DEPARTMENT OF ECONOMICS

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Financial Fair Play and the English Premier League

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Vertical restraints in soccer: Financial Fair Play and the English Premier League

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Abstract: In 2010 UEFA, the governing body of European soccer, announced a set of financial restraints, that clubs must observe when seeking to enter its competitions, notably the UEFA Champions League. We characterize these "Financial Fair Play" (FFP) regulations as a form of vertical restraint and assess their impact on the intensity of competition in the English Premier League. We build a structural empirical model to show that introducing FFP would substantially reduce competition, resulting in lower average payrolls, while average revenues would hardly be affected. Depending on the exact regime, wage to turnover ratios would decline by 8% to 15%.

Keywords: vertical restraints, soccer, Financial Fair Play

JEL-codes: L42, L83, L51

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1 Introduction

Vertical agreements are usually defined as concerted practices among undertakings operating at different levels of a production or distribution chain (see e.g. Zanarone (2009) p691). Typical examples include restraints placed on car dealerships by manufacturers, on bars and pubs by brewers or on high street retailers by producers of luxury goods. In this paper we analyze a more unusual type of vertical restraint, one placed by a governing body on professional sports clubs aiming to compete in its championships.

The governing body in question is UEFA, which holds jurisdiction over soccer played in Europe, and organizes the UEFA Champions League. This international club competition generates over €1 billion a year from broadcasting contracts negotiated by UEFA, and a large part of this revenue is paid out to participating soccer clubs as prize money. It is therefore a vital source of income to most of the participating clubs. Since 2004/05 UEFA has introduced the "club licensing" system which sets out minimum standards relating to stadium quality, administration and legal documentation. Clearly, club licensing functions as a set of vertical restraints, much in the same way that for example car manufacturers try to preserve quality standards at their dealerships. Recently UEFA added requirements relating to solvency and financing to the club licensing system. These regulations, which are commonly referred to as "Financial Fair Play" (FFP), are the main focus of this paper.

FFP has essentially two dimensions, one which requires soccer clubs entering UEFA competition to be solvent and the other which requires them to limit their spending on players to the extent of their "football income" [3]: the so-called break-even rule. UEFA justifies these rules on efficiency grounds: "to improve the economic and financial capability of the clubs" and "to protect the long-term viability and

[3] Soccer is referred to as football in Europe, and as such UEFA uses football instead of soccer in its phrasing of the FFP rules.

sustainability of European club football." However, these regulations might just as easily be seen as a means of restricting competition in the Champions League itself or in the national league championships. In particular, the break-even constraint may limit club expenditure on player wages and as such increase the profitability of clubs. This would allow UEFA to retain a larger share of broadcast revenue, thus enabling both the clubs and UEFA to extract rents at the expense of the players.

In this paper we examine to what extent the FFP break-even rule would restrict competition in the English Premier League (EPL). We develop a model of competition at the club level with two crucial ingredients, a contest success function linking match outcomes to payrolls and a revenue function linking financial gains to on-pitch performance. We estimate the model combining accounting with sporting performance data. We then use simulations to show that, depending on the exact regime, the enforcement of FFP could reduce labor costs in the English Premier League by as much as 22% without significantly impacting on revenues. In other words, competing clubs succeed in restricting horizontal competition using a vertical agreement.

The paper is set out as follows. In the next section we discuss the outline of our analysis in the context of the relevant literature. Section 3 describes the structural model and section 4 describes the data and estimation procedure. Section 5 presents the estimation results and section 6 the simulation results. The final section discusses our conclusions.

2 Sports league competition and vertical restraints

There is a substantial literature on vertical restraints, both from a theoretical and empirical point of view. In theory restraints may be pro-competitive, enhancing the capacity of independent businesses to co-ordinate in the efficient delivery of goods and services, which might otherwise be plagued with externality problems such as double marginalization, hold-up and free-rider problems (see e.g.

Mathewson and Winter (1984) and Rey and Tirole (1986)). Lafontaine and Slade (2008) review the empirical evidence on the economic impact of vertical restraints and find that different studies often produce contradictory results. There appears to be a general tendency for restraints imposed by manufacturers on retailers to have pro-competitive effects, largely because the manufacturer usually has an incentive to make sure that consumers receive the product in the best possible condition. In any case, many puzzles remain about the competitive effects of vertical restraints and generalizations are problematic. In this paper we construct a structural empirical model of a specific industry, professional soccer in England, and assess the impact of a vertical restraint by simulating the counter-factual equilibrium. In that sense we follow the papers by Asker (2005), Brenkers and Verboven (2006) and Ferrari and Verboven (2012), which have taken this approach to examine restraints in the beer, car and magazine industries, respectively. We provide evidence of the anti-competitive impact of this restraint, which at first glance seems to operate as a quality standard, rather than a coordination device.

Considered as economic entities, professional team sports leagues are unique in the degree of co-ordination that is permitted among ostensibly competing businesses. In North America and Europe sporting competitors are allowed to agree the rules of the game and to collectively manage activities such as the sale of league broadcasting rights. On the one hand it is clear that the sporting competition itself cannot exist without “collusion” over the setting of the sporting rules. On the other, the rationale for allowing competing sports organizations to agree on economic issues is less obvious. The courts in both Europe and the US have sought to draw a distinction between “sporting rules” required for the regulation of an orderly and attractive contest, as opposed to rules that are intended to restrict competition and benefit the contestants. Thus for example, the European Commission in its White Paper on Sport (2007) recognized the “specificity of sport” while affirming that “Competition law and Internal Market provisions apply to sport in so far as it constitutes an economic activity”.

Horizontal restraints are commonplace and have been extensively analyzed (and litigated) in the context of North American sports leagues. For example, salary caps have existed for some time in American leagues; the first was introduced in the National Basketball Association in 1984 and the National Football League adopted a salary cap in 1994.[4] The caps were the result of a collective bargaining agreement between union and team owners, with a view to fixing the percentage of league revenues that would accrue to the players. The effect of a salary cap on player earnings, league performance (competitive balance) and total welfare has been extensively discussed in the literature; see e.g. Fort and Quirk (1995), Vrooman (1995), Késenne (2000b) and Dietl et al. (2009). Since the American-style cap is intended to place a common limit on all teams (usually defined as a fixed percentage of league revenues), it is generally thought that its main effect is to reduce the variance of team performance (equalizing results), although Vrooman (1995) argues that the main purpose of the cap is to hold down salaries while teams evade the effects of the cap by working around the constraint.

A fundamental difference between the American and European sports leagues system concerns the role of governing bodies. Governing bodies generally exist to promote the development of sport inside a particular country, and to manage the preparation and participation of national teams in international competition (e.g. the Olympics or the FIFA World Cup). In the US the jurisdiction of governing bodies is limited by law to the administration of amateur sports, and the professional leagues are self-governing.[5] In Europe (and most of the world) governing bodies claim jurisdiction over both amateur and professional sport. National soccer associations in Europe were mostly established before the First World War (the English Football Association (FA) being the first, created in 1863), and professional or semi-professional domestic leagues were created contemporaneously. UEFA, by contrast,

[4] We describe these as horizontal restraints because the NBA and NFL represent nothing more than the collective will of the owners, by contrast with governing bodies in soccer, discussed below.
[5] The situation in the US is presently regulated by the Ted Stevens Olympic and Amateur Sports Act (36 U.S.C. Sec. 220501)

was created in 1954 with limited powers. Interestingly, the European Champion Clubs' Cup (which eventually evolved into the Champions League) was initiated in early 1955, not by UEFA, but by Gabriel Hanot, a soccer journalist working for the French sporting newspaper L'Equipe. Only later that year, just before the competition began, was UEFA persuaded to take over its administration (Murray (1994), pp166-7).

UEFA's role in European soccer has expanded dramatically since its foundation, and it is involved in many aspects of the development of the game as well as running a variety of competitions. However, its financial position and prestige rests almost entirely on its control of the Champions League. According to its 2010/11 Financial Report UEFA generated €1385 million from the sale of broadcast and commercial rights to its competitions and paid out €1001 million to participating clubs, leaving around 28% of revenues to cover its own costs and discretionary spending. Until the introduction of the club licensing system in 2004, UEFA imposed few restrictions on clubs. The purpose of club licensing was to impose a minimum set of standards, thus having the character of a set of vertical restraints. The original investigation into the creation of a licensing system in 1999 also considered the imposition of a salary cap which was at the time considered infeasible. The 1995 Bosman judgment of the European Court of Justice had demonstrated that regulation which restricted competition in the market for players that was not backed by pro-competitive reasoning was doomed to failure under EU law.[6]

In 2010 UEFA announced the introduction of the Financial Fair Play (FFP) regulations into the club licensing system. These rules can be divided into two parts. The first deals with insolvency, a chronic problem which has plagued European soccer clubs; this issue is examined in a related paper (Szymanski (2012)). The second part deals with the break-even rule, the focus of our paper, which requires that

[6] The relevant European law in the Bosman case concerned the freedom of movement of labour, but UEFA also became embroiled with the European Commission over the collective sale of broadcast rights, a competition law issue.

“relevant expenses” must not exceed “relevant income”. The definition of “relevant” is highly specific, and on the revenue side covers mainly income from broadcasting, match-day income (e.g. ticket sales) and sponsorship. It excludes, for example, direct subsidies from wealthy owners.

