Human Resources Turnover as an Asset Acquisition and Divestiture Process: Evidence from the UK Football Industry

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Abstract

We shed light on the drivers and consequences of turnover in human resources for the UK football industry. We employ an event study using daily panel data of player transfers for a group of listed UK football clubs. Our results suggest asymmetric wealth effects: the acquisition of players is associated with negative abnormal club stock returns while player sales have an opposite effect. According to our findings, shareholders perceive that football managers overpay to acquire human resources. Our discussion draws possible links to the corporate finance literature which deals with the purchase and sale of firms and assets.

JEL Codes: G34; G14; D22; Z21

Keywords: Human resources turnover, Asset acquisition and divestiture, Football industry, Event study

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1. Introduction

The present paper studies the stock market reaction to the announcement of player transfers within the UK football industry. This is related to a widely debated topic in the literature that examines the economic consequence of changes in human resources for a firm. Efforts to study this topic are limited by the very nature of human resources, which represent skills, knowledge, personal attributes, problem solving, decision-making and learning, all of which are notoriously difficult to isolate, define and measure. Notwithstanding, research has shown that various aspects of improvements in human resources can be associated with superior performance at both the employee and the firm level (see, for example, the arguments and papers cited by Davidson et al., 1996; Pfeffer, 1996). Most previous studies have concentrated on the effect of human resource aspects that can be easily measured, such as formal education, training, labour quality, managerial skills and satisfaction (e.g., see Griliches and Regev, 1995; Lynch and Black, 1995; Hitt et al., 2001; Edmans, 2007; Ton and Huckman, 2008). However, what the drivers and effects of investment in human talent are, largely remains an open question.

The professional sports industry is well suited for the purposes of our study, since it involves a human capital pool which may not be easily imitated or replaced and can contribute significantly to firm performance (Wright et al., 1995). Also, sports is the only research setting where we have extensive data about every production worker in the industry.[1] In particular, the UK football industry offers a number of advantages for our analysis. First, it is a labour-intensive, mature, homogeneous and largely commercialized industry. The success of a team principally depends on its players. Controlling for firm characteristics is not necessary since we focus on a single industry. Second, human capital is valued competitively and monitored in a direct and regulated basis on a liquid market. Liquidity is

[1] See Kahn (2000) for an excellent review of studies that employ the sports industry to study labor markets.

important since it prevents ‘liquidity discounts’ and improves market efficiency (see Schlingemann et al., 2002). Third, turnover in players receives wide publicity and detailed data is readily available. Overall, our approach is in the same spirit as the recent contributions of Hughes et al. (2010) and Desai et al. (2018) that respectively investigate the impact and the reasons of changes in the top management of a firm using data from the UK football industry.

In our empirical analysis, we undertake a robust event study methodology. Our results indicate that the acquisition of football players is associated with negative abnormal club stock returns around the date of the event while player sales have the opposite effect. The magnitude of these effects increases with the fee paid for the completion of the transfer. We also find that stock volatility declines around the transfer announcement date. Our findings indicate that investors assess that football club managers overpay to acquire human capital. The perceived overpayment can be driven by a “winner’s curse” effect, where competition among clubs to acquire human talent significantly drives the acquisition cost up (e.g., see Cassing and Douglas, 1980; Burger and Walters, 2008) or myopic investors that fail to correctly assess the long-term added value of football players (as implied by the theoretical model of Sloane, 1971).

Within the football economics literature, our work extends previous studies on the drivers and the effects of football manager changes (e.g., see Bruinshoofd and Ter Weel 2003; de Dios Tena and Forrest 2007; Bell et al., 2013). We differ in considering turnover in football players. More relevant to this work, Amir and Livne (2005) find that aggregate club investments in players are positively associated on an annual basis with share prices for UK football clubs. Amir and Livne find no association between these investments and accounting performance measures. Our paper takes a completely different perspective by studying the immediate reaction to individual turnover events using daily data.

More widely, the main contribution of this work is to provide evidence that investors can have a significant and immediate reaction to changes in human resources. Relevant research has only examined top management level changes and corporate lay-offs. The first literature finds that the market reaction to CEO turnover depends on the reasons underlying the managerial change (for a review of this literature, see Brickley, 2003). For example, Bonnier and Bruner (1989) report gains for shareholders of distressed firms around the announcement of CEO changes, while Dedman and Lin (2002) show that CEO turnover has adverse effects on firm value when CEOs leave the firm to take up another job.[2] Due to the special role of the CEO in the firm, such findings do not apply to changes in human resources outside the top echelon. The second literature documents a negative market reaction to employee layoff announcements, as these typically indicate a decline in the future investment opportunities of the firm (e.g., Hallock, 1998; Chen et al., 2001; Hillier et al., 2007). However, corporate layoffs usually occur for distressed firms and are not a representative example of the human capital changes in a typical firm.

Finally, our results can also be interpreted in the context of the more general framework of asset acquisition and divestiture. Our work considers football players as an intangible corporate asset to study the price effects of player acquisitions and sales. Such an approach allows us to use ideas, techniques and evidence from the corporate finance literature that studies how firm and asset acquisitions affect the value of the firm. Our findings can contribute to previous work on acquisition of firms that mainly consist of intangible assets. Arikan (2004) and Gerbaud and York (2007) provide evidence that such acquisitions tend to lead to negative abnormal returns. The latter study attributes this finding to the uncertainty about the value of the intangible assets. Our work provides consistent findings with these studies. In particular, we show that acquisition of specific intangible assets, i.e.,

[2] The effects of CEO turnover on stock prices are also examined by Furtado and Rozeff (1987), Weisbach (1988) and Warner et al. (1988), among others.

football players, tends to be associated with negative abnormal returns around the announcement of the acquisition.

2. Literature review and hypotheses

The literature on the links between human resources and firm performance is vast, spanning across fields such as economics, management, strategy, psychology, sociology, etc. In this paper, we examine the wealth effects of the turnover in human resources for UK football clubs by considering players as corporate intangible assets. The idea of human resources as an asset which can be valued using financial tools is certainly not new (see, for example, Weisbrod, 1961). It is also in line with the significant interest nowadays in measuring and reporting human resources along with other intangible assets (see Lajili and Zéghal, 2006). Treating human capital as a corporate asset allows us to assume a novel theoretical perspective of the human resources turnover process and treat it as part of the general process of asset acquisition and divestiture that takes place in the firm. In this context, laying-off (hiring) an employee is analogue to the divestment (acquisition) of an intangible corporate asset. This analogy allows us to study the consequences of human resources turnover building on the corporate finance literature that studies the wealth effects of firm or asset acquisitions and sales.

At the firm level, the extensive Mergers and Acquisitions (M&A hereafter) literature investigates the impact of acquisition announcements on the abnormal returns experienced by the shareholders of the acquiring firm, the target firm, or, both (for a review, see Martynova and Renneboog, 2008). On one hand, the consensus is that the shareholders of target firms experience significant gains around the announcement date, due to the high premium they receive (Asquith and Kim, 1982; Malatesta, 1983; Mulherin and Boone, 2000; Andrade et al., 2001). On the other hand, the shareholders of acquiring firms tend to experience losses or at best break even, either in the short run (Bradley et al., 1983; Franks and Harris, 1989; Walker, 2000; Sudarsanam and Mahate, 2003; Moeller, 2005), or, in the long run (Malatesta, 1983; Agrawal et al., 1992; Loughran and Vijh, 1997; Sudarsanam and Mahate, 2003) while there is evidence of increased managerial compensation following acquisitions (e.g., see Coakley and Iliopoulou, 2006).[3] These findings imply that there may be non-value-creating managerial motives behind acquisition decisions (Jensen, 1986; Roll, 1986; Shleifer and Vishny, 1989).

