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When Pep comes calling, the oil market answers: The effect of football player transfer movements on abnormal fluctuations in oil price futures

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ABSTRACT

We examine the effect of player-transfers entered into by football clubs owned, or financed, by individuals who are key players in the oil market on abnormal returns in oil futures. In oil-financed football clubs, the sums expended buying players frequently far exceeds the amount received from selling players in the player-transfer market. We find that in order to finance these deficits in the player-transfer market, the owners act opportunistically by withholding the oil supply, resulting in higher abnormal oil spot returns. We also find that these spot price adjustments are reflected in abnormal returns in the futures market. The exception is when the deficit in the player-transfer market is above a very high threshold, which is typically only the case when the highest profile players in football are transferred. The high-profile transfers attract widespread media attention, making oil futures investors aware of the potential transmission from the player-transfer market to the oil market on a wide-scale, which dissipates the effect of a deficit in the player transfer market on abnormal returns in oil futures.

"My friend Pep told me what happens when he wants a player that costs more than €100 million. … He puts some videos together and goes to see the Sheikh. There is an opulent feast put on, during which he teaches the video to him and the money is transferred.… The next day, the Sheikh raises the price of oil a little bit and recovers the money."

[(Uli Hoeness, President of Bayern Munich, 2019 (Fox Sports Australia, 2019))]

1. Introduction

The amount of 'oil money' (wealth that has been acquired through the petroleum industry) circulating among football clubs has been increasing since the turn of the millennium. One of the earliest, and most notable, examples of oil money in football is the Russian state oil company Gazprom. It owns the Russian football club Zenit; has a long-standing business deal with the Bundesliga club Schalke; and has financed Premier League club, Chelsea's on-field success through Roman Abramovich's investment company, Millhouse Capital.

Much of the oil money in European football originates in the Middle East. The former Prime Minister of Qatar, Abdullah bin Nasser Al Thani, has owned Malaga Football Club in the La Liga in Spain since 2010. The Qatar Sports Investment group has owned the French champion, Paris Saint-Germain, since 2011 with the club also being sponsored by the Dubai based Fly Emirates. The 2019 Premier League champion, Manchester City, is funded by oil money from the UAE through the Abu Dhabi-based City Football Group headed by Sheikh Mansour who also owns the club. The club's home stadium is also named after City's chief sponsor, Etihad Airways headquartered in Abu Dhabi. Most recently, in 2020 Newcastle United were the subject of a takeover bid by the Saudi Arabian Public Investment Fund.

Football clubs that are financed by businesses operating in the petroleum industry, or have been bought outright by groups or individuals whose financial clout emanates from their dealings in oil markets,

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have also been at the forefront in paying large sums for top players in the player-transfer market. This reflects that the owners of these clubs want to assemble squads consisting of the very best players in order to have immediate on-field success, including winning titles (such as their league championship, cups and/or the UEFA Champions League). This strategy, however, typically requires substantial financial resources that the clubs are not able to accommodate by outward player transfers alone. The empirical data on player transfers shows that oil-financed football clubs frequently experience large deficits on the player-transfer market (i.e. the sums that they expend buying players far exceeds the amount that they receive selling players on the transfer market). These deficits have to be financed from sources outside the player-transfer market. One possible source for such funds is via the oil market as these clubs are owned or controlled by Russian oil interests or Middle Eastern sheikhs.[1]

A large number of studies have emerged on the determinants of oil price fluctuations since the 1973 oil crisis. Yet, recent studies have challenged long-held conventional beliefs on the causes, and consequences, of oil price movements (Kilian, 2014; Baumeister and Kilian, 2016). To this point, though, there are no studies that have examined the effect of sponsorship, or ownership, of sports clubs on movements in oil markets. We examine the relationship between activities of football clubs owned by oil bosses or sheikhs in the player-transfer market and abnormal fluctuations on oil price futures. We are the first to explore the shock transmission mechanism between the football player-transfer market and the oil market.

We conjecture that when oil-financed football clubs acquire players in the transfer market, this results in an abnormal increase in oil returns, which is consistent with what Pep Guardiola told Uli Hoeness about the practice at Manchester City. We examine two channels via which the player transfer market could potentially influence oil markets using player transfer data of the five European football clubs owned by oil investors between 2003 and 2019. One possible mechanism is that the oil-backed owners may behave opportunistically, such that they withhold the oil supply to drive the price up over a short time window. This channel is in line with the spirit of the model presented in Hassler et al. (2010). A second potential channel is that oil investors may monitor the financial demands of oil-financed clubs in the player-transfer market and use them to inform their oil trading decisions.

We find that when oil-financed clubs have a deficit in the player-transfer market, this has a positive and significant effect on abnormal returns in the oil spot market. We posit that to cover for the deficit, the oil-rich owners exploit the low liquidity level of the oil spot market, a physical commodity market, to drive the oil spot price up in a very short period by reducing the oil supply. This effect is reinforced by a fear from investors about the reduction in the oil supply in the days surrounding the deficit day. Using daily Google Search Volume Index data, we find that the abnormal search volume for the term “oil supply reduction” starts to increase 4 days before the deficit day and peaks on the deficit day. On average, the abnormal search volume is significantly higher on deficit days compared to other days.

The increase in abnormal returns in the spot market transmits to the oil futures market, except when the threshold on the deficit is in excess of £70 million. We reason that when the deficit is higher than £70 million, the players being transferred are exceedingly high profile, which attracts widespread media attention that likely makes oil futures investors widely aware of the potential transmission from the player transfer market to oil market. In such cases, the funds needed have a positive and significant effect on abnormal trading volumes in oil futures and that this dissipates the effect of funds needed in the transfer market on oil futures returns.

Our study also contributes to the literature that investigates the impact of news on oil price movements as player transfers are discrete events. Previous studies have focused on the impact of structural news such as OPEC announcements (e.g., Demirer and Kutan, 2010; Mensi et al., 2014; Loutia et al., 2016), inventory announcements (e.g., Ye and Karali, 2016), and regulatory intervention (e.g., Berk and Rauch, 2016). However, our focus is different to these studies as the impact of financial demands of oil-financed clubs for player transfers on oil markets can be short-lived and a “one-off” for each event.

The remainder of the article is structured as follows. Section 2 describes the data collection and measurement of the variables, as well as presenting preliminary analyses of the data. We present, and discuss, the methodology in Section 3. Section 4 provides the main results, as well as a series of robustness checks. We conclude the article in Section 5.

2. Data selection, variable measurement and summary statistics

2.1. Data selection

We focus on the popular leagues in Europe and only consider football clubs (FCs) that are owned by oil bosses. Specifically, we focus on five European FCs that are owned by oil-rich investors; namely, Manchester City FC (Manchester City), Chelsea FC (Chelsea), Málaga Club de Fútbol (Malaga), Paris Saint-Germain FC (PSG) and FC Zenit (Zenit). The relationship between each of these football clubs and oil money is outlined in Table 1.

Our analysis covers the period 1st July 2003, which was when Roman Abramovich bought Chelsea FC, to 1st February 2019, the end date of the 2019 winter transfer market. We collect player-transfer data from *transfermarkt.com*, a publicly available website that provides historical data related to the European football transfer market. The website records four types of player-transfers, consisting of purchase (sell) transactions and loan-in (loan-out) contracts. Purchase (sell) transactions entail buying (selling) players to other clubs, generating cash outflows (inflows) for the club. Loan-in (out) contracts allow the club to borrow (lend) players from (to) other clubs for a specific period, also generating cash outflows (inflows) for the club.

Each transaction (or contract) includes the player's name, player's nationality, current football club, the football club to which the player is being transferred, date of the transaction (or contract) and the value of the transaction (or contract) in £ million.[2]

We focus on two main properties of the oil futures market: Brent oil abnormal returns and Brent oil abnormal volume, which represent abnormal oil price movements and abnormal trading activities in the oil futures market, respectively. We concentrate on abnormal, rather than normal, fluctuations in oil markets, because the oil market is affected by various macroeconomic variables on a frequent basis, but football-player transfer transactions, especially those with high values, are infrequent. As a result, abnormal measures are good proxies to reflect the effects of financial demands for player transfers on oil markets.

We also include a set of control variables for macroeconomic conditions that potentially affect oil abnormal return and oil abnormal volume. The related literature (e.g., Yousefi and Wirjanto, 2004; Fan et al., 2008; Yu et al., 2008; Jammazi and Aloui, 2012; Ratti and Vespignani, 2016) shows that stock market activities, foreign exchange

[1] Note that under Article 61 of the UEFA Financial Fair Play Regulations (FFP), the break-even deficit threshold of EUR 5 million can be exceeded up to a certain amount “only if such excess is entirely covered by contributions from equity participants and/or related parties” (see, UEFA, 2010). Thus, the FFP do not prohibit contributions that the club receives directly from the club owners. In addition, Article 58 in the regulations defines sponsorship as one of the relevant income sources that can be counted in the break-even calculation. Article 58 can be exploited as another channel through which owners can indirectly provide funds to clubs through sponsorship deals. One such example is Paris Saint-Germain, which receives EUR 120 million a year from Qatar Tourism Authority (see, https://www.theguardian.com/football/2018/apr/11/psg-may-face-uefa-sanctions-overvalued-qatari-deal).

[2] Note, that we do not include hiring head coaches as a transfer, since this type of transaction is not a purchase and there is normally no transfer fee information available. We do not include bonus payments paid to players, since these are a contingency that depend on the player's performance at a date subsequent to the transfer.

Table 1
Summary of oil-related football club owners.

