The effect of geographic proximity and rivalry on performance: Evidence from the English football league

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ABSTRACT
Using data on league position for clubs that have participated in the English football leagues for 21 seasons this paper tests, using spatial econometric techniques, whether clubs' within-season performances are positively affected by better performances of other clubs located geographically closer to them. The paper provides evidence of positive spatial dependence between clubs' performance. This means that proximity to high performing clubs drives others to perform better, ceteris paribus. This is consistent with the view in regional analysis that spatial factors are important considerations in understanding business performance.

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Introduction

There is strong consensus in regional economics literature that the determinants of business performance lie increasingly in factors external to the business within its locality. These factors include access to skilled labour markets, proximity to customers, knowledge spillovers, access to specialised intermediate inputs and the benefits of greater rivalry. While Porter (1998) argues that businesses' competitive advantages are increasingly local, this paper considers whether this is the case for the football industry in England, or whether local rivalries continue to matter in an era of greater globalisation of football.

This paper uses the English football industry to shed light on the effects of spatial proximity on business performance. The football industry in England is a particularly interesting case for such an analysis, not least given the industry's scale. Also, football clubs in England are largely immobile and rooted traditionally in particular cities and communities for historical, social, and cultural reasons. These clubs operate at the same stage of the industry value chain, while intermediate inputs tend to be provided on a national, rather than local, level. Finally, data on performance of participants in the football industry is easily observed and collected.

Using data on league position for all clubs that have featured in the four divisions of the English League in all 21 seasons from 1992/93 to 2012/13, this paper tests, using spatial econometric techniques, whether clubs' within-season performances are positively affected by better performances of other clubs located geographically closer to them. To test for spatial dependence we apply a spatial panel model, outlined in Section 5. The paper also controls for other factors that are found in the sports economics literature to affect clubs' within-season performance. A novel measure of club wealth is constructed using a perpetual inventory method based on clubs' transfer spending on new players between 1980 and 2013.

Previous literature has demonstrated the importance of club factors, including wealth, for explaining performance. This paper confirms this relationship, but in addition provides evidence of positive spatial dependence between clubs' performance, even when controlling for other relevant factors. This means that, on average, clubs proximate to higher performing clubs perform better than would have been expected given their wealth, managerial change etc. The evidence suggests that, for this industry, geographic distance matters.

The next section sets out theoretical and conceptual frameworks underpinning the analysis, including the rationale for studying spatial effects in this industry. The peculiar characteristics of this industry make it particularly insightful for spatial analysis. The following sections present the data and method of analysis. The results of the econometric analysis and its implications are discussed subsequently.

Geographic proximity and performance

There is now strong evidence from the regional science literature that geographic proximity to high performing businesses positively affects business-level performance (Breschi & Malerba, 2005; Mancinelli & Mazzanti, 2009; Oerlemans & Meeus, 2005). The importance of geographical concentration of businesses for business-level performance can be traced back as far as Marshall (1890) who identified three sources of agglomeration benefits for businesses - information spillovers, a local skilled labour pool, and access to subsidiary and specialised inputs. Marshallian sources of agglomeration economies are echoed in Porter's (1990, 1998) cluster framework. One significant difference between Marshall's (1890) and Porter's (1998) frameworks is the importance in Porter's (1998) clusters of competition between businesses. While Marshall (1890) does not refer to the businesses located in "near neighbourhood" competing it could be inferred that, since a significant proportion of trade in Marshall's time was local, competition was implied. However, Porter's (1998) clusters are characterised by the high level of rivalry between businesses within the cluster which encourages each business to continually strive to innovate and improve.

The general consensus in regional literature is that geographic proximity and spatial concentration of businesses are favourable because they facilitate knowledge spillovers, allow for shared skilled labour pools and shared intermediate resources, provide easier and less costly access to larger markets, and encourage both increased competition and rivalry and mutual trust (Boschma, 2005; J. Jacobs, 1969; Malmberg & Maskell, 2002). This paper tests whether these effects are found in the football industry. This industry provides a particularly useful case study, partly because of its substantial and growing value to the British economy, but more interestingly from a scholarly perspective the immobility of clubs in this industry. In other industries it is potentially difficult to know if firms locate in successful places or places are more successful because successful firms locate there. The immobility of football clubs removes this endogeneity problem.

The literature remains equivocal on whether location advantages are derived to greater extents from specialised agglomerations, so-called localisation economies, or from diversified agglomerations, so-called urbanisation economies. Porter (1998, p. 83) argues that “local rivalry is highly motivating. Peer pressure amplifies competitive pressure within a cluster, even among non-competing or indirectly competing companies. Pride and the desire to look good in the local community spur executives to attempt to outdo one another”. Malmberg and Maskell (2002, p. 439) refer to ‘comparability’ as the key element in local rivalry, meaning that shared conditions, opportunities, and threats facing each individual firm are known to the others. Lublinski (2003, p. 456) contends that local rivalry provides specific motivational effects because closer geographic proximity allows easier benchmarking and strong interpersonal competition for position and prestige between comparative workers. This element of “interpersonal competition for immaterial gratification” may be particularly relevant for the football industry.

Spatial effects on performance in football

The sports literature demonstrates that local rivalries are important factors underpinning the demand for attendance (Forrest & Simmons, 2006; Madalozzo & Villar, 2009) and football club identity (Benkwitz & Molnar, 2012; Dmowski, 2013). Of course rivalry is an essential feature of sports, including football. It is a peculiar feature of sports however that, unlike other industries in which businesses may seek to perform so well that rivals go out of business, clubs require rivalry for their own survival. As Szymanski (2009, p. xi) states "here is the fundamental truth of modern sports – rivalries make for excitement….That sporting competitions succeed when they create exciting rivalries is the central proposition of the economics of sports".

The football industry is an interesting case for this analysis, not least because of the scale of the industry. Szymanski and Smith (1997) state that the football industry is a long-established industrial cartel with a product that experiences strong demand and lack of close substitutes. It is clear from the financial performance of the Premier League that the industry is a substantial one for the English economy. The bargaining power of the Premier League, which collectively negotiates for participating clubs, can be seen in the dramatic rise in broadcasting rights values for Premier League football. The Premier League will receive £5.1 billion for the rights to broadcast live matches between 2016 and 2019, which is an increase of 71% on the previous agreement and compares with £190 million received for the first broadcast deal for 1993 to 1997 (Chadwick, 2015). While the scale of the football industry in England in unclear, annual revenue for the Premier League in 2015 is estimated at just under £4 billion (Deloitte, 2015), to which would be added Football League revenues and related and supporting industries to estimate the size of the industry and its contribution to the economy.

