) as an indicator of financial strength or club size and used it to explain team performance. Other studies have emphasized the role of financial resources on sports performance [26,27]. By contrast, Gasparetto and Barajas [13] believed that the number of employees and total asset are not suitable to reflect the firm (club) size in a professional football setting. For the number of employees, their rationale was that "the production function of a football club is essentially different than in a normal firm. An identical and limited number of employes (eleven players in a starting

lineup and a limited number of substitutions per team) is required to produce a sports good (match), which makes such metric not valid for assessing firm size on that setting" [13] (p. 549). Yet, the authors use the number of players in the squad in their regression model.

Although there are indeed only 11 players per team on the pitch and a limited number of substitutions allowed during a game, it can be argued that roster size (the number of players in the squad) is still relevant to team performance and, therefore, can be considered as a suitable indicator. If the number of players in the squad is too low, there are some potential consequences likely to have a negative impact on team performance: the head coach may find it challenging to select players in case of injuries for several of them or may have to fill players that are not in good physical condition, and players may not be incentivized to produce their maximum effort due to the lack of competition and not play at their best. Similarly, if the number of players in the squad is too high, there are also some potential consequences likely to have a negative impact on team performance: too many players may lead to coordination issues and not all players can play, so there may be some potential unhappiness for the players not playing regularly, which may ultimately affect the cohesiveness and relationships between players, as well as between players and the head coach. This suggests the need to build a squad based on an appropriate number of players, rather than a number as high as possible. Accordingly, contrasting results have been found about the impact of roster size on team performance in the previous football literature, with some authors finding a significantly negative impact [12,13] and other authors finding no significant impact [14,15]. In the Persian Gulf Pro League, the average roster size was 34.58 players over the period studied (2009–2022). We assume that this average number representing more than three teams of 11 players is too high compared to what is needed, with a negative impact on team performance as per the explanations developed above. Accordingly, in our study, Hypothesis 2 is:

Hypothesis 2. *Roster size has a significant negative impact on team performance in Iranian men's football.*

2.4. Staff Turnover and Team Performance

In professional football, staff (player) turnover is linked to players' transfers. These can be seen as the primary sources of interorganizational partnership relations [28], although the notion of partnership should be qualified given the complex nature of the player transactions between clubs that can be considered as either economic vs. sporting cooperation or competition [29]. Players' transfers can have various influences on sports organizations [28]. They can be the reasons for providing coopetition activities between clubs [30]. Moreover, the transfers mainly affect the organizational structures of the clubs by changing their cross-cultural abilities [31]. In their study of Italian clubs over the 2007–2017 period, Dimitropoulos and Scafarto [32] found that the net annual transfer investment had no significant impact on team performance when considering the entire period; however, its impact became significantly positive from 2011 onwards, when UEFA financial fair play (FFP) was implemented. The authors interpreted this finding as the result of more efficient decision-making on player transfer issues because the FFP regulation constraints clubs not to make financial losses.

At the player level, professional football players use their transfers between teams to develop a career trajectory that favours their qualities, skills and value to the market [7]. This has been facilitated after the adoption of the 2003 transfer market regulations liberalizing football's labour market [33]. Employment spells are relatively short, with players staying at the same club for around one or two years before moving to a new employer [7]. At the club level, this high mobility of professional football players leads to high staff turnover, which can jeopardize team stability and performance. Accordingly, negative impacts of arrivals and departures on team performance can be expected, consistent with previous literature [10,16–19]. These previous results specific to football are consistent with findings in other sports and sectors. In the National Basketball Association (NBA),

Berman et al. [34] showed that high turnover in a team can disrupt the ability of its members to draw on experientially constructed behavioural patterns to operate in a synchronous fashion. In the film industry, Delmestri et al. [35] showed that when teams are characterized by low turnover, team members are able to interact with each other over time and construct the stable patterns of behaviour required for successful mutual adjustment. Specifically in football, Gerhards and Mutz [10] (p. 230) suggested that "Routines and implicit understanding require a lot of training and very good knowledge of one's teammates. High fluctuation in the squad can hamper the establishment of routines, cause coordination problems, and might have a negative impact on team performance and success".

However, the previous literature does not distinguish between arrivals and departures; hence, it does not explain explicitly how and why both aspects affect team performance. For arrivals, a negative impact can be expected because too many new players means that they need some time to fit in with the team and understand how other players play, which is highly detrimental in a fast game such as football where decisions need to be made quickly. For departures, a negative impact on team performance may be expected because a club may lose its best players. Nevertheless, departures may help reduce a large roster size, in which case they may have a positive impact on team performance. Similarly, arrivals may help reach a roster size sufficiently large. In the Persian Gulf Pro League, the average numbers of arrivals and departures were between 18 and 19 players over the period studied (2009–2022). We assume that the average number of arrivals is too high, with a negative impact on team performance, while departures may have helped reduced a large roster size, with a positive impact on team performance, as per the explanations developed above. Accordingly, in our study, Hypotheses 3, 4a and 4b are:

Hypothesis 3. *The number of arrivals has a negative impact on team performance in Iranian men's football.*

Hypothesis 4a. *The number of departures has a positive impact on team performance in Iranian men's football.*

Hypothesis 4b. *The number of departures has a positive impact on team performance in Iranian men's football if it helps reach a sustainable (smaller) roster size.*

