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football**

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**MARKET SIZE AND ATTENDANCE IN ENGLISH PREMIER LEAGUE
FOOTBALL**

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ABSTRACT

This paper models the impacts of market size and team competition for fan base on matchday attendance in the English Premier League over the period 1997-2004 using a large panel data set. We construct a comprehensive set of control variables and use tobit estimation to overcome the problems caused by sell-out crowds. We also account for unobserved influences on attendance by means of random effects attached to home teams. Our treatment of market size, with its use of Geographical Information System techniques, is more sophisticated than in previous attendance demand studies.

MARKET SIZE AND ATTENDANCE IN ENGLISH PREMIER LEAGUE FOOTBALL

Introduction

In professional team sports leagues around the world, market size is a fundamental determinant of league outcomes, as measured by league standings or probability of winning trophies. This proposition is valid for North American leagues, where teams (franchises) are typically viewed as trying to maximise profits (Fort and Quirk, 1995). It is also valid for European football leagues, even if clubs try to maximise an alternative objective such as number of games won (Késenne, 1999). Large disparities in market size sometimes induce league authorities to introduce cross-subsidisation schemes to transfer resources to smaller clubs. An example of this can be found in Major League Baseball where a luxury tax is levied on the largest teams, such as the New York Yankees, with the proceeds redistributed to smaller teams such as the Kansas City Royals.

At club level, the size of the market generates resources which can be used for investment in playing talent. Also, players will tend to gravitate towards teams where the extra revenues from their contributions to the team are highest and hence their salaries are highest (Burger and Walters, 2003). Again, this migration of talent will occur whether teams maximise profits or games won (Kesenne, 1999).

A crucial difference between North American and European sports leagues is that North American franchises tend to be allocated centrally by the league and tend to be widely dispersed geographically. This quite deliberate policy is designed to protect club revenues from competition by ensuring monopoly status for teams in their local

markets (see Leeds and von Allmen, 2005, 190-192 for details). In North America, leagues are closed (without promotion or relegation) and each league is essentially a franchise monopolist working to maximise members' monopoly profits. There are two direct consequences of this. First, franchises can and do migrate. In the National Hockey League there has been a steady drift of Canadian franchises to larger markets in the United States over the last two decades (Cocco and Jones, 1997). Second, it is rare to find more than one team competing with another in the same metropolitan area. Indeed, some large metropolitan centres may be without a major league team in a particular sport (for example, Los Angeles in American Football).

In European football, restriction on entry to the top tier of a league is primarily by promotion and in principle any team can aspire to top tier status. Some leagues do impose conditions on stadium suitability but generally entry and exit in the top divisions is fluid. Also, it is common to find several teams in major cities competing at the top level. For example, London had six teams in the English Premier League in 2005/6 out of a total of 20.

Hence, market size is a key concept in the literature on economics of professional team sports, whether the focus is primarily North American or European. One important channel by which market size generates resources for sports teams is through gate attendance. In this paper, we examine how and to what extent market size determines matchday attendance in the English Premier League. We take explicit account of two potential influences. First, we assess the role of local population size in determining matchday attendances. Second, we examine the role of competition between clubs. Other things equal, including size of local population, we predict that

the greater the number of competing clubs in a specific area, the lower will be matchday attendance. Our key concepts are market size and competition between clubs and each is to be calibrated using Geographical Information System (GIS) techniques applied to data from the England and Wales Census of Population 2001. Such techniques have received little prior attention in the sports management and economics literatures.

The paper is constructed as follows. In section 1 we establish our attendance demand model. Section 2 develops our measures of market size and competition between clubs. Section 3 deals with estimation issues and presents our data. Section 4 offers our empirical results while section 5 concludes.

1. An attendance demand model

Economists' consumer theory typically generates a demand function for a product in which quantity demanded is a function of own price, price of related goods, income and tastes.¹ Inclusion of ticket price in a model of sports matchday attendance creates problems as price data are difficult to obtain and clubs usually have an array of prices for different groups of spectators and different types of seating accommodation. Consequently, it is common practice for researchers to let club intercept terms, or fixed effects, capture unobserved ticket prices. This is the approach followed here.² Moreover, the literature on matchday attendance in team sports tends

¹ The notion of substitution between goods induced by relative price variations does not fit comfortably into sports fan behaviour. Fans are unlikely to switch allegiance between teams because one team offers lower ticket prices than another. However, they may be less inclined to attend when prices are perceived as too high and/or alternative activities appear more attractive.