At the individual corporate asset level, the effects of divestitures and acquisitions depend on whether the asset is tangible or intangible (for an overview of this literature, see King et al., 2004). In the case of tangible assets, the evidence suggests positive wealth effects for both acquisitions and divestitures (Maksimovic ad Phillips, 2001; Mulherin and Boone, 2000; Warusawitharana, 2008). These effects can be explained in three ways. First, asset divestitures can help the firm concentrate on its core activities by reversing unsuccessful diversification (see John and Ofek, 1995; Berger and Ofek, 1999). Second, the market for tangible assets can result in the allocation of assets to firms that can operate them more efficiently (see Jain, 1985; Hite et al., 1987; Maksimovic and Phillips, 2001). Third, divestitures may reduce financial leverage and relieve the firm from credit pressure (see Afshar et al., 1992; Lang et al., 1995; Lasfer et al., 1996; Shleifer and Vishny, 1997). In the case of intangible assets, the evidence suggests that the effects are likely to be asymmetric. For example, Arikan (2004) finds that acquisitions of target firms that mainly constitute of intangible assets produce negative abnormal returns while acquisitions of firms with mostly tangible assets tend to break even. It is argued that this is because intangible resources are less likely to be effectively redeployed without a loss in their value. Gerbaud and York (2007) demonstrate that acquirers of knowledge-based firms

[3] The evidence of negative wealth effects of M&A for acquiring firms in developed countries does not appear to extend to some emerging economies. For instance, Amewu and Alagidede (2018) and Huang et al. (2019) find that M&A produce positive abnormal returns around the announcement date in Africa and China, respectively.

experience more negative returns than acquirers of property-based firms due to the additional uncertainty surrounding the value of the intangible resources in the first case.

Based on the evidence in the M&A and intangible asset transactions literature, we form the following two hypotheses with respect to the wealth effects of football player turnover:

H1. Acquisition of players tends to decrease shareholder wealth.

H2. Divestment of players tends to increase shareholder wealth.

We test the above hypotheses in the next section.

3. Empirical Analysis

3.1. Data

We perform our empirical analysis using 9 major UK football clubs that have a history of publicly traded stock: Aston Villa, Birmingham City, Charlton, Chelsea, Leeds United, Manchester United, Newcastle United, Nottingham Forest and Tottenham. Financial data for these football clubs are obtained from Thomson-Reuters Datastream. As shown in Table 1, five of these clubs have been listed in the London Stock Exchange (LSE) while the remaining have been listed in the Alternative Investment Market (AIM).[4]

The time period considered for each club starts with the initial public offering date. Given that these stocks are no longer traded publicly, we exclude their final calendar year of data from our analysis in

[4] Although there are more UK football clubs that have listed in the past, we narrow our selection to 9 clubs based on two criteria. First, we exclude clubs that have less than three years of data. Second, we exclude thinly-traded stocks that trade for less than 60% of their lifetime.

order to make our results immune to delisting effects. Also, we remove long periods of no trading. Panel A of Table 1 lists the time period under study for each club, as well as the average market capitalization and the percentage of zero-volume days. As Panel A of Table 1 indicates, the average market capitalization ranges from £12.74 million for Nottingham Forest to £305.55 million for Manchester United. Naturally, clubs with a low equity value are more affected by thin trading compared to clubs with a high value.

For each club, we collect daily stock closing prices adjusted for dividends. Descriptive statistics for the corresponding returns are presented in Panel B of Table 1. We observe that six out of nine stocks have a negative average return. The standard deviation is relatively large, a phenomenon that is typical in small-cap stocks. The kurtosis coefficients also reveal that the distribution of the stock returns is highly leptokurtic. As a result, the Jacque-Berra test strongly rejects the hypothesis of normality for all stocks, as the last column shows.

Data on player transfers for the football clubs considered are obtained from the website www.soccerbase.com as follows. First, we collect data on all transfers taken place during the period under study for each stock. For each transfer, we obtain the date that the transfer is announced, the type of the transfer (acquisition or sale) and the transfer fee, i.e., the price that the acquiring club pays to the selling club to purchase the player. We then narrow our sample of player transfers in line with approaches followed in the M&A literature. We select the 10 largest sales and the 10 largest acquisitions, in terms of transfer fee, for each club. We choose the most expensive transfers, because they are the most likely to send a signal to the market. We also choose the same number of transfers for each club in order to prevent our analysis from being biased towards the richest clubs. In this way, we can also capture the behaviour of a larger number of investors. We end up with a sample of 180 events (90 sales and 90 acquisitions).[5] Table 2 summarizes the average transfer price for each club. As expected, there is a positive relation between transfer prices and market capitalization. For example, the average acquisition price for Nottingham Forest is £1.35 million, while for Manchester United is £15.37 million.

3.2. Methodology

Motivated by the M&A literature, we use a standard event study methodology (e.g., see Brown and Warner, 1985) to assess the impact of announcements of player transfers on the short-term behavior of club stock prices.[6] In line with our hypotheses, we separately study the two type of events under consideration, namely, acquisitions of players and sales of players. We consider the first trading day after the date of the transfer completion as the event date. To study whether transfer announcements affect market prices, we examine whether abnormal returns are realized around the event date.

The abnormal return for club *j* at time *t* is defined as

$$AR_{j,t} = R_{j,t} - E\left(R_{j,t} \mid X_t\right), \tag{1}$$

where $R_{j,t}$ and $E\left(R_{j,t} \mid X_t\right)$ are the real return and the normal return, respectively and X_t stands for the conditioning information at time *t*. In line with the literature, we adopt the standard choices for modelling the normal return, i.e., the constant-mean model and the market model. In the first case,

[5] The size of our sample is of similar order to that of other event studies in the M&A literature (e.g., Loughran and Vijh 1997; Rau and Varmaelen, 1998; Megginson et al., 2004, among many others). If we consider more transfers per team, say 15 or 20, in our sample, some transfers for some of the clubs have very small value and are likely to add noise to our results. By examining the transfer dates in our sample, we observe that 5 pairs of sales/acquisitions take place in the same 10-day window. As a robustness check, we carried out again our empirical analysis after excluding these transfers from our sample, but due to their relatively small number, the results practically remain the same.

[6] For other applications of the standard event study method to football clubs stock prices, the reader may refer to Renneboog and Vanbrabant (2000), Gannon et al. (2006) and Scholtens and Peenstra (2009). Bernile and Lyandres (2011) apply a regression-based event study to European football clubs in order to study investor sentiment. A regression-based approach is also adopted by Hanke and Kirchler (2013) who study the effects of football match results on team sponsor's stock price.

X_t is a constant and in the second X_t is the return on the market portfolio. As a proxy for the market portfolio, we use the FTSE All Shares index (FTAS). The data for the index is again collected from Datastream.