3. Overview of the Persian Gulf Pro League in Iran

Before the 1970s, Iran did not have an official national men's football league. Since 1970, the Iranian men's football first tier has held five titles: Local League (1970–1972), Takht Jamshid League (1973–1979), Qods League (1989–1990), Azadegan League (1991–2001) and Iran Pro League/Persian Gulf Pro League (since 2001: Iran Pro League 2001–2006, Persian Gulf Pro League since 2006). The number of teams and the competition format have changed over time [36]. Since 1995–1996, a single group and round has been in place, with the number of teams ranging from 12 in 2000–2001 to 18 from 2007–2008 to 2012–2013. Since 2013–2014, the number of teams is 16, with two teams being promoted from/relegated in the Azadegan League (the second tier since 2001–2002) since 2015–2016. The Iranian Football Federation established a professional men's football league in 2001–2002 [37]. Over the 21 seasons played at the time of writing (i.e., up to 2021–2022), Persepolis was champion seven times (including five times in a row from 2016–2017 to 2020–2021), Sepahan five times (the last time in 2014–2015), Esteghlal Tehran four times (including 2021–2022), and Foolad Khuzestan twice (the last time in 2013–2014), while Pas Tehran (2003–2004), Saipa (2006–2007) and Esteghlal Khuzestan (2015–2016) won once.

The establishment of a professional men's football league in Iran in 2001–2002 needs to be contextualized in the broader Asian football context at the time. After choosing South Korea and Japan as hosts for the 2002 men's football World Cup, the Fédération Internationale de Football Association (FIFA) and the AFC improved the situation of Asian football and its member associations so that they could operate on a much broader scale

than hitherto [20]. This is exemplified by the case of the AFC Champions League. This is an annual continental club men's football competition that the AFC administered as the Asian Champion Club Tournament from 1967 to 1972, and then the Asian Club Championship from 1985–1986 to 2001–2002. Only domestic champions took part in the competition over 1967–2002, except for the national association of the title holder, allowed to enter two teams. The competition was rebranded as the AFC Champions League in 2002–2003, with the best national associations (including Iran) being allowed initially two teams before this number increased to four, similar to its European counterpart [38]. At the time of writing (2022 edition ending in May 2023), one to four top teams of 24 national associations (out of 47 in the AFC) are present in the AFC Champions League. Iran was supposed to have four teams in 2022; however, two teams (Esteghlal Tehran and Persepolis) were declared ineligible to participate because they did not satisfy the mandatory criteria of the AFC Club Licensing Regulations [39]. Four teams for Iran means that the top three to four teams in the Persian Gulf Pro League qualify (or are supposed to qualify), depending on whether the Hazfi Cup (Iranian cup) winner belongs to these top three or four teams.

The Iranian Football Federation announces the rules and regulations for transfers and player lists in Iranian leagues annually. Over 2009–2022, each Persian Gulf Pro League club was allowed to take up to six to seven new Iranian players from the other clubs who already played in the league the previous season. Additionally, each club was allowed to take up to two to three free agents (i.e., players who did not play in the league the previous season), to take new youth players (under 23, 21 and 19 years old), and to take up to four new foreign players, including a slot for a player from AFC countries. This number of four foreign players including one from AFC was the maximum over the period. Iranian football clubs were allowed to have up to 35 players in their player lists until 2016–2017 (18 adult players without age limit, 9 under 23 players and 8 under 21 players); however, their number of players having belonged to the club over the season could be higher due to the existence of a winter transfer window in addition to the summer transfer window. In 2017–2018, the number of players increased to a maximum of 57 (18 adult players without age limit, 9 under 23 players, 15 under 21 players and 15 under 19 players), before reducing to 45 in 2018–2019 and 2019–2020 (18 adult players without age limit, 3 under 25 players, 9 under 23 players and 15 under 21 players), and then increasing to 63 from 2020 to 2021 (20 adult players without age limit, 4 under 25 players, 9 under 23 players, 15 under 21 players and 15 under 19 players). The age restrictions may have impacted the average age of the players in the different clubs. This variable will be included as a control variable in our study.

According to the Deloitte economic report, which determines the amount of income for the richest teams worldwide every year, the three primary sources of income are the sale of television broadcasting rights, ticket sales and commercial activities; see, e.g., Deloitte [40]. However, Iranian football clubs do not have any share of the income from broadcasting rights. Clubs such as Persepolis, Esteghlal Tehran and Tractor sometimes draw 90,000 spectators to the stadium. However, even with many spectators for some games for these teams, the average league attendance was most of the time below 10,000 people per game over 2009–2022. At the same time, the best European men's football leagues (England, France, Germany, Italy and Spain) have an average of 22,500 to 45,000 spectators per game [41]. Furthermore, most teams in Iran have low stadium attendance and are therefore largely deprived of ticket sales [42]. Among the business activities, one of the only ways to generate income for Iranian clubs is to use sponsorship and financial support. Nevertheless, only a few teams can earn a reasonable income this way, and the rest cannot conclude appropriate financial contracts due to the lack of spectators and fans. This is consistent with the idea that, in the Persian Gulf Pro League, the teams have historically had a low ability to generate income [43].