Name	Position (Club)	Position (oil corporation/country)	Nationality	Club	Takeover date
Nasser Ghanim Al-Khelaïfi	President	Minister of Qatari government (close relationship to the emir of Qatar).	Qatar	PSG	4th November 2011
Sheikh Mansour bin Zayed Al Nahyan	Owner	Member of the royal family of Abu Dhabi.	UAE	Manchester City	1st September 2008
Abdullah bin Nasser Al Thani	Owner	Prime Minister of Qatar (Royal member).	Qatar	Malaga	12th June 2010
Gazprom	Owner	Majority owned by the Government of Russia.	Russia	Zenit	5th December 2005
Roman Abramovich	Investor	Owner of Sibneft oil company (close relationship to Vladimir Putin).	Russia	Chelsea	1st July 2003

rates and global economic conditions potentially drive oil markets. Therefore, we also control for Log (VIX), S&P500 returns, EUR/USD returns and include dummies for financial crises. We winsorize all variables at the 1st and 99th percentiles to avoid possible bias caused by extreme outliers. A full description of variables and their sources are provided in Table 2. The oil futures data is downloaded from Bloomberg. It records daily Brent oil futures prices ($US) and total global oil volume (number of contracts) excluding weekends.

2.2. Variable measures

2.2.1. Football player transfer market variables

Our main independent variable of interest is funds needed for player-transfer transactions of our five European oil-financed football clubs. We construct the variable in four stages. In the first stage, we calculate cash outflows (*cash-out*) and cash inflows (*cash-in*) for each club *f* on event day *t*. The cash-out for each club *f* on day *t* is calculated as the sum of its daily cash outflows by purchase transactions and loan-in contracts as follows:

$$Cash\_out_{f,t} = \sum_{i=1}^{p} Purchase_{i,f,t} + \sum_{i=1}^{li} Loan\_in_{i,f,t} \tag{1}$$

Table 2
Variable definitions and data sources.

	Description	Data source
Panel A: Dependent variables		
Abnormal oil return (Fama-French 5 factors)	The abnormal return on date t is extracted by regressing Fama-French 5 factors model.	Bloomberg & Kenneth French-Data Library
Abnormal oil volume	Abnormal oil volume on date t is calculated as the difference between oil volume traded and average oil volume on date t and then is scaled by 1,000,000 (unit: million contract).	Bloomberg
Panel B: Independent variables		
Fund needed	Fund needed is calculated as the net cash-out of oil related football clubs needed to fund for player-transfers in a certain time window (unit: £100 million).	Transfermarkt.com
Panel C: control variables		
EUR/USD return (%)	EUR/USD return is measured as the natural logarithm of fraction between exchange rate between EUR and USD on date t and date t − 1.	Macrotrends.net
Log (VIX)	Log (VIX) is measured as the natural logarithm of VIX index on date t.	CBOE.com
SP500 return (%)	SP500 return is measured as the natural logarithm of fraction between SP500 index on date t and date t − 1.	Finance.yahoo.com
Crisis	Crisis is a binary variable that takes one if the observation is in crisis periods or zero otherwise	

where *p* and *li* are the number of the purchase and loan-in transactions on day *t*, respectively.Similarly, the cash-in for each club *f* on day *t* is measured as the sum of its daily cash inflows for sell transactions and loan-out contracts as follows:

$$Cash\_in_{f,t} = \sum_{i=1}^{s} Sell_{i,f,t} + \sum_{i=1}^{lo} Loan\_out_{i,f,t} \tag{2}$$

where *s* and *lo* are the number of the sell and loan-out transactions on day *t*, respectively.

In the second stage, we calculate net cash-out for each club *f* on day *t* as cash-out minus cash-in, scaled by 100 (unit: £100 million) as follows:

$$Net\_out_{f,t} = \frac{Cash\_out_{f,t} - Cash\_in_{f,t}}{100} \tag{3}$$

Positive net cash-out indicates that oil-financed clubs require money from other sources to fund player-transfers (Cash-out > Cash-in). Conversely, negative net cash-out implies that oil-financed clubs receive money from player-transfers (Cash-out < cash-in).

In practice, football clubs tend to use positive cash flows by player-transfers (negative net cash-out) surrounding day *t* (i.e., $t \pm k$) to fund negative cash flows from player transfers (positive net cash-out) on day *t*. Therefore, in the third stage, we accumulate $Net\_out_{f,\,t}$ calculated in Eq. (3) for each of the five oil-financed football clubs during an event time window (w) [−2,2]. We also consider alternative time windows including, [−5, 5] and [−10,10] in robustness checks. We define the base event day *t* as when the net cash-out on that day is positive. Hence, the net cash-out over an event window *t* is calculated as:

$$Net\_out_t = \sum_{f=1}^{5} \sum_{t-2}^{t+2} Net\_out_{f,t} \tag{4}$$

In the last stage, we define the funds needed to finance player transfers as:

$$Fund\_needed_t = Max[0, Net\_out_t] \tag{5}$$

This definition illustrates that if the net cash outflows from player transfers into which oil-financed clubs enter (i.e., Net_out_t) is negative, the clubs do not need additional money from other sources to fund player movements, so $Fund\_needed_t = 0$. However, if Net_out_t is positive, oil-financed football clubs will require additional funds from other sources to finance their player transfers transactions; that is, $Fund\_needed_t = Net\_out_t$.

2.2.2. Oil market variables

We apply the most recent version of Fama and French multi-factor model, the five-factor model, presented in Fama and French (2015) to estimate the Brent daily abnormal returns. In robustness checks, we also estimate abnormal returns using the three-factor model of Fama and French (1993), as used by Demirer and Kutan (2010), and the four-factor model of Carhart (1997) as well as the Capital Asset Pricing

Model (CAPM) and Arbitrage Pricing Theory (APT) model. The Fama and French (2015) model is specified as follows:

$$R_{oil,t} - R_{f,t} = a_i + \beta_{oil}(R_{M,t} - R_{f,t}) + \beta_S SMB_t + \beta_H HML_t + \beta_R RMW_t + \beta_C CMA_t + e_{oil,t} \tag{6}$$

where $R_{i,t}$, $R_{M,t}$ and $R_{f,t}$ denote oil daily returns, the daily return of a commodity market portfolio and the risk-free rate respectively. We follow Demirer and Kutan (2010) and select the Dow Jones AIG commodity index as the market portfolio. The risk-free rate is the 3-month US Treasury bill rate. SMB_t, HML_t, RMW_t and CMA_t represent the size, the value, the profitability and the investment factor respectively (see Fama and French, 2015). The model is estimated using a rolling window of 252-trading-days to extract the daily oil return series, $\widehat{R}_{oil,t}$. The daily abnormal returns (AR) of the oil market, therefore, can be measured as:

$$AR_{oil,t} = R_{oil,t} - \widehat{R}_{oil,t} \tag{7}$$

Our other variable of interest in the oil market is the abnormal oil volume (AV) on day t, which is calculated as the difference between global oil volume traded and average oil volume measured on day t and then scaled by 1,000,000 (i.e., million futures contracts) as follows:

$$AV_{oil,t} = \frac{volume_{oil,t} - average\ volume_{oil,t}}{1,000,000} \tag{8}$$

The average oil volume on day t is measured as the average global oil trading volume over 252 trading days prior to day t:

$$average\ volume_{oil,t} = \frac{\sum_{i=1}^{252} volume_{t-i}}{252} \tag{9}$$

2.2.3. Media attention

We collect data on media attention from the FACTIVA database, compiled by Dow Jones, associated with all player arrivals in our sample to examine whether media attention is a channel through which funds needed on the player transfer market influence abnormal futures volume. We measure the media attention associated with a player arrival by aggregating the number of hits over a 10-day period leading up to when the transfer is finalized.

Table 3
Summary statistics of football player-transfers.

	N	Max	Mean	Median	Min	Std
Panel A: Arrivals						
(1) Purchase transaction	313	1.9980	0.1486	0.0810	0.0018	0.1886
(2) Loan transaction (in)	12	0.4050	0.0492	0.0053	0.0014	0.1151
(3) Daily cash out = (1) + (2)	216	2.0160	0.2181	0.1211	0.0018	0.2644
Panel B: Departures						
(4) Sell transaction	211	0.5940	0.0881	0.0540	0.0009	0.1022
(5) Loan transaction (out)	71	0.0711	0.0144	0.0090	0.0011	0.0157
(6) Daily cash in = (4) + (5)	192	0.9090	0.1021	0.0450	0.0009	0.1543
(7) Fund needed	199	1.7127	0.1765	0.0810	0.0000	0.2169

The table presents descriptive statistics of football player-transfers by the five oil-financed European football clubs - Manchester City, PSG, Chelsea, Zenit and Malaga - since 1st July 2003 when Roman Abramovich acquired Chelsea. The table is separated into two panels. Panel A (B) lists arrival (departure) transactions, purchase (sell) transactions and loan-in (out) contracts. Specifically, to reflect financial demands for player-transfers, we measure funds needed (7) by three stages. In the first stage, we calculated daily net cash-out as daily cash-out (3) minus daily cash-in. In the second stage, positive net cash-out (net buy) is adjusted by negative net cash-out (net sell) in time window [−2, 2]. Adjusted net cash-out could be either negative (net sell) or positive (net buy). In the third stage, if the adjusted net cash-out is positive (net buy), funds needed (7) equals the adjusted net cash-out. In this case, on aggregate, these oil-financed football clubs need funds from sources other than player transfers to finance purchase transactions. If the adjusted net cash-out is negative (net sell), funds needed (7) is set to zero. In this case, on aggregate, these oil-financed football clubs can fund purchase transactions by using cash inflows from sell transactions. The unit is £100 million. We note that the variables are winsorized at the 1st and 99th percentiles to avoid possible biases caused by extreme outliers.