As some stocks in our sample are subject to thin trading bias, we follow the recommendation of Maynes and Rumsey (1993) and Bartholdy et al. (2007) and use trade-to-trade returns.[7] The trade-to-trade approach ignores the days of zero returns and uses multi-period returns for the remaining days, defined as:

$$R_{j,n_t} = \log \frac{P_{j,t}}{P_{j,t-n_t}}, \qquad (2)$$

where $P_{j,\mathrm{t}}$ stands for the price of the *j* stock at date *t* and n_t is the length of the no-trading period that ends on day *t*. The market model for the trade-to-trade returns can be expressed as

$$R_{j,n_t} = a_j n_t + \beta_j R_{m,n_t} + \sum_{s=0}^{n_t-1} \varepsilon_{j,t-s}, \qquad (3)$$

where R_{m,n_t} is the return on the market portfolio computed in the same period to R_{j,n_t}. Then, the normal return for the market model is estimated as

$$\overline{R}_{j,n_t} = \hat{a}_j n_t + \hat{\beta}_j R_{m,n_t}. \qquad (4)$$

[7] We deal with potential thin trading in football team stocks in two additional ways. First, we checked the volume in all event windows and found that no event window appears to have zero volume. Second, we performed our event study only on the stocks traded at AIM for which volume appears to be lower. Our qualitative conclusions remain the same. These results are available upon request.

Alternatively, the constant-mean model results from imposing the restriction $\beta_j = 0$ in (3). In this case, the estimated normal return is $\bar{R}_{j,n_t} = \hat{a}_j n_t$. Overall, the abnormal return can be computed by

$$AR_{j,t} = R_{j,n_t} - \bar{R}_{j,n_t} . \qquad (5)$$

Unless otherwise stated, we estimate normal returns using a window of 70 trading days that starts 91 days before the event date and ends 22 days before the event date. In this way, any leakages/rumors about the event are unlikely to affect our estimates of normal returns.[8]

We consider symmetric event windows that include up to 10 trading days before and after the event day for two reasons. First, many transfers are leaked to the press before they are formally announced. Second, because of thin trading, it may take several days for some investors to react to a transfer. Given this uncertainty, we quantify the effect of a transfer *k* on the market using cumulative trade-to-trade abnormal returns (CARs) around the event day ($t = 0$) defined as

$$CAR_{L,k} = \sum_{\tau=-L}^{L} AR_{k,\tau} \qquad (6)$$

for an event window (-*L*,*L*) that includes the 2*L*+1 trading days that are closest to the event day. If $CAAR_L^A$ and $CAAR_L^D$ are the population means of $CAR_{L,k}$ across player acquisitions and sales, respectively, then the null-hypotheses in our testing procedures can be formulated as:

$$\mathrm{H}_1^0 : CAAR_L^A = 0$$

$$\mathrm{H}_2^0 : CAAR_L^D = 0$$

[8] As a robustness check, we also use an estimation window of 240 days and rerun our tests. These results are reported in the Appendix. We find that altering the estimation window does not affect our conclusions.

To test the above, we apply the non-parametric generalized rank method (GRANK-Z) of Kolari and Pynnönen (2011) to sample average CARs for five reasons. First, as there is strong evidence against normality in our data, a non-parametric test would be more suitable compared to a parametric one. Second, Kolari and Pynnönen find that their test is more powerful in empirical data than most competing tests in the literature. Third, the generalized rank test tends to be robust to changes in the volatility around the event. Fourth, it can better handle serial correlation and event clustering, compared to a parametric approach. Fifth, it can be readily applied to cumulative abnormal returns, in contrast to other rank tests in the literature. Given that our analysis assumes trade-to-trade returns, we use the suggestions of Maynes and Rumsey (1993) in order to compute the ranks for CARs required by the method of Kollari and Pynnönen.

4. Results

Tables 3 and 4 present the main results from our event study for the market model and the constant-mean model, respectively. They report the average and median CARs and the associated *p*-values. The differences between the median CAR and zero is tested using the Wilcoxon signed rank test. We compute CARs for two samples of events: the first contains all 180 transfers and the second consists of 90 transfers that correspond to the 5 largest transfers for each club, in terms of transfer fee. The subsample allows us to study the role of the transfer fee on the CAR. Panel A reports the results for acquisitions of players and Panel B for sales of players. CARs are computed for 4 symmetric event windows, namely (-10,10), (-5,5), (-3,3), (-1,1), and for just the event day (t=0).

4.1. CARs around acquisitions

According to Panel A of Table 3, the average CARs for the market model around player acquisition announcements are negative in all cases, in line with the hypothesis H1. However, average CARs are not significant in most cases when the sample of events includes all transfers under study. The average CAR obtains its highest value of -2.2% for the (-5,5) event window being significant at the 10% level. The median CAR of -2% in the same window is also significant at the 5% level. When we constrain our event sample by considering the five most expensive acquisitions for each team, the CARs drastically decline. The average CAR is highly negative, namely, -5.7% and -4.5% for the (-10,10) and (-5,5) windows, respectively. In the first case, the mean CAR is significant at the 5% level and, in the second at the 1%, level. Median CARs attain similar values. Our findings indicate that the cost of the transfer moderates the effect on the stock price. Panel A of Table 4 presents our results for the case that the constant-mean model is used for the derivation of normal returns. Most conclusions from Table 3 remain the same in this setting. Average CARs are negative in all cases considered. They are significant for the subsample of the most expensive transfers and for the (-5,5) window in the original sample.

4.2. CARs around sales

In Panel B of Table 3, we report the average and median market model CARs around the sale of players. In contrast to the results for the acquisition of players, the CARs for sales are positive in all cases. When all 90 sales are considered, average CARs are significant at the 5% level in the (-10,10) and (-5,5) windows, attaining values of 2.5% and 1.7%, respectively. These findings hold when the constant-mean model is applied for the estimation of abnormal returns, as the results in Panel B of Table 4 indicate. In general, our results support the hypothesis H2. In the subsample of the five most profitable sales for each team, CARs increase for all windows. For example, for the (-10,10) window the CARs increase from 2.5% to 4.3%. In the three longest windows, the CARs are significant at the 5% level, while in the window (-1,1), CARs are significant at the 10% level. As in the case of acquisitions, the sale of a player appears to have a stronger effect on the market when it bears a higher fee. We further explore this finding in the next subsection within a regression framework.

4.3. Relation between transfer fees and abnormal returns

Our results in Tables 3 and 4 demonstrate that the effect of player transfers on stock prices is stronger for the subsample of the 5 most expensive transfers. This motivates us to study the relationship between the transfer fee and the CARs. In this context, we adopt a regression model, defined as

$$CAR_{L,k} = a + \beta_1 Fee_k + \beta_2 Pos_k + \beta_3 Int_k + \varepsilon \,, \tag{7}$$

where the main explanatory variable Fee_k is the ratio of the transfer fee to the market capitalization of the firm on the day of the k event. Standardizing the transfer fee allows us to pool the returns and transfers for different clubs in a single regression model. We further control for the player position (Pos_k) and the book value of the intangibles (Int_k) of the club at the day of the k event.[9] The first control is motivated by evidence in Whitlam and Preston (1998) that transfers of forward players receive more media coverage compared to transfers of players in other positions. As a result, forward player transfers may have a stronger impact on the stock price. Pos_k takes a value of 1 if the player's position is forward and a value of zero, otherwise. Second, we control for the book value of the intangibles in the accounting year that the transfer takes place as a proxy of the wealth of a club. We hypothesize that, given a specific transfer fee, the stock price of wealthier clubs may be less sensitive to the transfer announcement than that of a poorer club, as the latter will be experiencing a relatively more prominent change in the value of their intangibles.