Perhaps a more pertinent reason why football is an interesting case to explore the effects of proximity on performance arises from the immobility of the clubs within the industry.

Unlike US sports, where franchises may relocate to benefit from market opportunities or infrastructural investment by city authorities, English football clubs tend to be rooted in a specific location and community. This removes potential endogenous effects in spatial analysis where it is extremely difficult to identify whether businesses are more productive in particular locations and/or whether productive businesses are attracted to locate in a particular location. This is not to say that football clubs do not compete for revenue outside of their local area, the industry is becoming increasingly global with clubs extending their reach for support and revenue across the world. However, clubs conduct their core activities and are, for the most part, rooted in the cities and communities in which they have long been established and are largely immobile.

There are other aspects of the football industry that make it an interesting case study for spatial analysis. Marhsallian and Porterian sources of localisation economies include shared locally-provided intermediate inputs, access to a local skilled labour market, and knowledge spillovers. In the football industry there is largely an absence of locally-provided intermediate inputs, with critical inputs such as player performance statistics, legal services, scouting, and sponsorship provided on a national or international basis. Increasingly the labour market in the football industry is global, rather than local or even national. On the first day of the opening season of the Premier League in 1992 there were 15 non-British players appearing across all the games, while in 2007 there were 340 such players (Hill, Vincent, & Curtner-Smith, 2014). In the 2014/15 season, the proportion of domestic players in the Premier League is 35%, compared to 60% in Germany and 59% in Spain (Peck, 2015). Knowledge spillovers may be mediated locally, at least initially, though labour market movement and substantial media coverage is likely to mean innovations in, for example, coaching, tactics, and nutrition may be diffused through the sport more quickly than in other industries (Jones & Cook, 2015).

While this paper is concerned with geographic proximity, Boschma (2005) suggests that there are alternative forms of proximity that also affect business performance, namely cognitive, organisational and cultural proximity. It is considered unlikely that these forms of proximity could be significant sources of differences in performance in the football industry. The historical development of football clubs and leagues would suggest that cultural and organisational differences between clubs would be marginal, while the substantial and growing media attention dedicated to the football industry and the movement between clubs of players, managers, and support staff, would diminish opportunism for new knowledge and approaches to remain undiffused for a long period. These features would reduce the importance of alternative forms of proximity.

As well as proximity, there may be agglomeration effects at play, where clubs that are co-located in large urban areas perform better (or worse) on average than clubs in smaller urban or peripheral areas. This could explain positive spatial dependence where the market size of the large urban area, the attractiveness of the urban setting for global talent, and/or positive urbanisation or cluster effects are driving club performance. Buraimo, Forrest, and Simmons (2007) find that greater success is achieved by English football league clubs in markets with larger populations, though this is mitigated by co-location of clubs in larger markets. The results may reflect the attractiveness of large urban centres, such as London and Manchester, for more talented, highly mobile players and coaches. This is redolent of a form of creative class of elite athletes attracted to the 'scene' in larger cities with more amenities, greater access, and the presence of other elite athletes, as part of a "super creative core" (Florida, Mellander, & Stolarick, 2008, p. 625). These potential effects suggest that a spatial analysis of football club performance must control for agglomeration. The analysis presented in subsequent sections includes indicators of capital city location and urban effects.

Football clubs, of course, are not homogenous in every way. Some have access to substantially greater resources than others, most recently through the advent of wealthy foreign owners, and some have larger local markets in which they may have few or many co-located rivals.

It is necessary in this analysis of the spatial effects on performance to control for other factors that have been demonstrated in the literature to affect football club performance. There is a sizeable and, at this stage, long-standing sports economics literature on the determinants of sporting success by game (see for example, Audas, Dobson, and Goddard (1997, 2002). There has also been a more limited focus on explaining within-season performance.

Across several sports it has been shown that performance has been influenced by managerial turnover (Allen, Panian, & Lotz, 1979; Brown, 1982; Dobson & Goddard, 2011; Fizel & D'Itri, 1997; Flint, Plumley, & Wilson, 2014; Gammelsæter, 2013; D. Jacobs

& Singell, 1993). Performance has also been shown to be influenced by club wealth, which has been measured in various ways in different studies due to the limited (historical) data available on football club finances (for example, (Carmichael, McHale, & Thomas, 2011; Halkos & Tzeremes, 2013; Kesenne, 2004; Ribeiro & Lima, 2012). In this paper we control in the econometric analysis for managerial change within the season and for potential club wealth, indicated by average attendance. This means in interpreting the results, spatial effects must be considered in combination with traditional drivers of club performance.

Data

This paper uses data from teams that have consistently competed in the four divisions of the English League every season from 1992/3 to 2012/3 (Appendix 1 presents a list of clubs included in the analysis). In total, 70 different clubs have competed every year in the English League over the period. This means there is a balanced panel of 70 clubs across 21 seasons. A balanced panel is required to facilitate the estimation strategy in this paper. While there are 92 positions in the four divisions, a number of clubs have entered and left these divisions over the course of the time period. Figure 1 shows the location of the clubs in the dataset.[i] Figure 2 shows the clubs' locations weighted by performance, where larger circles represent higher performing teams. This shows there are concentrations of better teams in the mid-west (Manchester and Liverpool) and in London.

Figure 1 Here

Figure 2 Here

Performance is measured by a club's position across the four leagues in the English football league containing 92 clubs, so that the champions of the Premier League has a value of 1 and the club finishing in the final position in the current League Two (the fourth tier of English football) has a value of 92. It is necessary to normalise this rank data to facilitate analysis. The rank values are converted into a standardised, normally distributed variable. Initially, the performance outcomes in each season are ranked from 1 to 70 and this is converted to a percentile rank score using (i-1)/(N-1) where i is the rank of a given club and N is the number of clubs in the sample (70). Since percentile scores are ordinal and have a rectangular (uniform) non-normal distribution, they are transformed into z-scores using an inverse normal function. The resulting standardized variable is used as the measure of performance in subsequent analyses (Gujarati, 2015).