These problems have led to five clubs being dissolved over 2009–2022, the period studied in the present article (Steel Azin in 2012, Gostaresh Foolad and Saba Battery Qom in 2018, Shahrdari Tabriz in 2020, and also Esteghlal Ahvaz in 2020 but it was established again in 2021 and currently plays in the third division). Moreover, these economic and financial

difficulties make clubs unable to hire high-quality foreign players in the league during the transfer season, hence limiting the internationalization of the league [44]. It remains to be seen if foreign players in the Persian Gulf Pro League are of sufficient standard to make a difference compared to Iranian players. The number of foreign players per club will be included as a control variable in our study.

4. Method: Model, Variables and Data

4.1. Model and Variables

Similar to previous studies explaining team performance by several variables and in particular the sources used for our theoretical foundation, this study uses an econometric model specification. The following equation is estimated:

$$TP_{it} = \beta_0 + \beta_1\,MV_{it} + \beta_2\,RS_{it} + \beta_3\,AR_{it} + \beta_4\,DE_{it} + \beta_5\,AG_{it} + \beta_6\,(AG_{it})^2 + \beta_7\,FP_{it} + \beta_8\,(FP_{it})^2 + \mu_i + \tau_t + \varepsilon_{it} \qquad (1)$$

TP represents team performance, MV market value, RS roster size, AR arrivals, DE departures, AG and AG^2 age and its square, FP and FP^2 foreign players and its square, μ unobserved heterogeneity across clubs, τ yearly effects and ε the error term. The dependent variable TP_{it} corresponds to the points collected by club i in season t divided by the average points collected by all clubs that season; MV to the players' market value of club i in season t divided by the average players' market value for all clubs that season; RS to the total number of players AR to the total number of arrivals to the club; DE to the total number of departures from the club; AG the average age of the players in the squad; and FP the number of foreign players in the squad. All data were collected from the website Transfermarkt (https://www.transfermarkt.com/, accessed on 26 April 2023).

The rationale for the use of points collected by a club in a given season divided by average points for all clubs in that season is that the number of clubs and points in the league evolves over time, making the use of points collected unreliable if we do not control for the average in a particular season. For example, it is more challenging to collect 60 points in a season with 16 clubs (maximum number of points per club = 90) than with 18 clubs (maximum number of points per club = 102).

The rationale for the use of players' market value for a club in a given season divided by average players' market value for all clubs in that season is that the league average of players' market value per season is likely to increase as a consequence of inflation in transfer fees internationally, making the use of players' market value unreliable if we do not control for the average in a particular season. For example, the same players' market value may correspond to one of the highest values in the league at the start of the period and one of the lowest values at the end.

AG, AG^2, FP and FP^2 are used as control variables. Contrasting results are found for age in the literature, e.g., Maderer et al. [14] found no impact on team performance, while Gasparetto and Barajas [13] found a negative impact until reaching a certain age and then a positive impact above that age, i.e., a positive sign for the square of age. The authors interpreted their result as indicating an optimal average age in the squad about 27 years old; however, it must be noted that this is more specifically the average age when team performance is the lowest. FP is used as a proxy for more sophisticated measures such as cultural diversity [10,14], for which contrasting results are found in the literature, with Maderer et al. [14] finding a negative impact on team performance and Gerhards and Mutz [10] finding a positive impact until reaching a certain cultural distance and then a negative impact above that cultural distance.

Table 1 provides an overview of the variable measurements.

Table 1. Variable measurements.

Variables	Measurements
Team performance	Clubs' points/Average points in the league that season
Market value	Players' market value of the club/Average players' market value of all clubs in the league that season
Roster size	Number of players in the squad
Arrivals	Number of arrivals to the club
Departures	Number of departures from the club
Age	Average age of players in the squad
Foreign players	Number of foreign players in the squad

4.2. Data

This study used panel data. The panel data combine time-series and cross-sectional dimensions, thus eliminating many of the disadvantages of cross-sectional or time-series data. Panel data capture more social and economic information, and significantly avoid biased estimates caused by ignoring variables [45]. In the current research, panel data were built based on 13 seasons from 2009–2010 to 2021–2022 in the Persian Gulf Pro League, with 18 clubs for each season for the four initial seasons and then 16 clubs for each season for the last nine seasons. Therefore, this study has $4 \times 18 + 9 \times 16 = 216$ observations. The rationale for starting in 2009–2010 rather than earlier is that this is the first season for which data provided by Transfermarkt are reliable for the Persian Gulf Pro League. In 2008–2009, there are a few clubs with a roster size unrealistically low, e.g., Malavan of Bandar Anzali had only eight players according to Transfermarkt. Diagnostic tests and regressions were conducted with Stata/MP 17.0. They are presented in the next section, together with their results. Although the diagnostic tests and regressions are part of the method implemented, developing them here would lead to redundancies between the method and results sections, hence the choice to introduce them later.

5. Results

5.1. Descriptive Statistics

The descriptive statistics for the variables analysed in the present study are in Table 2. Team performance is 1.32 points per game on average, with the ratio between the highest and lowest score being more than 5.5. The market value is more than EUR 7 m on average, with the ratio between the highest and lowest value being almost 88, suggesting large differences. The roster size is 34.58 players on average (the median, not displayed in Table 2, is 34 players), with the ratio between the highest and lowest numbers being 2.24. The number of arrivals is 18.83 players on average, with the ratio between the highest and lowest numbers being 9.5, suggesting important variations. The same applies to the number of departures, which is 18.17 on average, with the ratio between the highest and lowest numbers being 22. Age is 26.01 years old on average, with the ratio between the highest and lowest values being 1.20. The number of foreign players is 2.52 on average, ranging from 0 to 4 (the maximum number allowed in the Persian Gulf Pro League).