Table 5 reports the OLS coefficients and adjusted R^2 estimate for the above regression for $L = 5$ and 10 and for both models of the normal return. We find that the transfer fee has a significant

[9] We obtain data on the intangibles of each club from Fame.

negative effect on the returns around acquisitions and a significant positive effect on the returns around sales. The effect is stronger for acquisitions. For example, an increase in the ratio of the acquisition fee to the market capitalization by 1% is estimated to lead to a decrease of the CAR in the (-5,5) window by 0.35%. The same increase for the sale fee is expected to increase the CAR by 0.14%.[10] The regression model has higher explanatory power in the first case with an estimated adjusted R^2 of 12.5% compared to 5.4% for player sales. The explanatory power is higher in the (-5,5) window for both acquisitions and sales. Finally, we observe that the coefficients of both controls are insignificant, although their sign is generally consistent with our hypotheses.

The analysis in this section motivates us to also investigate if transactions that do not involve a transfer fee affect the stock price. To this end, we study the stock price reaction around free transfer announcements using the same event study methodology as in the rest of the paper. Our sample of free transfers include all feeless player acquisitions and player releases, which do not coincide with other transfers within a 10-day event window. We present the corresponding results in table A.3 in the Appendix. We find that mean and median CAR is insignificant across both free acquisitions and player releases. This finding confirms the moderating role of the fee in the impact of the transfer on the market price.

4.4. When are the abnormal returns observed?

The results in Tables 3- 5 indicate that the effect of player transfers is stronger in the period that starts 5 days before the event and ends 5 days after the event, compared to the other windows under study. We further explore this finding in Figures 1 and 2. These depict the evolution of the average CAR for the window (-10, *L*), *L*= -10,…10 around the transfer. The solid (dashed) line represents the mean

[10] This finding is consistent with the work of Clubb and Stouraitis (2002) who show that the profitability of an asset divestiture is positively related to the abnormal return of the selling around the divestiture announcement.

CAR around a sale (acquisition). CARs are computed for all events for Panel A and for the sample of events that correspond to the most expensive transfers for Panel B.

We observe that CARs around sales start to increase 7 days before the event and keep increasing until 7 days after the event (Panel A). When we compute CARs using the 5 most expensive transfers, most of the abnormal returns are observed in the period that starts 2 days before the event and ends 7 days after the event. In the case of player acquisitions, negative abnormal returns appear to arise in the window (-5,7) for both the whole sample and the subsample of events. These findings are not sensitive to the underlying model that yields normal returns, as Figures 1 and 2 are similar. This result helps to explain why we observe higher statistical significance in the (-5,5) event window than in the (-10,10) window for acquisitions. As also the negative abnormal returns are spread within the (-5,7), we find that CARs in smaller event windows and on the announcement day are not as significant as CARs for the (-5,5) window.

There are two main implications from these findings. First, since we observe abnormal returns up to 7 trading days before the announcement, it appears that there is some information about the transfers accessible to some investors in advance, either from the media or via rumours. This phenomenon is analogue to the pre-bid price run evinced in the M&A literature which is usually attributed to merger anticipation, insider trading or information leakage (e.g., see Weston et al., 2014, and the references therein). Second, we observe significant abnormal returns up to 7 trading days after the announcement. In contrast, the price reaction to typical merger announcements are usually realised up to 1 day after the merger announcement (e.g,, see Alexandridis et al. 2010). Consistent with relatively low volumes, this finding indicates price inefficiencies in the market of football club stocks.

4.5. Volatility around human resources changes

We further study the effects of intangible asset acquisitions/sales on the risk of the firm. An extensive literature documents that information flow affects return volatility. Related to this study, the M&A literature provides evidence that volatility rises when a bid is first leaked or announced, and it declines during the bid period and after the announcement of the transaction. For example, Hutson and Kearney (2001) show that unconditional volatility for the targets reduces in the bid period. They attribute this reduction to the convergence of the investors' belief about the value of the target, as the probability of success of the takeover increases. Balaban and Constantinou (2006) using a large sample of M&A in the UK market find that the conditional volatility declines for the bidder on the announcement day. Levy and Yoder (1993) also report a decrease in the implied volatility of the target firm after the announcement of the bid.

We test whether announcements of player transfers affect the volatility of the returns on the football club in the period around the transfer. For an event *k*, we measure abnormal volatility as the difference between the average absolute abnormal return in the event window and the average absolute abnormal return in the estimation period:

$$AV_{k,L} = \frac{1}{2L+1}\sum_{t=-L}^{L}\left|AR_{k,t}\right| - \frac{1}{T_2 - T_1 + 1_1}\sum_{t=T_1}^{T_2}\left|AR_{k,t}\right| \qquad (8)$$

Our null hypothesis is that the median volatility in the event period is the same as the median volatility in the estimation period ($[T_1, T_2]$), i.e., the median $AV_{k,L}$ across events is 0. We test this hypothesis, using the Wilcoxon signed rank test.

Tables 6 reports the cross-sectional median $AV_{i,L}$ in percentage terms for $L = 0,1,3,5,10$. Abnormal returns are computed using the market model.[11] We observe that volatility is lower in the event window compared to the estimation period in all cases considered. We attribute this finding to the existence of noise traders, i.e., traders that could act based on noisy information, such as rumours. Noise is typically lower in the event window, when the probability of the completion of a transfer is higher and there is more extensive news coverage of the event. As a result, uncertainty is also lower in the event window. We observe that the abnormal volatility is somewhat lower and more significant, around acquisitions rather than around sales.

4.6. What drives the market reaction to player transfers?

The findings from the empirical analysis support our two hypotheses. The reported asymmetric effects reveal that shareholders assess that football clubs overpay to acquire human talent. The perceived overpayment increases with the player transfer fee. There are two potential explanations for this finding. First, we could observe a "winner's curse" effect where competition among clubs to acquire a specific player leads to a transfer fee that exceeds the value of the player. Winner's curse has also been observed in player markets in other high-level competing sports (e.g., see Cassing and Douglas, 1980; Burger and Walters, 2008). A similar effect has also been observed in the market of corporate takeovers (e.g., see Varaiya and Ferris, 1987; Boone and Mulherin, 2008). Managerial hubris could be the driver of human resources turnover under this scenario instead of wealth creation.

Second, football club investors may fail to correctly assess the long-term added value of fooball players. The seminal work of Sloane (1971) promotes that football clubs act as utility maximizers instead of profit maximizers. While utility can increase with profits, most of the utility in Sloane's

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[11] Similar results are derived using the constant mean model to derive abnormal returns. These results are available upon request.

model comes from other factors, such as team performance and event attendance. Due to information or knowledge barriers, the contribution of a player to such qualities may be difficult to be assessed by the club's investors and may add uncertainty to the player's value. Uncertainties around the value of intangible assets are known to lead to negative abnormal returns around acquisitions (see Arikan, 2004; Gerbaud and York2, 2007), similar to what we observe in this work. Identifying which of the two potentials drivers of our findings is more prominent is not possible because of data constraints, but based on the aforementioned evidence it is likely that both contribute to our results.