² A common problem in many studies of matchday attendance is that price elasticity of demand is often estimated to be substantially below unity. A revenue-maximising team would set ticket prices where

to emphasise sport-specific characteristics, comprising attributes of the teams involved in particular matches and we follow this direction (see Borland and Macdonald, 2003, for a comprehensive review of studies of attendance demand in various sports).

Our model of attendance demand for a match i between home team j and away team k at time t is:

$$\text{Log attendance}_{it} = f(\text{team support}_{jk}, \text{team quality}_{jk}, \text{outcome uncertainty}_i, \text{broadcast}_i, \text{market size}_{jk}, \text{competition}_{jk}) \quad (1)$$

Variables identified by jk subscripts are identified separately for home and away teams. The characteristics of away teams will be important for matchday attendance for two broad reasons. First, the attractiveness of the away team will influence how many home fans turn up to the game. Second, fans of the away team will travel to the game and the number of these who appear will depend on away team characteristics.³

Under the heading of *team support*, we first include the log of average home team gate from the previous season for home and away teams: *log average home attendance last* and *log average away attendance last*. The former variable is intended to capture the substantial habit persistence of home fans. A hard core of supporters

price elasticity is unity. Empirical studies that use ticket price as an explanatory variable run into the problem that price variation may be correlated with changes in tastes. Forrest, Simmons and Feehan (2002) argue that price elasticities have been understated in the sports economics literature and propose a generalised measure of fan costs of attendance which includes travel costs. Applying this measure to cross-section fan survey data for 1995/6, they find that price elasticity rises to close to unity for several English Premier League clubs.

³ Interestingly clubs that experience excess demand by home fans still allocate a proportion of seats to away firms. This is partly to encourage reciprocal behaviour by rival teams but also to encourage a lively atmosphere within the stadium.

will turn out to follow their team whatever its fortunes. The size of away team support is proxied by the away team's average attendance in the previous. Since promoted clubs will have prior season attendance in the division below, we interact previous season attendance with a dummy variable for promoted teams: *Promoted* log average home attendance last* and *Promoted* log average away attendance last*. Some teams have a long tradition of support and we hypothesise that the longer and more established is league membership the greater will be home fan attendance. Also, longer-established away teams will bring more travelling fans and also be more attractive to home fans.

Two variables are constructed to measure length of membership of the Football League and these are *home membership* and *away membership*.⁴ Fan support may also depend upon *distance*. This is the Automobile Association measured road distance between grounds of home and away team. Distance is a proxy for travel cost. Higher travel costs will deter away fans from travelling to a match and will reduce home team gates accordingly. Forrest, Simmons and Szymanski (2004) found that distance affected both Premier League and Football League gate attendances negatively but also found a significant role for *distance squared* and this is duly inserted here. Finally, we include under the set of support variables a dummy variable, *derby*, to indicate matches of intense local rivalry. Examples include Manchester City versus Manchester United, Arsenal versus Tottenham and Manchester United versus Liverpool.

⁴ This is similar to the notion of *team reputation* used as an explanatory variable by Czarnitski and Stadtmann (2002) in their study of German league football.

Team quality is measured by two pairs of variables, The quality of team in a season is indicated by the relative wage bill of the club i.e. the club's wage bill divided by Premier League average for a particular season. This measure was gleaned from club balance sheets summarised in various issues of *Deloitte and Touche Annual Review of Football Finance*. Szymanski and Kuypers (1999), Hall, Szymanski and Zimbalist (2002) and Simmons and Forrest (2004) have shown that relative spending on team wage bills is a good predictor of team league standings in European football. We proceed on the basis that team quality can be reasonably proxied by club wage bills.⁵ *Home relative wage* and *away relative wage* then capture quality of playing squads of two teams in a match. Increases in either of these measures are predicted to raise matchday attendance. The home team relative wage measure is constant across a season. Short-term variations in team quality are measured by *home points* and *away points*. These are points accumulated to date of match divided by number of games played and are representative of team fortunes in the Premier League at the time of the match.