We will argue that the break-even rule operates analogously to a salary cap. As mentioned above, the key benefit that is claimed for a salary cap in North America is that it promotes competitive balance amongst the teams in the league. Clearly, since FFP only limits spending of an individual club in proportion to its own resources, and these resources vary hugely in European soccer, no such benefit can be claimed. Indeed, some have argued that the break-even rule will reduce competitive balance by limiting the opportunity of smaller teams to erode the dominance of the established teams since they will not be able to use outside resources to fund a challenge. Proponents of the break-even rule claim that this is indeed a benefit to the clubs, since the only sources of outside resources are debt, which adds risk to the system, and equity injections from “sugar daddies”, which undermine the integrity of competition by turning soccer into a wealth contest rather than a sporting contest.

This paper shows how the impact of the restraint goes beyond those clubs wanting to spend more than their soccer resources. Given that higher spending tends to generate better sport performance, restraining the spending of some clubs reduces the cost of winning for all clubs. Thus there will be spill-over effects to clubs not directly affected by the limit, by lowering the cost of achieving a given level of success. The simulation results from our structural model show that the effect on total payroll spending is substantial. Once fully operational, the FFP rules could reduce the ratio of payroll spending to turnover by up to 15%. Essentially, the vertical restraint introduced by UEFA would result in a comparably anti-competitive outcome, as the horizontal agreements between competing firms, which exist in the US under the form of salary caps.

This result has already been discussed in a theoretical context by Dietl et al. (2009) who examine the effect of a salary cap based on a fixed percentage of team income, exactly the kind of cap imposed by the FFP break-even rule. Their model shows that while implying more variation in spending than an American style cap, it unequivocally reduces aggregate salaries.

Ours is not the first paper to consider FFP. Two recent papers by Madden (2012) and Franck and Lang (2012) build theoretical models to analyze the effects of FFP on so-called “sugar daddy” owners, who bail out their club in case of financial losses. Both papers reach different conclusions, as Madden (2012) finds negative welfare effects from FFP, while Franck and Lang (2012) identify conditions under which FFP enhances welfare. Muller et al. (2012) analyze the FFP rules from a largely ethical standpoint. They claim that allowing team owners to inject their own funds into a club amounts to “behavior that damages the integrity of the competition or violates sport-ethical standards” and advance this as a justification for restrictions under FFP. Finally, Szymanski (2012) examines FFP from the point of view of controlling insolvency problems, examining the causes of 67 known cases of insolvency in English professional soccer.

From a modeling perspective, sports leagues should be viewed as a kind of rent-seeking contest where success in sporting competition depends on the relative share of total resources devoted to competition (e.g. Tullock (1980)). There is an extensive theoretical literature on rent seeking contests (much of which is reviewed in Konrad (2009)). Szymanski (2003) argued that sporting competitions in general should be viewed as rent seeking contests since they exhibit a “fixed supply of winning”. Each season consists of a fixed number of games, and the winning team is the one that gains the largest possible share of wins, teams expend resources in the form of effort or money to gain the largest possible share.[7] The literature on professional sports leagues, starting from Rottenberg (1956), recognized the existence of the fixed supply but did not adapt the contest literature results to the modeling of league choices (see e.g. Fort and Quirk (1995), Vrooman (1995)). This literature assumed that teams could choose the level of success they achieved, independently of the choices of the other teams, which cannot be true in a proper contest setting (see Szymanski and Késenne (2004)).

Empirical models of American sports leagues starting with Scully (1974) assumed that teams invested in talent to the point where the marginal revenue product (MRP) equaled the wage, where MRP was the product of the player's marginal contribution to winning multiplied by the marginal revenue to the team of a win. This approach was then used to show the discrepancy between wages and MRP when team owners possessed monopsony power, and the erosion of that monopsony power in the era of collective bargaining and limited free agency (see e.g. Kahn (2000)). The fixed supply of winning is accounted for neither in these models nor in the empirical models of European leagues (e.g. Szymanski and Smith (1997), Garcia-del-Barrio and Szymanski (2009)). Likewise, there is a substantial literature that seeks to estimate a production function for wins (relating resources to success) in order to identify the relative efficiency of teams in a league (e.g. Barros and Leach (2006), Lee and Berri (2008)) and these too ignore the problem of modeling the fixed supply.

In this paper we explicitly model the contest among clubs using a Tullock contest success function which we can estimate using game-by-game results and accounting data on resources devoted to winning in the form of team wage expenditure. While there is an extensive theoretical literature, the literature on the estimation of contest success functions is sparse (see e.g. Jia et al. (2012)).

[7] In league soccer the success of a team is generally recorded in the form of points scored, and until the 1980s a drawn game was treated as equivalent to half a win. Since then leagues have adopted a system of awarding three points for a win and one for draw. One implication of this is that the total number of points awarded in a season depends on the number of draws. However, the league still remains essentially a zero sum game.

3 Model

To simulate the introduction of Financial Fair Play we need to model the best response of the clubs to the policy shift. In our model teams try to win by devoting resources, because the outcome of competition depends on the relative share of invested resources. Revenues and profits are then determined by contest success. As will become clear, FFP will affect the equilibrium by altering the budget constraint of the teams. We now discuss the model setup in more detail.

3.1 Model Setup

(a) The sporting competition and the contest success function

A typical European soccer league consists of m clubs divided into k hierarchical divisions (or tiers), where mobility between divisions is permitted by the system of promotion and relegation. [8] Each division d in year t contains n_{dt} teams that play each other twice in season, once at home and once away, generating $2(n_{dt}-1)$ contests for each club in a season. In each contest the probability of success depends on the playing resources of the team which we label p_{it}. At the match level a contest success function (CSF) relates the payrolls of the home and away team to the probability of winning, drawing or losing the game. [9] We adapt the standard Tullock CSF to allow for the possibility of a draw. We use the following specification[10], where y_{ijt} denotes the result of a game between team *i* and *j* at the home stadium of team in season t:

[8] Under this system teams finishing at the bottom of the league table are forced to play in a lower division in the following season (relegation), whereas teams finishing at the top of the table gain the right to play in a higher division (promotion). In other words, sporting merit determines which teams play in the higher tiers, as opposed to the league choosing which cities may host teams, as is common in the American major leagues.

[9] Draws are common in soccer, with about 30% of games ending in a tie. In contrast to most other team sports, there is no tie-breaking mechanism during the regular season, instead each team is awarded 1 point in the league table.

[10] An alternative specification to allow for draws in the Tullock CSF has been proposed by Pavlo Blavatskyy (2010). In his specification however, the probability of a draw necessarily declines in the sum of both investments, which is a clearly not a feature of soccer contests. Hence, we choose to introduce this alternative.

$$Pr(y_{ijt} = win\ i) = \left(1 - Pr(y_{ijt} = draw)\right) \frac{\alpha_h \omega_{it} p_{it}^{\beta_d}}{\alpha_h \omega_{it} p_{it}^{\beta_d} + \omega_{jt} p_{jt}^{\beta_d}} \quad (1a)$$

$$Pr(y_{ijt} = win\ j) = \left(1 - Pr(y_{ijt} = draw)\right) \frac{\omega_{jt} p_{jt}^{\beta_d}}{\alpha_h \omega_{it} p_{it}^{\beta_d} + \omega_{jt} p_{jt}^{\beta_d}} \quad (1b)$$

$$Pr(y_{ijt} = draw) = \delta_{dt} - \delta_0 \left(\frac{\alpha_h \omega_{it} p_{it}^{\beta_d} - \omega_{jt} p_{jt}^{\beta_d}}{\alpha_h \omega_{it} p_{it}^{\beta_d} + \omega_{jt} p_{jt}^{\beta_d}}\right)^2. \quad (1c)$$

Where

- α_h represents the advantage derived from being the home team. This may stem from a number of factors such as the bias of the fans toward the home team, the convenience for the players (e.g. less travel) or the bias of the referees (see e.g. Garicano et al, 2005).
- ω_{it} is the productivity of team *i* in transferring resources p_{it} into win probability, for example this may reflect the relative effectiveness of the team manager or "team spirit".
- β_d is the Tullock parameter, which captures the sensitivity of the contest to the relative investments of each team. We allow this sensitivity to vary by league division.
- δ_{dt} is a season-division specific constant which measures the baseline probability of a draw, i.e. when both teams would be equally matched in the contest.
- δ_0 is a parameter measuring the sensitivity of draws to the variance of team resources. We expect that contests where both sides are more heterogeneous have less probability of ending a draw.

To measure p_{it} we will use club payrolls for which accounting data is available.[11] Previous research has shown that payrolls in soccer are highly correlated with team success over the season (see e.g. Szymanski and Smith (1997), Forrest and Simmons (2002)). Playing talent is highly mobile and the typical

[11]The accounting data refers to total payment to all employees, but almost the entire wage bill is paid to the players.

means of attracting a player is to offer a significant increase on their current wage. The issue of reverse causality (the possibility that success leads to higher wage payments) does not arise since seasonal wage payments will not be significantly influenced by the outcome of individual games (teams play between 38 and 46 league games in season). Thus in our model we can measure "effective effort"[12] as talent resources (wage payments), the effectiveness with which those resources are used and the context (home or away). The outcome of the contest then depends on these inputs and the sensitivity of winning to relative resources.