5. Conclusions

In this paper, we study the effects of changes in the human capital of the firm within the UK football industry. We consider turnover in human resources as part of the overall process for corporate asset divestiture and acquisition. Our empirical analysis investigates the impact of player transfers on football club stock prices. We find that shareholders significantly react to changes in human capital. Specifically, sales (acquisitions) of players have a positive (negative) effect on stock prices around the announcement. These findings indicate that non-wealth creating managerial motives may underlie human resources turnover in the sports industry or that shareholders fail to properly assess the added value of the new player.

This work could be extended in two promising directions for future research. First, despite the advantages of focusing on the sports industry, it remains an open question if similar results would be observed in other industries. Further empirical analysis with data from other sectors could potentially address this question. Second, throughout this work we assume that investors acquire all the relevant information about the event within the event-window. In cases this is not true, the market effects of human resources changes will not be fully reflected in the corresponding abnormal returns. In this context, future research in the area could also account for partly anticipated events (e.g., see Cornett et al., 2011).

Data Availability Statement

Data on player transfers used in this work is openly available at https://www.soccerbase.com/. All financial data used in this paper is available on Thomson-Reuters DataStream and Fame.

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Table 1. Descriptive Statistics

Panel A: Financial Data

Club	Period	Exchange	Observations	Market Cap.	Nonzero volume days
Aston Villa	24/05/2001 - 17/10/2005	LSE	1114	£24,950,036	82%
Birmingham	06/03/1997 - 17/11/2008	AIM	2971	£17,888,314	84%
Charlton	20/03/1997 - 21/09/2005	AIM	2162	£14,884,452	61%
Chelsea	18/04/1997 - 23/08/2002	AIM	1362	£102,986,380	96%
Leeds United	02/08/1996 - 28/02/2003	LSE	1675	£40,438,303	99%
Manchester United	07/06/1991 - 22/06/2004	LSE	3316	£305,553,604	91%
Newcastle United	01/04/1997 - 18/07/2006	LSE	2361	£77,903,373	98%
Nottingham Forest	09/10/1997 - 17/04/2001	AIM	898	£12,784,244	80%
Tottenham	10/06/1998 - 14/01/2011	LSE	3200	£62,765,114	97%

Panel B: Return Statistics

Club	Mean	Median	Std	Skewness	Kurtosis	JB
Aston Villa	0.0008	0	0.0161	3.3846	57.0024	168468
Birmingham	0.0002	0	0.0291	0.5712	36.8536	154034
Charlton	-0.0003	0	0.0181	1.4464	82.5531	637139
Chelsea	-0.0007	0	0.0294	1.0727	21.1745	22509
Leeds United	-0.0012	0	0.0382	1.2167	32.7233	71374
Manchester United	0.0008	0	0.0194	0.8845	22.4826	56879
Newcastle United	-0.0001	0	0.0250	1.3728	19.8104	31576
Nottingham Forest	-0.0015	0	0.0272	-2.8871	99.7014	449283
Tottenham	-0.0002	0	0.0172	-1.1095	42.3705	223590

Notes: This table presents a set of descriptive statistics for the stocks of the nine football clubs under study. The statistics in Panel B are computed using daily returns. Std stands for standard deviation and JB is the Jacque-Berra statistic for the test that the returns have skewness and kurtosis that matches that of a normal distribution.

Table 2. Player Transfer Fees Statistics

Club	Period	Acquisitions		Sales	
		Average	Median	Average	Median
Aston Villa	24/05/2001 - 17/10/2005	£2,835,000	£2,250,000	£1,092,000	£150,000
Birmingham City	06/03/1997 - 17/11/2008	£3,925,000	£4,000,000	£3,702,500	£3,250,000
Charlton	20/03/1997 - 21/09/2005	£2,370,000	£2,000,000	£1,710,000	£325,000
Chelsea	18/04/1997 - 23/08/2002	£8,100,000	£7,500,000	£4,210,000	£3,250,000
Leeds United	02/08/1996 - 28/02/2003	£7,985,000	£6,500,000	£7,685,000	£4,500,000
Manchester United	07/06/1991 - 22/06/2004	£15,374,000	£12,710,000	£8,950,000	£6,000,000
Newcastle United	01/04/1997 - 18/07/2006	£9,000,000	£8,750,000	£6,105,000	£5,200,000
Nottingham Forest	09/10/1997 - 17/04/2001	£1,660,000	£1,500,000	£1,735,000	£775,000
Tottenham	10/06/1998 - 14/01/2011	£13,180,000	£12,900,000	£11,955,000	£8,000,000

Notes: This table presents the average and median player transfer fee for each football club considered in the paper.

Table 3. Cumulative Abnormal Returns (CARs) based on the market model

Panel A: Acquisitions

	10 Transfers					5 Transfers				
Event window	(-10,10)	(-5,5)	(-3,3)	(-1,1)	0	(-10,10)	(-5,5)	(-3,3)	(-1,1)	0
Mean CAR	-0.018	-0.022*	-0.008	-0.002	-0.001	-0.057**	-0.045***	-0.017	-0.006	-0.004
(p-value)	(0.75)	(0.09)	(0.64)	(0.74)	(0.31)	(0.04)	(0.00)	(0.35)	(0.68)	(0.98)
Median CAR	0	-0.020**	-0.007	0.001	0	-0.061**	-0.057***	-0.006*	0.001	0
(p-value)	(0.21)	(0.03)	(0.21)	(0.93)	(0.41)	(0.02)	(0.00)	(0.07)	(0.71)	(0.75)

Panel B: Sales

	10 Transfers					5 Transfers				
Event window	(-10,10)	(-5,5)	(-3,3)	(-1,1)	0	(-10,10)	(-5,5)	(-3,3)	(-1,1)	0
Mean CAR	0.025**	0.017**	0.009	0.005	0.004	0.043**	0.024**	0.019**	0.014*	0.004
(p-value)	(0.04)	(0.04)	(0.11)	(0.27)	(0.41)	(0.04)	(0.04)	(0.03)	(0.08)	(0.49)
Median CAR	0.022*	0.013*	0.01	0.002	0.001	0.054*	0.033*	0.018	0.007*	0.002*
(p-value)	(0.09)	(0.10)	(0.37)	(0.47)	(0.13)	(0.08)	(0.10)	(0.11)	(0.07)	(0.08)

Notes: This table reports the average and median CARs for five event windows, i.e., (-10,10), (-5,5), (-3,3). (-1,1) and 0. The event day (t=0) is the first trading day after the announcement of a player acquisition for Panel A and of a player sale for Panel B. Two samples of events are considered. They respectively include the 10 and 5 most expensive acquisitions/sales for each team in Table 1. CARs are computed using trade-to-trade returns, as in Maynes and Rumsey (1993). The market model is adopted for the derivation of the normal return, which is estimated using a history of 90 trading days. One, two and three '*' denote that the corresponding statistic is significantly different from zero at the 10%, 5% and 1% level, respectively. The p-values for the mean are derived using the GRANK-Z test derived by Kolari and Pynnönen (2011). The p-values for the median are derived using the Wilcoxon signed-rank test.

