Broadcasting, Attendance and the Inefficiency of Cartels

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Abstract. The English Premier League is a cartel of soccer teams that collectively sells the rights to broadcast its matches. Despite considerable demand for their product from broadcasters, the clubs agreed to sell only a small fraction of the broadcast rights (60 out of 380 matches played each season between 1992 and 2001). The clubs have explained this reluctance by claiming that increased broadcasting would reduce attendance at matches and therefore reduce cartel income. However, this paper produces detailed econometric evidence to show that broadcasting has a negligible effect on attendance and that additional broadcast fees would be likely to exceed any plausible opportunity cost. The paper concludes that a more likely explanation for the reluctance to market their rights is the failure of the cartel to reach agreement on compensation for individual teams.

Key words: Attendance, broadcasting, cartels, football, inefficiency

I. Introduction

> "it is desirable to limit the number of matches which are televised live because excessive live broadcasting of football would be likely to reduce attendances" FA Premier League, Statement of Case, Restrictive Practices Court, 1999

A typical cartel sets out to maximise the joint profits of its members. Most industrial countries have adopted antitrust laws prohibiting cartel-like behaviour because of the adverse consequences for social welfare of monopolistic behaviour. However, a cartel is more complex than a monopoly. To achieve joint profit maximisation members of a cartel must reach agreement among themselves, and if they fail to reach an agreement

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consistent with joint profit maximisation the consequences of this may be even more adverse for social welfare than a simple monopoly.[1] This paper illustrates that argument using the case of the English Premier League, a collection of soccer (henceforth football) teams that agree, *inter alia*, to jointly market their television broadcast rights.

In 1995 the Office of Fair Trading challenged the collective selling arrangements of the Premier League. One important reason for the challenge was the excessive restriction on output imposed by the agreement: between 1993 and 2001 an average of only 60 of the 380 Premier League matches played each season were broadcast. The Premier League claimed that if clubs were free to sell their broadcast rights individually they would attempt to sell them for all or nearly all of the matches played, and that this would lead to a significant reduction in attendance at matches themselves. Expert witnesses for both sides debated at great length the econometric evidence on this point, but in the end the Court accepted the position of the OFT, and indeed previous research on the impact of broadcasting on match attendance, that this effect would not be such as to have a significantly adverse effect on the clubs (see Restrictive Practices Court (1999), paras 222–229). In this paper we produce detailed econometric evidence to demonstrate that broadcasting of Premier League matches has had a negligible effect on attendance.

However, this leaves a puzzle. The Premier League itself could have sold more matches, collectively, and the broadcaster, Sky, would have paid more had it been able to acquire this additional programming material. So why, if the robust statistical evidence shows that there will be little cost in terms of attendance, has the Premier League not chosen to sell more matches?

We consider a model of cartel decision making in which it can be rational for clubs to restrict the number of broadcasts below the revenue maximising level. If the opportunity cost to each team of a live broadcast is private information then it is straightforward to show that a contract to broadcast all league matches may violate incentive compatibility constraints. As a result the incentive compatible equilibrium may involve showing only the matches of the low cost team. This situation seems to approximate the Premier League contracts agreed in 1992 and 1997 which allowed for the broadcasting of fewer than 20% of all matches, the majority of which involved the larger clubs whose matches have typically been played at or close to capacity. The latest Premier League contract, implemented from the 2004/05 season provides for 138 matches to be broadcast (see Harbord and Szymanski, 2004).

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[1] There is a substantial literature on the possibility of implementing efficient cartel agreements (see e.g. Roberts, 1985; Cramton and Palfrey, 1990). It is also possible that an inefficient cartel agreement works in the interests of consumers, but that is not the case in the example advanced in this paper.

The paper is set out as follows. Section 2 reviews English Premier League broadcasting arrangements, Section 3 details our econometric evidence and Section 4 introduces a model that could account for the relatively small number of matches broadcast in England. Section 5 concludes.

II. Football on TV in England

1. BSKYB'S BROADCASTING CONTRACT

Prior to the formation of the Premier League in 1992, the main competition in England was the Football League which comprised 92 clubs in four divisions, with promotion and relegation to facilitate team mobility. In 1991, with big clubs increasingly frustrated by the small size of receipts from sale of broadcasting rights to terrestrial channels, the Football Association (the FA, the governing body of football in England) proposed the creation of an autonomous "Premier League" as the top tier of English football. This was able to negotiate its own TV contract and retain all of the proceeds (Football Association, 1991). Although autonomous, the Premier League retained promotion from and relegation to the Football League, which reverted to three divisions also linked by promotion and relegation, with Division One as its top tier.

Having obtained the approval of the FA, the Premier League proceeded to negotiate a £170m four year contract with pay TV satellite broadcaster BSkyB (Sky) to show 60 live matches per season (out of 462 played in the first three seasons and 380 thereafter) – amounting to less than 15% of all matches played. Under the terms of the agreement each club was to be broadcast at least three times in each season. This part of the agreement seems to have been at the insistence of the smaller clubs which, having formerly opposed all live TV broadcasting, now felt that at least some exposure was desirable. Within these limits Sky could choose which games to show, and not surprisingly tended to weight its selections towards the more popular and successful clubs, notably Manchester United, during this period. The Premier League also introduced a novel distribution formula – allocating 50% of the TV income as an equal share to all member clubs, 25% as a performance bonus and 25% for facility fees paid out to the teams actually broadcast.[2]

Some of the broadcasting rules (revenue sharing, "parachute" payments to compensate relegated clubs) were designed to facilitate agreement between clubs on terms of collective selling. Restrictions on timing of broadcast

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[2] The precise formula for the performance element is $V_R = \frac{n+1-R}{\sum\limits_{i=1}^{n} R_i}$ where V_R is the prize awarded to the Rth ranked team and n is the number of teams in the League. There is also a "parachute" payment paid to terms relegated from the Premier League in the previous season that is deducted from the equal share portion.

matches were imposed to eliminate potentially adverse impacts on gate attendance from simultaneous scheduling of televised and non-televised fixtures.