The descriptive statistics presented above and in Table 2 provide an overview over the entire period studied. However, the fact that 13 seasons are covered means that there may be some variations over time, e.g., in terms of players' market value. Therefore, the evolution of the key variables (market value, roster size, arrivals and departures) is analysed from 2009–2010 to 2021–2022 in the next step before presenting and commenting on the diagnostic tests and regression results.

Table 2. Descriptive statistics.

Variables	Mean	Standard Deviation	Minimum	Maximum
Team performance (in points)	1.32	0.40	0.4	2.27
Market value (in EUR)	7,099,491	4,181,924	225,000	19,730,000
Roster size	34.58	5.57	25	56
Arrivals	18.83	5.78	4	38
Departures	18.17	6.49	2	44
Age	26.01	0.95	23.6	28.4
Foreign players	2.52	1.48	0	4

Notes: team performance corresponds to clubs' points per game rather than clubs' points; this is to control for the different number of teams and points allocated across seasons. Market value corresponds to the actual values. For these two variables, displaying, respectively, the means for clubs' points/average points in the league that season and players' market value of the club/average players' market value of all clubs in the league that season would not make sense since, by definition, these means are equal to 1. The number of foreign players has been retreated compared to the values provided by Transfermarkt. This is because Transfermarkt includes all the foreign players who belong to a club at some point during a season, with 35 occurrences where the number of foreign players was over four despite their number being limited to four. Other values are based on players having belonged to the club at some point during a season.

5.2. Evolution of Key Variables over 2009–2022

Figure 1 shows that the average players' market value tended to regularly increase from 2009–2010 to 2018–2019, in particular from 2011–2012 to 2012–2013, before going slightly down towards the end of the period. This evolution confirms that using the actual players' market value would bias the results in the regressions, hence justifying the use of players' market value of the club/average players' market value of all clubs in the league that season.
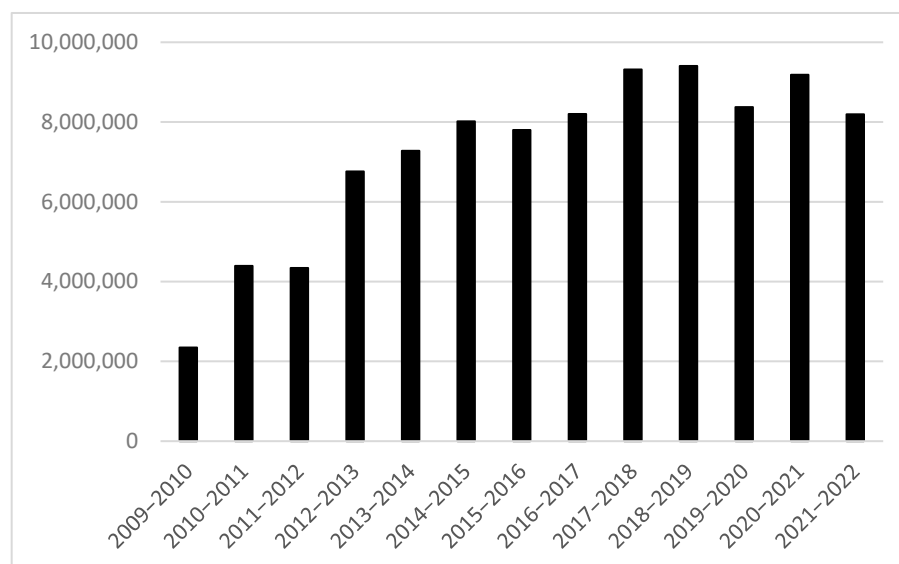

Figure 1. Average players' market value (in EUR).

Figure 2 shows that the average roster size also tended to regularly increase from 2009–2010 to 2017–2018, when the Iranian Football Federation allowed up to 57 instead of 35 players. The average roster size went slightly down towards the end of the period, having in mind that the maximum number of players also went down from 57 to 45 in 2018–2019 and 2019–2020, before increasing to 63 from 2020 to 2021. However, the average roster size towards the end of the period did not go back to the lower averages towards the start of the period, when the average roster size was below 35 players, consistent with the