Table 4. Cumulative Abnormal Returns (CARs) based on the constant-mean model

Panel A: Acquisitions

	10 Transfers					5 Transfers				
Event Window	(-10,10)	(-5,5)	(-3,3)	(-1,1)	0	(-10,10)	(-5,5)	(-3,3)	(-1,1)	0
Mean CAR	-0.017	-0.021*	-0.008	-0.002	-0.001	-0.054	-0.045***	-0.017	-0.006	-0.004
(p-value)	(0.64)	(0.10)	(0.68)	(0.94)	(0.89)	(0.18)	(0.00)	(0.42)	(0.97)	(0.64)
Median CAR	-0.005	-0.02**	-0.009	0	0.001	-0.055**	-0.052***	-0.014*	0	0
(p-value)	(0.24)	(0.04)	(0.14)	(0.81)	(0.42)	(0.02)	(0.00)	(0.08)	(0.64)	(0.91)

Panel B: Sales

	10 Transfers					5 Transfers				
Event Window	(-10,10)	(-5,5)	(-3,3)	(-1,1)	0	(-10,10)	(-5,5)	(-3,3)	(-1,1)	0
Mean CAR	0.034*	0.021**	0.012*	0.008*	0.004	0.057**	0.032**	0.024**	0.016**	0.005
(p-value)	(0.06)	(0.01)	(0.08)	(0.06)	(0.83)	(0.05)	(0.01)	(0.02)	(0.03)	(0.95)
Median CAR	0.027*	0.013*	0.008	0.006	0.002	0.052**	0.034*	0.02*	0.01**	0.003**
(p-value)	(0.08)	(0.09)	(0.24)	(0.16)	(0.07)	(0.04)	(0.10)	(0.08)	(0.02)	(0.03)

Notes: This table reports the average and median CARs for five event windows, i.e., (-10,10), (-5,5), (-3,3). (-1,1) and 0. The event day (t=0) is the first trading day after the announcement of a player acquisition for Panel A and of a player sale for Panel B. Two samples of events are considered. They respectively include the 10 and 5 most expensive acquisitions/sales for each team in Table 1. CARs are computed using trade-to-trade returns, as in Maynes and Rumsey (1993). The constant-mean model is adopted for the derivation of the normal return, which is estimated using a history of 90 trading days. One, two and three '*' denote that the corresponding statistic is significantly different from zero at the 10%, 5% and 1% level, respectively. The p-values for the mean are derived using the GRANK-Z test derived by Kolari and Pynnönen (2011). The p-values for the median are derived using the Wilcoxon signed-rank.

Table 5. Effect of player transfer fees on football club stock returns

Panel A: Market model

	Event window = (-10,10)					Event window = (-5,5)				
	α	*Fee*	*Position*	*Intangibles*	Adj.- R^2	α	*Fee*	*Position*	*Intangibles*	Adj.- R^2
Acquisitions	0.011	-0.503***	0.015	1.00E-09	0.112	0.010	-0.352***	0.009	5.34E-10	0.125
	(0.81)	(0.00)	(0.65)	(0.18)		(0.73)	(0.00)	(0.66)	(0.26)	
Sales	0.013	0.147*	-0.014	1.26E-10	0.004	0.015	0.142**	-0.017	-1.21E-10	0.054
	(0.75)	(0.09)	(0.69)	(0.88)		(0.59)	(0.02)	(0.49)	(0.83)	

Panel B: Constant-mean model

	Event window = (-10,10)					Event window = (-5,5)				
	α	*Fee*	*Position*	*Intangibles*	Adj.- R^2	α	*Fee*	*Position*	*Intangibles*	Adj.- R^2
Acquisitions	0.001	-0.451**	0.014	1.06E-09	0.092	0.004	-0.337***	0.011	5.96E-10	0.117
	(0.98)	(0.01)	(0.67)	(0.17)		(0.87)	(0.00)	(0.61)	(0.22)	
Sales	0.043	0.160*	-0.034	-3.44E-10	0.022	0.025	0.160**	-0.028	-2.71E-10	0.078
	(0.34)	(0.09)	(0.37)	(0.71)		(0.40)	(0.01)	(0.29)	(0.66)	

Notes: This table presents the estimates of the intercept (*α*), the coefficients and the adjusted R^2 for a linear regression of the Cumulative Abnormal Returns (CARs) around the event day on the ratio of the transfer fee to market capitalization. We control for the position of the player by including a dummy that takes a value of 1, if the player's position is "forward" and 0, otherwise. We also control for the value of the intangibles in the accounting year that includes the event. The corresponding p-values are in parenthesis. CARs are computed for two event windows, namely, (-10,10) and (-5,5). The regression results are reported separately for the two types of events, i.e., acquisitions and sales. The market model and the constant-mean model are used for the computation of CARs for Panel A and B, respectively. These models are estimated using a window of 90 trading days. One, two and three '*' show that the corresponding estimate is significantly different from zero at the 10%, 5% and 1% level, respectively.

Table 6. Abnormal Volatility

Panel A: Acquisitions

	10 Transfers					5 Transfers				
Event Window	(-10,10)	(-5,5)	(-3,3)	(-1,1)	0	(-10,10)	(-5,5)	(-3,3)	(-1,1)	0
Abnormal Volatility	-0.285***	-0.250***	-0.417***	-0.497***	-0.703***	-0.240***	-0.252***	-0.343***	-0.456***	-0.596***
(p-value)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.06)	(0.02)	(0.00)	(0.00)	(0.02)

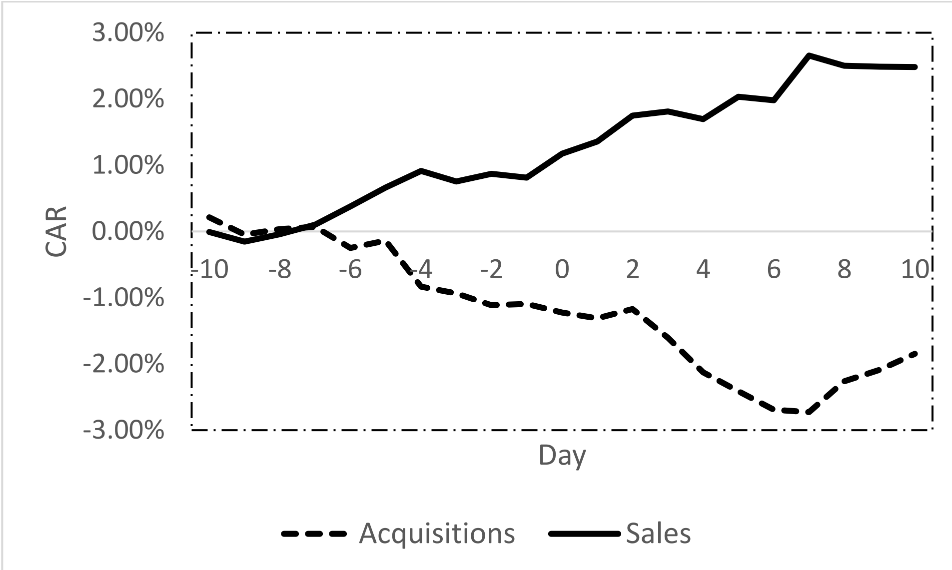
Panel B: Sales

	10 Transfers					5 Transfers				
Event Window	(-10,10)	(-5,5)	(-3,3)	(-1,1)	0	(-10,10)	(-5,5)	(-3,3)	(-1,1)	0
Abnormal Volatility	-0.220**	-0.222**	-0.197	-0.210	-0.592***	-0.213	-0.097	-0.063	-0.163	-0.587**
(p-value)	(0.01)	(0.03)	(0.15)	(0.94)	(0.00)	(0.21)	(0.33)	(0.67)	(0.71)	(0.03)