In 1997 a second contract was agreed with Sky for the greatly increased sum of £670m over 4 years but on essentially the same conditions. About this time the UK competition authorities began to question these arrangements, in particular Rule D.7.3 of the Premier League rulebook that required any club wishing to broadcast a match to obtain permission from the Premier League Board. In practice such permission has never been granted, even though only a small fraction of all matches are shown. When this came to court the Premier League based its defence on a number of factors, but one on which they placed great emphasis was the need to protect live gate both of those matches that are being broadcast and of other matches that might be played at the same time. Section 3 deals with our estimates of these two effects for Premier League and Football League clubs over the first six seasons of the Premier League's existence.

2. PREVIOUS ECONOMIC STUDIES

The impact of live broadcasting on match attendance is part of a wider question, namely the determinants of the demand for sporting events. Demand studies in association football have tended to focus on impacts of playing success of home team, market size, income and uncertainty of outcome (Dobson and Goddard, 2001; Garcia and Rodriguez, 2002).[3] The impact of outcome uncertainty is a significant issue in the present context because collective selling has also been justified on the grounds of this promoting competitive balance.

Studies of the impact of broadcasting on attendance in the UK have exploited the fact that only a fraction of games have been shown live. The first published studies coincided with the creation of the Premier League. Kuypers (1995) and Baimbridge et al. (1996) both estimated the effect of broadcasting on Premier League match attendance for the season 1993/94. Kuypers' found no significant impact of live TV broadcast on attendance.[4]

Kuypers' preferred model was a Tobit regression to take account of the number of sell-out games, which were about 10% of the total in 1993/94. Collection of this data required particular care since many grounds were

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[3] There is a substantial literature in the US on the effect of broadcasting on attendance at major league sports (e.g. Putsis and Sen, 2000; Siegfried and Hinshaw, 1979).

[4] One weakness in Kuypers' specification is that it did not differentiate broadcast matches by day of the week. About half the games in that season were shown on a Sunday afternoon, while most of the remainder were broadcast on Monday nights (an innovation borrowed from the US). One might reasonably expect the effect on attendance *via* displacement from live TV to be greater for a Monday night game, since fans may find it difficult to get to the game after work, compared to a Sunday.

under reconstruction during the early 1990s and therefore capacity could vary from match to match.

Baimbridge et al. distinguished between matches played on a Sunday and on a Monday night. In the former case, they found no statistically significant effect, while Monday night games were found to have 15% lower attendance. However, they did not estimate a separate coefficient for weekday matches not broadcast. If all midweek matches have lower attendance, then broadcasting itself would not be the cause of lower attendance, although to the extent that broadcasting causes matches to be rescheduled to weekdays it would still be the indirect cause.[5]

A recent paper by Garcia and Rodriguez (2002) examines the effect of broadcasting on attendance in the top division of Spanish football between 1992 and 1996, during which period about 20% of matches were broadcast. They find that broadcasting had a very large and statistically significant negative effect on attendance by non-season ticket holders.

III. Estimated Effects

1. DATA

For our study we have gathered data on all league matches played in the six seasons from 1992/93 to 1997/98 in the Premier League and the Football League First Division. For each match the data provide information on the league position of the home team and the away team (an indicator of the attractiveness and competitive balance of the teams), the day and the date the match was played (to account for day of week, holiday and time of season effects), the distance of the away team ground from the home team ground (as an indicator of the cost of travelling for away fans) and whether or not the match was broadcast live. In addition, for First Division matches another variable was included to allow for the impact of broadcasting "European" matches[6] involving top English teams at the same time as the First Division match was played. Matches in the European competitions are invariably midweek and attract a large national TV audience. They seldom clash with Premier League matches but the greater number of teams in the First Division dictates that more games have to be scheduled for midweek. Thus, using the Football League sample, we are able to investigate not only the effect of own broadcasting of a match on attendance but also the effect of broadcasting other attractive matches on attendance at a game.

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[5] The econometric modelling of Baimbridge et al. was less sophisticated than that of Kuypers. They only estimated an OLS equation, implicitly ignoring capacity restraints, and reported few diagnostic tests.

[6] The Champions' League, UEFA Cup and Cup Winners' Cup competitions.

2. EMPIRICAL MODEL

The empirical model broadly follows the specification of match day attendances in the literature (see *inter alia* Forrest and Simmons, 2002; Garcia and Rodriguez, 2002) and seeks to identify and quantify the impact of broadcasting on gate attendance in a robust, parsimonious form. (Log) home attendance in game i is a function of home and away team quality, last season's average league attendance for home and away teams, distance between locations of home and away teams and various dummies to capture scheduling on days of week, months of year and, of course, broadcasting of games. Team quality is proxied by league position and its square, to allow for non-linearity. The role of last season's average attendance is to control for persistent, core support from loyal fans who are relatively impervious to variations in team quality.[7] Greater distance between locations of home and away teams is likely to deter attendance due both to increased travel costs and reduced intensity of fan rivalry. Although parsimonious, our model specification is still rich in detail and is more sophisticated than most previous attendance demand studies. Variable definitions are shown in Table I.[8]

3. PREMIER LEAGUE ATTENDANCE ESTIMATES 1992/93 TO 1997/98

The impacts of broadcasting on football attendance are derived using dummy variables to capture particular matches that are televised. In the case of the Premier League, over the sample period, one broadcaster (BSkyB) was the sole provider; its live games were usually scheduled for Sunday afternoons and Monday evenings. In Division 1, terrestrial regional ITV companies showed live games from 1992/93 to 1996/97, mainly on a Sunday afternoon, but BSkyB bought rights for coverage in 1996/97 and 1997/98. BSkyB Division 1 games were typically televised on Friday evenings. The empirical estimates distinguish between day of transmission and identity of broadcaster.