Geographical proximity is measured by the distance in kilometres between each club's stadium. For clubs that have relocated to a new stadium over the time period studied, the distance from the new stadium is used for all observations. Since no club moved to a new stadium more than 2 kilometres from their previous stadium this is not considered a limitation. A W-matrix is constructed using the distance from other clubs and is an N*N matrix containing a measure of the 'distance' between observations. This paper defines the W-matrix as the inverse of the distance in kilometres between points (where each point is the location of the stadium of each club) with the matrix being row-standardised and the diagonal of the matrix possessing only zeros (as each club has no distance between itself).

At the level of the club the analysis controls for the effects of managerial change and club wealth. The former is measured using a binary variable taking a value of 1 if at least one new manager was appointed in a given season. Table 1 presents data on the incidence of managerial changes in the English League over the study period and for sub-periods. This shows that the average club changed managers in just over 8 of the 21 years. There was a decline in the average number of seasons with a managerial change in the middle third of the study period, though there has been a rise if the incidence of managerial change more recently. Figure 3 shows that, for the full study period, there is a positive relationship between the number of seasons with managerial change and average league position, so that poorer performing clubs, perhaps unsurprisingly, see a higher rate of managerial turnover.

Table 1 Here

Figure 3 Here

There is empirical evidence that club wealth affects performance. It is necessary to control for this effect in this paper, though historical financial data are unavailable, and would likely be unreliable, for clubs across all divisions of the football league since 1993. A commonly used proxy measure of club wealth is average season attendance. This data are available for all clubs for all seasons, and is closely correlated with traditional financial measures of club wealth. However, since attendance is limited by stadium size and match-day income has decreased in importance for clubs, this measure is not optimal. Ideally this analysis would use reported club wealth, though this is not available for the full period.

Data on club wealth is available for Premier League clubs for the period 2009-2013. Using this data would limit the number of clubs in the study to 12 and limit the analysis to only five years. Therefore, we calculate an alternative measure of wealth using transfer data and an approximation of the perpetual inventory method (PIM). The PIM is typically used in the calculation of physical capital stocks from a flow variable (gross capital formation). We propose to apply this approach to build a stock of wealth for each of our clubs using transfer data, which is also a flow variable.

The PIM assumes that

$$K_t = K_{t-1} + I_{t-1} - D_{t-1}$$

Where K_t is the stock of capital (or club wealth) in time period *t*, K_{t-1} is the stock of wealth in time period *t-1*, I_{t-1} is a flow variable measuring investment (club expenditure on acquiring new players) in *t-1*, and D_{t-1} is the amount of capital (or wealth) which depreciated in time period *t-1*. If we assume that the rate of depreciation is constant at a rate δ we can re-write the stock as:

$$K_t = (1-\delta)K_{t-1} + I_{t-1}$$

If we repeat this substitution throughout time from the first time period we have:

$$K_t = \sum_{i=0}^{\infty}(1-\delta)^i I_{t-(i+1)}$$

Thus, club wealth in period t is a weighted sum of the history of transfer investments. The weights result from the geometric depreciation function.

To construct our stock of wealth measure we use transfer spending by clubs. We assume that wealthier clubs will acquire more players and therefore the repeated acquisition of players over time represent increasing stock of club wealth. I_{t-1}. To construct an initial value of wealth we use transfer data dating from 1980 to 1992. The summation of the total expenditure by clubs on players over this period (under differing assumptions regarding depreciation) provides us with our initial K_{t-1} measure for 1993. We apply the above equations to arrive at a value representing the stock of wealth a club possesses for each year 1993 through 2013.

Since the club wealth indicator is constructed, and is a proxy rather than a reported value, its validity must be tested. As noted, the primary reason for constructing this indicator is that data on wealth is not available prior to the 2009 season and, even then, is generally only available for clubs in the premier league. A measure of club market value is obtained from transfermrkt.de (2017) and provides this value for all clubs in our sample but just for the final five years of our period of analysis. In addition, data on turnover, game and match day income, TV and broadcasting, commercial activity, and wages are available for the 20 clubs in the Premier League in a given season for the last four years of our data. We obtain these data from the clubs' financial statements as reported in the Guardian (Various Years) newspaper.

Data on attendance are available for each year of our data. We correlate the logged value of our wealth variable with the logged values of these variable. Note that this is done for the 20 clubs[ii] in the Premier League in each of the seasons from 2009 to 2013. The results of our correlation analysis are presented in Table 2.

Table 2 Here

The PIM constructed variable is highly correlated with many of the desirable, but unavailable, indicators of club wealth. Indeed the calculated measure of wealth has a remarkably strong positive correlation with the log of wealth, turnover, and the wage bill for each club. It also has a high correlation with the average attendance. It is less correlated with match day income and broadcasting rights, however, even with these variables there is a moderate to strong correlation.

This provides confidence that the measure of club wealth (constructed using player transfer payments) is appropriate and an acceptable proxy for club wealth. Indeed, as a further robustness check of the club wealth indicator, using an often employed proxy of the log of attendance as an indicator of wealth, does not materially alter the estimation results. While the magnitude of the coefficients vary marginally, the significance, relative magnitude, and direction of the coefficients are consistent. Given these robustness checks the indicator of wealth is appropriate and allows reliable inferences regarding the importance of spatial dependence for club performance to be drawn.

The inclusion of managerial change and club wealth in explaining club performance introduces potential endogeneity. Clubs may perform poorly because of higher managerial turnover, or managers may be replaced because clubs are performing poorly. Also, wealthier clubs, or, using our proxy, clubs with higher attendances, may have resources to improve performance, or it may be that clubs that are performing well attract more interest and higher attendances. The subsequent analysis addresses these endogeneity issues.

In addition to club level variables this paper also controls for two regional factors which may affect club performance. The first is a standard control for a capital city effect. As London is the largest urban agglomeration in the UK, and also contains the largest number of football clubs of any region in close proximity (12% of clubs approximately), the analysis includes a dummy variable to control for any possible London effect. We also estimate the model excluding London clubs as a robustness check as to whether spatial dependence is driven solely by London clubs. This is found not to be the case with the results being robust to the exclusion of London clubs. The second regional control is the population density of the NUTS2 region in which the club is located. This controls for potential urban agglomeration effects (separate from our London dummy) which may affect clubs in more densely populated areas.