There is a vast literature in sports economics on the impact of *outcome uncertainty* on audience interest in sports. Other things equal, it is argued that greater outcome uncertainty should be associated with enhanced audience interest. Yet demonstration of this hypothesis is difficult. First, the other things equal caveat is especially important here and it is necessary to control for team attributes, including recent league performance. Second, a large difference in league standings may be mistakenly

⁵ The wage bills used here are for the entire club and not just playing staff but the bulk of the wage bill is taken up by playing staff. Since the Bosman ruling of 1995, European clubs have removed restrictions on the player labour market making this more competitive. The remaining restrictions are first, that movement of players who are under 24 and within their agreed contract period may entail a transfer fee payable by the receiving club and second, that work permit restrictions apply for players

attributed to outcome uncertainty when in fact the host team has home advantage. This means that a home team placed several positions below an opponent still has the greater chance of winning the game due to home field advantage.⁶ A measure of outcome uncertainty that corrects for inherent home advantage is the absolute value of total number of points divided by maximum gained at home by all teams in the Premier league in the previous season minus total number of points divided by maximum gained away by all teams plus home team points per game to date minus away team points per game to date. This measure was successfully applied by Forrest, Simmons and Buraimo (2005) to show that outcome uncertainty had a significant, positive impact on TV audiences for Premier League football. We use this measure in our attendance demand model. Attempts to show that outcome uncertainty affects matchday attendance in sports have yielded mixed results, however (Borland and Macdonald, 2003; Szymanski, 2003). It is not at all obvious that closeness of contest should affect matchday attendance when the crowd is overwhelmingly partisan and is primarily concerned with a victory for a team of its allegiance.

Some Premier League games were broadcast live over our sample period by the satellite provider Sky Sports. Other things equal, broadcast matches should lower matchday attendance as some fans swap the comfort (and lower cost) of viewing at home or in a pub for attendance at the ground. Indeed, Sky recognises the potential loss in gate revenues for clubs whose games are broadcast live by offering a substantial ‘facility fee’ which more than compensates the clubs for loss of gate revenues (Forrest, Simmons and Szymanski, 2004). Here, we establish a set of

from non-European Union countries. Overall, we expect that a player’s salary will be a good reflection of his expected contribution to team performance and revenues.

dummy variables to capture the effects of live broadcasting on attendance. Most live telecasts are on Sunday and Monday so *Sunday TV* and *Monday TV* are indicators for such events. *Bank Holiday TV* and *Other TV* indicate telecasts on public holidays and not on Sunday or Monday. Teams that have games broadcast on Monday night would lose attendance through scheduling away from the weekend at night, even without the telecast. Hence, we control for scheduling by a dummy variable *Weekday* set equal to one for games played but not televised over the Monday to Friday period.

Our set of control variables also includes month and year dummy variables and a dummy variable for games played on public holidays (*bank holiday*).

Although interesting in their own right, all variables constructed thus far are merely control variables and are secondary to our main concerns which are the effects of market size and team competition on gate attendance. In the next section, we show how GIS methods are used to generate measures of market size and team competition for fans.

2. Measuring market size and competition for fans

Population information is taken from the 2001 census survey of England and made available by the Office of National Statistics. Our data set covers attendances at Premier League games between the 1996/97 and 2003/04 seasons but population measures are time-invariant. We do not expect that population changes would be sufficiently large as to undermine the validity of our population measures. Our

⁶ Home field advantage is a bundle of attributes including home team psychology, greater familiarity with pitch, passionate home fans and susceptibility of referees to home crowd pressure. Around 48

Premier League data cover three seasons on either side of the census survey as well as the season in which the census was conducted.