2.3. Summary statistics

2.3.1. Statistics on the player transfer market

Table 3 presents descriptive statistics on football player-transfers of oil-financed European football clubs. Panel A provides statistics on purchase transactions and loan-in contracts. Table 4 presents a summary of the largest and smallest transactions in each category. Over the relevant period, the five oil-financed football clubs made 313 purchase transactions and 12 loan-in contracts. The transfer of Neymar da Silva Santos Júnior (Neymar) from Futbol Club Barcelona (Barcelona) to PSG, recorded on 3rd August 2017, was the largest purchase transaction valued £ 199.8 million. In contrast, the transfer of Pablo Marí from Club Gimnàstic de Tarragona (Tarragona) to Manchester City on 15th August 2016, and Cenk Gönen from Galatasaray SK to Malaga were the smallest purchase transactions (£ 0.18 million). The average purchase price for players was £ 14.86 million (the median was £ 8.1 million).

Among loan-in transactions, the largest case reported was £ 40.5 million for the transfer of Kylian Mbappé from AS Monaco to PSG on 31st August 2017. The average value of loan-in contracts was £ 4.92 million (median £ 0.53 million), which, as one would expect, is much lower than purchase transactions. The largest (smallest) value of aggregate cash outflows for transfers was recorded as £ 201.6 million (£ 0.18 million) on 3rd August 2017 (19th July 2017).

Panel B of Table 3 presents statistics on sell transactions and loan-out contracts. There were 211 and 71 cases for sell transactions and loan-out contracts respectively. The transfer of Diego Costa from Chelsea to Club Atlético de Madrid (Atlético Madrid) recorded on 1st January 2018 was the largest sell transaction valued at £ 59.4 million (for more detail see outstanding transactions in Table 4). Conversely, the transfer of Jaroslav Nesvadba from Malaga to NK Inter Zapresic on 1st January 2008 was the smallest sell case (£ 0.09 million). The average sale value of a player departing from oil-related clubs was around £ 9 million.

The largest loan-out transaction was £ 7.11 million for the transfer of Kurt Zouma from Chelsea to Everton on 9th August 2018. The average value of loan-out contracts was about £1.5 million. The largest (smallest) value of aggregate cash inflows for transfers in the five oil-financed clubs was £ 90.9 million (£ 0.09 million) on 1st July 2017 (1st January 2008).

We record 199 event windows of funds needed by the oil-financed clubs after combining information on cash-out and cash-in transactions and aggregating them as per the methodology outlined in Section 2.2.1. The five oil-financed football clubs have overall spent much more than they have earned on the player-transfer market. Notably, the oil-financed clubs needed around £ 171.27 million to fund the deficit on the player-transfer market in one event window. This was predominantly due to the number of purchase transactions being significantly higher than sell transactions (313 versus 211), including purchases of the most expensive, and talented, players, such as Neymar. The deficit per event window was around £ 17.65 million, on average, that these clubs needed to find from sources other than the transfer market. The number of lending transactions that oil-related clubs made was about six times that of borrowing transactions (71 versus 12). However, the average value per transaction of the former was about four times less than the latter (£ 1.44 million versus £ 4.92 million).

2.3.2. Summary statistics for oil futures market and macroeconomic variables

Table 5 reports summary statistics of oil market and macroeconomic variables. Panel A of Table 5 presents descriptive statistics for the Brent oil abnormal return (%) and abnormal oil volume (million contracts). These variables were matched with 199 event windows in which there were financial demands for player-transfers by oil-financed

Table 4
Summary of largest and smallest transactions in each category.

	Date	Value	Detailed information
Section 1: Arrivals			
(1) The largest purchase transaction	3rd Aug 2017	£199.8 million	Neymar da Silva Santos Júnior, from Barcelona to PSG
(2) The smallest purchase transaction	15th Aug 2016 19th Jul 2017	£0.18 million	Pablo Marí, from Tarragona to Manchester City Cenk Gönen, from Galatasaray SK to Malaga
(3) The largest loan transaction	31st Aug 2017	£40.5 million	Kylian Mbappé, from AS Monaco to PSG
(4) The smallest loan transaction	5th Dec 2005	£0.135 million	Fernando Ricksen, from Rangers FC to Zenit
(5) The largest cash out	3rd Aug 2017	£201.6 million	Neymar da Silva Santos Júnior, from Barcelona to PSG Diego González, from Malaga to Sevilla
(6) The smallest cash out	19th Jul 2017	£0.18 million	Cenk Gönen, from Galatasaray SK to Malaga
Section 2: Departures			
(7) The largest sell transaction	1st Jan 2018	£59.4 million	Diego Costa, from Chelsea to Atlético Madrid
(8) The smallest sell transaction	1st Jan2018	£0.09 million	Jaroslav Nesvadba, from Malaga to NK Inter Zapresic
(9) The largest loan transaction	9th Aug 2018	£7.11 million	Kurt Zouma, from Chelsea to Everton
(10) The smallest loan transaction	5th Dec 2005	£0.108 million	Artem Dzyuba, from Zenit to Arsenal
(11) The largest cash in	1st Jul 2017	£90.9 million	Asmir Begovic, from Chelsea to Bournemouth Bertrand Traoré, from Chelsea to Olympique Lyon Christian Atsu, from Chelsea to Newcastle United Juan Cuadrado, from Chelsea to Juventus FC Aaron Mooy, from Manchester City to Huddersfield Town Enes Ünal, from Manchester City to Villarreal CF Youssouf Sabaly, from PSG to FC Girondins Bordeaux Robert Mak, from Zenit to PAOK Thessaloniki Nicolas Lombaerts, from Zenit to KV Oostende
(12) The smallest cash in	1st January 2018	£0.09 million	Jaroslav Nesvadba, from Malaga to NK Inter Zapresic

Table 5
Summary statistics for the oil market and macroeconomic variables.

	N	Max	Mean	Median	Min	Std
Panel A: Dependent variable						
Abnormal return (Fama-French 5 factors)	199	0.1395	0.0022	0.0017	−0.0669	0.0266
Abnormal volume (million contracts)	199	0.1600	0.0036	0.0120	−0.2384	0.0711
Panel B: Control variable						
EUR/USD return	199	0.0144	0.0000	0.0004	−0.0130	0.0051
Log (VIX)	199	3.8377	2.8271	2.7955	2.2364	0.3602
SP500 return	199	0.0617	0.0020	0.0017	−0.0490	0.0126
Crisis (dummy variable)	199	1.0000	0.7889	1.0000	0.0000	0.4091

This table reports descriptive statistics for abnormal returns and volume in the oil market and macroeconomic variables. The sample size is matched with event windows of the funds needed by the five oil-financed football clubs. The table is separated into two panels. Panel A displays the descriptive statistics for abnormal oil returns and abnormal oil volume. Panel B shows descriptive statistics of macroeconomic variables that are correlated with oil prices. All variables are defined in Table 2. The variables are winsorized at 1st and 99th percentiles to avoid possible biases due to extreme outliers.

football clubs. The oil abnormal return and volume seem to be small on average; 0.22% and 3600 contracts, respectively. However, in the extreme, there are event windows in which abnormal returns and volumes are very high. This pattern might be indicative of shock transmission from the financial demands of oil-financed clubs caused by high-value player transfers to the oil market.

Panel B of Table 5 displays summary statistics of the macroeconomic variables, which are also matched with 199 event windows of funds needed by the oil-financed clubs in the player transfer market. Interestingly, the average return of the S&P 500 is about the same as the average oil abnormal return (0.2% versus 0.22%) over these 199 event windows. However, the maximum value of the latter is more than double that of the former (13.95% versus 6.17%). Fluctuations in the USD exchange rate are even less than the S&P 500. Overall, it seems that the factors which are commonly associated with oil price fluctuations are not the main reason for abnormal fluctuations in oil markets over these 199 events windows.

3. Methodology

We employ a linear regression framework to examine the impact of the overall financial demand generated by player transfers on the oil abnormal return and volume:

$$AR_{oil,t} = \alpha_R + \beta_R Fund\ needed_t + \beta_{R,X} X_t + \epsilon_{oil,t} \tag{10}$$

$$AV_{oil,t} = \alpha_V + \beta_V Fund\ needed_t + \beta_{V,X} X_t + v_{oil,t} \tag{11}$$

where $AR_{oil,t}$ and $AV_{oil,t}$ are oil abnormal return and volume respectively. *Fund needed*$_t$ is the financial demands of the oil-financed clubs for player-transfer transactions that cannot be funded through the player transfer market. X_t denotes the control variables; namely, return on the EUR/USD rate, logarithm of VIX, S&P 500 returns and crises dummies. We control for fixed year effects.[3] The values for β_R and β_V, respectively, will be significant if the financial demand of oil-financed clubs for player-transfers has an impact on abnormal returns and abnormal volumes. We intuitively expect β_R to be positive if the channel via which a shock in the funds needed to acquire players on the player-transfer market impacts the oil market is through the oil owners exercising their monopoly power. We expect β_V to be positive if the channel through which the transmission shock occurs is through oil investor trading decisions.

We conjecture that abnormal fluctuations in oil markets will be more associated with event windows in which larger funds are needed. The reason is that the larger financial demand of the oil-financed clubs for their player transfers in a given window translates into higher likelihood that their owners will seek to fund it from the oil market.[4]

[3] Note that we do not control for club fixed effects since *funds needed* in our analysis is defined as the sum of funds needed collectively by all five oil-financed clubs.

[4] Football clubs have multiple sources of revenue, including ticket sales, merchandise and, in particular, in England, television broadcast money. These revenue flows, however, are typically, pre-allocated for operating expenses throughout the year and, we submit, clubs would not risk the routine operations of the club on bringing in one-or-two-star players. We do not control for these alternative revenue streams in our main analysis because this data is only reported on a yearly basis; hence, we do not have the revenue data right before the player transfer, in order to conduct the precise analysis. However, we perform a robustness check in Section 4.3.2, which adjusts the funds needed using information on annual revenue. We find consistent results.