In European soccer leagues, a win is awarded three points and a draw one point. Given that each team faces every other team once at home and once away, we may therefore calculate the expected end-of-season points total W_{it} as:

$$W_{it} = \sum_{\substack{j=1 \\ j \neq i}}^{n_{dt}} \left[3\left(\Pr\left(y_{ijt} = win\ i\right) + \Pr\left(y_{jit} = win\ i\right)\right) + \Pr\left(y_{ijt} = draw\right) + \Pr\left(y_{jit} = draw\right)\right]. \quad (2)$$

Since the number of points a club can obtain varies in a given season, we rescale W_{it} by the total number of points obtainable in season t, i.e. $3 * 2 * (n_{dt} - 1)$, and denote this relative points total as w_{it}.

(b) Revenue and Profit

Each season t, every owner sets a budget constraint b_{it} which is either a positive amount the owner wants to earn, or a negative amount which the owner is willing to put into the club. Thus teams can be thought of as win maximizers subject to budget constraint rather than profit maximizers. Almost all researchers since Sloane (1971) have emphasized the lack of profit orientation in European soccer, and win maximization is the most commonly assumed objective, see e.g. Késenne (2000b).[13] Andreff (2007) and Storm and Nielsen (2012) emphasize that within this framework the soft-budget constraint facing

[12] We will continue to use this term to refer to $\alpha_h \omega_{it} p_{it}^{\beta_d}$ and $\omega_{jt} p_{jt}^{\beta_d}$.

[13] Also note that win maximization leads to the most generous estimate of the counterfactual payrolls, which underlines the significance of our results.

many of the teams can be negative, which we model by assuming that b_{it} may take a negative value. Given the constraint set by the owner, club managers attempt to win as many points as possible setting a payroll p_{it}. The manager behaves as a cost minimizer towards non-payroll costs, c_{it}, which include overhead costs such as maintenance of the stadium. We assume these costs are independent of the payroll decision.

Club revenues, R_{it}, are modeled as a Cobb-Douglas function of the club's capital stock,[14] k_{it}, relative points obtained, w_{it}, time-varying league-wide factors,[15] γ_{dt}, and constant club-specific unobservables,[16] γ_i. This gives us,

$$\log(R_{it}) = \gamma_i + \gamma_{dt} + \beta_w \log(w_{it}) + \beta_k \log(k_{it}). \quad (3)$$

Combining the elements (1a)-(3) allows to formulate the profit function for club *i* in reduced form as $\pi_{it} = R_{it}\big(w_{it}(p_{it}, p_{-it})\big) - c_{it} - p_{it}$. from this, the manager's optimization problem is to solve $\max_{p_{it}}\{w_{it}(p_{it}, p_{-it})\}$, subject to $R_{it}\left(w_{it}\big(p_{it}, p_{-it}\big)\right) - c_{it} - p_{it} \geq b_{it}$. As we expect a positive impact of payroll on win probabilities ($\beta_d > 0$) for all values of w_{it}, optimizing the number of points boils down to setting the highest payroll allowed by the revenue generating capacity of the club and the budget constraint. The best response in terms of payroll, p_{it}^*, may therefore be found as the implicit solution of the budget constraint when it binds:

$$R_{it}\big(w_{it}(p_{it}^*, p_{-it}^*)\big) - c_{it} - p_{it}^* = b_{it}. \quad (4)$$

Note that (4) only generates a pure strategy Nash-equilibrium for certain ranges of the parameter values. In particular, if winning and revenues are too sensitive to payroll and relative points, respectively, then there will only be an equilibrium in mixed strategies (see e.g. Baye et al (1994)).

[14] By far the most valuable asset teams own is their stadium. As such, this capital stock variable may be interpreted as the value of the stadium, which is proportional to its size and quality.
[15] E.g. the value of the league-wide media rights deal
[16] E.g. the size of the club's support in the local market, commonly referred to as drawing power in the literature.

3.2 Introducing Financial Fair Play

In our policy experiment we focus on the break-even requirement in the FFP regulations. This requirement stipulates that a club's "football-related costs" should not be greater than its "football-related income".[17] In terms of our model, we interpret this as UEFA setting a lower bound, b_{it}^{FFP}, on b_{it}, the (negative) amount the owner gets out of the club, or conversely, an upper bound on the amount he may put up to finance the club's losses.

FFP has a direct effect on clubs for which this new constraint is binding, i.e. when $b_{it}^{FFP} > b_{it}$. The budget constraint for affected teams becomes

$$R_{it}\left(w_{it}\left(p_{it}^{FFP}, p_{-it}^{FFP}\right)\right) - c_{it} - p_{it}^{FFP} = b_{it}^{FFP} > b_{it}, \quad (5)$$

where p_{it}^{FFP} denotes the updated best response payroll. As we have assumed other costs, c_{it}, are minimized and independent of the payroll decision, the manager has to set a lower payroll under FFP. The direct effect of the break-even requirement is therefore a decline in payrolls for affected teams. However, when payrolls across the league are lower, all teams will, ceteris paribus, win more points and revenues for a given payroll. Note that even a club whose budget is constrained by FFP will benefit from this effect if there are other clubs also constrained by FFP.[18] Following our assumption that clubs are win maximizers, we also assume that the response of clubs is to spend this extra revenue (slack) up to the point where their budget constraint binds again (whether that constraint is directly affected or unaffected by FFP).[19] This indirect effect of FFP therefore leads to higher wage bills for teams not

[17] More details can be found in articles 58-63 of the FFP regulations (UEFA, 2010).

[18] Imagine, for example, that there are two clubs that are bound by FFP, one by £1 million and the other by £100 million. The first club will reduce expenditure due to the direct effect, but will almost certainly increase expenditure by more because of the indirect benefit of the other club's reduction in expenditure.

[19] Alternatively, we could assume the owner pockets the additional revenue, i.e. wage bills for the unaffected teams are constant. This would only reinforce our conclusion that the wage to turnover ratio decreases, while the distribution of points be more stable.

constrained by FFP, and possibly even for some teams constrained by FFP. There are three possible cases:

(i) If $b_{it}^{FFP} \leq b_{it}$ for all *i* (FFP does not bind any clubs) then FFP does not affect payroll

(ii) If $b_{it}^{FFP} > b_{it}$ for only one club, then payroll falls for that club and increases at all other clubs

(iii) If $b_{it}^{FFP} > b_{it}$ for more than one club, then (a) payroll falls for at least one club bound by FFP and (b) payroll rises at all clubs not bound by FFP.

Thus in case (iii) there can exist clubs who are bound by the FFP constraint but still increase their payroll due to the indirect effect of the FFP constraint binding on other clubs.

4 Data and estimation procedure

In order to estimate the model we need to identify all elements of the equilibrium condition (4). The financial information is taken from the audited financial accounts of teams in the top 3 tiers of English soccer over the 1993/94-2009/10 seasons. Under English law limited companies (all English soccer clubs are owned by limited companies) are obliged to file their annual report and accounts at Companies House, which are then accessible to public for a small fee.[20] We assume that the budget constraint set by the owner, b_{it}, can be proxied by the financial profit or loss reported by the club in a given year. We can also back out the magnitude of non-payroll costs, c_{it}, as the difference between turnover minus wage costs and the profit/loss for the year, which we all observe in the accounts.

We estimate the CSF given by equations (1a) - (1c) using a maximum likelihood procedure. As (1a)-(1c) directly describe a probability for each outcome, we simply minimize the difference between these probabilities and the actual outcomes in the data. The main problem we face when estimating the CSF, is that we cannot directly observe firm productivity, ω_{it}. As more productive clubs can afford to invest

[20] http://www.companieshouse.gov.uk/.

more in payroll, because their marginal return of winning on wage spending is larger, payroll and productivity are expected to be positively correlated. Running the estimation without controls for ω_{it}, would therefore lead us to overestimate β_d.

This problem has been discussed extensively in the production function literature (see Olley & Pakes (1996) and Levinsohn & Petrin (2003) for two seminal papers on this issue), where it leads to upward bias of the labor coefficient. We correct for this upward bias in a couple of different ways. First, we introduce fixed effects (FE) for each club in the estimation procedure. We implement this by including a dummy for each team, which is equivalent to assuming that productivity is constant over the sample period, $\omega_{it} = \overline{\omega_i}$. This is clearly a very limiting assumption. We relax this assumption in a second approach by introducing time-varying firm specific effects. We split up the sample period in different ways, and report both the results with three and four sub-periods. [21]

In the production function literature, using (time-variant) firm specific effects has usually been avoided, as it leads to unrealistically low estimates of the coefficients on fixed inputs (i.e. capital). As an alternative we follow Levinsohn & Petrin (2003), who suggest including a polynomial of observables which are correlated with productivity into the estimation. This polynomial functions as a proxy for productivity, taking away the upward bias, while still being more flexible than fixed effects. In our application the tenure of the current team manager serves as an instrument for on-field productivity. We conjecture that a positive correlation between tenure and productivity exists, because teams usually fire their manager in response to on-field performances which fail to live up to expectations. As such, a longer tenure for the current manager is only possible if the team manager has been productive enough to avoid being dismissed.

[21] The 3 sub-periods reported here are 1994-1998, 1999-2004 and 2005-2010, the 4 sub-periods are 1994-1997, 1998-2001, 2002-2005 and 2006-2010.

We also add the level of tangible fixed assets in the club to the polynomial. The intuitive argument here is that more productive teams, who obtain wins more cheaply, also have a stronger incentive to build the revenue generating capacity of the team, i.e. its capital stock. We use both of these instruments by including a fourth order polynomial of logged manager tenure measured in games and logged tangible fixed assets. A final issue in obtaining the estimates, controlling for firm productivity, is that given the CSF structure, productivity may only be interpreted relative to competitors. We therefore define one team-season to serve as the reference team, for which we restrict $\omega_{it} = 1$.