Population data are available at various levels for England and Wales, including county, local authority and ward. We construct our market size measure by first using the smallest level, the output area. This gives a very detailed picture of population as the average number of people within an output area is 297 with a standard deviation of 71. We then count the number of individuals within output areas that lie within specified distances from each team's stadium. Concentric rings are derived using the GIS programme, Mapinfo. These rings increase by five mile radii up to a maximum of 30 miles. *Market size* is then the log of population within a particular ring zone and we experiment with radial distances in the empirical specification. A clue as to what can be expected is to be found in Forrest, Simmons and Feehan (2002). Using fan survey data and the same method of constructing concentric rings around stadia (with 1991 census of population data) they found that the relationship between attendance and distance travelled by supporters was best fitted using a gravity model, sharp reduction in support as distance travelled increased. The majority of home fans lived within 10 miles of the stadium. The use of five mile intervals for the width of concentric rings preserves homogeneity of travel costs within each zone. In our case, we lack precise travel cost information for fans so it is important that the assumption of homogeneous costs can be sustained.

Fans do not switch easily between support for neighbouring clubs. Once allegiance is established, the critical decision becomes whether to attend or not. But support tends

percent of games in English football are won by the home team.

to be handed down through generations and although many fans take up support through parent-induced loyalty there will be others who take up the option of forming their own allegiance. In that precise sense, there is competition between teams for the fan base within a particular area. We already have a variable, *Membership*, which captures what we perceive as ‘first mover advantage’ for long-lived clubs in an area. The tradition and reputation of these older clubs form entry barriers for newer clubs to develop and sustain their fan base. At present, an example of this is Wigan Athletic who only joined the Football League out of semi-professional status in 1978. Located in the Greater Manchester conurbation they face competition for fans from Manchester United and City and Bolton Wanderers to the east and Liverpool and Everton to the west. This is likely to be a more difficult obstacle to overcome than the local peculiarity that, until recently, the town’s Rugby League team enjoyed greater attendances than the football team.

As noted above, the multiplicity of football teams in metropolitan areas stands in sharp contrast to the territorial restrictions imposed in North American major league sports. The level of competition between clubs is likely to be negatively related to the amount of playing talent that can be hired. Indeed, this is an important reason why the North American teams invoke their particular restrictions. Here, we hypothesise that increased competition between teams will reduce gate attendance, given market size and our various control variables.

To measure competition, we could simply count the number of other Premier and Football League teams within a specified distance, say 20 miles. Although this would be useful we prefer to exploit information from the census of population more

precisely. Using Mapinfo, we construct 10 mile radial rings around each club.

Suppose there are two clubs located within 10 miles of the focus club's ground. The proportion of all people residing within a club's 10 mile radial ring and within a 10 mile radial ring of the other club is taken as our measure of *competition*. Figure 1 shows an example of overlapping rings for two clubs in our sample, Newcastle and Sunderland.

Where there is more than one neighbouring club, we have more than one intersection of overlapping rings. In this case, the proportions of overlapping population are aggregated and the value of *competition* may exceed unity. In fact, the value of *competition* ranges from zero to 7.88 with a mean of 1.90 and standard deviation of 2.37. The highest value occurs for Arsenal, revealing the intensity of competition for fans in the Inner London area. Tottenham Hotspur, located close to Arsenal, have the next lowest value at 7.76.

Our measures of *market size* and *competition* are entered into our model separately for home and away teams in a particular fixture. This is consistent with our treatment of our fan support variables. We offer a treatment of market size that is not restricted to arbitrary local authority boundaries.⁷ Moreover our measure of team competition overcomes the *ad hoc* treatment of dividing metropolitan population by number of teams as a measure of market size per team that has occurred in some previous studies (e.g. Burger and Walters, 2003). The use of GIS methods allows us to model market size and competition jointly as explanatory variables in our attendance demand model.

⁷ For example, Schmidt and Berri (2001) use size of metropolitan statistical area (SMSA) in their study of attendance at Major League Baseball games. This is an inadequate proxy for market size as travel costs are not homogeneous across cities with different SMSA size. Higher SMSA size does not translate into higher market size because travel costs are greater in bigger urban areas.

3. Data and empirical estimation

We need to address the problem that several Premier League clubs regularly sell tickets at levels close to ground capacity. This is an awkward problem that must be confronted in our empirical estimation. For a high proportion of games in our sample, we find that reported attendances are close to stadium capacity. Police segregation policies mean that clubs rarely report attendances exactly at capacity levels. We define ‘at capacity’ to mean attendance levels at more than 95% of stated ground capacity. On this basis, the proportion of censored games in our sample was 54.6%. Attendance at capacity cannot vary, for the team in question, by construction and Ordinary Least Squares estimates will be biased. As an alternative we use Tobit estimation.