Table II reports results of a Tobit regression for Premier League games from 1992/93 to 1997/98, with log attendance as the dependent variable, while Table IV reports results of a fixed effects OLS regression for First Division games over the same period. Tobit estimation for Premiership games is necessary since many games have attendances at or close to capacity. Retaining these observations for OLS estimation would result in

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[7] This core support will depend, *inter alia*, on income and population; inclusion of last season's attendance allows for influence of these omitted variables.

[8] We experimented with, but dropped, a set of variables to capture weather, such as temperature and dummy variables to denote freezing conditions, rainfall and sunshine. Coefficients on weather variables were not statistically significant, at 5%, either directly or interacted with TV coverage.

Table I. Variable definitions

Continuous variables	Definition
LOG ATTEND	Log home team attendance
LOG ATTEND LAST	Log average home attendance of home team in previous season
LOG ATTEND LAST AWAY	Log average home attendance of away team in previous season
HOME POS, HOME POS SQ	League position (immediately prior to the match) of home team and its square
AWAY POS, AWAY POS SQ	League position (immediately prior to the match) of away team and its square
DISTANCE, DISTANCE SQ	Distance between teams' grounds (miles) and its square
PROM ATT	Log average home attendance of home team in previous season, if promoted
PROM ATT AWAY	Log average home attendance of away team in previous season, if promoted
Dummy variables used in Premiership and Division 1 regressions	
BANK HOL	Bank holiday
Dummy variables used in Premiership regression	
PROM	Home team promoted from Division 1
PROM AWAY	Away team promoted from Division 1
WEEKDAY	Game played on any day excluding Saturday or Sunday, not televised
APRILMAY	Game played in April or May
SKYSUN 1992/93 to 1997/98	Game played on Sunday, televised by BSkyB in the particular season identified (1992/93, 1993/94 to 1997/98)
SKYMON 1992/93 to 1997/98	Game played on Monday, televised by BSkyB in the particular season identified
MIDWEEK	Game, not televised, not a Bank Holiday, played on Tuesday, Wednesday or Thursday
Dummy variables used in Division 1 regression	
DERBY 1992/93, DERBY 1993/94, DERBY 1994/95, DERBY 1995/96, DERBY 1996/97, DERBY 1997/98	Game between two locally proximate sides, regarded by fans as of intense local interest, not televised in: 1992/93 to 1997/98

Table I. Continued.

Continuous variables	Definition
ITVDERBY 1992/93, ITVDERBY 1993/94, ITVDERBY 1994/95, ITVDERBY 1995/96, ITVDERBY 1996/97	Local derby match televised by ITV
SKYDERBY 1996/97, SKYDERBY 1997/98	Local derby match televised by BskyB
ITV 1992/93, ITV 1993/94, ITV 1994/95, ITV 1995/96, ITV 1996/97	Game televised by ITV in: 1992/93, 1993/94, 1994/95, 1995/96, 1996/97
SKYFRI 1996/97, SKYFRI 1997/98	Game televised by BSkyB on Friday in: 1996/97; 1997/98
SKYSUN 1996/97, SKYSUN 1997/98	Game televised by BSkyB on Sunday in: 1996/97; 1997/98
EUROTV 1992/93, EUROTV 1993/94, EUROTV 1994/95, EUROTV 1995/96, EUROTV 1996/97, EUROTV 1997/98	Game played at same time as a European club tournament match which was televised on Tuesday, Wednesday or Thursday
MONTUES	Game played on Monday or Tuesday, not Bank Holiday, no competing European televised match
WEDTHUR	Game played on Wednesday or Thursday, not Bank Holiday, no competing European

biased coefficients whereas deleting the censored observations involves loss of information.

In the Tobit estimation of attendance demand, the upper limit of attendance should not be published stadium capacity. Capacity figures are notoriously unreliable since they are not regularly updated to allow for increases in attendance brought about by introduction of flexible seating accommodation or decreases in attendance occasioned by police controls on crowd segregation (where sections of stands may be left vacant on police advice) and "no-shows". In our sample, only 38 out of 2526 matches were strictly capacity constrained, based on official capacity figures, but casual observation suggests a much greater number of "sell-out" games. We decided to adopt an arbitrary capacity limit of 95% of "official" ground capacity to allow for the frequently observed reduction in capacity due to crowd segregation imposed by police. This gives 688 censored observations, representing 27% of the full sample. Our results are robust to stricter censoring at 90% of capacity. Second, we face the econometric problem, noted above, that non-normality of residuals will lead to inconsistent estimates. Tests for normality of residuals from the regression in Table II could not reject non-normality.