Finally, we also control for the effect on club performance of the division in which the club plays in a given season and whether the club was promoted or relegated in the previous season. These variables enter our model as binary variables. In the case of divisions, three binary variables are created, one each for divisions two, three and four with the Premier League (the highest possible division) used as the reference category. For promotion and relegation, two dummy variables are introduced which each take a value of one if the club was promoted or relegated respectively in the previous season.

As we are specifically concerned with the presence of spatial effects a discussion of tests for the presence of spatial dependence in our data is available in Appendix 3.

Method – estimating the effect of geographical proximity

A spatial panel model is used to estimate the effect of spatial proximity on club performance. The estimator employed is based on Elhorst (2010) and Lee and Yu (2010). The following model is estimated.

$$y_{it} = \rho W_{ij} y_{it} + \beta X_{it} + \varepsilon_{it}$$

where y_{it} is the standardised performance of club *i* in time period *t*. The spatial lag of performance is given as $\rho W_{iit} y_{it}$. This is a contemporaneous spatial lag of performance, where the spatial connectedness is given as W_{ij} and the spatial autoregressive parameter is given as ρ. βX_{it} is a series of independent variables which have been shown in the literature to affect performance including managerial change, average attendance for club *i* in time period *t*, a dummy variable taking the value of one if club *i* is located in London (this variable is time invariant), and the population density in time period *t* of the NUTS2 region in which club *i* is located; these variables have previously been described in the data section. ε_{it} is the associated error term.

The W-matrix is based on the distance between each club and does not vary over time. This is defined as follows:

$$W_{ij} = \begin{bmatrix} 0 & d_{12} & \cdots & d_{1N} \\ d_{21} & 0 & & \vdots \\ \vdots & & \ddots & \vdots \\ d_{N1} & \cdots & \cdots & 0 \end{bmatrix}$$

This is an N*N matrix of values, where each d_{ij} value is the inverse of the distance between point i and j, where i and j represent the stadiums of the respective clubs. The matrix is row-normalised (each row sums to 1). The leading diagonal of the matrix is constrained to equal 0, as a club is zero distance from itself. W_{ij} is observed for each club relative to every other club. To ensure the robustness of our estimator to the many different possible specifications of *W* a discussion of alternative *W*-matrices is included in Appendix 2 along with the estimations of equation (1) using these alternative *W*-matrices.

Maximum likelihood estimation, based on Elhorst (2010); Lee and Yu (2010), is used with the contemporaneous spatial lag estimated as an endogenous lag. The estimation procedure utilised is a random effects estimator. The use of a random effects estimator is beneficial as the random effects should control for unobserved club heterogeneity which is not captured by the variables in our model. It is assumed that the independent variables are exogenous and a temporal lag is also employed, to address endogeneity between performance measures and the control indicators.

To provide further insight into the impact of spatial proximity on club performance, in line with resent research using spatial econometrics, direct and indirect effects may be derived from our model estimates. Following Corrado and Fingleton (2012) the mean total effect of a unit change in a variable on the dependent variable can be calculated as:

$$N^{-1}\sum_{ir}^{N}\frac{\partial Y_i}{\partial X_{ri}} = N^{-1}\iota'(I-\rho W)^{-1}Ib_j\iota$$

Where *N* is the number of clubs, *i* is club *i*, *r* is club *r* where $i \neq r$, ∂ is the derivative, ι is an N by 1 vector of ones, *I* is an N by N identity matrix, ρ is the estimated spatial lag from equation (1), *W* is the previously defined *W* matrix, and b_j are the regression coefficients.

This effect will differ from the coefficients as it takes into account the fact that changes in X_{rj} effect Y_i which in turn effects Y_s (s≠i).

This total effect can be decomposed into a direct effect and an indirect effect. Where the direct effect is the direct effect of a change of X_{ij} on Y_i and the indirect effect, through spatial spillovers, of a change in X_{rj} on Y_i.

The direct effect can be captured as:

$$N^{-1} \sum_{r}^{N} \frac{\partial Y_r}{\partial X_{rj}} = N^{-1} trace\left[(I - \rho W)^{-1} I b_j\right]$$

The difference between the total effect and the direct effect is the indirect effect which is equal to the mean of the off diagonal cells of the matrix $(I - \rho W)^{-1} I b_j$ yielding:

$$N^{-1} \sum_{r=s}^{N} \frac{\partial Y_r}{\partial X_{sj}} = N^{-1}\left(\iota'(I - \rho W)^{-1} I b_j \iota - trace\left[(I - \rho W)^{-1} I b_j\right]\right)$$

We use these direct and indirect effects to discuss the impact of spatially proximate clubs on one another.

Empirical results

This section presents the results of the analysis. For ease of explanation, performance has been inverted so that a high value for y_i indicates better league performance. Table 3 presents the results of an estimation of the determinants of club performance, including weighted spatial performance. The results show that, when controlling for the effects of managerial change and club wealth, club performance is positively and significantly spatially dependent on the performance of other clubs. This result is found when the control variables are estimated contemporaneously or with a time lag to account for endogeneity. The sign of the effect for each of the independent variables is as expected *a priori*.

Table 3 Here

However, as noted previously we decompose these coefficients into their direct and indirect effects. The direct and indirect effects are presented in Table 4. The discussion begins with the direct effects.

Wealthier clubs tend to perform better, most likely because of the investment that can be made in attracting better players and managers. Also, greater managerial turnover is associated with poorer performance. This suggests that changing manager in one season adversely affects performance in the following season. This suggests that managerial stability is a positive influence for successful clubs.

We note that a significant London effect is present, with clubs in London, *ceteris paribus*, achieving higher league performances than clubs outside of London, suggesting a capital city effect driving club performance. The sources of such an effect may be increased abilities to attract elite players to the club due to the attractiveness of London as a location to live, or improved performance due to better access to infrastructure. These mechanisms indicate that London clubs, on average and holding other variables constant, outperform their rivals.

When considering controls for divisions, as would be expected due to the nature of the data, clubs in lower divisions have poorer performance. We note that promoted clubs tend to do less well in the subsequent season, most likely due to the problems of adapting to higher level opponents.