In our model, stadium capacity is the censoring point and our attendance data are right-censored (see Figure 2). Only the data to the left of the censoring point can be used for estimation and so we have a truncated normal distribution for our dependent variable. The statistical distribution that is relevant for our attendance data is a mixture of discrete and continuous distributions representing the probability of a sell-out crowd and the attendances for games that are not sold out.

Following Greene (2003) we can analyse this mixed distribution by defining a random variable, A , which is derived from ‘true’ demand, D , as⁸:

$$\begin{aligned} A &= C \text{ if } D \geq C \\ A &= D \text{ if } D < C. \end{aligned} \tag{2}$$

⁸ Greene’s explanation of the tobit model is accompanied by a numerical example using stadium capacity as the censoring point.

Suppose that true demand is normally distributed with mean μ and constant variance σ^2 . Let $D = x\beta + \varepsilon$ where ε is a random error term. Then the first component of the tobit model is the probability of a sell-out crowd which is given by:

$$Pr\{A = C\} = Pr\{D \geq C\} = \Phi((x\beta - C)/\sigma). \quad (3)$$

The second component of the tobit model is the distribution of A given that it is below capacity. This is a truncated normal distribution with expectation

$E\{A|A < C\} = x\beta +$ conditional expectation of a mean-zero normal variable, given that it is less than $x\beta - C$. We now see why it would be inappropriate to restrict attention to games that do not sell out. The conditional expectation of A is not equal to $x\beta$ as it depends on x in a nonlinear relationship.

There are two extensions that can be readily made to fit our purpose. First, the censoring values can be made to vary across clubs as these have different stadium capacities. Secondly, we can estimate a random effects tobit model. This specifies true demand for game i hosted by team j at time t as

$$D_{it} = x_{it}\beta + \alpha_j + \varepsilon_{it} \quad (4)$$

The random effects model specifies a set of team-specific constant terms that are randomly distributed across teams. We are assuming here that the team-specific effects are strictly uncorrelated with the regressors.

The coefficients generated by the random effects tobit model cannot be interpreted as impacts as would be the case in a linear regression model. Suppose we obtain a coefficient of β_1 on a variable x_1 . Then we can obtain the marginal effect on the expected value of A of a change in x_1 as

$$\partial E\{A\}/\partial x_1 = \beta_1 \Phi((x\beta - C)/\sigma) \quad (5)$$

This gives the marginal effect of a change in x_1 upon the expected attendance A as the estimated coefficient multiplied by the probability of the game not being sold out. If this probability is one for a particular game then the marginal effect reduces to β_1 as in the linear model. Below, we report marginal effects rather than coefficients from our tobit estimates.

Attendance data were compiled from editions of the *Sky Football Yearbook* (previously the *Rothmans Football Yearbook*). Financial data were obtained from the *Deloitte and Touche Annual Review of Football Finance*. Descriptive statistics for our variables are shown in Table 1. It is apparent that matchday attendances are widely dispersed so there is considerable variation in our dependent variable to be explained by our model. Allowing for some small amount of missing information on financial data, we have a sample size of 2,553 of which 1,394 games are designated as censored. Our sample period is 1996/97 to 2003/04 and we therefore have a substantial unbalanced data set. The context for our study is a period of growth in Premier League attendances, sufficiently strong for several clubs (e.g. Arsenal, Liverpool, Manchester City, Southampton) to contemplate moving to larger stadia to release existing capacity constraints.

4. Empirical results

Results from our random effects tobit estimation are shown in Table 2. We should first note the absence of *outcome uncertainty*. This was included initially and as the coefficient was found to be not significantly different from zero we dropped this variable from the final results. Failure to find any significant role for outcome

uncertainty is not a new finding in the sports economics literature. For example, Baimbridge *et al.* (1996) found no significant effect of a measure of outcome uncertainty based on absolute differences in league rankings in their study of Premier League football in the 1993/94 season (although they did not use tobit estimation).⁹

Our reported t-statistics will be understated, inference will be undermined and our estimates will be inefficient if the error term does not have constant variance. To test for unequal variance in the error term (heteroskedasticity) we apply the Goldfield-Quandt test (Greene, 2003). Our dataset is partitioned into three based on the magnitude of the following variables: home team's prior season attendance, home team's relative wage and current performance of the home team. The variances of the error terms from regression models of the partitions were tested for equality. The Goldfield-Quandt test did not reject equality of variance of the error term.