Table II. Tobit regression of Premiership attendance

Variable	Marginal effect	*p*-value
HOME POS	−0.0204	0.000
HOME POS SQ	0.00059	0.000
AWAY POS	−0.0168	0.000
AWAY POS SQ	0.00049	0.000
LOG ATTEND LAST	1.725	0.000
LOG ATTEND LAST AWAY	0.582	0.000
PROM ATT	−0.150	0.008
PROM ATT AWAY	−0.0098	0.808
PROM	2.130	0.000
PROM AWAY	0.501	0.174
DIST	−0.0012	0.000
DIST SQ	4.02E-06	0.000
BANK HOL	0.0219	0.111
SKYSUN 1992/93	−0.0328	0.152
SKYSUN 1993/94	−0.0378	0.178
SKYSUN 1994/95	−0.0911	0.016
SKYSUN 1995/96	−0.0926	0.004
SKYSUN 1996/97	−0.0063	0.814
SKYSUN 1997/98	−0.0910	0.001
SKYMON 1992/93	0.0698	0.018
SKYMON 1993/94	−0.0122	0.713
SKYMON 1994/95	−0.0389	0.146
SKYMON 1995/96	−0.0550	0.195
SKYMON 1996/97	−0.129	0.003
SKYMON 1997/98	−0.0196	0.635
WEEKDAY	−0.0600	0.000
APRILMAY	0.0576	0.000
Season effects	Yes (significant)	
Log-likelihood	33.42	
Sigma	73.56	0.018

Dependent variable is log attendance, $n = 2526$, 688 right-censored observations.

The reported estimates are corrected for identifiable multiplicative heteroscedasticity in previous season average attendances for home and away teams.

The control variables in the Tobit estimates perform much as expected. Home teams with higher average home attendance in the previous season generate higher matchday attendances this season. Likewise, but to a smaller

extent, away teams which had higher average home attendance last season draw bigger crowds for the home teams this season. Positions are ranked from 1 (top) to 20 or 22. In 1995/96 the Premiership was reduced in size from 22 to 20 clubs. An improvement in either home or away team position raises attendance at a decreasing rate, with the turning point occurring outside the sample range. Longer distances between team locations deter attendance demand, again in a non-linear manner. It appears that fixtures scheduled in April or May, as the season reaches its climax, attract higher crowds, as do games played on Bank Holidays. Fixtures played on weekdays, but not televised, attract lower crowds, *ceteris paribus*. The season dummies do not reveal a rising time trend although the 1995/96 and 1997/98 seasons stand out as featuring generally high attendances. Overall, the inconsistent pattern of coefficients on the broadcasting dummies suggests that there is no clear evidence that broadcasting mattered for attendances in the Premier League over our sample period.

In estimating the impact of broadcasting on attendances, it is difficult to separate the impact of scheduling on, say, Monday nights from the impact of broadcasting *per se*. Over our sample period, the vast majority of games were played on Saturday afternoons. It would appear reasonable, therefore, to base our estimate of loss of gate attendance from broadcasting upon the assumption that the alternative scheduling of a televised fixture would be on Saturday. We would expect that *either* a Sunday afternoon or a Monday night televised match would have been scheduled for Saturday afternoon in the absence of broadcasting. Our estimates show that the impacts of Sunday broadcasting of Premiership matches on attendances are significantly negative, *compared to regular Saturday games*, in the 1994/95, 1995/96 and 1997/98 seasons only, with marginal effects of 9.11%, 9.26% and 9.10%, respectively. The impact of Monday night broadcasting is significantly negative in the 1996/97 season only with a marginal effect of 12.91%.

As part of the Premier League's contract with the sole broadcaster of live games (BSkyB), clubs taking part in televised matches received a "facility fee" as compensation for potential loss of gate revenue through lower attendance and related inconvenience such as reduced sponsorship, advertising income and catering and merchandise sales.

Our model fails to deliver any significant adverse impact of broadcasting on gate attendance, either from Sunday afternoon or Monday night television scheduling, in the 1993/94 season. In this season, and also for the 1992/93 season, clubs hosting televised matches actually generated a pure financial gain since their attendances were not harmed and they still received the match facility fee. Table III reports revenue losses from broadcasting for a typical Premier League club, based upon average admission prices reported by Dobson and Goddard (2001) and average Saturday attendances from our own sample. Losses of gate revenue are

Table III. Estimated losses of gate revenue for premier league clubs from BSkyB broadcasts

	Average ticket price	Average attendance	Loss in revenue
1994/95 Sundays	£11.58	24,339	£25,648
1995/96 Sundays	£12.74	27,670	£32,784
1996/97 Mondays	£14.59	28.969	£54,523
1997/98 Sundays	£14.99	29,064	£39,646

estimated as £25,648, £32,784 and £39,646 for games scheduled for Sunday broadcasting in seasons 1994/95, 1995/96 and 1997/98 and £54,523 for games scheduled for Monday broadcasting in the 1996/97 season. Even this last figure is well below the level of facility fee. It should be borne in mind that most teams would expect to have games scheduled both on Sunday and Monday and the net gain in revenue is increased since there is no season for which our model reveals adverse impacts on attendance from broadcasting on both days.

A newly negotiated broadcasting contract between the Premier League and BSkyB was implemented for the 1997/98 season. This provided for a much larger facility fee (£269,551 per game for each participant) and the gains in revenue from broadcasting a particular game were consequently much larger, £229,905 according to our estimates.

Of course, the comparison of revenues with and without broadcasting ought to address some wider issues. For example, advertising (such as boards around the pitch) and sponsorship income will rise when games are televised. On the other hand, TV scheduling is not fully known before the season starts and the uncertainty attached to visits from the broadcasters, and associated re-scheduling of matches, will adversely affect both season ticket prices and the number of season tickets sold. Should attendances fall at televised games, advertising income may be adversely affected if cameras show sections of empty seats.