To ensure the robustness of our estimation to the inclusion of teams from London, which are spatially concentrated, we estimate an auxiliary regression model, identical to that presented in Table 2, excluding London teams (and therefore also the London dummy). The results of this auxiliary estimation are presented in Appendix 4. They show that the significance of our spatial coefficient and other control variables is unchanged. While the coefficient in our spatial coefficient has slightly decreased, it remains statistically significant. This indicates that London clubs do not drive the positive spatial dependence and that the results and conclusions are robust.

However, population density, a more broad measure of urban agglomeration, has no significant effect on club performance. This suggests that clubs located in more densely populated urban areas, *ceteris paribus*, do not outperform clubs located in less densely populated areas. This suggests that, when discussing access to infrastructure or benefits associated with attracting individuals to urban centres, outside of London there is no significant difference.

Most importantly for this paper, even after controlling for club and regional specific factors there is a positive spatial effect on club performance. The positive weighted spatial performance effect suggests that clubs perform better when they are located closer to other well performing clubs, and the poor performance of some clubs is explained by the relatively poor performance of close clubs. This suggests that location matters for performance in English football, just as it has been found to matter in other sectors, even though clubs are largely immobile, do not share locally-provided intermediate inputs, and rely (more on more) on global labour markets rather than local labour markets.

Table 4 Here

The significance of the spatial parameter, which presents an average effect, demonstrates that *ceteris paribus*¸ clubs benefit from proximity to high performance clubs. Additional insights are provided by estimating the indirect effects of the independent variables in proximate regions, as described in our method section. There are significant indirect effects from proximity to wealthier clubs, which suggests that clubs benefit from proximity to richer neighbours. Clubs in proximity to poorer performing clubs (in terms of division) are also more likely to be poor performing, suggesting that there are negative spillovers associated with being in close proximity to poorer rivals. There is also a negative spatial effect with proximity to a club that has changed manager.

These indirect effects may shed light on the mechanisms through which spatial effects occur. Some potential explanations may be suggested. Geographic proximity may facilitate knowledge spillovers and learning from one club to another, perhaps in the areas of coaching, nutrition, and scouting. Players and coaches may have more interaction with counterparts that are located nearer and this could result in intentional and/or unintentional sharing of information on techniques or available players. Also, clubs may be incentivised to emulate other closer clubs that are performing well and/or there may be acceptable underperformance for some clubs by reference to poorly performing close clubs. This may be the case for players, managers, club officials, and supporters whose expectations on performance are formed by social comparison (Festinger, 1954).

Of course, there are a number of cases where, in a given season, exceptions occur and clubs in relative spatial isolation perform extremely well. This does not negate the results of our model, it merely points to the fact (as acknowledged by the inclusion of a matrix of independent variables and random effects in our empirical model) that factors other than location drive performance. For instance, the results demonstrate that financial wealth has a positive effect on performance, as may be expected in this industry. There are several examples where promotion or new ownership increases the financial resources for investment in new players and/or improved coaching. The key finding of this paper is that, even when controlling for factors such as wealth, there is a spatial effect, and that, on average (i.e. over the 69 clubs and 21 seasons), this effect is significant and positive. This means where two clubs have similar financial resources, the club located closer to other high-performing clubs will have better performance than the club located further away.

The analysis finds that location and geographic proximity matter for club performance and, because of the peculiar features of the English football industry, these findings cannot easily be explained by 'traditional' concepts in the regional literature underpinning spatial dependence. The implications and research agenda prompted by these results are considered in the next section.

Conclusions and implications

This paper examines the extent to which the performance of English football clubs is affected by the performance of other geographically proximate clubs, after controlling for club-specific factors such as wealth. A bivariate analysis suggests positive spatial dependence, and, even when controlling for other factors shown in the sports economics literature to affect within-season performance, there is evidence of strong, positive, and significant spatial dependence between clubs. This suggests that, other things being equal, being located closer to a high performing club improves other clubs' performance and *vice versa*. This finding is particularly notable given the specific features of the English football industry. The finding that, ceteris paribus, spatial effects matter is particularly notable given the immobility of clubs, indicating that this effect is not a function of location decisions of clubs.

The results confirm the importance of traditional determinants of club performance. The wealth of a club and the effects of managerial change are found to be significant determinants of performance. The paper finds that spatial effects are observed in addition to these effects. So for example, a poorer club located closer to a well performing club will perform better than a poorer club located farther away from the well performing club. The model is not to be considered deterministic in explaining all of the determinants of football club perfromance. In practice there will be deviations, such as relatively poorer clubs with managerial change, located outside of London, and in relative spatial isolation which perform well and which the model would not anticipate e.g. Leicester City in 2015/16. The visibility of these outliers is greater in the football industry than it would be in industries with less media and popular attention, though they do not undermine the general findings.

The results have implications for regulation of English football and individual investors in clubs. The issue of competitive balance is important in sports, as evidenced by attempts by governing bodies to regulate financial power, allocate television revenues equally across the league, and provide financial supports to clubs relegated from the Premier League. Unlike many other business sectors, football clubs appreciate that their business model requires competitive opponents and is harmed by excessive dominance by one club. So, if there are spatial effects on club performance these need to be considered in addressing competitive balance. This may involve supports, financial and otherwise, to clubs that are more isolated and peripheral. For example, allocation of television revenues, which are negotiated on a league-wide basis, may include an allowance for locational disadvatanges. There may also be argument for funding for centres of excellence in coaching located in more peripheral areas, where clubs in those locations may benefit from shared resources that would not be economical on a single-club basis.

There are also implications for potential investors in football clubs, who should consider the performance of neighbouring and proximate clubs in their investment decision. There may be opportunities to identfy under-valued clubs close to other well-performing clubs. Also, investors should be aware that investing in clubs that are more peripheral and isolated are likely to perform poorly relative to clubs with similar wealth levels in proximity to rivals.

The applicability of the results to other business sectors is problematic. The football industry has specfic features and structures that are not seen in other industries. Indeed, one of the key motivations for this paper is the advantages provided for the analysis of the immobility of businesses within this industry, since it removes the endogenous effects of business location choice on spatial dependence. It is the case in most industries that businesses may relocate to successful locations or nearer to other businesses or customers to benefit from potential knowledge spillovers.

Generalisation of results is a common limitation of any industry study. This paper sheds light on the effect of location and proximity on performance in a major industry, and one of its primary motivations is the special case it presents to allow analysis of spatial effects without the endogenous effects of firm location decisions.