Table 1 shows summary statistics for the CSF dataset. We assemble an initial data set of 25,392 observations[22] at the game level from http://footballresultsonline.co.uk. We then drop all observations where the accounting year for the club did not correspond to the soccer season or wage data are missing from the accounts.[23] Thus we obtain a match level data set of 20,324 observations. Our dependent variable is the home team's result (*res)*, where 0 signifies a loss for the home team, 1 a draw and 2 a home win. About 45.8% of all games were won by the home team, while a further 27.5% ended in a draw, which indicates the significance of home advantage. The payroll variable includes wages plus relevant social security payments and taxes, as it is meant to signify relevant employment costs, rather than net wage. Although payroll inflation has been dramatic (averaging over 10% per year across the sample period), we do not need to control for this in estimating the CSF since the outcome depends only on the share of payroll resources in a given season. The summary statistics in Table 1 reveal the huge financial disparities in English soccer. For example, the maximum spent on wages by an individual team amounts to more than ten times the average payroll of £16m over the sample period.

<insert table 1 around here>

[22] We excluded play-off games which determine promotion to higher tiers, as these do not generate points for the final ranking.
[23] Usually wage data are missing either because clubs filed abbreviated accounts or because they failed to file accounts in case of insolvency proceedings. For the 1160 club seasons in the sample period we have 90% of the audited wage bills.

The season-division data show that the sample contains most games from the second tier with 40.7%, whereas the third tier makes up only 28.6% of the data. This is because (a) for most of the period there were fewer teams in the top tier and (b) several teams at the lower levels file abbreviated accounts without wage information. Finally, the table shows summary statistics for the variables included in the productivity polynomial. These are the tenure of the current manager, measured as the number of consecutive games the team played under his supervision and the stock of tangible fixed assets in the club.

<insert table 2 around here>

A final element of the model we need to identify is the revenue equation (3). We use data on revenues[24] and assets from the financial accounts matched with sports data from the RSSSF archive[25] to estimate this equation at the club-season level. Again dropping observations for which revenue data are missing or the accounting year does not correspond to the season, gives us an unbalanced panel of 87 clubs over 17 years. Table 2 displays summary statistics for the data set, where all financial variables are expressed in millions of 2010 UK Pounds. *Revenues* and capital stocks (*tangible fixed assets*) vary quite dramatically. Most of this variation plays between leagues and seasons, rather than between clubs in the same league-season. In about 10 percent of all observations the club is part of a larger legal entity. In that case, a part of the tangible fixed assets are often transferred to the holding company, which leads us to underestimate the true capital stock. We therefore include a dummy *not ultimate parent*, when an observation suffers from this issue. We also control for promotion or relegation of the club, which is especially relevant given the considerable "parachute payments" teams receive upon relegation from

[24] As FFP looks at "football related revenues", we have taken out revenues which were explicitly labeled non-football in the accounts. There were only three such cases, Arsenal (property development), Bolton Wanderers (hotel) and Sheffield United (conferences).

[25] www.rsssf.com.

the Premier League.[26] Finally, the division and season dummies indicate that our observations are homogeneously spread across divisions and seasons.

<*insert figure 1 around here*>

Figure 1 shows the key financial variables in the dataset split out by division. In the upper-left panel we clearly see a huge increase in revenues over the last decade, especially in the top division. The upper-right panel however shows that average wage bills have followed a similar upward trend. The overall wage-to-turnover ratio, a key indicator of profitability in sports leagues, has therefore gone up in all three divisions. As can be seen in the bottom-left panel, this has meant average profits have plummeted.

5 Estimation Results

Table 3 shows the estimation results for the CSF (Tullock) parameters. Overall, the estimates confirm that the model is well behaved, as all parameters have the expected signs. The return parameters, $\beta_1$through β_3, are positive and significant, so wage spending translates in higher win probabilities. Judging from the estimates, returns to investment appear to be highest in the Premier League. One explanation for this may be that the distribution of talent is more skewed at the top end of the talent distribution, so that a given ratio of wage payments generates a higher probability of winning at the highest level.

The home advantage parameter, α_h, is significantly larger than 1, confirming that home advantage matters in English soccer. The significance of the draw parameter δ_0 shows that draws are more likely when opponents are more closely matched in terms of their effective efforts. For simplicity table 3 does

[26]In the EPL a part of the media rights revenues is given to the teams relegated in previous seasons. In 2010 these "parachute payments" amounted to more than £15m, see http://www.premierleague.com/engb/news/news/broadcast-payments-to-premier-league-clubs.html for more on the EPL distribution scheme. There is no compensation for clubs relegated from the second to the third tier.

not report all the season-division dummies, δ_{dt}, included in the draw probability. Instead we report the average and standard deviation of δ_{dt}. The estimate implies that a match between two equal opponents in terms of effective efforts has about 30% chance to end up in a draw. This number is fairly stable across different estimation approaches, seasons and divisions.

<insert table 3 around here>

In terms of correcting the upward bias in the return parameter, the various approaches we employ lead to similar results. When we control for unobserved productivity differences, the estimated return on investment in the first division is significantly lower. The estimated return parameter in the other divisions turns out to be slightly higher, although the difference is often insignificant. The other parameters in the estimation remain unchanged by adding controls, which is in line with our expectations.

<insert table 4 around here>

To understand why controlling for productivity has different effects on the estimated return parameters across tiers, we need to examine the pattern of estimated firm productivities given in tables 4 and 5. These productivity estimates are obtained by calculating the firm specific effects and polynomial values for all teams. Since these may only be interpreted relative to competitors, we scale each estimated ω_{it} by the average over the tier and season. A first thing to note from table 4 is that the implied productivity measures from all approaches are highly correlated, which confirms that there is consistency over different approaches. Interestingly, the correlation between payroll and productivity is both positive and large, but only in the top division. We suspect this is the result of promotion and relegation. In the lower tiers newly relegated teams are often able to keep high payrolls,[27] while not

[27]This may be due to parachute payments and/or to the fans sticking with their club when it is relegated, at least in the short run.

being more productive than the league average. This effect counteracts the fact that productive teams generate wins more cheaply and may therefore invest more.

Table 5 shows the average, standard deviation and average maximum-to-minimum ratio of productivity split out by division. The table shows that introducing varying firm specific effects leads to larger varieties in the estimated productivities. Also, the standard deviation and maximum-to-minimum proportion in the top tier turn out to be significantly larger across all productivity measures, which means that the productivity gap between teams is greater there. This result is intuitive, because we would expect the system of promotion and relegation to lead to a clustering of highly productive teams at the very top of the tier system. The combined effect of the poor link between payroll and productivity, and the smaller productivity gap explains why we do not find the return coefficient to decrease when controlling for productivity. However, when the link between wages and productivity is absent and productivity differences are low, there is no reason to expect an upward bias in the return parameter in the first place.

<insert table 5 around here>

Estimation results for the final element of the model, the revenue function, are depicted in table 6. We report pooled OLS, random and fixed firm effects estimates. Across all estimation methods, every significant coefficient has the expected sign. Introducing firm specific random or fixed effects decreases the size of the estimated coefficients. Given that most firm specific dummies turn out to be significant, we reject using the simple pooled OLS estimates. A Hausman test shows that there is no consistency between the random and fixed effects estimates, so we restrict our attention to the fixed effects results.

Since we have assumed a Cobb-Douglas specification, the points and assets coefficient should be interpreted as an elasticity. This means that a 1% increase in relative points relates to about a 0.39% increase in revenues and a 1% increase in the value of tangible assets leads to a 0.08% increase in revenues. To give an indication of the economic relevance of the estimate of the points parameter, we calculated the monetary value of an additional point in the EPL 2010 season for each team. We find the average value to be £683k, with a minimum of £305k and maximum of £1405k.[28] The results show that relegated teams indeed hold a revenue advantage, which can largely be attributed to the "parachute payments" which the Premier League pays to relegated teams, whereas promoted teams do not seem to be at a disadvantage compared to their division competitors. This result confirms our hypotheses that newly relegated teams are able to sustain higher payrolls in the short run, while not necessarily being very productive.

Our control variable for not being the ultimate parent company is significant and positive. This compensates for the possible underestimation of the capital stocks for these clubs. We also estimated the model dropping all observations for which the club is not the ultimate legal parent entity, which led to very similar results. We do not report every individual season-division dummy to enhance the readability of the table. The pattern in these dummies corresponds to our expectations, i.e. they are increasing towards higher tiers and later seasons. In terms of the overall fit of the model, we achieve R-squared statistics which are consistently around 0.9, a reassuring number.

<insert table 6 around here>

6 Simulation Results

We now use our estimates to simulate the impact of the break-even condition of the Financial Fair Play regulations. Strictly speaking the regulations apply only to teams that qualify for participation in UEFA competition, which consists of only the top teams in the Premier League. Rather than focus on this arbitrary group (whose identity fluctuates significantly from year to year), we simulate the effect of applying FFP to *all* clubs in the Premier League. UEFA would certainly like to FFP adopted more broadly,

[28] These values are for Wigan and Manchester United, respectively.

and in the summer of 2012 the second tier of English soccer (the Football League Championship) announced that it would adopt comparable regulations. For our simulation we consider the most recent season for which we have data, which is 2009/10.