Control variables

From our set of *team support* variables, it appears that habit persistence is strong within the Premier League since home team attendance is positively related to average attendance last season for both home and away teams. This applies to both incumbent and promoted teams. Tradition and reputation as proxied by home team league membership appear to be significant determinants of attendance. However, away team league membership does not have a significant effect on attendance. Distance affects matchday attendance in a non-linear fashion as found in other studies (Forrest,

⁹ See Borland and Macdonald (2003) for some studies on other sports which find a similar result.

Simmons and Szymanski, 2004). Derby matches involving keen local rivalry raise attendances, other things equal, by 6.0 per cent.¹⁰

In our set of *team quality* measures, home team and away team wage bill have significant coefficients of almost equal magnitude, suggesting that fans react to total quality of teams in a match when deciding to attend. We see that improved quality of an away team does have a positive impact on home attendance. If a typical away team improves its team quality by raising relative wage bill by 45 per cent (an increase of one standard deviation), home gates improve by 1.3 per cent according to our results, *ceteris paribus*. A slightly smaller effect can be found by raising home team's relative wage bill by the same order of magnitude.

We find that home team performance, as measured by points per game to date of match, has a positive and significant (at 1 per cent) effect on attendance. This is in line with prior expectations. But away team performance does not have a significant effect on attendance. Away team attributes that impact on gates are to be found elsewhere in the relative wage bill and distance variables.

The set of *broadcasting* variables gives clear evidence that live telecasts of Premier league games does reduce attendance, with the exception of games televised on public holidays. We find that live broadcasting on Sundays, the most popular slot for viewers, reduces gate attendance by 7.6 per cent, other things equal¹¹. Taking account of the general loss in attendance for weekday games (4.7 per cent) we find that games

¹⁰ Impacts of dummy variables are shown using the formula $\exp(\beta x) - 1$ where β is the estimated coefficient.

broadcast on Monday nights are associated with 6.3 per cent lower attendance, *ceteris paribus*.

Market size and competition

Our results reveal a positive impact of market size on gate attendance, as expected. After experimentation with sizes of concentric rings, we find that the population located in rings outside a 10 radius from the home team stadium does not contribute significantly to attendance.¹² Our key result, then, is that a 100 per cent increase in population within 10 miles of a ground raises gate attendance by 11.5 per cent. Put another way, consider two teams that are otherwise identical as specified by control variables. Then if one team has a population within 10 miles that is 100,000 greater than the other team, the team with larger population density is predicted to have 0.79 per cent greater attendance. At mean attendance, we estimate that this converts to £151,000 extra revenue *per season*.

We also find that away teams with greater population density near their grounds generate additional attendance. A 100 per cent larger away team population is associated with a 2.8 per cent greater attendance.¹³ Alternatively a difference in away team population of 100,000 translates into an increase in attendance of 0.32 per cent.

¹¹ Forrest, Simmons and Buraimo (2005) report results from a probit model of selection of Premier League games by Sky. In the second half of a season Sky has unrestricted choice of which games to broadcast and does tend to focus on matches involving teams higher up the League table.

¹² The use of a 10 mile radius is consistent with Forrest, Simmons and Feehan (2002) who found that the majority of home fans travelled within this distance. Travel costs are reasonably homogeneous within this zone.

¹³ We lack data on numbers of away fans inside home stadia and so we cannot distinguish between the impacts of away team market on numbers of fans who travel and on attractiveness of larger away teams to home supporters.

Larger population centres tend to be associated with a greater number of competing teams. London and Greater Manchester, in particular, have several clubs competing within a 20 mile radius. The coefficients on *home competition* and *away competition* are each negative and significant at 5 per cent. As the degree of competition increases within both the home and away team markets, attendance is predicted to fall. But while larger markets do attract increased competition for fan base from rival teams, we find that this does not entirely eliminate the advantages of greater market size. If *home competition* is removed from the model, the marginal effect on *home market size* is reduced to 0.064.