The analysis prompts further research questions and extensions. The mechanisms through which spatial influences occur require further analysis. As mentioned in the previous section, the effect of agglomeration and/or urbanisation should be analysed for English football clubs. It may be that clubs co-located in larger urban centres benefit from urbanisation economies, or perhaps economies that arise from specific urban locations, such as London and Manchester. The geographic proximity effect may be driven by an agglomeration effect, though the sample includes clubs from across the country and there isn't a greater weighting provided to clubs from the higher performing cities. Also, clubs located in the English midlands, including Birmingham, and Yorkshire are relatively poorer performers, and an urbanisation explanation of performance would need to explore the reasons for under-performance in these large urban areas.

The paper cannot evaluate the mechanisms through which geographical proximity affects club performance, though the estimation of direct and indirect effects provides some insight. However, theory suggests some potential explanations. There may be knowledge spillovers between clubs, facilitated by geographic proximity. While it may be the case that players and coaching staff tend not to move between local and/or rival clubs, there may be knowledge sharing or unintentional spillovers between players and coaching staff of rival clubs facilitated by closer proximity. In addition, the effects of local rivalry and social comparisons that are more observable in closer proximity may also affect the performance of clubs, and this may also explain the proximity of poorly performing clubs where 'acceptable underperformance' may be a response to comparisons to other close clubs. To explore the mechanisms through which spatial effects operate would require data on the geographic distribution, and its changes over time, of human capital in the industry. This would shed light on the extent to which the flow of talent in the industry is associated with changes in club performance. Original survey data of participants in the industry (players, coaches, and administrators) and other stakeholders, such as fans, would be required to explore the effect of social comparisons on performance, since this would identify who clubs perceive as their key competitors locally.

Given the findings that club wealth is a significant determinant of club performance, further analysis may explore the extent to which spatial effects affect performance indirectly through differences in wealth across space. It may be the case that clubs are more attractive to investors in larger urban areas or that investors are more likely to invest in clubs with successful near rivals. There are fewer foreign-owned clubs in smaller and more peripheral cities, though this may be because they are unattractive for investors due lack of a large local market or competitive under-performance.

In addition, the analysis in this paper could also be extended to other countries, as the particular development of the football industry in England may be unique. In other European countries for example, capital city clubs tend to perform less well than clubs from larger provincial cities (Kuper & Szymanski, 2009). The analysis could also consider a longer time period, as the growth in television and other revenue opportunities for clubs participating in the Premier League and some Championship clubs may have had an effect on the persistence of performance of some clubs through the increased resources available to participants.

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Figure 1

Figure 2

Figure 3

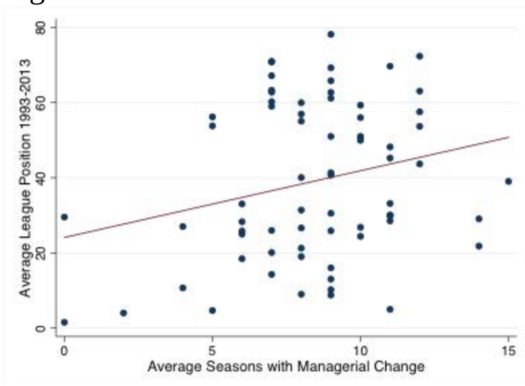

Average League Position 1993-2013
0
20
40
60
80
0
5
10
15
Average Seasons with Managerial Change

Table 1 Average Number of Seasons in which a Club Changed Manager in the Football League

	1993-2002	2003-2013	1993-1999	2000-2007	2007-2013	**1993-2013**
Number of Seasons	3.89	4.61	2.84	2.94	2.71	**8.50**

Table 2: Correlation Analysis of PIM Wealth and Financial Indicators

Variable	Correlation Coefficient
ln Market Value[1]	0.8916
ln Turnover[2]	0.7604
ln Game and Match Day Income[2]	0.6731
ln TV and Broadcasting[2]	0.5869
ln Commercial[2]	0.6425
ln Wage Bill[2]	0.8387
ln Average Match Attendance[3]	0.9224

Notes

1: Data on this variable are obtained for all 69 clubs from 2008/09 to 2012/13

2: Data on these variables are obtained for the 20 clubs in the Premier League in each of the seasons from 2009/10 to 2012/13

3: Data on this variable is available for all clubs for the full time period

Table 3: Estimate of Model

	Coeff (t)	Coeff (t-1)
Weighted Spatial Performance ($W_{jt}y_{it}$)	0.0946**	0.1115**
	(0.0460)	(0.0590)
Managerial Change	-0.0782***	-0.1576***
	(0.0158)	(0.0229)
Club Wealth	0.0340***	0.0661***
	(0.0094)	(0.0139)
London	0.1494*	0.1948*
	(0.0876)	(0.1137)
Population Density	0.0154	0.0276
	(0.0262)	(0.0341)
Division 2	-0.7978***	-0.5599***
	(0.0265)	(0.0386)
Division 3	-1.4979***	-1.2046***
	(0.0364)	(0.0533)
Division 4	-2.4838***	-1.8926***
	(0.0458)	(0.0665)
Promotion	-0.2976***	-0.0157
	(0.0269)	(0.0392)
Relegation	0.0308	0.0292
	(0.0278)	(0.0402)
Constant	0.2971	-0.4981
	(0.2208)	(0.3040)
R2	0.8865	0.7935
Obs.	1,449	1,380

Notes
1: ***, **, and * indicate significance at the 99, 95 and 90 percent level.
2: Coeff (t) indicates the model was estimated where the independent variables are treated as being contemporaneous to the dependent variable whereas Coeff (t-1) indicates the model was estimated with the independent variables lagged by one time period to account for potential endogeneity of between club performance and the independent variables.