A first issue in doing the simulation is the bankruptcy of Portsmouth FC during the 2010 season, which caused the club not to file accounts for the financial years ending 2009 and 2010. We use Portsmouth's 2008 figures as a proxy for the missing values of wages and assets. We assume that these figures do not change when calculating counterfactual scenarios, but drop the team's figures from all calculations of the effects of FFP and the assessment of the model.

<insert table 7 around here>

In a first step we predict the end-of-season points using the actual 2010 EPL payrolls. Table 7 shows summary statistics and standard goodness-of-fit measures for the end-of-season points using different estimation approaches. As a reference, we also report these measures for a null-model where the probability of each match outcome is equal to its frequency in the dataset. All the simulation models exhibit a slightly lower average point total than the actual results. This is due to the exclusion of Portsmouth, which has a larger points total in our simulation than in the real rankings. The standard deviation in the simulated models is slightly lower too, especially when productivity is not (or poorly) controlled for.

The root mean squared error (RMSE) and the mean absolute error (MAE)[29] clearly support the validity of the CSF model. Even in the simple model without productivity controls, the prediction error goes down by more than 50%. Among the different estimation approaches the varying-firm-effects

[29]The root mean squared error is calculated as the square root of the average of the squared difference between the predicted and actual values, i.e. $RMSE = \sqrt{E\left[\left(\widehat{W} - W\right)^2\right]}$. The mean absolute error is given by $MAE = E\left[\left|\widehat{W} - W\right|\right]$.The advantage of these measures compared to the mean squared error is that they are measured in the same units as the basic problem, making them easier to interpret.

models appear to result in the best fit for the 2010 season. In both models the average error declines by almost 10 points compared to the null model, whereas the RMSE reduces to about a third of its value in the null model.

When simulating the introduction of the break-even constraint, we try to keep as close as possible to the actual FFP regulations. These stipulate that the "difference between relevant income and relevant expenses is the breakeven result" (UEFA, 2010, p.34) and the accumulated breakeven result over the three previous seasons should not amount to a loss greater than the "acceptable deviation". For the 2013/14 and 2014/15 seasons this deviation is set to €45m, or an average of €15m per season, for the 2015/16, 2016/17 and 2017/18 seasons to €30m or €10m per season. After this phasing in period, the accepted deviation would eventually come down to €5m over three seasons, although UEFA has not yet determined a time scheme for this to happen.

We look at four scenarios, which correspond to an average accepted deviation of €15m, €10m and €5m per season, and the "final" scenario with a total acceptable deviation of €5m over three seasons.[30] We implement this policy change by looking at each team's combined losses for the 2007/08, 2008/09 and 2009/10 seasons. If these losses exceed the acceptable deviation, we diminish the club's payroll for the 2010 season by the amount necessary to comply with the breakeven constraint. Given these new payrolls, we recalculate the end-of-season points and revenues using our estimation results for equations (1a)-(3). We then re-evaluate whether the affected teams comply with the breakeven constraint and diminish their payroll further if necessary.

Our assumption of win maximization, implies that clubs which generate extra revenues as a consequence of FFP do not pocket these extra resources. We therefore add any revenue increase over

[30] In accordance with the FFP rules we convert these amounts to UK Pounds using the average ECB exchange rate over the reporting period, retrieved from: http://sdw.ecb.europa.eu/browseTable.do?node=2018794&CURRENCY=GBP&sfl1=4&DATASET=0&sfl3=4&SERIES_KEY=120.EXR.D.GBP.EUR.SP00.A

the original predicted revenue to the existing payrolls. Using this new set of payrolls we again calculate the end-of-season points and revenues using equations (1a)-(3). We iterate these steps until we reach a fixed point, which satisfies the breakeven constraints under FFP (5). We obtain standard errors on this simulation using a bootstrap procedure. We repeat the simulation 200 times using a set of independent draws from the distributions of the parameter estimates for each iteration. We then establish the sample standard error on all variables of interest and report these in the table.

<insert table 9 around here>

In table 8, we depict the change in payroll together with the original payroll levels for each team. The asterisks indicate whether a team is facing a payroll restriction because of FFP, which reveals that more than half of EPL teams would be affected. All unaffected teams put up higher wages, because they re-invest the extra revenue they generate under FFP. In most cases the restricted teams end up with a net decline in payroll, i.e. the direct effect of FFP dominates. In a couple of cases however, a restricted team gets an increase in revenues which offsets the mandatory decline under FFP, leading to a net increase in wages.[31]

Table 9 gives an overview of the financial variables in the counterfactual equilibria using all four estimation approaches for the CSF. As a reference point the table includes the level of payroll and predicted revenues in the absence of FFP ("no FFP"). Obviously, the effects of FFP are more dramatic when the accepted deviation is smaller. Interestingly, average revenues across all regimes decrease by less than £1.5m, well within the standard error of the simulation. This indicates that revenues are for a large part transferred among clubs in the EPL. The average payroll in the league declines between £10m and £16m, or 14% to 23% of its initial level. This in turn means that on average teams lower their wage-

[31] E.g. Fulham under the €10m regime.

to-turnover ratio (wtto) by about 8% in the most liberal regime, but up to 16% when the long-term maximum acceptable deviation is applied.

These results suggest that FFP may serve as a powerful tool for teams to coordinate on keeping wage costs down. Indeed, we estimate the total surplus transferred from players to owners to be between £160m to £390m, which is around 15% of total turnover in the league. Given that we have assumed owners do not pocket any of the additional revenues their teams generate in the new regime, these numbers should be viewed as a lower bound to the likely decrease in payrolls. A second important remark is that we have assumed league-wide factors to be taken up by our estimates of season-division fixed effects. If FFP would lead to an emigration of talented players from the EPL to other European leagues, the league-wide revenue sources, such as the TV contract, might be affected. As FFP is introduced at the European level however, it is hard to see where these players would emigrate to. If anything one would expect FFP to hit wages equally hard in the EPL's closest competitor leagues, such as the Spanish La Liga.

<insert table 10 around here>

Since the goodness-of-fit measures favored the three period firm effects approach, table 10 reports the counterfactual end-of-season table using these estimates. To obtain maximum robustness for our results, we also calculated the counterfactual points table using the other approaches for estimating the CSF and report the results in the appendix. Table 10 shows that the traditional powerhouses of English soccer would not be severely affected by FFP. Manchester United, Arsenal and Liverpool consolidate their strong position in predicted points totals. These teams combine a large revenue generating capacity with a high CSF productivity, which means that they can easily maintain their advantage when teams have to compete within their budgets. Given the results from table 8, it is noteworthy that especially Manchester United and Liverpool obtain these results setting a significantly lower payroll.

A couple of teams would see a significant decline in their on-field performance. Most notably Manchester City and West Ham stand to lose more than twice the bootstrapped standard error. [32] This is again good news for the incumbent top teams, as it indicates that building a top team by spending heavily on players in a club, which cannot (yet) produce the revenues to support this spending (which has been the strategy of the Manchester City owners over the past couple of seasons), would become virtually impossible.[33] While Chelsea under the ownership of Roman Abramovitch since 2003, followed a similar strategy to Manchester City over recent years, it has had longer to establish itself as a pre-eminent club and thus does not appear to face the same difficulty in sustaining its position under FFP. The most significant on-field gains go to teams near the bottom of the table, which so far have been able to compete within their means, for example Wolverhampton.

7 Conclusion

In this paper we have studied the impact a specific form of financial regulation on the intensity of competition in an industry. The effect of the regulation is to harden the budget constraint for a subset of firms in the industry. We show that the impact of this regulation is substantial even for those firms which are not directly affected by the regulation. Given that firms in this industry are engaged in a form of rent-seeking contest, the regulation is expected to impact almost entirely on costs, which primarily take the form of wages.

[32] Note that the standard error for West Ham is larger than the average in the league, because for the lower part of its productivity draws the wage bill would actually have to be driven down to 0 if West Ham wants to comply with FFP.

[33] Using alternative estimation procedures (see appendix) we even find that if the Financial Fair Play regime is sufficiently strict, West Ham would not be able to sustain a positive payroll. We interpret this as evidence that the revenue generating capacity and productivity of the club are too low to save the team from relegation under Financial Fair Play.

In particular, we find that had the Financial Fair Play regulations applied fully in the English Premier League in the 2009/10 season, wage to turnover ratios would have fallen by as much as 15%, which is in line with the theoretical predictions of Dietl et al (2009). As such, the FFP break-even rule will in many ways resemble a North American salary cap, although the latter applies the same spending cap to all teams. In other words, our paper shows that in this context a vertical restraint may restrict competition in exactly the same way as a horizontal agreement between competing firms. Salary caps have been justified in US courts under the theory that they promote competitive balance among the teams. On top of this, they are agreed upon in a system of collective bargaining with unions representing the players, and such agreements are exempt from antitrust. The break-even rule under FFP has not been negotiated as part of a collective bargaining agreement with unions, and furthermore such agreements are not exempt from competition law in the EU. Therefore, analyzing the impact of FFP on competition in national leagues is important to assess whether it complies with EU competition law.

The rationale advanced by UEFA for its regulation is not the promotion of competitive balance, but “discipline and rationality” in club finances. Considered as a vertical restraint, this might be deemed to have pro-competitive properties if the rules help to preserve the integrity of the competition and the financial stability of the clubs. On the other hand, our results demonstrate that the break-even rule could be construed as a means to raising profitability and therefore an anti-competitive vertical restraint under EU competition law.