Looking at away team characteristics, we find that the benefits of larger market size of an away team are again only partially offset by the significant, negative effect of increased competition for fans by means of a greater number of clubs in the away teams' localities.

An important implication of our results is that team relocation to stadia in out-of-town greenfield sites is predicted to result in loss of support as market size is reduced. Take the example of Bolton Wanderers who moved from Burnden Park in the centre of Bolton to a newly built stadium in Horwich, three miles away from the town centre and with lower population density. Setting control variables at their mean values, we find that the predicted reduction in average home attendance for Bolton is 1,278 per game. Using a Premier League average ticket price of £30 in 2003/04, the reduction in seasonal gate revenue for Bolton from its out-of-town site is then estimated at £728,460. Of course, in recent seasons Bolton have finished in the top half of the Premier League and have qualified for the UEFA Cup but this merely highlights the

importance of controlling for other factors when undertaking multivariate analysis. Of itself, a change in stadium from inner city to suburbs or out-of-town sites is predicted to reduce gate attendance.¹⁴

An example of a stadium move which took a club to a location with greater population density is Manchester City. Their move to the City of Manchester Stadium to the east of Manchester is predicted to raise gate attendance by a modest 91 per game. Arsenal's new stadium is located close to their old location at Highbury in north London and their move should have no effect on gate attendance, other things equal.

5. Conclusion

We have modelled Premier League matchday attendances over the period 1997-2004 using a large panel data set. We have constructed a suitable set of control variables and have overcome the problems caused by sell-out crowds by use of tobit estimation. We have also accounted for unobserved influences on attendance by means of random effects attached to home teams. Our treatment of market size, with its use of GIS techniques, is more sophisticated than in previous attendance demand studies and would merit application in studies of other sports leagues.

Our main result is that, subject to other controlling influences, teams located in bigger markets are able to generate higher gate attendances than those in smaller markets.

Competition between clubs for the fan base in particular region is a partially offsetting

¹⁴ However, offsetting the reduction in market size is a possible honeymoon effect as fans sample the new stadium (Coates and Humphreys, 2005, Leadley and Zygmunt, 2005).

influence. Our results support the fundamental proposition of various sports economists (Fort and Quirk, 1995; Késenne, 1999) that disparities in team performance ultimately reflect differences in playing talent that are in turn due to variations in market size. A companion paper, Buraimo, Forrest and Simmons (2005), follows through and tests the implication of this argument. In the long-term, team performance is predicted to depend on market size. That proposition is also upheld in these authors' empirical work. Here, we have checked the first step in the process linking market size to team performance. Essentially, teams with larger market size have the potential to convert a greater fan base into greater gate, and other, revenues so as to generate resource to invest in player talent. Competition between teams for the fan base in a region plays a negative, offsetting role in the determination of gate attendance but does not totally eliminate the benefits of greater market size.

We offer two problems which we regard as worthy of further research. First, how is it that some large metropolitan areas have football teams with systematically weak performance? Birmingham, Bristol and Sheffield are possible areas to consider as these appear to have underperforming clubs.¹⁵ Second, how do changes in population over time, through births, deaths and migration, impact upon disparities in market size between clubs. Our analysis has used 2001 census data. It would be interesting to compare our results from similar models constructed using the 1991 and earlier censuses to see how the dynamics of market size have impacted upon team attendances, revenues and performance (Dobson and Goddard, 1995, 2001). A highly relevant research question is whether disparities in market size have increased for football teams over the two census periods. This would cast much light on the critical

¹⁵ In France, the absence of a successful club in Paris needs explanation.

policy question of the optimal degree of cross-subsidisation that the Premier League should offer to smaller teams.

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Figure 1.



Figure 2.