limitation imposed by the Iranian Football Federation (although some teams still had more than 35 players having belonged to the club at some point during the season). The increase in the average roster size over time may mean a less sustainable management of human resources for the clubs driving the rise leading to lower team performance.
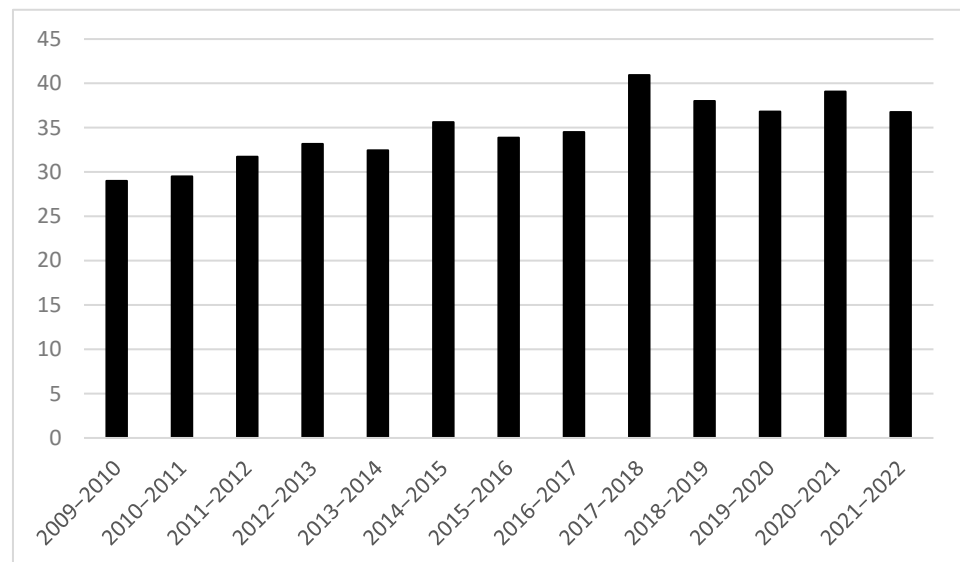

Figure 2. Average roster size.

Figure 3 shows that the average number of arrivals tended to regularly increase in the first part of the period, moving from fewer than 15 in 2009–2010 and 2010–2011 to more than 20 in 2014–2015. The evolution is less regular in the second part of the period, with the average number of arrivals moving up and down around 20. This number can be deemed high in the context of football, where only 11 players can be fielded at a time.
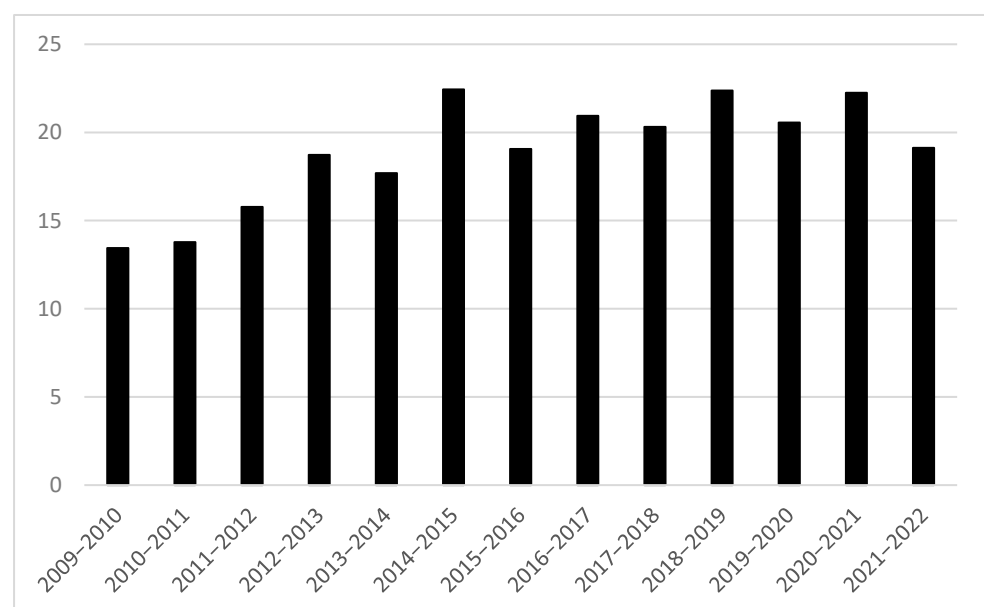

Figure 3. Average arrivals.

Similar to the average number of arrivals, Figure 4 shows that the average number of departures tended to increase over the first part of the period, moving from fewer than 15 in 2009–2010, 2010–2011 and 2011–2012 to more than 20 in 2014–2015. The evolution is less

regular in the second part of the period, with the average number of departures moving up and down around 20. As for the average number of arrivals, the average number of departures can be deemed high in the context of football, where only 11 players can be fielded at a time. However, if the departures allowed clubs to remove players not regularly fielded, and hence unhappy, while reaching a more sustainable roster size, they may have had a positive impact on team performance.
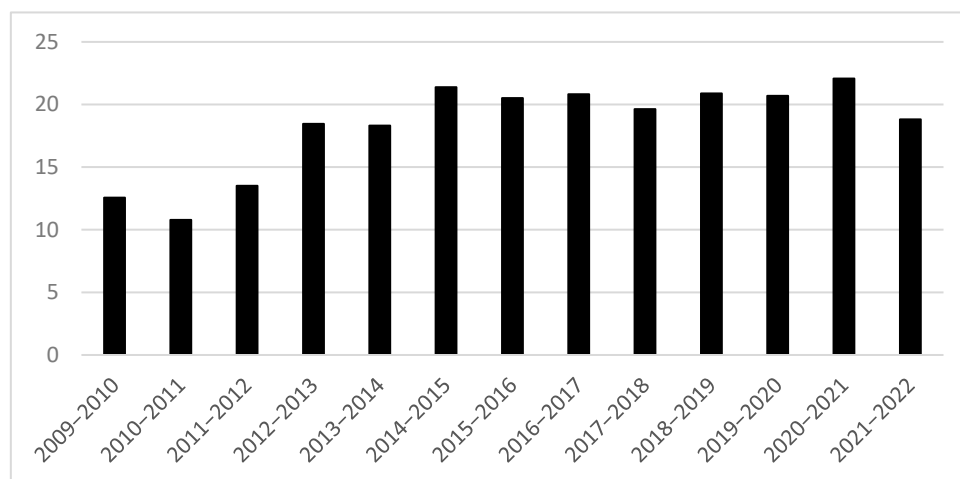

Figure 4. Average departures.