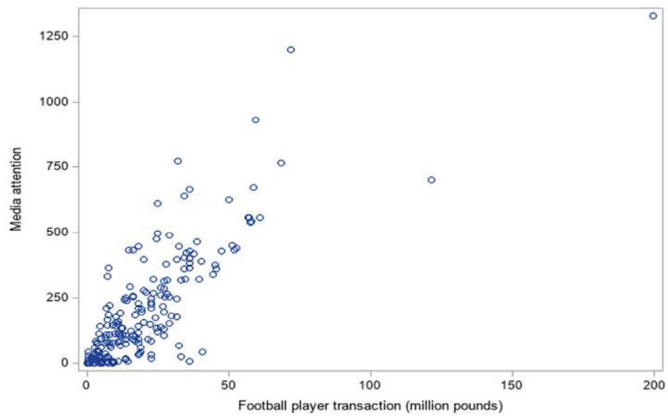

Fig. 1. Scatter plot between the media attention and oil-financed player transfers. Note: this figure shows the relationship between the transfer price of players in oil-financed football clubs and the media attention that those transfers attracted. Using the FACTIVA database, compiled by Dow Jones, we collect the number of hits associated with the arrivals of players in our sample and aggregate the number of hits for a 10-day-period leading up to when the transfer is finalized. The estimated correlation coefficient between the media attention received and the transfer price of players is 81.8%, which is statistically significant at 1% significant level.

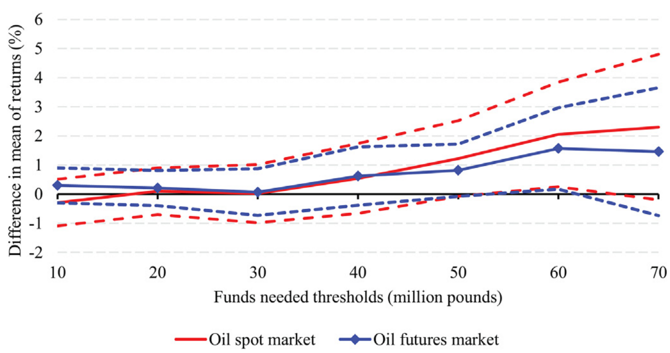

Fig. 2. Difference-in-mean of oil abnormal returns between 'higher' and 'lower' groups across funds needed thresholds. Note: This figure plots estimates of the difference-in-mean of the oil abnormal return, and their 95% confidence interval bounds, between higher and lower groups across thresholds of funds needed. The higher (lower) group consists of window events associated with funds needed that are higher (lower) than the threshold. The estimates, and their bounds, are extracted from *t*-tests for difference-in-mean with unequal variance between the higher group and the lower group.

Moreover, it is likely this will be associated with the transfer of more talented and expensive players, which will attract more news coverage in event windows in which larger funds are needed. Fig. 1 shows a significant and positive relationship between media attention and the transfer price of players. Large numbers of investors in oil futures are aware of transfers, given the widespread media coverage that they receive. Increased numbers may translate into abnormal trading volumes in the oil futures market as investors take out contracts in the hope of getting abnormal returns.

To examine this conjecture, we analyse the impact of high-value player transfers on the oil market using the following specifications for abnormal return and volume respectively:

$$AR_{oil,t} = \alpha_R + \beta_{R,u} Fund\ needed_t I(\geq m) + \beta_{R,d} Fund\ needed_t I(<m) + \beta_{R,X} X_t + \epsilon_{oil,t} \quad (12)$$

$$AV_{oil,t} = \alpha_R + \beta_{V,u} Fund\ needed_t I(\geq m) + \beta_{V,d} Fund\ needed_t I(<m) + \beta_{V,X} X_t + v_{oil,t} \quad (13)$$

We consider three different thresholds $m = \{£50$ million, £60 million, £70 million$\}$ of funds needed in the player-transfer market on abnormal returns in the oil market. Our choices of thresholds are driven by an analysis of potential thresholds of funds needed (see Fig. 2).[5] We expect $\beta_{R,u}$ and $\beta_{V,u}$ to be significant and positive, representing the effect of funds needed (greater than, or equal to, m) on oil abnormal returns and volume respectively.

4. Results

4.1. Impact of funds needed for player transfers on abnormal oil futures fluctuations

We present the results for how the financial demands (or *funds needed*) of oil-financed clubs for player transfers - i.e. additional funding sourced other than via the player-transfer market - affect oil futures abnormal returns in Table 6. We find that each additional £1 million in funds needed by oil-financed clubs on the player-transfer market results in a 0.008% increase in the daily oil futures abnormal return in the event window after controlling for macroeconomic effects and fixed year effects. The effect of each additional £1 million in funds needed is more pronounced if the funds needed are greater than £50 million or £60 million, resulting in a corresponding increase of 0.011% and 0.014% in the daily abnormal returns, respectively. However, the player transfer market no longer has a significant effect on abnormal oil returns when the funds needed are greater £70 million.

The results for how funds needed by oil-financed football clubs affect abnormal volume are given in Table 7. The coefficient on *funds needed* (β_V) in Eq. (11) is insignificant. Moreover, the additional increase also does not have an impact on the abnormal oil futures trading volume if the funds needed are greater than £50 million or £60 million. However, every £1 million increase in the funds needed above the £70 million threshold, leads to an increase of 800 futures contracts in abnormal oil futures trading volume.

Briefly, the results for the control variables are reassuringly consistent with expectations and previous studies. The oil price increases when the USD is relatively weaker than the EUR or there is an increasing fear about the future risk level of the stock market. This is consistent with portfolio rebalancing activities in which investors tend to shift from the stock market to oil market when the stock market becomes riskier. Our results also suggest that investors seek safe havens, such as bonds and gold, which, in turn, can lead to a decrease in returns on both the oil and stock markets during periods of financial crises.

4.2. What are the underpinning mechanisms that explain these results?

The first potential channel is that when the oil-financed clubs experience large deficits on the player-transfer market, their owners behave opportunistically to generate a spike in the oil spot price. The idea is that the oil-rich owners have sufficient market share to exploit the low liquidity level of the oil spot market, a physical commodity market, to drive the oil spot price up, at least over a very short window, by withholding the oil supply.[6] The price adjustment firstly occurs in the oil spot

[5] We firstly consider a series of potential thresholds of funds needed ranging from £10 million to £70 million and we divide our sample into two groups for each threshold, called the higher group and the lower group. The higher (lower) group consists of window events associated with funds needed that is higher (lower) than the threshold. We subsequently perform *t*-tests for difference-in-mean of oil abnormal returns between the higher group and the lower group. Fig. 2 plots the estimates of the difference-in-mean and its 95% confidence interval bounds across the series of potential thresholds. We find that the difference-in-mean of oil abnormal returns between the two groups is statistically significant when the threshold is £50 million and above.

[6] As of 2018, the oil production share of Russia was 12.1% while the total oil production share of UAE and Qatar was 6.2% (BP, 2020). In the robustness section below, we explore heterogeneity between the funds needed by Russian-financed and Middle East-financed clubs in the player-transfer market on the oil spot market. We find that Chelsea has a more pronounced effect on the oil spot market than either PSG or Manchester City, reflecting the differences in oil market share between Russia, on the one hand, and Qatar and the UAE on the other.

Table 6
Player-transfers of oil financed clubs and abnormal oil futures return with [−2, 2] window.

Abnormal oil futures return								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Intercept	−0.013	−0.023	−0.012	−0.020	−0.012	−0.018	−0.013	−0.022
	(0.013)	(0.019)	(0.012)	(0.019)	(0.012)	(0.020)	(0.013)	(0.020)
Fund needed	0.006	0.008*						
	(0.004)	(0.004)						
Fund needed*I (≥ 50)			0.010**	0.011**				
			(0.004)	(0.004)				
Fund needed*I (< 50)			−0.005	−0.006				
			(0.007)	(0.010)				
Fund needed*I (≥ 60)					0.012*	0.014**		
					(0.006)	(0.006)		
Fund needed*I (< 60)					−0.002	−0.002		
					(0.006)	(0.007)		
Fund needed*I (≥ 70)							0.009	0.011
							(0.009)	(0.010)
Fund needed*I (< 70)							0.004	0.005
							(0.007)	(0.007)
Control variable:								
EUR/USD return	0.230	0.110	0.219	0.090	0.244	0.133	0.223	0.103
	(0.274)	(0.245)	(0.270)	(0.236)	(0.270)	(0.242)	(0.279)	(0.248)
Log (VIX)	0.005	0.008	0.005	0.007	0.005	0.007	0.005	0.008
	(0.004)	(0.006)	(0.004)	(0.006)	(0.004)	(0.006)	(0.004)	(0.007)
SP500 return	−0.622**	−0.517**	−0.626**	−0.522**	−0.617**	−0.512**	−0.623**	−0.519**
	(0.214)	(0.240)	(0.216)	(0.241)	(0.216)	(0.241)	(0.214)	(0.241)
Crisis	−0.001	−0.005**	−0.002	−0.005**	−0.002	−0.005**	−0.001	−0.005*
	(0.004)	(0.002)	(0.004)	(0.002)	(0.004)	(0.002)	(0.004)	(0.002)
Fixed year effects	No	Yes	No	Yes	No	Yes	No	Yes
Number of observations	199	199	199	199	199	199	199	199
R-squared	0.147	0.207	0.154	0.216	0.155	0.217	0.148	0.208

This table presents the estimated impacts of funds needed for player-transfers by oil-financed clubs on abnormal oil returns (*AR*) using a window of [−2, 2]. We investigate the impact of overall funds needed as well as amounts above given thresholds on the abnormal oil return employing the two following models:

$$AR_{oil,t} = \alpha_R + \beta_R Fund\ needed_t + \beta_{R,X} X_t + \epsilon_{oil,t}$$

$$AR_{oil,t} = \alpha_R + \beta_{R,u} Fund\ needed_t I(\geq m) + \beta_{R,d} Fund\ needed_t I(<m) + \beta_{R,X} X_t + \epsilon_{oil,t}$$

The dependent variable is Brent oil abnormal return (*AR*) extracted from the Fama-French five factor model. The independent variable (*Fund needed*) is measured as the net cash-out of oil-financed football clubs needed to fund player-transfers (unit: £100 million). $I(<m)$ (or $I(\geq m)$) takes the value one if *fund needed* is less (or more) than a threshold of £ *m* million, and zero otherwise. We test three different thresholds: £50 million, £60 million and £70 million. Control variables X_t included in the specification are EUR/USD returns, S&P500 returns, Log (VIX) and dummy variables for financial crises. All the variables are defined in Table 2. We include estimates with, and without, year fixed effects. Standard errors in parentheses are adjusted for heteroskedasticity and clustering at the year level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

market since the financial demands resulting from deficits on the player-transfer market can be short-lived and one-offs for each event window.