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9 Tables and Figures

Figure 1: Average revenues, wage bills, profits and wage to turnover ratios in English soccer

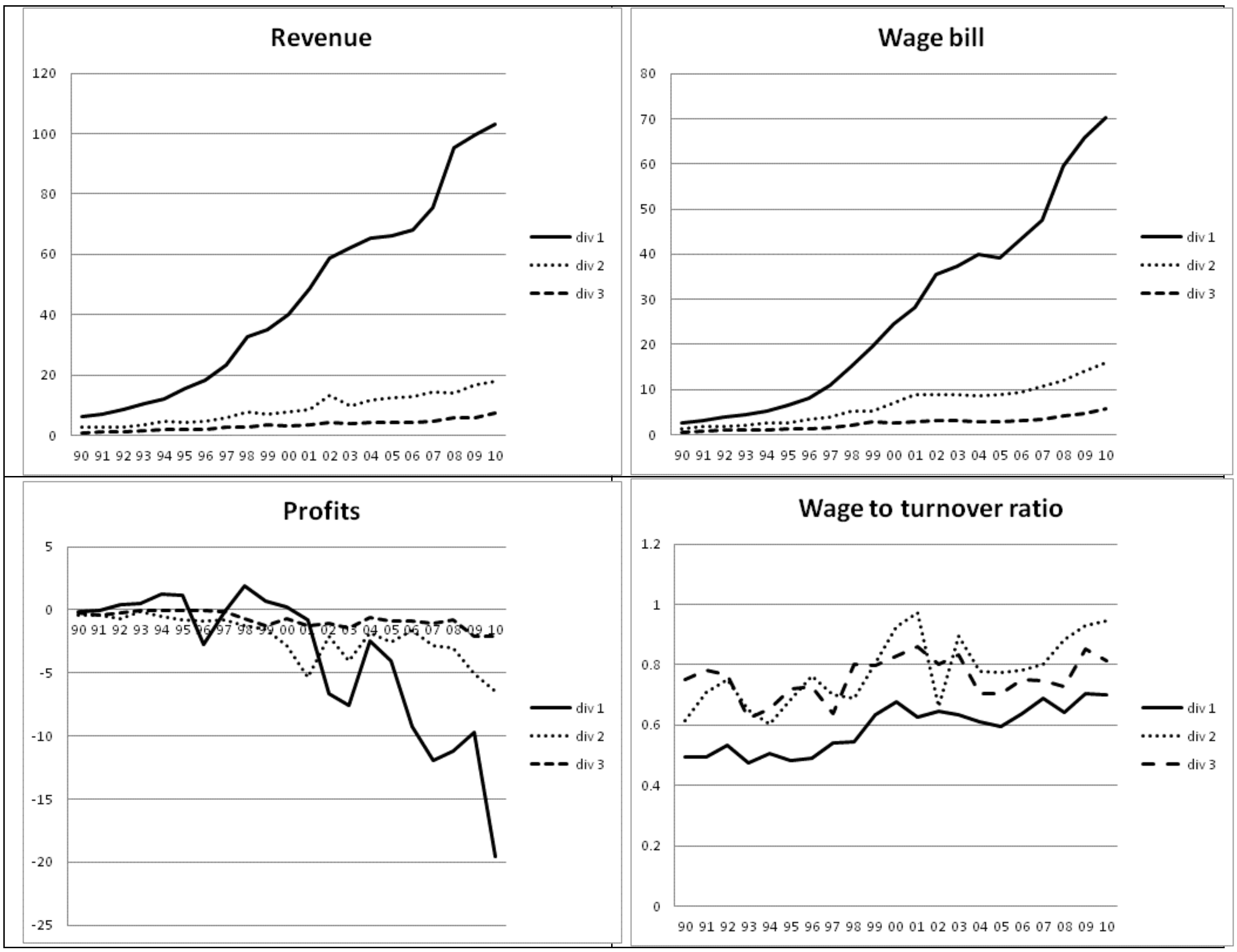

Table 1: Summary statistics CSF estimation

Variable	Obs	Mean	Std. Dev.	Min	Max
Primary data					
res	20324	1.192	0.830	0	2
home win	20324	0.458	0.498	0	1
home draw	20324	0.275	0.446	0	1
wage	20324	16.00	22.06	0.92	177.78
Season - Division					
year	20324	2001.4	4.858	1994	2010
division 1	20324	0.307	0.461	0	1
division 2	20324	0.407	0.491	0	1
division 3	20324	0.286	0.452	0	1
Polynomial					
manager tenure	20324	107.969	144.107	1	1092
tangible fixed assets	20283	26.40	50.40	0.0034	508.00

Table 2: Summary statistics revenue estimation

Variable	Obs	Mean	Std. Dev.	Min	Max
revenues	1010	26.600	39.500	1.045	286
tangible fixed assets	1008	27.900	52.700	0.003	508
points	1010	60.140	15.468	11	106
relative points	1010	0.460	0.114	0.096	0.833
promoted	1010	0.132	0.338	0	1
relegated	1010	0.092	0.289	0	1
not ultimate parent	1010	0.103	0.304	0	1
year	1010	2001.732	4.900	1994	2010
division 1	1010	0.330	0.470	0	1
division 2	1010	0.368	0.483	0	1
division 3	1010	0.302	0.459	0	1

Table 3: Estimation Results Contest Success Function

VARIABLES	no controls	FE	3 period FE	4 period FE	Polynomial
β_1	1.4599***	1.2064***	0.9559***	1.0248***	1.3276***
	(0.057)	(0.105)	(0.140)	(0.147)	(0.070)
β_2	0.6133***	0.6946***	0.7070***	0.7218***	0.6659***
	(0.040)	(0.061)	(0.085)	(0.097)	(0.043)
β_3	0.8271***	0.9367***	0.9090***	1.0433***	0.8686***
	(0.056)	(0.082)	(0.118)	(0.140)	(0.059)
α_h	1.7773***	1.7891***	1.8090***	1.8150***	1.7801***
	(0.032)	(0.032)	(0.033)	(0.033)	(0.032)
δ_0	0.1520***	0.1589***	0.1832***	0.1811***	0.1646***
	(0.021)	(0.020)	(0.018)	(0.018)	(0.020)
Average δ_{dt}	0.2947	0.2976	0.3056	0.3065	0.2975
Std. dev. δ_{dt}	0.0250	0.0253	0.0251	0.0247	0.0248
firm effects	no	yes	yes	yes	no
log likelihood	-20964.94	-20839.35	-20602.28	-20531.45	-20811.67
Observations	20 324	20 324	20 324	20 324	20 242

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 4: Correlation between productivity measures and payroll

Correlation coefficient	FE	3 period FE	4 period FE	Polynomial
FE	1			
3 period FE	0.736	1		
4 period FE	0.692	0.881	1	
Polynomial	0.685	0.569	0.609	1
Payroll				
All tiers	0.169	0.273	0.214	0.174
1st tier	0.339	0.517	0.444	0.312
2nd tier	-0.154	-0.093	-0.079	-0.156
3rd tier	-0.140	-0.077	-0.160	-0.155

Table 5: Summary statistics for productivity estimates

Variable	Observations	Mean	Std. Dev.	min/max
FE				
1st tier	334	1	0.283	2.742
2nd tier	383	1	0.166	1.871
3rd tier	317	1	0.206	2.141
3 period FE				
1st tier	334	1	0.498	5.758
2nd tier	383	1	0.294	3.191
3rd tier	317	1	0.357	4.007
4 period FE				
1st tier	334	1	0.501	6.015
2nd tier	383	1	0.353	3.915
3rd tier	317	1	0.403	4.558
Polynomial				
1st tier	334	1	0.208	2.023
2nd tier	382	1	0.108	1.501
3rd tier	316	1	0.101	1.480

Table 6: Estimation Results Revenue Function

VARIABLES	OLS	RE	FE
tang fixed assets	0.118***	0.0965***	0.0721***
	(0.00899)	(0.00966)	(0.00974)
points	0.880***	0.490***	0.376***
	(0.0461)	(0.0375)	(0.0360)
promoted	-0.0852**	-0.0120	0.0216
	(0.0334)	(0.0245)	(0.0231)
relegated	0.290***	0.243***	0.219***
	(0.0399)	(0.0291)	(0.0272)
not ultimate parent	0.216***	0.187***	0.168***
	(0.0454)	(0.0495)	(0.0491)
Constant	14.16***	14.60***	14.95***
	(0.186)	(0.167)	(0.172)
season - division FE	yes	yes	yes
Observations	1008	1008	1008
Overall R-squared	0.918	0.906	0.889
Hausman test value	225.70	chi-sq.	0.000

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 7: Summary statistics and measures of fit for end-of season points

	Real	null	no controls	FE	3 period FE	4 period FE	Polynomial
Average	53.47	51.81	52.24	52.45	52.25	52.18	52.46
St. Dev.	17.70	0	14.60	14.59	17.23	17.13	15.69
RMSE	-	17.31	8.10	7.79	5.87	6.02	7.52
MAE	-	14.81	7.10	6.09	4.83	4.88	5.93