5.3. Estimation Approach: Diagnostic Tests and Regression Results

Due to the panel structure of the data, a Fisher-type unit root test was first undertaken, leading to four different statistics, i.e., the inverse chi-squared P, the inverse normal Z, the inverse logit L* and the modified inverse chi-squared Pm. Choi [46] suggested that Z offers the best tradeoff between size and power. This statistic was significant (Z = −1.7366, *p*-value = 0.0412), a result confirmed by the inverse logit L* (L* = −1.8827, *p*-value = 0.0313), hence suggesting the absence of unit roots.

In terms of econometric modelling, fixed and random effects regressions were tested. F tests for the fixed effects regressions were all significant, suggesting that team effects regressions should be favoured over pooled OLS (see Table 3 for the results of the F tests and subsequent diagnostic tests). Hausman tests showed that the fixed effects regressions should be favoured over the random effect regressions. The heteroscedasticity tests then indicated that the regressions had to be corrected for heteroscedasticity. Furthermore, autocorrelation tests highlighted the presence of autocorrelation. For the cross-dependence tests, the command xtcd2 was used in Stata. This command displays four statistics, i.e., the CD test (CD), the weighted CD test (CD$_w$), the power enhanced CD$_w$ test (CD$_{w+}$) and the bias-corrected CD test (CD*). Based on Ditzen [47], the use of CD$_w$ and CD* was favoured. The tests did not indicate cross-dependence for residuals; hence, there was no need to conduct regressions with Driscoll–Kraay standard errors. Therefore, fixed effects regressions robust to heteroscedasticity were used. These regressions control for autocorrelation, despite Hoechle [48] suggesting distinguishing between fixed effects regressions robust to heteroscedasticity only and to both heteroscedasticity and autocorrelation, since both types of regressions provide the same results.

Table 3. Regression results.

	Model 1 with Departures	Model 2 with Departures 35− vs. Departures 35&+	Model 3 with Departures 33− vs. Departures 33&+
Market value	0.155 *** (0.047)	0.154 *** (0.048)	0.149 *** (0.046)
Roster size	−0.006 * (0.004)	−0.003 (0.004)	−0.002 (0.004)
Arrivals	−0.012 *** (0.004)	−0.011 ** (0.005)	−0.011 ** (0.004)
Departures	0.004 (0.004)		
Age	−1.998 *** (0.631)	−1.951 *** (0.638)	−1.954 *** (0.644)
Age^2	0.038 *** (0.012)	0.037 *** (0.012)	0.037 *** (0.012)
Foreign players	0.069 * (0.040)	0.070 * (0.039)	0.069 * (0.040)
Foreign players^2	−0.012 (0.009)	−0.012 (0.009)	−0.012 (0.009)
Departures 35−		0.005 (0.004)	
Departures 35&+		0.003 (0.004)	
Departures 33−			0.007 * (0.004)
Departures 33&+			0.003 (0.004)
Constant	27.555 *** (8.259)	26.825 *** (8.328)	26.817 *** (8.421)
Observations	216	216	216
R^2 within	0.2670	0.2713	0.2787
R^2 between	0.5031	0.4932	0.4696
R^2 overall	0.4990	0.4997	0.5011
Team effects vs. pooled OLS (F)	2.34 ***	2.35 ***	2.36 ***
Hausman test (chi2)	58.40 ***	53.87 ***	55.45 ***
Heteroscedasticity test (chi2)	2.6×10^{32} ***	6.4×10^{32} ***	3.2×10^{32} ***
Autocorrelation test (F)	16.008 ***	14.153 ***	11.582 ***
Weighted cross-dependence test (CD$_w$)	−0.55	0.79	1.11
Bias-corrected cross-dependence test (CD *)	0.37	0.37	0.37

Notes: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. Standard errors are displayed in brackets. All models are fixed-effects regressions corrected for heteroscedasticity. In the first row and the first column of the table, − means 'below' (e.g., 35− means below 35) and &+ means 'and more' (e.g., 35&+ means 35 and more). In the first column of the table, ^{2} is used for square (e.g., Age^2 means the square of age).

Table 3 presents the results of the regressions conducted. Model 1 corresponds to the earlier Equation (1). Its results show a significant positive impact of market value, the square of age and foreign players on team performance, a significant negative impact of roster size, arrivals and age, and no significant impact of departures and the square of foreign players. These results confirm that better players (represented by a higher players' market value) lead to better team performance (H1 confirmed). They also suggest a negative impact of a number of players in the squad too high (H2 confirmed), which can be associated to the subsequent issues in terms of cohesiveness and relationships between players, as well as between players and the head coach. The negative impact of arrivals

confirms that having too many new players means they need some time to fit in with the team, with a negative impact on performance (H3 confirmed). The nonsignificant impact of departures does not confirm H4a; furthermore, it does not address H4b since it does not inform about the subsequent roster size and whether it is sustainable (smaller) or not, hence the test of additional models (2 and 3) presented afterwards. The results for age and its square suggest that an average age of the players in the squad around 26.5 years old corresponds to the minimum, i.e., team performance is the lowest when age is at this level. The results for foreign players and its square suggest that an average number of foreign players around 2.8 corresponds to the maximum, i.e., team performance is the highest when the number of foreign players is at this level. A team cannot have 2.8 foreign players, so it is safe to conclude that a number of three foreign players is optimal. A fourth foreign player decreases team performance; however, this is not significant.