Despite these qualifications, the conclusion from our analysis must be that the opportunity cost of broadcasting of Premiership games is small or even zero. In all seasons our results show that the facility fee more than outweighs any loss of gate revenue from broadcasting.[9]

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[9] Our econometric analysis of Premier League attendances relates to the first two contracts with BSkyB under which the average number of broadcast games per season was 60. The 2001–04 contract provided for 106 games per season, with 46 on BSkyB's pay-per-view channel, while the 2004–07 contract provides for 138 games per season with 8 sub-contracted to free-to-air broadcasters (Harbord and Szymanski, 2004). The impact of increased broadcasting of Premier League matches on gate attendance merits further research.

4. Football League Division 1 Estimates

In Division 1, regional ITV companies showed live games from 1992/93 to 1996/97, mainly on Sunday afternoons, but BSkyB bought rights for coverage in 1996/97 and 1997/98. BSkyB Division 1 games were typically televised on Friday evenings. The empirical estimates reported in Table IV distinguish between day of transmission and identity of broadcaster.

For Division 1, empirical analysis is simplified by the much lower frequency of sell-out games. On the other hand, greater complexity is introduced by the co-existence of satellite and terrestrial (ITV) broadcasters in the live coverage of these games. We proceed to show OLS estimates in Table IV, with fixed effects for home teams. The same controls for home and away positions and for distance are used as for the Premier League analysis. For Division 1 games we add further controls for local 'derby' matches (games between local rivals), both televised and not televised.[10] Coverage of Division 1 games by ITV was undertaken by regional TV companies within the ITV network, always on Sunday afternoon, and tended to involve a disproportionate number of local derby matches in order to generate viewer interest at the local level. We also adopt controls for appearances of European tournament matches on television in midweek.

The impacts of the control variables have the expected signs with coefficients of similar order of magnitude to the marginal effects obtained from the Tobit estimates shown for the Premier League. Home and away teams with higher league positions draw bigger crowds, home and away teams with larger average support last season generate higher attendances and longer distance between teams deters attendance. Games played on Monday or Tuesday evening suffer a 2.5% reduction in attendance compared to non-televised weekend games while those played on Wednesday and Thursday evenings suffer a 7.5% loss in attendance. Games played in the latter part of the season (March, April and May) add to attendance as the season's dénouement approaches, with a particularly large boost to attendance (25.4%) from games played at the very end of the season in May.

With 24 teams in Division 1, as opposed to 20 in the Premiership, the fixture schedule is more crowded and there is a greater incidence of midweek evening matches. Clubs find it impossible to avoid scheduling Division 1

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[10] The list of local derby matches inevitably contains an element of subjectivity. Such matches cannot simply be defined by distance, which is already controlled for. In East Anglia, for example, Ipswich against Norwich counts as a local derby because these are the only two clubs in a sparsely populated region and notwithstanding that the two grounds are over 40 miles apart. But Bury against Stockport in Greater Manchester is not deemed to be a local derby even though the distance between them is only 15 miles; there are many clubs within the Manchester conurbation and these two are on opposite sides of the conurbation with no tradition of rivalry.

Table IV. OLS regression of Division 1 attendance with fixed home team effects

Variable	Coefficient	*p*-value
HOME POS	−0.0272	0.000
HOME POS SQ	0.00067	0.000
AWAY POS	−0.0210	0.000
AWAY POS SQ	0.00067	0.000
LOG ATTEND LAST	0.414	0.000
LOG ATTEND LAST AWAY	0.204	0.000
PROM ATTEND	−0.078	0.049
PROM ATTEND AWAY	−0.127	0.000
PROM	0.837	0.022
PROM AWAY	1.192	0.000
DISTANCE	−0.00178	0.000
DISTANCE SQ	3.85E−06	0.000
DERBY 1992/93	0.127	0.050
DERBY 1993/94	0.199	0.000
DERBY 1994/95	0.182	0.013
DERBY 1995/96	0.152	0.010
DERBY 1996/97	0.147	0.061
DERBY 1997/98	0.054	0.379
ITVDERBY 1992/93	0.033	0.673
ITVDERBY 1993/94	−0.052	0.536
ITVDERBY 1994/95	0.079	0.423
ITVDERBY 1995/96	0.138	0.062
ITVDERBY 1996/97	0.058	0.667
SKYDERBY 1996/97	0.223	0.015
SKYDERBY 1997/98	0.088	0.301
ITV 1992/93	−0.164	0.000
ITV 1993/94	−0.173	0.000
ITV 1994/95	−0.103	0.001
ITV 1995/96	−0.152	0.000
ITV 1996/97	0.213	0.006
SKYFRI 1996/97	−0.125	0.008
SKYSUN 1996/97	−0.157	0.002
SKYFRI 1997/98	−0.079	0.114
SKYSUN 1997/98	−0.095	0.019
EUROTV 1992/93	−0.154	0.000
EUROTV 1993/94	−0.154	0.000
EUROTV 1994/95	−0.082	0.018
EUROTV 1995/96	−0.084	0.017
EUROTV 1996/97	−0.117	0.000

Table IV. Continued.