One might ask, if these owners have sufficient market share to drive the price up, why don't they do it at other times? We suspect that they do not have the market power to routinely do this. If they were doing it routinely, it is likely they would attract the attention of other OPEC members. It could be that they do manipulate the price at other times as well in response to particular opportunities or a need for quick funds. But, if it is done infrequently, again in response to an opportunity such as buying a player, it can go largely unnoticed. There is also a psychological element to this behaviour. We are not arguing that the owners are strategic in manipulating the price to maximize their profits as part of a long-term plan. Rather, if the owners are acting opportunistically, withholding supply to get a temporary spike in the market can be more or less a spur of the moment thing. A manager presents them with an opportunity to purchase a player and they make a snap decision in response to that. It is not necessarily well-thought out as part of some long-term profit maximizing strategy.

Table 8 shows the results for the effect of player-transfers of oil-financed clubs on abnormal oil spot returns. With a full set of controls, for each additional £1 million in funds needed by oil-financed clubs on the player-transfer market, there is a 0.014% increase in the daily oil spot abnormal return. Moreover, funds needed have a positive and significant impact on the abnormal oil spot returns across the £50 million, £60 million, and £70 million thresholds.

To provide a back of the envelope estimate of the economic significance of this effect, we collect annual data on worldwide oil consumption for the period 2003–2019 from the BP Statistical Review of World Energy (BP, 2020). We calculate average daily worldwide spending on oil for each year as (annual worldwide oil consumption/365)*the average daily oil spot price. The average daily abnormal worldwide spending on oil for each year, due to the effect of funds needed, is subsequently calculated as the average daily worldwide spending on oil*0.014%. The figures are then averaged over the sample from 2003 to 2019. We find that, on average, the world spends about USD6.5 billion per day on oil consumption. If the oil spot price abnormally increases by 0.014% for each additional of £1 million in funds needed on the transfer day, on average it costs the world about USD 0.91 million more for oil.[7]

To test our conjecture that oil-rich owners behave opportunistically in curtailing oil supply, we collected monthly oil supply data of Russia, the UAE, and Qatar from January 2003 to December 2019 and calculate the abnormal oil supply in each month as the difference between the oil supply level in that month and the average monthly oil supply over the previous 12 months. We regress monthly abnormal oil supply on the monthly aggregate funds needed in the transfer market by the clubs. We present the results in Table 9. On average, every £1 million increase in the funds needed is associated with almost a 50,000-barrel decrease in the abnormal oil supply. We note that this marginal negative effect

[7] To conserve space, we present this result in Table A1 in the Online Appendix.

Table 7
Player-transfers of oil financed clubs and abnormal oil futures volume with [−2, 2] window.

Abnormal oil futures volume								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Intercept	−0.131*	−0.336***	−0.132*	−0.340***	−0.130*	−0.338***	−0.130	−0.329***
	(0.072)	(0.107)	(0.070)	(0.105)	(0.071)	(0.100)	(0.075)	(0.108)
Fund needed	0.018	0.025						
	(0.024)	(0.020)						
Fund needed*I (≥ 50)			0.013	0.021				
			(0.024)	(0.021)				
Fund needed*I (< 50)			0.035	0.044				
			(0.044)	(0.042)				
Fund needed*I (≥ 60)					0.019	0.022		
					(0.025)	(0.024)		
Fund needed*I (< 60)					0.016	0.031		
					(0.042)	(0.045)		
Fund needed*I (≥ 70)							0.072***	0.080***
							(0.013)	(0.018)
Fund needed*I (< 70)							−0.024	−0.018
							(0.030)	(0.027)
Control variable:								
EUR/USD return	0.150	0.912	0.167	0.939	0.153	0.899	0.016	0.806
	(0.987)	(1.093)	(0.999)	(1.107)	(0.984)	(1.103)	(0.991)	(1.087)
Log (VIX)	0.045*	0.109***	0.045*	0.110***	0.045*	0.110***	0.047*	0.109***
	(0.024)	(0.036)	(0.024)	(0.036)	(0.024)	(0.035)	(0.025)	(0.037)
SP500 return	−0.457	−0.324	−0.452	−0.317	−0.456	−0.327	−0.481	−0.349
	(0.402)	(0.456)	(0.404)	(0.452)	(0.403)	(0.455)	(0.417)	(0.468)
Crisis	0.005	0.001	0.005	0.001	0.005	0.001	0.005	0.005
	(0.014)	(0.012)	(0.014)	(0.012)	(0.014)	(0.012)	(0.014)	(0.012)
Fixed year effects	No	Yes	No	Yes	No	Yes	No	Yes
Number of observations	199	199	199	199	199	199	199	199
R-squared	0.054	0.210	0.056	0.211	0.054	0.210	0.081	0.236

This table presents the estimated impact of funds needed for player-transfers by oil related clubs on abnormal oil volume (*AV*) using a window of [−2, 2]. We investigate the impact of overall funds needed as well as amounts above given thresholds on the abnormal oil return employing the two following models:

$$AV_{oil,t} = \alpha_V + \beta_V Fund\ needed_t + \beta_{V,X} X_t + v_{oil,t}$$

$$AV_{oil,t} = \alpha_V + \beta_{V,u} Fund\ needed_t I(\geq m) + \beta_{V,d} Fund\ needed_t I(<m) + \beta_{V,X} X_t + v_{oil,t}$$

The dependent variable is Brent oil abnormal volume (*AV*) calculated as the difference between oil volume traded and average oil volume. The independent variable (*Fund needed*) is measured as the net cash-out of oil financed football clubs needed to fund player-transfers (unit: £100 million). $I(<m)$ (or $I(\geq m)$) takes value one if *fund needed* is less (or more) than a threshold of £ m million, and zero otherwise. We test three different thresholds: £50 million, £60 million and £70 million. Control variables X_t included in the specification are EUR/USD returns, S&P500 returns, Log (VIX) and dummy variables for financial crises. All the variables are defined in Table 2. We include estimates with, and without, year fixed effect. Standard errors in parentheses are adjusted for heteroskedasticity and clustering at the year level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

increases alongside an increase of the thresholds, from roughly 50,380 barrels to 57,170 barrels for every additional £1 million in funds needed, corresponding to a threshold from £50 million to £70 million.

We posit that the transitional effect of oil rich owners' opportunistic behaviour on reducing the oil supply will be reinforced if there is group of investors who monitor both the oil market and the financial activities of the oil-rich owners. Here, player transfers of oil-financed clubs are included in the financial activities that this group of investors looks at. Our conjecture is that when there are high-value player transfers of oil-related clubs, which lead to a deficit in the player transfer market, these investors worry that this will translate into a reduction in the oil supply if they expect the oil-rich owners to behave opportunistically.

To test this conjecture, we collected the daily Google Search Volume Index (SVI) for the term “oil supply reduction” from Google Trends. Following the method in Huang et al. (2019), we calculated the daily abnormal SVI and performed a t-test for the difference in mean between the (abnormal) SVI in days that the funds-needed is positive (deficit days) and in days with no deficit. Panel A in Table 10 shows that both the normal and abnormal SVI for the term “oil supply reduction” are significantly higher on deficit days compared to non-deficit days. The result is strongly reconfirmed by the regression of SVI on a dummy denoting deficit days presented in Table 10. The search trends surrounding deficit days presented in Fig. 3 show that the abnormal SVI starts to increase above the baseline (i.e., average abnormal SVI in non-deficit days) around 4 days before the deficit day and it peaks on the day. Given this result, we perform additional analyses on the relationship between funds needed and the oil spot returns using the windows [−1,0], [−2,0] and [−5,0] for oil returns. We find that that the more concentrated the window around the deficit day, the stronger the effect and the effect tends to disappear in the [−5, 0] window. These results suggest that there is a supplementary role for the market in reinforcing the effect of an oil supply reduction on oil spot prices.[8]

The spot price is one of the main determinants of the futures price. Thus, price adjustment in the oil spot market will subsequently be reflected in the oil futures market, unless it is dissipated by oil futures investors seeking to take advantage of the shock transmission and engaging in abnormal trading on a wide scale (see e.g., French, 1986).[9] The effect of abnormal oil futures trading volumes on abnormal oil futures returns is negative and significant. Hence, an increase in abnormal oil futures trading volumes dilutes abnormal oil futures returns.[10]

The manner in which the trading activities of oil futures investors influence how the player transfer market affects the oil futures price is the second channel. There are two possible scenarios. One is that if oil futures investors are aware on a broad scale of the shock transmission from the player-transfer market to the oil spot market, oil futures

[8] We do not report the results for alternative time windows for oil spot returns to conserve space. However, details are available upon request.