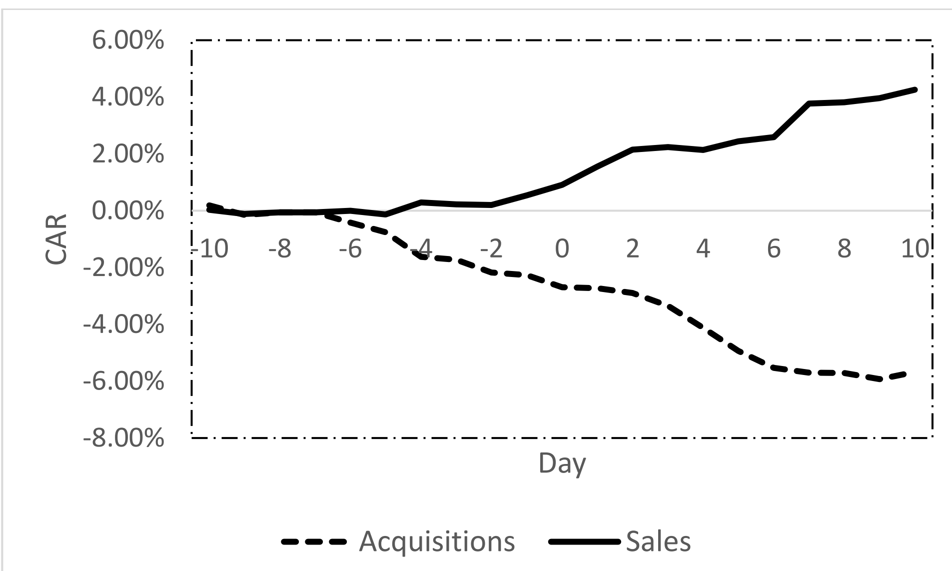
Notes: This table reports the median abnormal volatility for five event windows, i.e., (-10,10), (-5,5), (-3,3). (-1,1) and 0. The event day (*t*=0) is the first trading day after the announcement of a player acquisition for Panel A and of a player sale for Panel B. Two samples of events are considered. They respectively include the 10 and 5 most expensive acquisitions/sales for each team in Table 1. The abnormal volatility is computed as the percent difference in the average absolute daily abnormal return between the event window and the estimation window. The estimation window contains 90 days. One, two and three '*' show that the corresponding statistic is significantly different from zero at the 10%, 5% and 1% level, respectively. The p-values for the volatility are derived using the Wilcoxon signed-rank test.

Figure 1. Evolution of CARs based on the market model

Panel A: 10 Transfers



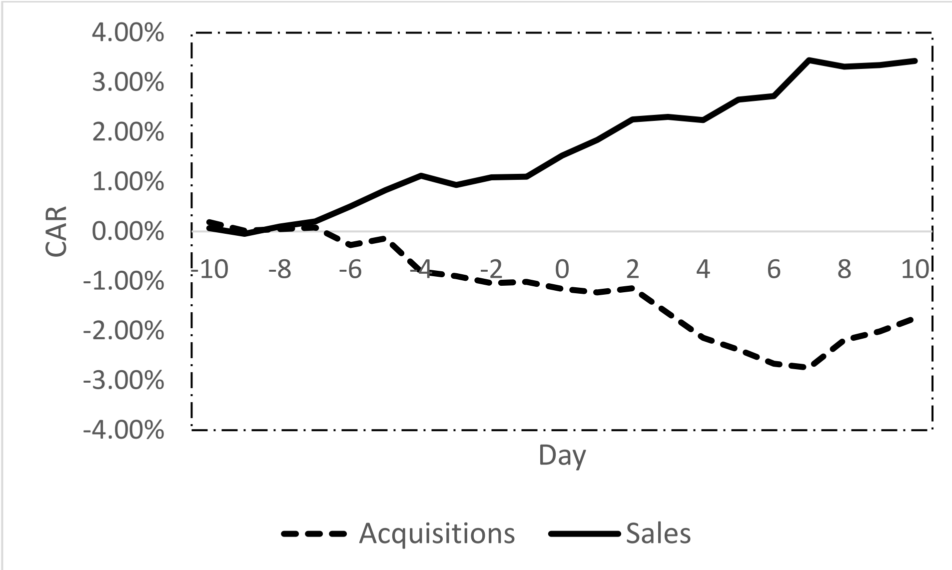
Panel B: 5 Transfers



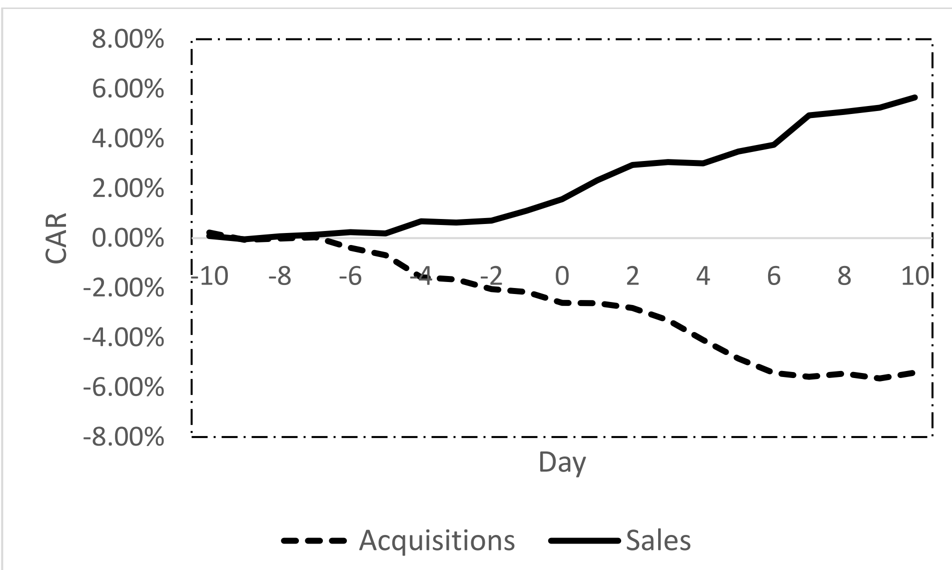
Notes: This figure depicts the average CAR on the window (-10,*L*) around the event, for *L*=-10,…,10. The event day (day=0) is the first trading day after the announcement of a player acquisition (dashed line) or a player sale (solid line). Two samples of events are considered. They respectively include the 10 (Panel A) and 5 (Panel B) most expensive acquisitions/sales for each team in Table 1. CARs are computed using trade-to-trade returns, as in Maynes and Rumsey (1993). The market model is adopted for the derivation of the normal return, which is estimated using a history of 90 trading days.