Model 2 corresponds to model 1; however, the variable departures is replaced by departures for squads below 35 players (Departures 35−) vs. departures for squads with 35 players and more (Departures 35&+). The rationale is the initial expectation that departures may have a positive impact on team performance if this helps reach a more sustainable (smaller) roster size; yet, considering the number of departures alone is not enough, there is also the need to observe whether the roster size is small enough. In other words, a positive impact on team performance can be expected for Departures 35− but not for Departures 35&+. The choice for below 35 players vs. 35 players and more is based on the average roster size over the period studied, which is equal to 34.6 players. In model 2, club size has no significant impact on team performance anymore. The same applies both to Departures 35− and Departures 35&+; however, Departures 35− is close to a significant positive impact at the 10% level. The same results (not displayed in Table 3 for the sake of conciseness but available upon request) are obtained when replacing Departures 35− and Departures 35&+, respectively, with Departures 34− and Departures 34&+, i.e., departures for squads below 34 players vs. departures for squads with 34 players and more (the rationale for 34 being that this corresponds to the median in our sample).

In model 3, when replacing Departures 35− and Departures 35&+, respectively, with Departures 33− and Departures 33&+, i.e., departures for squads below 33 players vs. departures for squads with 33 players and more (the rationale for 33 being that this corresponds exactly to three teams of 11 players), Departures 33− has a significant positive impact on team performance at the 10% level, while this is not the case for Departures33&+. This confirms that departures have a positive impact if they help reach a more sustainable (smaller) roster size (H4b confirmed).

6. Discussion

6.1. Comparison of Findings with Previous Literature

In the present research, we investigated the impact of market value and the sustainable management of human resources (i.e., roster size, arrivals and departures) on team performance in Iranian men's football, while controlling for age and foreign players, hence addressing our main aim and first research objective and contribution.

The study showed a significant and positive impact of players' market value on team performance (H1 confirmed). This result is consistent with the previous literature [10,11]. The market values of players and the methodology of their calculation are much-discussed topics among the public and experts. Their crowd-driven nature has been criticized in academia [1]. However, the selective process leading to these values is supposed to provide them with a certain level of reliability [9].

Our research also showed that roster size has a negative and significant effect on team performance; hence, increasing the roster size leads to a decrease in team performance (H2 confirmed). This result is in the line with Franck and Nüesch [12] and Gasparetto and Barajas [13], but opposite to Maderer et al. [14] and Tertuliano et al. [15], who found no significant impact of roster size.

Our research also showed that there is a significant negative effect of arrivals on team performance, suggesting that more arrivals lead to a decrease in team performance (H3 confirmed). This result was expected in the sense that too many new players means they need some time to fit in with the team, understand their new teammates, establish routines and reach an appropriate level of collaboration and coordination, consistent with previous literature such as Gerhards and Mutz [10], as well as Bahramfard et al. [17] and Hosseini Keshtan et al. [18], more specifically in the context of the Persian Gulf Pro League. However, previous studies suggesting that team stability should be favoured over team fluctuation did not differentiate between arrivals and departures.

Our research found no significant impact of departures on team performance overall (H4a not confirmed); however, it found a significant positive impact of departures when they help reach a more sustainable roster size, i.e., fewer than 33 players (H4b confirmed).

6.2. Theoretical, Managerial and Policy Implications

Our findings have a number of implications, including for the Persian Gulf Pro League, hence addressing the second and third research objectives and contributions of the current study.

First, one may have wondered whether the market values of players would have a significant positive impact on team performance for competitions outside the very best leagues worldwide. Our study suggests that using players' market values in leagues such as the Persian Gulf Pro League leads to consistent and trustable results. Furthermore, this variable was strongly significant, suggesting that not incorporating it may lead to an econometric model specification not sufficiently reliable, which may question the subsequent regression results. Since players' market values are widely available through Transfermarkt, while proxies such as revenue, payroll and transfer fees are more difficult to access internationally (revenue and payroll) or potentially based on unofficial estimation if not officially disclosed (transfer fees), we suggest that players' market values should be automatically included in team performance models when proxies are not available or reliable.