[9] We note that the temporary shock transmission from the player-transfer market to the oil spot market will not be diluted by spot trading activities due to its much lower liquidity in comparison with the oil futures market.

[10] We do not report the results, but they are available on request.

Table 8
Player-transfers of oil financed clubs and abnormal oil spot return with [−2, 2] window.

Abnormal oil spot return								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Intercept	−0.054**	−0.082*	−0.052**	−0.076*	−0.051**	−0.073*	−0.054**	−0.080*
	(0.022)	(0.044)	(0.019)	(0.041)	(0.020)	(0.041)	(0.022)	(0.044)
Fund needed	0.011	0.014*						
	(0.007)	(0.007)						
Fund needed*I (≥ 50)			0.020***	0.022***				
			(0.006)	(0.006)				
Fund needed*I (< 50)			−0.022	−0.017				
			(0.014)	(0.016)				
Fund needed*I (≥ 60)					0.025***	0.027***		
					(0.007)	(0.008)		
Fund needed*I (< 60)					−0.011	−0.007		
					(0.011)	(0.011)		
Fund needed*I (≥ 70)							0.023**	0.025**
							(0.009)	(0.010)
Fund needed*I (< 70)							0.002	0.005
							(0.009)	(0.011)
Control variable:								
EUR/USD return	1.324*	1.407*	1.292*	1.362*	1.358*	1.453*	1.295*	1.385*
	(0.676)	(0.793)	(0.644)	(0.767)	(0.664)	(0.781)	(0.676)	(0.791)
Log (VIX)	0.021**	0.029*	0.022***	0.027*	0.021***	0.027*	0.022**	0.029*
	(0.008)	(0.015)	(0.007)	(0.014)	(0.007)	(0.014)	(0.008)	(0.015)
SP500 return	−0.454**	−0.500**	−0.466**	−0.511**	−0.443**	−0.490**	−0.460**	−0.505**
	(0.160)	(0.226)	(0.164)	(0.226)	(0.158)	(0.223)	(0.160)	(0.225)
Crisis	−0.007*	−0.001	−0.008**	−0.001	−0.007**	−0.001	−0.007*	0.000
	(0.004)	(0.006)	(0.003)	(0.006)	(0.003)	(0.006)	(0.005)	(0.002)
Fixed year effects	No	Yes	No	Yes	No	Yes	No	Yes
Number of observations	199	199	199	199	199	199	199	199
R-squared	0.197	0.238	0.234	0.266	0.227	0.262	0.206	0.246

This table presents the estimated impacts of funds needed for player-transfers by oil financed clubs on abnormal oil return (*AR*) using a window of [−2, 2]. We investigate the impact of overall funds needed as well as amounts above given thresholds on the abnormal oil return employing the two following models:

$$AR_{oil,t} = \alpha_R + \beta_R Fund\ needed_t + \beta_{R,X} X_t + \epsilon_{oil,t}$$

$$AR_{oil,t} = \alpha_R + \beta_{R,u} Fund\ needed_t I(\geq m) + \beta_{R,d} Fund\ needed_t I(< m) + \beta_{R,X} X_t + \epsilon_{oil,t}.$$

The dependent variable is Brent oil abnormal return (*AR*) extracted from the Fama-French five factor model. The independent variable (*Fund needed*) is measured as the net cash-out of oil-financed football clubs needed to fund player-transfers (unit: £100 million). $I(<m)$ (or $I(\geq m)$) takes the value one if *fund needed* is less (or more) than a threshold of £ m million, and zero otherwise. We test three different thresholds: £50 million, £60 million and £70 million. Control variables X_t included in the specification are EUR/USD returns, S&P500 returns, Log (VIX) and dummy variables for financial crises. All the variables are defined in Table 2. We include estimates with, and without, year fixed effect. Standard errors in parentheses are adjusted for heteroskedasticity and clustering at the year level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

investors cannot earn abnormal returns. In the other scenario, when only a limited number of investors are aware of this transmission, potential exists for those investors to earn abnormal returns. These channels are consistent in spirit with Fang and Peress (2009) who find that stocks with high media coverage have lower expected returns than those with no media coverage.

The relationship between funds needed and abnormal oil futures trading volume can be used to identify which scenario is operating. Specifically, if the effect of funds needed on abnormal oil futures trading volume is significant (insignificant), the oil futures market is in scenario one (two). This is because trading volumes are positively correlated with the level of information that is incorporated in the oil market.

That funds needed do not have a significant effect on abnormal oil futures trading volume (Columns 1 and 2 of Table 7), nor if the funds needed exceed the £50 million (Columns 3 and 4 of Table 7) or £60 million (Columns 5 and 6 of Table 7) thresholds, suggests that investors generally do not pay significant attention to the effect of oil-financed clubs player-transfer activities on oil futures. Overall, oil futures investors can generally earn abnormal returns by exploiting the shock transmission between the player-transfer market and oil market. As a result, we find significant and positive impacts of the fund needed on both abnormal oil spot and futures returns for the £50 million and £60 million thresholds (see Tables 6 and 8). The trading activities of oil futures investors are mostly consistent with the second scenario.

It is only in event windows when the funds needed exceed a very high threshold (£70 million) that oil futures investors become aware of the transmission on a wide-scale and that funds needed have a significant effect on abnormal oil futures trading volume (Columns 7 and 8 of Table 7). This result makes sense as these event windows are normally associated with the purchase of the highest profile players in the eworld, such as Neymar Júnior (from Barcelona to PSG). As such, these transfers are broadly covered in the media, often with reference to the deep pockets of the oil owners of the club who are financing the transfer.

The significant positive effect of funds needed on abnormal returns in the oil spot market (Columns 7 and 8 of Table 8) do not translate into a significant positive effect on abnormal returns in the oil futures market (Columns 7 and 8 of Table 6) when the threshold exceeds £70 million. This reflects that the majority of oil futures investors seek to take advantage of awareness of the likely shock transmission from the player-transfer market to the oil market, having a positive effect on abnormal trading volume in the oil futures market (Columns 7 and 8 of Table 7). At a very high threshold this is consistent with the first scenario.

We argued earlier that media attention mediates the impact of funds needed by oil-financed clubs for player transfers on abnormal oil futures volume. This is because media attention on player transfers can increase awareness of oil futures investors about the possibility of the shock transmission between the two markets, especially when the transfer value is high. Fig. 1 provides suggestive evidence for this hypothesis. Our hypothesis is also in line with Peress' (2014) findings that in stock markets trading volume decreases 12% on days in which there were

Table 9
Player-transfers of oil financed clubs and the abnormal oil supply of Russia, United Arab Emirates, and Qatar.

Abnormal monthly oil supply (million barrels)	(1)	(2)	(3)	(4)
Intercept	7.129***	7.006***	6.781***	6.693***
	(1.998)	(2.054)	(1.938)	(1.995)
Fund needed	−4.989*			
	(2.796)			
Fund needed*I (≥ 50)		−5.038*		
		(2.803)		
Fund needed*I (< 50)		−1.393		
		(5.871)		
Fund needed*I (≥ 60)			−5.494*	
			(3.090)	
Fund needed*I (< 60)			2.582	
			(3.572)	
Fund needed*I (≥ 70)				−5.717*
				(3.179)
Fund needed*I (< 70)				3.315
				(3.490)
Control variable	Yes	Yes	Yes	Yes
Fixed year effects	Yes	Yes	Yes	Yes
Number of observations	204	204	204	204
R-squared	0.175	0.177	0.191	0.201

This table presents the estimated impacts of monthly aggregated funds needed for player-transfers by oil financed clubs on monthly abnormal oil supply (AS). We investigate the impact of overall funds needed as well as amounts above given thresholds on the abnormal oil supply employing the two following models:

$$AS_{oil,t} = \alpha_S + \beta_S Fund\ needed_t + \beta_{S,X} X_t + \eta_{oil,t}$$

$$AS_{oil,t} = \alpha_S + \beta_{S,u} Fund\ needed_t I(\geq m) + \beta_{S,d} Fund\ needed_t I(<m) + \beta_{S,X} X_t + \eta_{oil,t}$$

The dependent variable is abnormal monthly oil supply (AS) calculated as the difference between the oil supply level in that month and the average monthly oil supply over the previous 12 months. The oil supply data of Russian, UAE and Qatar are collected from Datastream for the period ranging from January 2003 to December 2019. The independent variable (*Fund needed*) is measured as the net cash-out of oil-financed football clubs needed to fund player-transfers (unit: £100 million). The fund needed is then aggregated on a monthly basis. $I(<m)$ (or $I(\geq m)$) takes the value one if *fund needed* is less (or more) than a threshold of £ m million, and zero otherwise. We test three different thresholds: £50 million, £60 million and £70 million. Control variables X_t included in the specification are EUR/USD returns, S&P500 returns, Log (VIX) and dummy variables for financial crises. All the variables are defined in Table 2. Standard errors in parentheses are adjusted for heteroskedasticity and clustering at the year level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 10
Difference between the Google Search Volume Index (SVI) in deficit days and non-deficit days.