Figure 2. Evolution of CARs based on the constant-mean model

Panel A: 10 Transfers



Panel B: 5 Transfers



Notes: This figure depicts the average CAR on the window (-10,*L*) around the event, for *L*=-10,…,10. The event day (day=0) is the first trading day after the announcement of a player acquisition (dashed line) or a player sale (solid line). Two samples of events are considered. They respectively include the 10 (Panel A) and 5 (Panel B) most expensive acquisitions/sales for each team in Table 1. CARs are computed using trade-to-trade returns, as in Maynes and Rumsey (1993). The constant-mean model is adopted for the derivation of the normal return, which is estimated using a history of 90 trading days.

Appendix: Additional Results

Table A.1 Cumulative Abnormal Returns (CARs) based on the market model for an estimation window of 240 days

Panel A: Acquisitions

	10 Transfers					5 Transfers				
Event Window	(-10,10)	(-5,5)	(-3,3)	(-1,1)	0	(-10,10)	(-5,5)	(-3,3)	(-1,1)	0
Mean CAR	-0.008	-0.015	-0.005	0	-0.001	-0.035*	-0.032**	-0.012	-0.003	-0.003
(p-value)	(0.88)	(0.12)	(0.20)	(0.95)	(0.20)	(0.10)	(0.01)	(0.11)	(0.82)	(0.28)
Median CAR	0.001	-0.008*	-0.005	0	0.001	-0.060*	-0.038**	-0.012	0.002	0.001
(p-value)	(0.44)	(0.10)	(0.31)	(0.87)	(0.16)	(0.08)	(0.01)	(0.12)	(0.92)	(0.77)

Panel B: Sales

	10 Transfers					5 Transfers				
Event Window	(-10,10)	(-5,5)	(-3,3)	(-1,1)	0	(-10,10)	(-5,5)	(-3,3)	(-1,1)	0
Mean CAR	0.035***	0.025***	0.018**	0.008***	0.004*	0.046**	0.026**	0.020**	0.014**	0.004**
(p-value)	(0.00)	(0.00)	(0.01)	(0.01)	(0.08)	(0.03)	(0.01)	(0.02)	(0.01)	(0.04)
Median CAR	0.038**	0.019**	0.010*	0.004	0.001**	0.038**	0.021*	0.011*	0.007*	0.001*
(p-value)	(0.01)	(0.02)	(0.07)	(0.10)	(0.03)	(0.03)	(0.10)	(0.09)	(0.07)	(0.09)

Notes: This table reports the average and median CARs for five event windows, i.e., (-10,10), (-5,5), (-3,3). (-1,1) and 0. The event day (*t*=0) is the first trading day after the announcement of a player acquisition for Panel A and of a player sale for Panel B. Two samples of events are considered. They respectively include the 10 and 5 most expensive acquisitions/sales for each team in Table 1. CARs are computed using trade-to-trade returns as in Maynes and Rumsey (1993). The market model is adopted for the derivation of the normal return, which estimated using a history of 240 trading days. One, two and three '*' mean that the corresponding statistic is significantly different from zero at the 10%, 5% and 1% level, respectively. The p-values for the mean are derived using the GRANK-Z test derived by Kolari and Pynnönen (2011). The p-values for the median are derived using the Wilcoxon signed-rank test.

Table A.2 Cumulative Abnormal Returns (CARs) based on the constant-mean model

Panel A: Acquisitions

	10 Transfers					5 Transfers				
Event Window	(-10,10)	(-5,5)	(-3,3)	(-1,1)	0	(-10,10)	(-5,5)	(-3,3)	(-1,1)	0
Mean CAR	-0.010	-0.016	-0.005	0	-0.001	-0.037*	-0.032***	-0.012*	-0.003	-0.004
(p-value)	(0.46)	(0.11)	(0.17)	(0.98)	(0.45)	(0.05)	(0.00)	(0.06)	(0.93)	(0.80)
Median CAR	-0.006	-0.008*	-0.006	-0.002	0.001	-0.058*	-0.04**	-0.012	-0.002	0.001
(p-value)	(0.36)	(0.09)	(0.28)	(0.91)	(0.22)	(0.06)	(0.01)	(0.12)	(0.89)	(0.96)

Panel B: Sales

	10 Transfers					5 Transfers				
Event Window	(-10,10)	(-5,5)	(-3,3)	(-1,1)	0	(-10,10)	(-5,5)	(-3,3)	(-1,1)	0
Mean CAR	0.036**	0.025***	0.018***	0.009***	0.004***	0.046**	0.027**	0.02**	0.014***	0.004***
(p-value)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.03)	(0.01)	(0.02)	(0.00)	(0.00)
Median CAR	0.035**	0.019**	0.012**	0.006**	0.002**	0.045**	0.019*	0.010*	0.005**	0.002**
(p-value)	(0.01)	(0.02)	(0.04)	(0.04)	(0.01)	(0.04)	(0.08)	(0.09)	(0.05)	(0.05)

Notes: This table reports the average and median CARs for five event windows, i.e., (-10,10), (-5,5), (-3,3). (-1,1) and 0. The event day (*t*=0) is the first trading day after the announcement of a player acquisition for Panel A and of a player sale for Panel B. Two samples of events are considered. They respectively include the 10 and 5 most expensive acquisitions/sales for each team in Table 1. CARs are computed using trade-to-trade returns as in Maynes and Rumsey (1993). The constant-mean model is adopted for the derivation of the normal return, which estimated using a history of 240 trading days. One, two and three '*' mean that the corresponding statistic is significantly different from zero at the 10%, 5% and 1% level, respectively. The p-values for the mean are derived using the GRANK-Z test derived by Kolari and Pynnönen (2011). The p-values for the median are derived using the Wilcoxon signed-rank test.

Table A.3 Cumulative Abnormal Returns (CARs) based on the constant-mean model around free transfers

	Acquisitions					Player Releases				
Event Window	(-10,10)	(-5,5)	(-3,3)	(-1,1)	0	(-10,10)	(-5,5)	(-3,3)	(-1,1)	0
Mean CAR	-0.023	-0.004	0.008	0.001	-0.002	0.017	0.008	0.012	0.003	-0.003
(p-value)	(0.19)	(0.39)	(0.79)	(1.00)	(0.57)	(0.95)	(0.68)	(0.94)	(0.51)	(0.53)
Median CAR	-0.023	-0.018	0.000	0.000	0.001	0.002	-0.011	0.007	0.004	0.001
(p-value)	(0.15)	(0.34)	(0.89)	(0.79)	(0.60)	(0.49)	(0.75)	(0.71)	(0.55)	(0.95)

Notes: This table reports the average and median CARs around free player transfers for five event windows, i.e., (-10,10), (-5,5), (-3,3). (-1,1) and 0. Free player acquisitions and player releases are separately considered. CARs are computed using trade-to-trade returns, as in Maynes and Rumsey (1993). The constant-mean model is adopted for the derivation of the normal return, which is estimated using a history of 90 trading days. One, two and three '*' denote that the corresponding statistic is significantly different from zero at the 10%, 5% and 1% level, respectively. The p-values for the mean are derived using the GRANK-Z test derived by Kolari and Pynnönen (2011). The p-values for the median are derived using the Wilcoxon signed-rank.