Second, our findings inform the optimal roster size in football. In the sample analysed in the present study, roster size varies from 25 to 56 players. Arguably, 25 players may be sufficient in football, as this allows to have each of the 11 positions covered by two players (22 players overall), while also allowing to have a third goalkeeper and two additional players able to cover for injuries and lack of form from other players. Of course, some teams may need more players if they are engaged in different competitions (e.g., if they also take part in the AFC Champions League) and/or have many injuries. They may also have more players if they rely heavily on new young players, whose ability to play at the highest level may not be at the standard expected. However, our study showed that, in general, clubs should aim for a roster size not too high, suggesting the need to carefully assess this dimension for a sustainable management of human resources. If the roster size is too high, a number of players will not play much or at all; hence, they will be unhappy. This, in turn, will deteriorate the relationships among the team, which is a sign of unsustainable management of human resources. Furthermore, a high roster size means the need to pay many players, which may not be financially sustainable. This is an important consideration in a context where Iranian men's football clubs have encountered economic and financial difficulties. The Iranian Football Federation may consider our findings when deciding the maximum number of players per club. This number is currently 63, with 33 players over 21 years old and 30 players under 21 years old. Interestingly, 33 players are the boundary for which departures leading to a roster size under this number of players have a significant positive impact on team performance in the fixed effects regressions tested in our research. The Iranian Football Federation may aim for a maximum number of players closer to 33, having in mind that it used to be 35 in the past. However, the impact on the opportunities for under 21 years old to play needs to be considered, as this is another important dimension of the sustainable management of human resources.

Third, our study also indicated that the effect of departures on team performance is not significant overall. Nevertheless, a rationale as to why a significant impact of departures could be expected is that it could help reduce the roster size to a more suitable (smaller) level, i.e., departures could be expected to have a positive impact on team performance if it leads to a more sustainable roster size. This suggests the need to distinguish between departures leading to a sustainable roster size vs. departures not sufficient to lead to a sustainable roster size. When distinguishing between departures for squads below 33 players (Departures 33−) vs. departures for squads with 33 players and more (Departures 33&+), Departures 33&+ has no significant impact on team performance, while Departures 33− has a significant positive impact. This confirms that departures can be used to reach a more sustainable (smaller) roster size, with a positive impact on team performance.

Coincidentally, departures can also reduce the burden of a high payroll, hence contributing to a more sustainable financial management, which again is an important consideration in a context where Iranian men's football clubs have encountered economic and financial difficulties. However, this is probably a temporary rather than sustainable solution. In the first place, a team should properly manage its roster size to ensure its sustainability rather than using departures to make it sustainable.

7. Conclusions

7.1. Limitations and Directions for Future Research

It is acknowledged that the present research has some limitations, leading to future research directions.

First, we used the number of players having belonged to a team during a season as our proxy for roster size. Yet, the example of the number of foreign players having belonged to a team during a season being over four in 35 occurrences while this number is limited to four at a specific time underlines the limitation associated with our choice, i.e., the roster size tends to be overestimated compared to its maximum size at a given time during the season. Our rationale is that using too many players over a season, even if not all players belong to the club at the same time, is still relevant to capture coordination issues between players and potential unhappiness for players not playing regularly. As a robustness check, we tested our regression models with the roster size being retreated to remove any foreign players over a number of four. Our results were unchanged. However, we acknowledge that we could also have looked at non-foreign players departing during the season to better capture the roster size at a specific time, and we observe the impact on market value and average age compared to the values provided by Transfermarkt. Future research could control for these considerations.

Second, we did not control for the quality of the players involved in arrivals and departures. Future research could address this limitation by looking at the market value of the players involved and the subsequent impact on team performance.

Third, we found a significant impact of foreign players on team performance; however, this impact was significant only at the 10% level, while the square of foreign players had no significant impact. Future research could use more sophisticated measures of cultural diversity or distance, following, e.g., the indicators suggested by Maderer et al. [14] and Gerhards and Mutz [10]. The market value of foreign players could also be controlled for.

Moreover, we found that an average age of around 26.5 years old corresponds to the lowest team performance but did not investigate further why this is the case. The U-shape obtained for age may seem surprising, as one may rather expect an inverted U-shape, i.e., team performance increases until average age reaches a certain level, and then decreases. Future research could attempt to further explain this result, e.g., younger average age may be associated to young players in the squad having grown together and used to play with each other at youth level, with a positive impact of this sustainable management of young human resources on team performance; older average age may be associated with having 'old' (e.g., 30 years old and more) players in the squad continuing to become better and better. There is recent anecdotal evidence of players becoming better and better—or at least

sustaining a high level of performance—while aging, e.g., Messi became World Champion in 2022 while being 35 years old, and Benzema (in 2022) and Modric (in 2018) became Ballon d'Or for the first time while being, respectively, 35 and 33 years old. Age diversity in the squad could be another direction to further explain the impact of average age.

7.2. Concluding Remarks

Despite the limitations identified, the current study delivers the three contributions suggested in the introduction.

First, it adds to knowledge about the impact of market value and the sustainable management of human resources (i.e., roster size, arrivals and departures) on team performance. Specifically, it confirms the significant positive impact of market value in a league outside the very best leagues worldwide; it suggests a significant negative impact of roster size, which is thoroughly discussed while previous literature lacked such in-depth discussion; and it distinguishes the impact of arrivals and departures while previous literature looked at overall staff turnover, revealing a significant negative impact of arrivals and a significant positive impact of departures when they lead to a more sustainable roster size.

Furthermore, our research contributes to a better understanding of the determinants of team performance in the Persian Gulf Pro League, i.e., a league overlooked in the literature. These determinants are discussed in relation to the rules and regulations applied in that league.

Subsequently, our article provides some managerial and policy recommendations relevant to the sustainability of the Persian Gulf Pro League and its clubs from sporting competitiveness and financial perspectives, such as limiting roster size and using departures to do so, with the potential to be replicable in other leagues internationally.

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