Variable	Coefficient	*p*-value
EUROTV 1997/98	−0.129	0.000
MONTUES	−0.025	0.015
WEDTHUR	−0.075	0.000
BANK HOL	0.142	0.000
MARCH	0.027	0.007
APRIL	0.082	0.000
MAY	0.254	0.000
Season dummies	Yes (significant)	
Fraction of variance due to fixed effects	0.669	
R^2 (within)	0.452	

Dependent variable is log attendance, $n = 3312$.

games in midweek when Premier League teams are competing in televised European matches. Our model shows the impact of scheduling alongside televised European fixtures to be between 8% and 16%. The loss of revenue from such games is not compensated for in any way as Premier League teams receiving broadcast income from, say, the European Champions' League are under no obligation to share revenues from this source to indirectly affected clubs in lower divisions.

Matches televised on the terrestrial ITV channels are associated with substantial (more than 10%) percentage reductions in attendance, given control variables, in every season. Significant reductions are also obtained for broadcasting of Division 1 matches by BSkyB in the 1996/97 and 1997/98 seasons, except for Friday evening broadcasts in 1997/98. However, although the coefficients are somewhat larger than the comparable marginal effects for the Premier League Tobit model, attendances and ticket prices are typically lower in Division 1. Hence, as Table V shows, the estimated revenue losses for an average Division 1 club are between £7,000 and £14,000 with a notable outlier of £21,341 for ITV transmission in 1996/97.

Matches between locally proximate teams tend to generate more intense rivalry and fan interest than other matches. The impact of televising these local derby matches can be assessed against non-televised local derby matches using a set of Wald tests. These revealed no significant difference in attendance as between non-televised and televised matches, with the single exception of ITV coverage in 1993/94.

Table V reports revenue losses from televising games which are not designated as local derby matches. Unfortunately, facility fees for televised Division 1 games are not published. We conjecture that (a) facility fees for

Table V. Estimated losses of gate revenue for Division 1 clubs from ITV and BSkyB broadcasts

	Average ticket price	Average attendance	Loss in revenue
1992/93 ITV	£6.21	10,677	£10,874
1993/94 ITV	£6.64	11,761	£13,510
1994/95 ITV	£6.46	10,820	£ 7,199
1995/96 ITV	£7.62	11,944	£13,833
1996/97 ITV	£7.96	12,587	£21,341
1996/97 BSkyB Friday	£7.96	12,587	£12,524
1996/97 BSkyB Sunday	£7.96	12,587	£15,730
1997/98 BSkyB Friday	£9.30	15,137	£11,121
1997/98 BSkyB Sunday	£9.30	15,137	£13,374

Division 1 games were considerably less than for Premier League games and (b) facility fees for Division 1 games broadcast by ITV were considerably less than facility fees for BSkyB broadcasts. If Football League clubs were alarmed by losses of revenue when ITV broadcast Division 1 matches, such fears would have been alleviated by the new BSkyB arrangements from the 1996/97 season and the eventual demise of ITV broadcasting of matches at this level. A useful benchmark for assessing losses from broadcasting of Division 1 games by BSkyB can be discerned from its rugby league contract in operation at the same time. A typical rugby league match commanded a facility fee of £20,000 in the 1994/95 season according to Carmichael et al. (1999). We would expect the facility fee for Division 1 soccer matches to be greater than this, reflecting larger audience ratings, but £20,000 is a useful benchmark with which to compare estimates of gate revenue losses. We can see from Table V that revenue losses from BSkyB broadcasts of Division 1 games, for an average club, are estimated from our model to be less than the conservative £20,000 figure assessed as compensation.

IV. A Model of Collective Selling with Unobservable Costs

On the basis of our regression results for Premier League and Football Division 1 attendances, and subsequent computations of revenue losses, the opportunity cost of broadcasting games is small or even zero relative to the value of broadcast contracts, particularly in the case of the Premier League. If the opportunity cost of broadcasting additional matches is less than the

expected gain in broadcast income, but the clubs choose not to make the matches available to broadcasters, we need to find some explanation for this apparent inefficiency.

We now develop a simple model of collective selling where the opportunity cost to each club (in terms of foregone attendance revenues) is unobservable to show how it might be impossible to ensure that the optimal number of matches are broadcast under the type of contract adopted by the Premier League.[11] In particular, we consider a sharing rule that captures the three main elements of the Premier League broadcast contracts (25% allocated to facility fees, 50% divided on an equal share basis and 25% allocated according to league performance).[12] The basic insight that we are highlighting is that this kind of sharing agreement may not be incentive compatible under some circumstances and therefore can result in fewer than the joint profit maximising number of matches being broadcast.

Of course, the nature of the Premier League rules governing collective selling may prevent joint profit maximisation for reasons other than restrictions on number of games broadcast. Our focus is on the welfare impacts of restrictions on number of games shown, as a quantity restriction. We show that imposition of such restrictions will lower joint revenues, compared to the outcome without such restrictions. The requirement for the cartel to satisfy incentive compatibility for its membership will lead to a departure from the (constrained) joint profit maximising outcome. In the context of established cartel theory, this is a logical and unsurprising result.

We suppose there are only two clubs and two matches played, one at the ground of each club. Suppose that each match is equally valuable when broadcast, and that the value of each match (V) is independent of whether the other is broadcast. This value is taken as pre-determined as part of the terms of the broadcasting agreement. The opportunity cost may take one of two values c^h and c^l ($c^h > c^l$) both of which values are private information (or too costly to verify). The terms of the collective broadcasting contract are assumed to specify that if a match is broadcast the home team will receive $(2 + p)V/4 - c^l$ where the facility fee and equal share are each $V/4$ and p is the probability that the home team whose match is broadcast wins the prize. The probability of the visiting team winning the prize is $1-p$ and it will receive $(2 - p)V/4$.

The game involves several stages:

Stage 1: Teams decide whether or not to enter into a collective deal
Stage 2: Teams observe their private signal (c^h or c^l)

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[11] This idea was first explored informally in Ross and Szymanski (2000).