Table 4: Total, Direct, and Indirect Effects

	Total	Direct	Indirect
Managerial Change	-0.0871***	-0.0785***	-0.0086*
	(0.0159)	(0.0135)	(0.0049)
Club Wealth	0.0382***	0.0344***	0.0038*
	(0.0100)	(0.0086)	(0.0023)
London	0.1743	0.1563*	0.0180
	(0.1099)	(0.0971)	(0.0168)
Population Density	0.0168	0.0156	0.0012
	(0.0307)	(0.0279)	(0.0032)
Division 2	-0.8855***	-0.7983***	-0.0872**
	(0.0542)	(0.0255)	(0.0449)
Division 3	-1.6564***	-1.4936***	-0.1628**
	(0.0873)	(0.0342)	(0.0828)
Division 4	-2.7453***	-2.4753***	-0.2700**
	(0.1422)	(0.0434)	(0.1382)
Promotion	-0.3285***	-0.2961***	-0.0324*
	(0.0364)	(0.0284)	(0.0171)
Relegation	0.0305	0.0277	0.0027
	(0.0307)	(0.0283)	(0.0030)

Notes

1: Direct and indirect effects are obtained from the coefficients displayed in Table 3 in the column Coeff (t).

2: ***, **, and * indicate significance at the 99, 95, and 90 percent level respectively.

Appendix A: List of Clubs that have participated in the Football League in every season between 1992/3 and 2012/13

Arsenal	Manchester United
Aston Villa	Middlesbrough
Barnsley	Millwall
Birmingham City	Newcastle United
Blackburn Rovers	Northampton Town
Blackpool	Norwich City
Bolton Wanderers	Notts County
Bournemouth	Nottingham Forest
Bradford City	Oldham Athletic
Brighton and Hove Albion	Peterborough United
Bristol City	Plymouth Argyle
Bristol Rovers	Port Vale
Burnley	Portsmouth
Bury	Preston North End
Cardiff City	Queens Park Rangers
Charlton Athletic	Reading
Chelsea	Rochdale
Chesterfield	Rotherham United
Colchester United	Scunthorpe United
Coventry City	Sheffield United
Crewe Alexandra	Sheffield Wednesday
Crystal Palace	Southampton
Derby County	Southend United
Everton	Stoke City
Fulham	Sunderland
Gillingham	Swansea City
Hartlepool	Swindon Town
Huddersfield Town	Tottenham Hotspur
Hull City	Walsall
Ipswich Town	Watford
Leeds United	West Bromwich Albion
Leicester City	West Ham United
Leyton Orient	Wigan Athletic
Liverpool	Wolverhampton Wanderers
Manchester City	

Appendix B: Alternative *W*-matrices and their effects on the estimated coefficients

A number of alternative *W*-matrices are considered by this paper. However, as the results are consistent regardless of the choice of *W*-matrix, we choose to present only one estimation in the main body of the text. We consider four alternative *W*-matrices; (i) global distance, (ii) distance truncated at the median, (iii) nearest neighbour, and (iv) population weighted distance matrix. The first *W*-matrix utilised in the preferred matrix and is presented in the main text. This is the global distance and it is a *W*-matrix which contains information on the distance between each club, no cut off distance is assumed and spillovers are assumed to occur between every club. The second measure is similar to the first, however, spillovers are truncated at the median distance value. Therefore, clubs on the periphery, under this specification, are likely to benefit from much smaller spillovers than assumed under the initial model. The third spatial weight assumed is the nearest neighbour. This assumes that spillovers are dependent upon the clubs nearest neighbour only. The final specification is a population-weighted spatial weight matrix which weights the distance between clubs by population, essentially assigning a stronger association between clubs if they are in more densely populated regions. The estimations of our model using all four weights are presented below. While the coefficients of the model vary dependent upon the precise specification of *W*, we note that the coefficients remain significant and the magnitudes do not change greatly. Therefore, we conclude that the results obtained in our paper are not dependent upon the *W* specification chosen.

Table B1: Estimation using various *W*-matrices.

	W	W-Median	W-Max	W-Pop
Weighted Spatial Performance ($W_{jt}y_{it}$)	0.0946**	0.0831**	0.0268**	0.0946**
	(0.0460)	(0.0388)	(0.0114)	(0.0460)

Managerial Change	-0.0782***	-0.0782***	-0.0783***	-0.0782***
	(0.0158)	(0.0158)	(0.0158)	(0.0158)
Club Wealth	0.0340***	0.0341***	0.0332***	0.0340***
	(0.0094)	(0.0094)	(0.0093)	(0.0094)
London	0.1494*	0.1505*	0.1537*	0.1494*
	(0.0876)	(0.0878)	(0.0865)	(0.0876)
Population Density	0.0154	0.0144	0.0210	0.0154
	(0.0262)	(0.0263)	(0.0254)	(0.0262)
Division 2	-0.7978***	-0.7979***	-0.7981***	-0.7978***
	(0.0265)	(0.0265)	(0.0265)	(0.0265)
Division 3	-1.4979***	-1.4973***	-1.4973***	-1.4979***
	(0.0364)	(0.0364)	(0.0364)	(0.0364)
Division 4	-2.4838***	-2.4834***	-2.4807***	-2.4838***
	(0.0458)	(0.0458)	(0.0459)	(0.0458)
Promotion	-0.2976***	-0.2976***	-0.2969***	-0.2976***
	(0.0269)	(0.0269)	(0.0270)	(0.0269)
Relegation	0.0308	0.0311	0.0320	0.0308
	(0.0278)	(0.0278)	(0.0278)	(0.0278)
Constant	0.2971	0.3029	0.2757	0.2971
	(0.2208)	(0.2212)	(0.2178)	(0.2208)
R^2	0.8865	0.8865	0.8876	0.8866
Obs	1,449	1,449	1,449	1,449

Notes
1: ***, **, and * indicate significance at the 99, 95 and 90 percent confidence level.
2: W is the W matrix as defined and used in the main text. W-median is a W matrix as defined previously but with any distance above the median coded as 0. W-max is the nearest neighbour W matrix. W-pop is a population weighted W matrix where population in this case is the population density of the region the club is located in.