Table 8: Wage differences in equilibrium with 3 period FE

team	Original	final		€ 5m		€ 10m		€ 15m	
Chelsea	172.6	-61.6*	(0.8)	-59.0*	(0.8)	-55.0*	(0.9)	-50.8*	(0.9)
Manchester City	133.3	-88.8*	(3.0)	-85.9*	(3.0)	-81.1*	(2.9)	-76.3*	(2.5)
Manchester United	131.7	-14.5*	(1.7)	-12.0*	(0.7)	-8.0*	(0.5)	-3.8*	(0.5)
Liverpool	121.1	-24.4*	(0.2)	-21.8*	(0.1)	-17.8*	(0.1)	-13.5*	(0.1)
Arsenal	110.7	3.8	(0.9)	3.2	(0.8)	2.5	(0.6)	2.0	(0.5)
Aston Villa	80.0	-32.6*	(0.7)	-29.6*	(0.8)	-25.1*	(0.7)	-20.4*	(0.6)
Tottenham	67.1	4.4	(1.3)	3.6	(1.0)	2.7	(0.7)	2.1	(0.6)
Everton	54.3	2.3	(0.7)	1.9	(0.5)	1.4	(0.4)	1.1	(0.3)
Sunderland	53.7	-23.0*	(1.1)	-19.4*	(1.0)	-14.0*	(0.7)	-8.6*	(0.3)
West Ham	53.6	-32.4*	(7.6)	-28.1*	(4.8)	-22.0*	(1.6)	-16.3*	(1.0)
Fulham	49.3	-6.5*	(0.5)	-3.6*	(0.3)	0.9*	(0.3)	1.0	(0.2)
Blackburn	47.4	2.3	(0.7)	1.9	(0.5)	1.4	(0.3)	1.1	(0.3)
Bolton	46.4	-19.5*	(0.7)	-16.1*	(0.6)	-11.0*	(0.3)	-6.0*	(0.1)
Stoke	44.8	0.0*	(0.5)	1.3	(0.4)	1.0	(0.2)	0.7	(0.2)
Wigan	39.4	-5.3*	(0.2)	-2.4*	(0.2)	0.7	(0.2)	0.5	(0.1)
Hull	38.3	-2.7*	(0.5)	0.2*	(0.4)	1.0	(0.3)	0.7	(0.2)
Birmingham	36.7	-2.3*	(0.8)	0.8*	(0.7)	1.7	(0.5)	1.3	(0.3)
Wolverhampton	29.8	4.7	(2.0)	3.8	(1.5)	2.7	(1.0)	2.0	(0.7)
Burnley	22.4	2.1	(0.9)	1.6	(0.6)	1.1	(0.4)	0.8	(0.2)

* indicates that club is restricted by FFP, bootstrapped standard error in parentheses.

Table 9: Simulation Results

Variable		no FFP		final		€ 5m		€ 10m		€ 15m	
rev	FE	104.7	*(5.6)*	103.5	*(5.4)*	104.2	*(5.4)*	104.3	*(5.5)*	104.4	*(5.5)*
	3 period FE	105.1	*(5.5)*	104.7	*(5.5)*	104.7	*(5.5)*	104.8	*(5.5)*	104.8	*(5.5)*
	4 period FE	105.1	*(5.6)*	104.6	*(5.4)*	104.7	*(5.5)*	104.7	*(5.5)*	104.8	*(5.5)*
	Polynomial	105.0	*(5.6)*	103.6	*(5.5)*	103.6	*(5.4)*	104.5	*(5.4)*	104.6	*(5.6)*
wage	FE	70.1		54.5	*(0.2)*	56.3	*(0.2)*	58.6	*(0.1)*	60.4	*(0.1)*
	3 period FE	70.1		54.7	*(0.1)*	56.5	*(0.1)*	58.7	*(0.1)*	60.5	*(0.1)*
	4 period FE	70.1		54.6	*(0.2)*	56.4	*(0.2)*	58.7	*(0.1)*	60.5	*(0.1)*
	Polynomial	70.1		54.5	*(0.6)*	56.1	*(0.2)*	58.5	*(0.2)*	60.4	*(0.1)*
wtto	FE	73.2%	*(3.7)*	57.6%	*(3.1)*	60.8%	*(3.3)*	63.6%	*(3.3)*	65.5%	*(3.4)*
	3 period FE	73.9%	*(3.8)*	59.0%	*(3.2)*	61.6%	*(3.3)*	64.4%	*(3.3)*	66.1%	*(3.4)*
	4 period FE	74.0%	*(3.9)*	58.9%	*(3.2)*	61.6%	*(3.3)*	64.4%	*(3.4)*	66.1%	*(3.5)*
	Polynomial	73.5%	*(3.8)*	57.8%	*(2.9)*	60.1%	*(3.2)*	63.9%	*(3.5)*	65.7%	*(3.4)*

Bootstrap standard errors in parentheses, obtained from 200 simulations using independent parameter draws.

Table 10: Points Table using 3 period fixed effects

Team	Real	No FFP		Final		€ 5m		€ 10m		€ 15m	
Chelsea	86	86.6	*(3.9)*	83.7	*(4.3)*	83.6	*(4.3)*	83.5	*(4.4)*	83.6	*(4.4)*
Manchester Utd.	85	83.7	*(4.3)*	85.0	*(4.1)*	84.8	*(4.2)*	84.7	*(4.2)*	84.8	*(4.2)*
Arsenal	75	72.3	*(4.3)*	76.3	*(3.9)*	75.6	*(4.0)*	74.9	*(4.1)*	74.3	*(4.2)*
Tottenham	70	58.7	*(3.6)*	63.7	*(3.6)*	62.8	*(3.6)*	61.7	*(3.6)*	61.0	*(3.6)*
Manchester City	67	60.6	*(4.0)*	45.3	*(4.1)*	45.6	*(4.2)*	46.4	*(4.2)*	47.4	*(4.1)*
Aston Villa	64	58.6	*(3.4)*	53.3	*(3.6)*	53.6	*(3.6)*	54.3	*(3.6)*	55.2	*(3.5)*
Liverpool	63	74.3	*(4.1)*	74.2	*(4.0)*	74.0	*(4.1)*	73.9	*(4.1)*	74.1	*(4.1)*
Everton	61	59.5	*(3.8)*	64.1	*(3.8)*	63.2	*(3.8)*	62.3	*(3.8)*	61.7	*(3.8)*
Birmingham	50	39.5	*(3.6)*	42.1	*(3.9)*	42.8	*(3.9)*	42.3	*(3.8)*	41.6	*(3.8)*
Blackburn	50	49.2	*(3.4)*	53.9	*(3.5)*	53.0	*(3.5)*	52.0	*(3.5)*	51.3	*(3.5)*
Stoke	47	44.1	*(3.6)*	48.0	*(3.9)*	47.7	*(3.8)*	46.7	*(3.8)*	46.1	*(3.7)*
Fulham	46	43.5	*(3.4)*	44.9	*(3.4)*	45.2	*(3.4)*	46.0	*(3.5)*	45.5	*(3.5)*
Sunderland	44	38.2	*(3.3)*	33.0	*(3.1)*	33.9	*(3.2)*	35.4	*(3.2)*	36.9	*(3.2)*
Bolton	39	46.0	*(3.7)*	40.6	*(3.6)*	41.8	*(3.7)*	43.5	*(3.7)*	45.3	*(3.7)*
Wolverhampton	38	33.8	*(3.1)*	39.7	*(3.8)*	38.5	*(3.5)*	37.2	*(3.3)*	36.3	*(3.3)*
Wigan	36	42.2	*(3.9)*	43.6	*(4.0)*	44.2	*(3.9)*	44.7	*(4.0)*	44.1	*(4.0)*
West Ham	35	41.5	*(3.0)*	30.5	*(8.0)*	32.5	*(5.6)*	35.0	*(3.2)*	37.1	*(3.1)*
Burnley	30	27.8	*(2.9)*	32.3	*(3.3)*	31.3	*(3.2)*	30.2	*(3.0)*	29.6	*(3.0)*
Hull	30	32.7	*(3.5)*	35.1	*(3.8)*	35.5	*(3.8)*	35.1	*(3.7)*	34.4	*(3.7)*
Portsmouth	19	49.0	*(3.8)*	52.9	*(3.8)*	52.1	*(3.8)*	51.3	*(3.9)*	50.7	*(3.9)*

Bootstrap standard errors in parentheses, obtained from 200 simulations using independent parameter draws.