[12] In fact the contract also allocates some of the money for administrative expenses, some for payments outside the League and some to teams that were relegated over the previous two seasons. We abstract from these complications.

Stage 3: Given a collective deal, a contract is signed contingent on the announcement of opportunity cost types

Stage 4: Each team announces its cost type

Stage 5: Broadcasts are scheduled and teams receive compensation contingent on their announcement

If individual contracts could be signed, stages 3–5 would be irrelevant. We assume that competition would induce each team to sell their rights at their opportunity cost if there is no collective deal – although rather extreme this enables us to normalise the outside opportunity to zero. The value of collective selling may lie in the exclusivity that the broadcaster achieves by buying the championship (as was argued by the broadcaster Sky during the Premier League case). There is no reason to suppose that under individual selling teams will fail to realise profitable opportunities where they exist.

We need to consider three cases:

Case (a) If $V - c^h > 0$ – Broadcasting all matches is always optimal

Case (b) If $V - c^l > 0 > V - c^h$ – Broadcasting of the c^l match only is optimal

Case (c) If $V - c^l < 0$ – Broadcasting of any match is never optimal

We assume that the values of c^h and c^l are common knowledge, and therefore we can dispose of case (c) immediately since neither team has any interest in offering matches for broadcast. Case (a) is straightforward.

1. CASE (A)

A contract must be both individually rational and incentive compatible. Incentive compatibility requires that there is no gain to misrepresenting your type:

$$t^{ll} - c^l \geq t^{hl} - c^l \tag{1a}$$

$$t^{lh} - c^l \geq t^{hh} - c^l \tag{2a}$$

$$t^{hl} - c^h \geq t^{ll} - c^h \tag{3a}$$

$$t^{hh} - c^h \geq t^{lh} - c^h \tag{4a}$$

where t is payment to each team contingent on its report and the report of the other team, and the first superscript term refers to a team's own report and the second to the report of the other team. Thus Equation (1a) says that when both teams have a low opportunity cost it must be more profitable for a team to report its low opportunity cost than report untruthfully that it is high.

Individual rationality requires that the expected gain from reporting your type (truthfully) is positive:

$$t^{ll} - c^l \geq 0 \tag{5a}$$

$$t^{lh} - c^l \geq 0 \tag{6a}$$

$$t^{hl} - c^h \geq 0 \tag{7a}$$

$$t^{hh} - c^h \geq 0 \tag{8a}$$

PROPOSITION 1. When all matches are to be broadcast there is no incentive to misreport the cost parameter. However, the expected return may be less than opportunity cost of broadcasting, so that the Premier League allocation rule may not be individually rational and may therefore fail to implement the first best.

Proof. Since both matches are shown the broadcast revenue is $2V$. Since both matches are always broadcast regardless of a team's report, then the payments under the Premier League contract are each $(3 + 2p)V/4$ for the home team and $(5-2p)$ $V/4$ for the visiting team, regardless of either team's report. The incentive compatibility constraints are reduced to strict equalities and are therefore satisfied. The individual rationality constraints (5a)–(8a) may all be violated. For example, if we consider the home team, whose probability of winning is p, even though by assumption $V > c^h$ this does not guarantee that $(3 + 2p)V/4 > c^h$. If $p = 0$ the constraint may not be met for the visiting team whose probability of winning is $1-p$. Hence, only if the league is perfectly balanced ($p = \frac{1}{2}$) will contraints be met for both teams.

This suggests that teams with low expectations of receiving a share of the performance related element may prefer not to participate in the collective broadcast agreement. However, in practice, the Premier League teams *did* agree to a contract formula in 1992 and have stuck to it ever since.   □

2. CASE (B)

In case (a) it was always optimal to broadcast all matches. Under case (b) it is only optimal to broadcast the matches of teams with a low opportunity cost. This means that teams announcing c^h should not be scheduled, and the total revenue from broadcasting depends on the announcements of the two teams. If both announce c^l then both matches should be shown and revenue is the same as in case (a). If both announce c^h no matches should be shown and broadcasting revenue is zero. If one announces c^h and the other c^l, then only the match of the latter team will be shown.

This alters the incentive compatibility constraints, which are now:

$$t^{ll} - c^l \geq t^{hl} \tag{1b}$$

$$t^{lh} - c^l \geq t^{hh} \tag{2b}$$

$$t^{hl} \geq t^{ll} - c^h \tag{3b}$$

$$t^{hh} \geq t^{lh} - c^h \tag{4b}$$

Of the individual rationality constraints (5a) and (6a) are unchanged, but the remaining two are altered due to the fact that an announcement c^h means no broadcasting. Thus in sum we have:

$$t^{ll} - c^l \geq 0 \tag{5b}$$

$$t^{lh} - c^l \geq 0 \tag{6b}$$

$$t^{hl} \geq 0 \tag{7b}$$

$$t^{hh} \geq 0 \tag{8b}$$

PROPOSITION 2. In case (b) The Premier League contract cannot guarantee to implement the first best broadcasting schedule.