Appendix C: Testing for Spatial Dependence

Figure C1: Plot of Moran's I p-values for each year

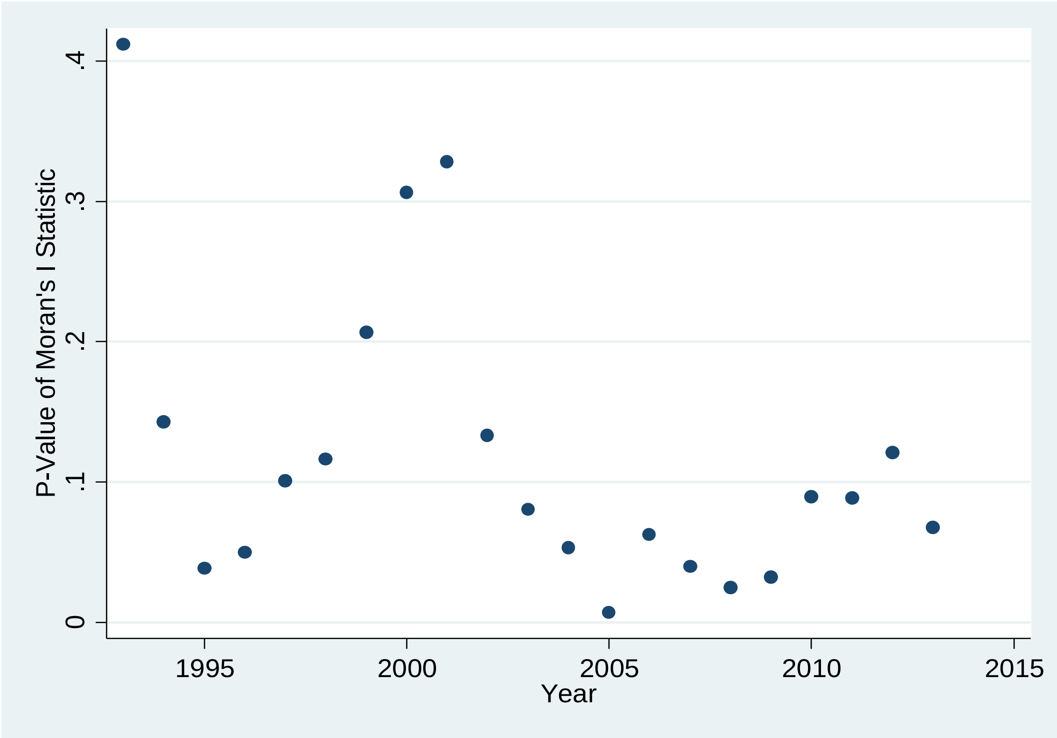
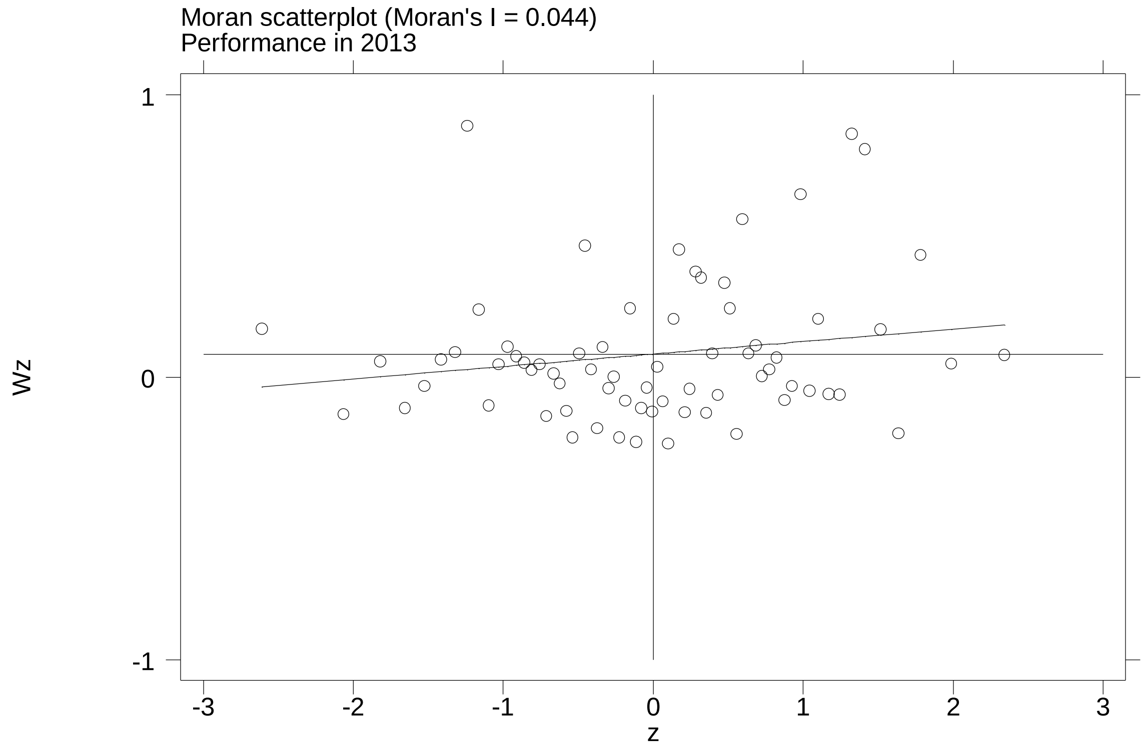


Figure C2: Moran's I Plot for 2013


Moran scatterplot (Moran's I = 0.044)
Performance in 2013
Wz
1
0
-1
-3
-2
-1
0
1
2
3
z

Appendix D: Estimations of Equation (1) excluding London Clubs

As a robustness check to ensure that the significant spatial effects in our analysis are not solely driven by a 'London-effect' we estimate equation (1) excluding London clubs. The results of this estimation, using our preferred W matrix, are presented in Table A4.1 below. It can be seen that the spatial coefficient remains statistically significant. This suggests that spatial dependence in club performance exists for clubs in the English Leagues that are not London-based.

Table D1: Estimation using clubs outside of London

	Clubs Outside London
Weighted Spatial Performance ($W_{jt}y_{it}$)	0.0851***
	(0.0271)
Managerial Change	-0.0776***
	(0.0170)
Club Wealth	0.0219**
	(0.0102)
London	na
Population Density	0.0247
	(0.0242)
Division 2	-0.7982***
	(0.0282)
Division 3	-1.5086***
	(0.0386)
Division 4	-2.5008***
	(0.0487)
Promotion	-0.3014***
	(0.0286)
Relegation	0.0259
	(0.0292)
Constant	0.4321**
	(0.2220)
R^2	0.8846
No of Obs	1,260

Notes

1: ***, **, and * indicate significance at the 99, 95 and 90 percent confidence level.

[i] Although referred to as the English League, the league also includes Cardiff City and Swansea City from Wales.

[ii] These clubs vary from year to year due to the fact that clubs are promoted and relegated from the Premier League on a yearly basis.