10 Appendix

10.1 Full table Fixed Effects

Team	Real	no FFP		final		€ 5m		€ 10m		€ 15m	
Chelsea	86	77.3	*(2.0)*	72.9	*(2.0)*	72.3	*(2.1)*	71.9	*(2.1)*	72.0	*(2.1)*
Manchester Utd.	85	81.0	*(2.2)*	83.3	*(2.1)*	82.9	*(2.1)*	82.7	*(2.2)*	82.7	*(2.2)*
Arsenal	75	74.6	*(2.1)*	80.1	*(2.0)*	79.1	*(2.0)*	78.1	*(2.0)*	77.3	*(2.0)*
Tottenham	70	50.9	*(1.7)*	59.6	*(2.1)*	57.4	*(2.1)*	55.6	*(2.0)*	54.4	*(1.8)*
Manchester City	67	64.1	*(2.5)*	43.6	*(3.7)*	42.1	*(2.5)*	43.4	*(2.4)*	45.1	*(2.3)*
Aston Villa	64	60.3	*(2.0)*	54.1	*(2.0)*	53.4	*(2.0)*	54.3	*(2.0)*	55.5	*(2.0)*
Liverpool	63	69.5	*(2.1)*	70.0	*(2.1)*	69.3	*(2.2)*	69.1	*(2.2)*	69.2	*(2.2)*
Everton	61	48.0	*(2.0)*	55.9	*(2.2)*	53.7	*(2.2)*	52.1	*(2.2)*	51.0	*(2.1)*
Birmingham	50	42.0	*(1.7)*	48.0	*(2.0)*	47.4	*(2.1)*	46.5	*(1.9)*	45.4	*(1.8)*
Blackburn	50	46.5	*(1.7)*	54.5	*(1.8)*	52.2	*(1.8)*	50.5	*(1.7)*	49.5	*(1.7)*
Stoke	47	45.9	*(2.0)*	52.6	*(2.2)*	51.2	*(2.3)*	49.6	*(2.2)*	48.7	*(2.1)*
Fulham	46	45.6	*(2.1)*	49.2	*(2.2)*	48.4	*(2.3)*	49.3	*(2.2)*	48.5	*(2.2)*
Sunderland	44	47.7	*(1.9)*	41.8	*(4.3)*	40.8	*(2.1)*	43.3	*(2.0)*	45.8	*(2.0)*
Bolton	39	49.6	*(1.9)*	43.8	*(1.9)*	43.6	*(2.1)*	46.2	*(2.0)*	48.7	*(1.9)*
Wolverhampton	38	35.8	*(1.8)*	47.6	*(2.4)*	44.0	*(2.6)*	41.6	*(2.1)*	40.1	*(1.8)*
Wigan	36	45.4	*(2.0)*	48.8	*(2.1)*	48.4	*(2.2)*	49.0	*(2.1)*	48.0	*(2.1)*
West Ham	35	45.8	*(1.9)*	6.4	*(11.9)*	28.4	*(12.5)*	35.0	*(7.2)*	38.9	*(2.4)*
Burnley	30	29.5	*(1.6)*	39.0	*(2.1)*	35.4	*(2.2)*	33.4	*(1.8)*	32.3	*(1.6)*
Hull	30	37.1	*(2.4)*	42.6	*(2.5)*	41.7	*(2.7)*	40.7	*(2.5)*	39.7	*(2.5)*
Portsmouth	19	45.9	*(1.9)*	52.1	*(2.2)*	50.2	*(2.2)*	49.0	*(2.1)*	48.2	*(2.0)*

Bootstrap standard errors in parentheses, obtained from 200 simulations using independent parameter draws.

10.2 Full table 4 period Fixed Effect

Team	Real	no FFP		final		€5m		€ 10m		€ 15m	
Chelsea	86	84.2	*(6.6)*	80.9	*(6.6)*	80.7	*(6.9)*	*80.6*	*(7.0)*	80.7	*(7.0)*
Manchester Utd.	85	83.9	*(5.9)*	85.2	*(5.5)*	85.1	*(5.8)*	*85.0*	*(5.9)*	85.1	*(5.9)*
Arsenal	75	71.2	*(3.8)*	75.6	*(3.5)*	74.8	*(3.6)*	*74.0*	*(3.6)*	73.4	*(3.7)*
Tottenham	70	58.8	*(3.8)*	64.3	*(3.9)*	63.3	*(3.8)*	*62.2*	*(3.8)*	61.4	*(3.8)*
Manchester City	67	60.9	*(4.6)*	44.1	*(5.7)*	44.4	*(4.5)*	*45.3*	*(4.4)*	46.4	*(4.3)*
Aston Villa	64	59.4	*(3.4)*	53.7	*(3.4)*	54.0	*(3.5)*	*54.8*	*(3.5)*	55.7	*(3.5)*
Liverpool	63	76.5	*(5.5)*	76.4	*(5.2)*	76.2	*(5.5)*	*76.2*	*(5.5)*	76.4	*(5.5)*
Everton	61	58.7	*(3.6)*	63.7	*(3.7)*	62.8	*(3.7)*	*61.7*	*(3.7)*	61.0	*(3.7)*
Birmingham	50	39.6	*(3.7)*	42.7	*(4.0)*	43.3	*(4.0)*	*42.8*	*(3.9)*	42.0	*(3.8)*
Blackburn	50	49.8	*(3.6)*	55.1	*(3.7)*	54.0	*(3.7)*	*52.9*	*(3.6)*	52.2	*(3.6)*

Stoke	47	44.5	*(3.6)*	48.8	*(4.0)*	48.5	*(4.0)*	*47.4*	*(3.9)*	46.7	*(3.8)*
Fulham	46	44.0	*(3.2)*	45.7	*(3.4)*	46.0	*(3.4)*	*46.8*	*(3.4)*	46.3	*(3.3)*
Sunderland	44	37.0	*(3.8)*	31.3	*(3.7)*	32.3	*(3.7)*	*33.9*	*(3.8)*	35.5	*(3.8)*
Bolton	39	44.8	*(3.6)*	39.0	*(3.4)*	40.2	*(3.6)*	*42.2*	*(3.6)*	44.0	*(3.6)*
Wolverhampton	38	34.9	*(3.3)*	41.7	*(3.9)*	40.3	*(3.7)*	*38.7*	*(3.5)*	37.7	*(3.4)*
Wigan	36	40.6	*(3.8)*	42.1	*(3.8)*	42.7	*(3.9)*	*43.2*	*(4.0)*	42.5	*(3.9)*
West Ham	35	42.1	*(3.8)*	29.3	*(11.3)*	31.9	*(7.9)*	*34.8*	*(4.6)*	37.2	*(3.8)*
Burnley	30	27.5	*(3.0)*	32.6	*(3.5)*	31.4	*(3.3)*	*30.2*	*(3.1)*	29.5	*(3.1)*
Hull	30	33.1	*(3.3)*	35.8	*(3.9)*	36.3	*(3.7)*	*35.7*	*(3.6)*	35.0	*(3.5)*
Portsmouth	19	50.3	*(4.3)*	54.6	*(4.5)*	53.7	*(4.5)*	*52.8*	*(4.4)*	52.2	*(4.4)*

Bootstrap standard errors in parentheses, obtained from 200 simulations using independent parameter draws.

10.3 Full table productivity polynomial

Team	Real	no FFP		final		5m €		10m €		15m €	
Chelsea	86	74.2	*(2.4)*	68.9	*(2.4)*	68.5	*(2.4)*	67.8	*(2.4)*	67.9	*(2.4)*
Manchester Utd.	85	81.3	*(4.5)*	83.8	*(4.1)*	83.6	*(4.3)*	83.3	*(4.3)*	83.3	*(4.4)*
Arsenal	75	77.6	*(4.3)*	83.1	*(3.9)*	82.4	*(4.0)*	81.3	*(4.1)*	80.6	*(4.2)*
Tottenham	70	54.2	*(1.1)*	63.5	*(1.4)*	62.2	*(1.4)*	59.6	*(1.4)*	58.3	*(1.2)*
Manchester City	67	68.6	*(2.1)*	45.3	*(5.9)*	46.3	*(4.7)*	45.8	*(2.7)*	47.8	*(2.6)*
Aston Villa	64	62.1	*(1.1)*	55.2	*(1.6)*	55.8	*(1.3)*	55.6	*(1.2)*	57.0	*(1.2)*
Liverpool	63	72.9	*(1.6)*	73.5	*(1.6)*	73.2	*(1.6)*	72.7	*(1.6)*	72.9	*(1.6)*
Everton	61	51.4	*(1.4)*	59.9	*(1.7)*	58.7	*(1.8)*	56.1	*(1.7)*	54.9	*(1.6)*
Birmingham	50	39.4	*(0.9)*	46.2	*(1.3)*	47.2	*(1.6)*	44.4	*(1.5)*	43.0	*(1.0)*
Blackburn	50	44.1	*(0.7)*	53.1	*(1.2)*	51.9	*(1.3)*	48.7	*(1.2)*	47.5	*(0.8)*
Stoke	47	45.1	*(1.7)*	52.5	*(1.8)*	52.2	*(1.9)*	49.3	*(1.9)*	48.2	*(1.7)*
Fulham	46	46.6	*(1.0)*	50.5	*(1.2)*	51.1	*(1.3)*	50.8	*(1.3)*	49.8	*(1.1)*
Sunderland	44	45.4	*(1.2)*	38.8	*(5.9)*	40.8	*(3.0)*	40.3	*(1.6)*	43.2	*(1.3)*
Bolton	39	43.0	*(0.6)*	37.3	*(4.1)*	39.2	*(1.4)*	39.1	*(1.1)*	41.8	*(0.6)*
Wolverhampton	38	35.6	*(1.2)*	49.0	*(1.9)*	47.4	*(2.3)*	42.5	*(2.2)*	40.7	*(1.5)*
Wigan	36	39.4	*(1.0)*	43.4	*(1.2)*	44.3	*(1.4)*	43.2	*(1.4)*	42.1	*(1.1)*
West Ham	35	48.5	*(0.8)*	6.1	*(11.9)*	6.0	*(13.3)*	35.5	*(10.6)*	40.4	*(1.5)*
Burnley	30	27.6	*(1.0)*	38.2	*(1.3)*	36.8	*(1.9)*	31.9	*(1.7)*	30.6	*(1.0)*
Hull	30	39.7	*(1.2)*	45.5	*(1.4)*	46.4	*(1.6)*	43.9	*(1.5)*	42.7	*(1.3)*
Portsmouth	19	45.6	*(1.0)*	52.4	*(1.2)*	51.4	*(1.3)*	49.0	*(1.3)*	48.1	*(1.1)*

Bootstrap standard errors in parentheses, obtained from 200 simulations using independent parameter draws.