Proof. Consider again the home team whose winning probability of winning is ½. Constraints (1a) and (1b) each require that the payoff to a team if it reports that its opportunity cost is low is greater than the payoff to announcing a high opportunity cost. In both cases this reduces to the condition that $(2 + p)V/4 - c^l \geq 0$, which cannot be guaranteed. Suppose for example that $p = 0$, then V, the value of the broadcast right, must equal at least twice the opportunity cost of broadcasting. In other words, a team with a low opportunity cost may refuse to enter a collective broadcast contract because the private gain for the team does not exceed the opportunity cost, even though it would be efficient from the cartel's perspective that the match be shown. Once again, only if the probability of winning is ½ will the incentive compatibility constraints be met for both teams.   □

This result is reminiscent of the cartel literature where firms can collude over output but the marginal cost of each firm is private information. In such situations side payments are necessary from low marginal cost firms to persuade high marginal cost firms to reveal their cost truthfully (see Vives, 1999, pp. 264–273). Cramton and Palfrey (1990) show that, where firms do not know rivals' costs initially, incentives for truthful cost revelation tend to break down in cartels bigger than five in number.

Clearly, if facility fees could be differentiated according to the type of match, an efficient broadcasting arrangement would be possible – but this would require agreement on the opportunity cost of matches. Reaching this kind of agreement would be extremely difficult. In general, the bigger teams might be thought to have a higher opportunity cost, since they have

bigger crowds and might lose more gate revenue. On the other hand, the bigger clubs also tend to be sold out more often, and may therefore have a lower opportunity cost. There are no simple indicators of opportunity cost.

In the example above no matches are broadcast even though it would be profitable to broadcast one or both matches. In a more general setting with several teams it might be the case that it would not be profitable to broadcast some matches, that some matches would be profitable to broadcast but would not be made available while some matches would have a value large enough relative to their private opportunity cost that they would be broadcast.

Our model offers a particular co-ordination cost explanation for the fact that only 60 Premier League games were broadcast by BSkyB under the terms of its agreement with the Premier League. A rival explanation for the low number of games broadcast is simply that the marginal value of an extra game to the media provider was too small.[13] If marginal broadcaster valuation of an extra game is less than the value of lost gate attendance then it is jointly rational for both broadcaster and clubs for this extra game to be excluded from broadcast.

We can estimate the broadcast value of matches as follows. Between 1997/98 and 2000/01 BSkyB paid £670m for the rights to broadcast an average of 60 games per season, and a total of 380 over the contract period. This was equivalent to £167.5m per season. In the 1997/98 season, the last in our data set, total TV audience was 87.5m for 61 games (Monopolies and Mergers Commission, 1999). This converts to a valuation of £1.91 per viewer. Assuming that the matches selected by BSkyB in 1997/98 were the games with highest audience potential, we can estimate an audience equation determined by rank of audience (1 as top to 61 as bottom):

$$\text{Log (audience)} = 14.058 - 0.017 \text{ Rank (audience)} \qquad R^2 = 0.95$$
$$\qquad\qquad (0.19) \ (0.0005) \qquad\qquad \text{(standard errors in parentheses)}$$

This equation reveals that each successively less popular match broadcast attracts an audience 1.7% smaller than the next highest game in the rankings. We can use the estimated equation to predict the audience, and estimated audience value, of each game in the full set of 380 games played in the 1997/98 season (Table VI).

Based on our figures, 260 out of 380 Premier League games had an audience valuation greater than our maximum estimate of the value of lost gate equal to £54,523. Our estimates of audience value in Table VI are lower

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[13] We are grateful to an anonymous referee for highlighting this point.

Table VI. Estimated audience and audience value from Premier League games 1997/98

Game number	Estimated audience £000	Estimated value £000
62	808	1546
70	705	1349
80	594	1138
90	501	960
100	423	809
125	276	529
150	180	345
175	118	226
200	77	147
225	50	96
250	33	63
275	21	41
300	14	27
325	9	18
350	6	11
380	4	7

bound figures since many of the games not shown may have been more popular than some of the games broadcast. Hence, we conclude that the marginal valuation of an extra game to the broadcaster was sufficient for it to be worthwhile from the point of view of Premier League clubs collectively to permit broadcasting, beyond the 60 scheduled games in 1997/98, since this extra provision would have been revenue-augmenting for the clubs concerned and the broadcaster.

V. Policy Implications and Conclusions

This paper has focused on a cartel decision-making problem: how to market and share the income from the broadcast rights to matches played in a professional sports league. It was motivated by the observation that broadcasters have been willing to pay to broadcast many more English Premier League matches than they have in fact been allowed to broadcast over the last decade. The paper examined the econometric evidence behind the cartel's claim that broadcasting would not in fact increase profits because of the opportunity cost implied when fans stay at home to watch the match on TV rather than pay to attend at the stadium. We found that this argument had

no statistical basis, and that any small loss of attendance implied by our estimates would have been more than compensated by the large facility fees paid by broadcasters to the home team for every match.

We have advanced one explanation for this puzzle, namely that cartels are seldom able to negotiate efficient joint profit maximising decisions. We have provided an example where a revenue sharing agreement of the type used by the English Premier League might result in some matches failing to be broadcast even though efficiency would require them to be broadcast. A more complex contract could ensure that an efficient number of matches are broadcast, but the cartel may not be able to reach agreement on this. It is striking that the Premier League was unable to reach an agreement to broadcast a significantly greater number of matches from its foundation in 1992 until 2001. Following a series of exchanges with the European football leagues, the European Commission launched an investigation into collective selling of football broadcast rights in England and Germany in December 2002 (Harbord and Szymanski, 2004). This pressure may be partly responsible for the increase in number of games broadcast to 106 games under the 2001 contract and then to 138 games per season under the contract implemented from 2004/05. This still leaves two-thirds of games unavailable for broadcast. Even though BSkyB has agreed to sub-contract eight games to free-to-air broadcasters from 2004/05 it still retains a monopoly position as England's provider of live football broadcasting.

Acknowledgements

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