	Normal SVI for "Oil Supply Reduction"			Abnormal SVI for "Oil Supply Reduction"		
	Deficit days (1)	Non-deficit days (2)	Diff. (1)–(2)	Deficit days (1)	Non-deficit days (2)	Diff. (1)–(2)
Panel A: Difference (t-test)						
Mean	55.038	45.846	9.193***	0.399	0.106	0.293***
			(0.006)			(0.000)
Median	51.766	41.838	9.929***	0.348	0.023	0.324***
			(0.001)			(0.000)
Panel B: Regression						
Deficit day (dummy)	10.783***			0.257***		
	(0.002)			(0.000)		
Fixed effects	Yes			Yes		
R-squared	0.007			0.043		
Number of observations	5841			5841		

The Panel A of this table shows the T-test for difference in mean of the SVI between deficit days and non-deficit days in the player transfer markets of the oil-financed clubs. Meanwhile, the Panel B shows the regression of SVI on the deficit day dummy. The daily SVI and abnormal daily SVI are constructed following Huang et al. (2019) based on Google Trends data. We note that the unit of the difference in daily SVI is index point, whereas that of the abnormal daily SVI is percentage points. The abnormal daily SVI is calculated as the dispersion of the daily SVI from its median from the previous 25th week to the 5th week, then scaled by its median

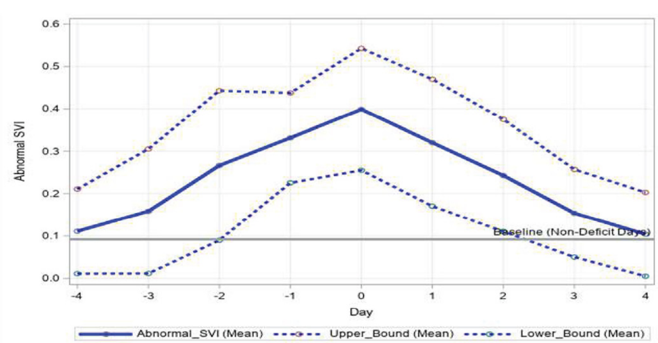

Fig. 3. Abnormal SVI for term "Oil supply reduction" surrounding deficit days. This figure shows the changing trend of the daily abnormal SVI for term "Oil supply reduction" around the deficit days that oil-financed clubs experienced in the player transfer market. The trend is compared with the baseline of average abnormal SVI level in non-deficit days, which is represented by the horizontal line.

national newspaper strikes or limited news coverage. We follow the approach used in studies such as Alesina and Zhuravskaya (2011) to formally test whether media attention plays a major role in facilitating the effect of funds needed on abnormal oil futures volume. We firstly test whether there is a positive association between funds needed and the media attention by regressing media attention, proxied by the aggregate number of hits on FACTIVA which the transfer received in the 10-day period leading up to when the transfer is finalized, on funds needed in the first stage. In the second stage, we regress the abnormal oil futures volume on funds needed with, and without, media attention as a covariate. Following Alesina and Zhuravskaya (2011), we conclude that media attention is a mediator if (i) the impact of funds needed on media attention is statistically significant, and (ii) the estimated effect

Table 11
Test for media attention as a mediator between funds needed and abnormal oil futures volume.

Stage 1: Media attention			Stage 2: Abnormal oil futures volume	
Parameter	No controls	With controls	Without media attention	With media attention
Intercept	0.030**	−0.031	−0.336***	−0.335***
	(0.011)	(0.167)	(0.106)	(0.105)
Fund needed	0.960***	0.959***	0.025	0.004
	(0.071)	(0.072)	(0.02)	(0.039)
Control variables	No	Yes	Yes	Yes
Fixed year effect	No	Yes	Yes	Yes
R-squared	0.616	0.644	0.21	0.211
No. of obs.	199	199	199	199

This table present the estimates of two regressions to illustrate the role of media attention as a channel through which funds needed (£100 million) influences abnormal trading activities on the oil futures market. In stage 1, the dependent variable is media attention (or number of hits that news of the transfer receives in the 10 days leading up to the transfer on Dow Jones, FACTIVA in '000 s). In stage 2, the dependent variable is abnormal oil futures volume. Control variables are the same as in earlier tables. Standard errors in parentheses are adjusted for heteroskedasticity and clustering at the year level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

of funds needed on abnormal oil futures volume decreases after including media attention as a covariate.

We report the results of this exercise in Tables 11 and 12. In the first stage, there is a significant positive relationship between funds needed and media attention. In stage two, overall funds needed is insignificant with, and without, media attention as a covariate when abnormal oil futures volume is the dependent variable (Table 11) and when funds needed exceed the £50 million and £60 million thresholds (Table 12). However, the estimated effect of funds needed on abnormal oil futures volume decreases from a statistically significant value of 0.08 (at the 1% significance level) to a statistically insignificant value of 0.052 when funds needed exceed the £70 million threshold. Hence, media attention mediates the impact of funds needed on abnormal oil futures volume above the £70 million threshold. These results are consistent with our explanation for the findings in Table 7. It is only when funds needed are very high that media attention is sufficient to act as a channel to abnormal oil futures volume.

4.3. Robustness checks

4.3.1. Alternative time windows and model choices

As a first check, we examine the sensitivity of our results to employing [−5,5] and [−10,10] time windows for calculating the funds needed, which represent 1 and 2 weeks around the player transfer event on day *t*. Tables A2–A5 (see, the Online Appendix) report the results for abnormal oil futures returns and abnormal oil futures trading volume, respectively. Our main findings remain highly robust across these time windows. We also check the channel of these effects through the oil spot market as outlined in Section 4.2 by estimating the impact of funds needed on abnormal oil spot returns using the [−5,5] and [−10,10] time windows. The results, which are reported in Tables A6 and A7, are consistent with our main findings in Table 8.

In our main results we rely on the latest version of the Fama and French model - the five-factor model (see Fama and French, 2015) - to construct abnormal returns. As previous studies have used either three-factor (Fama and French, 1993; see Demirer and Kutan, 2010) or four-factor (Carhart, 1997) models for the same purpose, we first employ each of these models with alternative windows as robustness checks in Tables A8–A11. Our main results are robust to constructing abnormal returns using either the three-factor or four-factor model.

While the Fama-French model is widely used, one may be concerned whether the Fama-French factors, other than the commodity market risk premium factor, are best suited to explain abnormal oil returns. Hence, we use the CAPM with only the commodity risk premium factor, and APT model with multi-factors, including commodity risk premium factor and macroeconomic variables (exchange rate changes, investor gauge fear, S&P 500 returns) as alternatives to construct abnormal oil returns in further checks. The results are presented in Tables A12 and A13. Our main results are highly robust to constructing abnormal returns using either the CAPM or APT model. Overall, our results are robust across all considered models (i.e., three-, four-, five-factor, CAPM, and APT models), time windows (i.e., [−2, 2], [−5, 5], and [−10, 10]), and thresholds (i.e., £ 50 million, £ 60 million, and £ 70 million).

One might be concerned about the implications that flow from oil prices being volatile and that their volatility is time varying. GARCH-type models can be used in modeling time series when volatility is time-varying. To examine if volatility is confounding our results we perform additional robustness checks, in which we estimate abnormal oil

Table 12
Test for media attention as mediator between funds needed and abnormal oil futures volume at different thresholds of funds needed.

Abnormal oil futures volume						
Parameter	Without media attention	With media attention	Without media attention	With media attention	Without media attention	With media attention
Intercept	−0.34***	−0.338***	−0.338***	−0.337***	−0.328***	−0.327***
	(0.104)	(0.104)	(0.1)	(0.1)	(0.108)	(0.106)
Fund needed*I (≥ 50)	0.021	0.002				
	(0.021)	(0.04)				
Fund needed*I (< 50)	0.044	0.022				
	(0.042)	(0.054)				
Fund needed*I (≥ 60)			0.022	0.002		
			(0.024)	(0.037)		
Fund needed*I (< 60)			0.031	0.008		
			(0.045)	(0.063)		
Fund needed*I (≥ 70)					0.080***	0.052
					(0.018)	(0.034)
Fund needed*I (< 70)					−0.018	−0.051
					(0.028)	(0.054)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Fixed year effect	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.21	0.212	0.209	0.211	0.234	0.239
No. of obs.	199	199	199	199	199	199

This table presents the estimates of the stage 2 regression, similar to Table 11, for alternative thresholds of funds needed. The dependent variable is abnormal oil futures volume. Media attention is in '000 s and fund needed is in £100 million. Control variables are the same as in previous tables. Standard errors in parentheses are adjusted for heteroskedasticity and clustering at the year level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

returns using Fama-French specifications, the CAPM, and the APT model in the mean equation and the GARCH (1,1) model for the variance equation of oil returns. In Table A14 we present the results. We find that all results are highly consistent with our main findings.

4.3.2. Sensitivity tests

We check for whether the main results hold for the three largest oil-financed clubs by restricting our sample to PSG, Manchester City and Chelsea. These three clubs have the biggest fan bases and the highest net worth among the five oil-financed clubs.[11] These three clubs have also accounted for more than 70% of the player-transfer transaction windows in our sample (i.e., 142/199). The results in Tables A15 and A16 are consistent with those for the full sample and the magnitudes are very similar to the main analysis. Therefore, our sensitivity test indicates that the transmission of funds needed shocks from the player-transfer market to the oil market is primarily driven by the three major oil-financed clubs.

We have posited that the owners of oil-financed clubs behave opportunistically to withhold oil supply. Given their market shares, this can lead to an increase in the abnormal oil spot returns for a short period of time, so that the surplus can help compensate deficits in the player-transfer market. Russia's market share is double that of Qatar and the UAE. We would expect to see heterogeneity in the effect of player-transfers on oil spot market between Russian-financed and Middle East-financed clubs if our posited mechanism is at work. To examine if this is the case, we perform a sensitivity test in which we focus on Chelsea as the Russian-financed club and PSG and Manchester City as Middle Eastern-financed clubs. We report the results in Tables A17 and A18. We find that the effect of funds needed by Chelsea on the abnormal oil spot returns are much higher than that of PSG and Manchester City. This result implicitly reflects that the market power of the Russian oil owner is higher than that of the UAE and Qatar oil owners, consistent with their respective market shares.