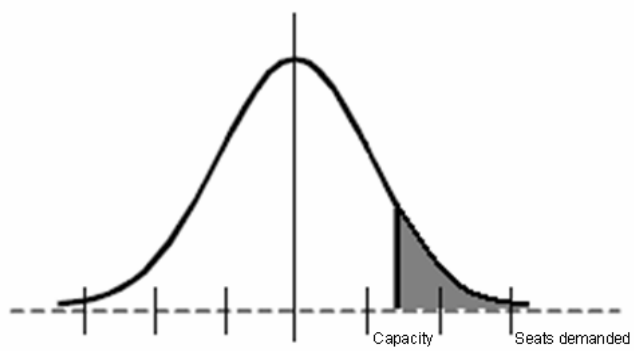


Table 1. Summary statistics.

Variable	Mean	Std	Min	Max
<i>Attendance</i>	32693	11246	7688	67757
<i>Average home attendance last</i>	33001	11041	15099	67602
<i>Average away attendance last</i>	31137	11403	11407	67602
<i>Promoted* average home attendance last</i>	21109	7455	11407	38745
<i>Promoted* average away attendance last</i>	21109	7455	11407	38745
<i>Home membership</i>	98	17	20	115
<i>Away membership</i>	97	17	20	115
<i>Distance</i>	140	82.40	0.00	347
<i>Derby</i>	0.05	0.22	0.00	1
<i>Home relative wage</i>	1.00	0.45	0.28	2.83
<i>Away relative wage</i>	1.00	0.46	0.28	2.83
<i>Home points</i>	1.36	0.53	0	3
<i>Away points</i>	1.38	0.53	0	3
<i>Sunday TV</i>	0.07	0.26	0	1
<i>Monday TV</i>	0.04	0.19	0	1
<i>Bank Holiday TV</i>	0.01	0.11	0	1
<i>Other TV</i>	0.05	0.22	0	1
<i>Weekday</i>	0.11	0.31	0	1
<i>Bank holiday</i>	0.06	0.23	0	1
<i>Home market size</i>	14.19	0.79	12.39	15.39
<i>Away market size</i>	14.19	0.79	12.39	15.39
<i>Home competition</i>	3.10	2.77	0.00	7.88
<i>Away competition</i>	3.16	2.87	0.00	7.88

Table 2. Tobit model for Premier League attendance.

<i>Explanatory Variables</i>	<i>Marginal effect</i>	<i>t statistic</i>
<i>Log average home attendance last</i>	0.5420	25.77
<i>Log average away attendance last</i>	0.0827	4.89
<i>Promoted* log average home attendance last</i>	0.0147	12.37
<i>Promoted* log average away attendance last</i>	0.0048	4.37
<i>Home membership</i>	0.0032	12.51
<i>Away membership</i>	0.0000	-0.17
<i>Distance</i>	-0.0006	-3.72
<i>Distance²</i>	0.0000017	2.99
<i>Derby</i>	0.0577	2.92
<i>Home relative wage</i>	0.0656	4.71
<i>Away relative wage</i>	0.0889	6.44
<i>Home points</i>	0.0521	6.69
<i>Away points</i>	0.0097	1.24
<i>Sunday TV</i>	-0.0728	-5.30
<i>Monday TV</i>	-0.1038	-6.12
<i>Bank Holiday TV</i>	-0.0281	-0.76
<i>Other TV</i>	-0.0446	-2.30
<i>Weekday</i>	-0.0460	-4.14
<i>October</i>	0.0166	1.21
<i>November</i>	0.0335	2.47
<i>December</i>	0.0316	2.57
<i>January</i>	0.0309	2.33
<i>February</i>	0.0549	3.82
<i>March</i>	0.0438	3.26
<i>April or May</i>	0.0740	6.60
<i>1998-99</i>	0.0113	0.84
<i>1999-2000</i>	-0.0966	-7.58
<i>2000-01</i>	-0.0918	-7.23
<i>2001-02</i>	0.0599	4.29
<i>2002-03</i>	-0.0063	-0.42
<i>2003-04</i>	0.0105	0.68
<i>Bank holiday</i>	0.0278	1.79
<i>Home market size</i>	0.1146	8.80
<i>Away market size</i>	0.0277	2.07
<i>Home competition</i>	-0.0242	-6.19
<i>Away competition</i>	-0.0082	-2.19
<i>Constant</i>	1.4874	4.82
Log likelihood		100.2241
<i>N</i>		2553
Censored observations		1394