One might expect that the oil rich owners will be less likely to withhold oil supply when oil prices are already high than when they are relatively low. This is because when oil prices are high, the owners are already making lots of money that they can spend on players. Translating this into the relationship between funds needed and the abnormal oil spot returns, we conjecture that the effect of funds needed on abnormal oil spot returns will more pronounced when oil prices are relatively low. We test this conjecture by running the following regression:

$$\begin{aligned} AR_{oil,t} = {} & \alpha_P + \beta_F Fund\ needed_t + \beta_P I(Price\ below)_t \\ & + \beta_{F,P} Fund\ needed_t * I(Price\ below)_t + \beta_{P,X} X_t + \theta_{oil,t} \end{aligned} \tag{14}$$

Here $I(Price\ low)_t$ is a dummy variable set equal to 1 if the oil price at time t is smaller than the mean of the oil price over the previous 1 month, and zero otherwise. In alternative specifications we employ the median rather than the mean of the oil price and consider alternative windows of 3, 6, and 12 months. If our conjecture is well founded, the coefficient $\beta_{F,\ P}$ should be positive and significant, while the coefficient β_F should be insignificant. We present the estimated output in Table A19. When we use a window of 1 month the sign and significance on $\beta_{F,\ P}$ are strongly consistent with our conjecture. When we extend the length of the window beyond 1 month, the coefficient $\beta_{F,\ P}$ becomes insignificant. These findings are consistent with the oil-rich owners behaving opportunistically rather than with a strategic, or long-term, plan as we discussed in Section 4.2.

In a further check, we address whether the football club's revenues from other sources are confounding our main findings. Football clubs can generate revenues from a number of sources, including ticket and uniform sales, broadcast rights, and other commercial sources. Recently, Depken II and Globan (2021) find that the windfall revenues from television revenues in England, relative to the other big five European leagues, might have provided resources that helped boost the prices paid in transfers to English teams.[12] While we do not have time series data on television revenue for the individual clubs, to examine this issue we collected annual total revenue data for all five football clubs and calculated the change in each club's annual revenues.[13] We assume that an increase in the revenue of the club in the preceding year can be exploited to fund the club's deficit on the player transfer market in the current year. This is because the typical revenue flows are normally pre-allocated for operating expenses throughout the year. As a result, we deduct the average surplus revenue per player purchased on the transfer market from the total funds needed and examine the impact of the revenue-adjusted funds needed on abnormal oil spot returns. We present the results in Table A20. We find that even though the magnitude of the impact is slightly smaller than in our main analysis reported in Table 8, the main findings remain highly consistent.

4.3.3. Falsification test

Player transfer deficits in other non-oil financed clubs should have no effect on the oil market if the results we observe for the five clubs in our sample are being driven by oil money. We collected player-transfer data for six large non-oil financed clubs over the same time period as employed in our main analysis to conduct the falsification test. The six clubs in our falsification sample are Real Madrid, Barcelona, Manchester United, Bayern Munich, Liverpool and Juventus. These are all leading European clubs and are all ranked in the top ten football clubs by their net worth. We follow the same steps as discussed in Sections 2 and 3 to construct the variables of interest and examine the effect of funds needed in the player-transfer market on abnormal oil futures and spot returns.[14] The results are reported in Tables A21 and A22. There is no relationship between the funds needed in the player-transfer market of these non-oil financed clubs and either abnormal oil futures returns or oil spot returns.

4.3.4. Exogenous shock

One might be worried that we are simply documenting the correlation between the funds needed to acquire players, on the one hand, and price changes in the crude oil market. To demonstrate that our results are causal, we treat the change in football club owner from non-oil rich to oil-rich as an exogenous shock. We run the following regression:

$$\begin{aligned} AR_{oil,t} = {} & \alpha_R + \beta_{R,Pre} Fund\ needed_t^{PRE} + \beta_{R,POS} Fund\ needed_t^{POS} + \beta_{R,X} X_t \\ & + \eta_{oil,t} \end{aligned} \tag{15}$$

where, $Fund\ needed_t^{PRE}$ ($Fund\ needed_t^{POS}$) represents the aggregate funds needed of each of the football clubs that we consider on the player transfer market before (after) they are owned by oil bosses or oil-sheiks. We calculate $Fund\ needed_t^{PRE}$ as follows:

$$Fund\ needed_t^{PRE} = Max\left[0, Net\ out_t^{PRE}\right] \tag{16}$$

[11] Rankings of football clubs by their worth are published by Forbes (2019).

[12] According to the finding of Depken II and Globan (2021), one might think it is interesting to check the difference of the effect between the oil-financed English and non-English clubs regarding the role of television revenue. We perform this analysis and see that the effect of funds needed on abnormal oil spot returns is more pronounced for the English teams. This result is somehow consistent with the oil-rich owners having the capability to influence the oil price because the owners of the English clubs in our sample are from Russia and the UAE which account for much larger market shares than Qatar. Due to this confounding effect, this analysis is not that useful in isolating the impact of television revenues on the relationship between the player transfer market and oil market. However, we still provide the results of this analysis in Table A24 and A25 in the Online Appendix for information.

[13] Annual revenue data is the highest frequency data publicly available.

[14] To avoid the confounding effect due to the player-transfer activities of the oil-financed clubs, we exclude the transaction windows of the non-oil financed clubs that overlap with the oil-financed clubs.

$$Net\ out_t^{PRE} = \sum_{f=1}^{5} \sum_{t-2}^{t+2} Net\ out_{f,t} \times PRE_{f,t} \tag{17}$$

Here, $Net\ out_{f,\ t}$ is similar to the definition in Eq. (3), whereas $PRE_{f,\ t}$ is a dummy variable equal to 1 in the period before the owner of club f changes from a non-oil to oil-boss and is zero otherwise. $Fund\ needed_t^{POS}$ can be constructed in a similar way.

The results are presented in Table A23. The estimates of $\beta_{R,Pre}$ are consistently insignificant, while the estimates of $\beta_{R,POS}$ are consistently positive and significant. These results are strong evidence that there is no connection between the funds needed on the player transfer market and the oil market prior to being owned by oil interests. However, funds needed have a positive impact on abnormal oil returns after being acquired by oil rich owners.

5. Conclusions

Our study provides new evidence on the linkage between the player-transfer market and the oil market. We present robust evidence that an increase in the financial demands of oil-related-clubs in the player-transfer market generates an increase in abnormal oil futures returns, except at very high thresholds. We show that the transmission mechanism is as follows. First, the oil-backed owners exhibit opportunistic behaviour by decreasing the oil supply. Given the low liquidity of a physical commodity market, the market shares of the oil-rich owners, supported by market's fear about the oil supply reduction, translates to a significant increase in the abnormal oil spot returns. Second, higher abnormal oil spot returns are reflected in higher abnormal futures market returns in most cases. The exception is when the deficit in the player-transfer market is above £70 million. Very high deficits incurred in the player transfer market are associated with high profile player transfers which receive a lot of media attention. In such cases, investors in oil futures seek to profit from the upward movement in the oil futures price, generating abnormal trading volumes, which dissipate the abnormal returns in oil futures.

Our findings have implications for the efficient market hypothesis (e.g., Fama, 1970). Player-transfers of oil-financed clubs in which small funds are needed are entirely predictable. There are two transfer windows each year occurring at a predetermined time and it is easy for investors to examine the league tables and identify which clubs are in danger of relegation and, hence, likely to buy new players. Our results show that the oil futures market ignores this information because small transfers, at thresholds of £50 million and £60 million, have an impact on the abnormal oil futures return. Yet, at the same time, the effect size is small in terms of magnitude. Therefore, one interpretation of our findings is that oil futures investors ignore the informational content of small transfers, which violates the efficient market hypothesis, but not the large transfers, which, in terms of the bigger picture, makes this violation meaningless.

Our study also extends the literature on the determinants of oil price fluctuations and will be of interest to investors and oil price speculators. Previous studies that have considered the effect of news on oil price movements have considered the impact of events such as OPEC announcements and regulatory interventions. Our findings suggest that the puzzle around why oil price fluctuations remains difficult to predict also needs to accommodate the possibility of a shock transmission mechanism between the football player-transfer market and the oil market. Such transmission mechanisms are likely to become increasingly important given the growing amount of oil money flowing into the major European leagues.

We conclude with suggestions for future research. Our focus has been on the relationship between the player transfer market and the oil market. While they do not involve transfers, to the extent that the data is available, future research could also consider other on-field investments, such as investments in managers and other coaching staff. We also do not consider other major investments that clubs make, such as stadium upgrades and marketing. Investments in major off-field projects might be fruitfully covered in a future study of the relationship between the whole of a football club's business and the oil market. While we provided some back of the envelope results, these are inconclusive on the full social welfare implications of the relationship between the player transfer market and the oil market which future research can closely examine. While producers' surpluses tend to increase because of a higher oil price, even in a rather short period to help clubs in their transfer transactions, the effect on consumer surpluses remain unclear. The change in ticket sales revenue before and after a big player transfer, ceteris paribus, is also another proxy measure of welfare change, which we are unable to report in this study due to data unavailability.

Author contributions

Hung Do conceptualised the study. He is also responsible for methodology framework, writing the original draft, revising the manuscript several times and coordination between the co-authors. Hung Do is the corresponding author.

Quan Nguyen is responsible for data curation, empirical analyses, writing the original draft, and revise the manuscript several times.

Rabindra Nepal contributed to write the original draft and revise the manuscript several times.

Russell Smyth provided overall critical comments and research pathways as well as contributed to write the original draft and revise the manuscript several times.

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Appendix A. Supplementary data

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