Economic Modelling 40 (2014) 12–20

Contents lists available at ScienceDirect

Economic Modelling

journal homepage: www.elsevier.com/locate/ecmod

Parity in professional sports when revenues are maximized☆

Burhan Biner

DePaul University, Department of Economics, 1 East Jackson Boulevard, Suite 6200, Chicago, IL 60604, United States

ARTICLE INFO

Article history:
Accepted 4 March 2014
Available online xxxx

JEL classification:
C13
C23
C34
L52
L83

Keywords:
Dominant team
Cartels
Censored regression
Heckman selection model
Random coefficients model

ABSTRACT

There are two major hypotheses regarding the talent distribution among the teams that would maximize the total revenues in a sports league; dominant teams versus parity. This paper examines the revenue structure of National Football League and proposes policy recommendations regarding talent distribution among the teams. By using a unique, rich data set on game day stadium attendance and TV ratings we are able to measure the total demand as a function of involved teams' talent levels. Reduced form regression results indicate that TV viewers are more interested in close games, on the other hand stadium attendees are more interested in home team's dominance, in other words stadium demand and TV demand work against each other. We therefore propose a policy that promotes slight parity among the teams where big market teams have a slight advantage over the others. Total revenues of the league are maximized under such policy.

1. Introduction

Professional sports leagues in North America are good examples of cartels. Most of them have some sort of exemption status from the laws of commerce that the rest of the economy has to abide by. They have a league governing body formed by the owners and players that plan and take care of the problems of the league. The league generates revenue through games and the revenue is shared between team owners and players. They are mostly free to adopt policies on governing the league as they wish. The league primarily wants to increase the total revenue made throughout the league in order to increase the salaries for players and profits for team owners. There are various actions available to the league including imposing a salary cap or revenue sharing.

There are two major hypotheses regarding how leagues use relative strength of teams to increase total revenues, player salaries and fan utility. The first is to follow the dominant team rule. Pick a few teams that have a revenue making advantage over the others and make sure that they have a stronger team ensuring that their fans will generate higher revenue. Major League Baseball, to some extent follows this, New York Yankees, Boston Red Sox, New York Mets and Chicago Cubs have clear advantage in revenue generation over other teams since they are in bigger cities. The second hypothesis is to distribute talent among the teams "evenly", ensuring a high level of competition and thereby attracting higher demand for the game.

In this paper we are going to empirically assess the superiority of these two hypotheses over each other for the National Football League.

Among all professional sports leagues the National Football League is by far the most lucrative sports league. In 2007, the NFL's annual revenues exceeded $7 billion. In 2010, the NFL's TV deals were $4 billion. In contrast, Major League Baseball generated revenues of just over $6 billion. Basketball and hockey lag far behind. The National Basketball Associations annual revenues stand at $3.3 billion. Bringing up the rear among the Big Four team sports leagues, the National Hockey League's revenues reach $2 billion annually. There are clearly certain things going right with the NFL. Popularity of the game has been increasing every passing year along with its revenue making potential. Clearly their policies are working for the league. They have been employing a salary cap rule along with revenue sharing due to a collective bargaining with the NFL Players Association since 1994. However, starting in 2010 some of the policies in the league has changed. The league started to bring back the free market rules to change the outlook in the game. Proponents of this idea claim that with free market rules, talent should be able to receive their worth even though there are opponents claiming that it may actually work the opposite.

This paper argues that in the NFL, TV audience in general likes to watch somewhat close games while fans attending the games like to see their teams dominate the other team. On average 66–70% of a team's revenue comes from national media deals. Since most of the revenue

☆ I would like to thank Ryan Rebholz of Pro Football Hall of Fame for helping me find the crucial TV data.

E-mail address: biner@umn.edu.

http://dx.doi.org/10.1016/j.econmod.2014.03.002
0264-9993/

comes from the media it's best to have a policy that advocates parity, yet favoring big market teams slightly more.

There is a rich literature in sports economics. In the first mathematical model of a professional sports league, El-Hodiri and Quirk,(1971), examine whether the current organization of professional team sports will lead to equalization of playing strengths. They develop a dynamic model involving the wages, revenues, trades, draft, skill level, and probability of winning a game. Profit maximization is not consistent with the equalization of playing strengths unless all teams are affected equally by a change in strength of one team in terms of gate receipts, or if the home team receives at least half of the gate receipts and all teams have the same revenue function. Additionally, to ensure equalization, there must be a constant supply of new playing skill and no cash sales. Equal strengths will converge regardless of the initial allocation of talent. Fewer teams and a quicker depreciation of talent will speed up the convergence process.

Biner (2013) argues that if one team acquires too much talent then that may impact the quality of the competition negatively and then develops a simple theoretical model to capture the effect of this externality on the revenue levels and wages when local fans care about winning only. He finds that due to externalities competitive market allocation is too equal compared to SPP allocation. He then shows that when local audience is mainly interested in seeing their local team dominating the visiting team and national audience only interested in watching a close game on TV, the only way in the model for it ever to be efficient to enforce parity is if we introduce a national TV market into the analysis. For the national TV market, parity is going to lead to a wider TV audience. The greater the weight on this revenue stream, the more likely it is a parity policy can increase league revenues.

Empirical papers in Sports Economics are mostly done with very limited data. This is usually due to a lack of useful team level game day data. Most of the empirical analysis is done for aggregate level data instead and usually done for a few years. The biggest problem is we don't have individual level data on consumers. The big elephant in the room is unobserved heterogeneity that's hard to touch due to lack of data at the individual level. Specifically it's hard to measure the “fanness” of consumers. In European sports leagues, people are more attached to their teams, in some cases cult like cultures exist. This is not really the case in the US. However, we still see that type of behavior for certain teams. Detroit Lions have been a losing team for quite some time, yet they have been playing to almost full stadium for most of their games. Whether this is due to fans' connection to their teams or some other reason is hard to guess.

Welki and Zlatoper (1994, 1999) analyzes the game day stadium attendance in NFL for 1991 season. In their paper they analyze the attendance in terms of ticket price, home team record, visiting team record, income level of home team population, temperature and some other dummy variables. Their Tobit analysis finds a clear bias for home team record which supports our hypothesis for game day attendance. However, their data is only for one season which raises doubts about the validity of the results. In their (1999) paper they analyze the games for 1986 and 1987 seasons. In that paper they use betting lines to measure how close a game is expected to be by the general audience. They find that fans do care about closeness of games and quality of the playing teams, especially home team.

Carney and Fenn (2004), on the other hand analyzes the TV ratings for NFL games in 2000 and 2001 seasons. In their analysis they find that closeness of the games matter by using winning records of opposing teams. Their results suggest evidence of race of coach, team success, and closeness of the contest as significant determinants of TV viewership. However their analysis relies on local TV ratings which is a relatively minor consideration for the general discussion since most of the revenue comes from national media deals.

There is no research done on NFL for the entire revenue scheme. Our analysis is done for both TV ratings and stadium attendance making it possible for us to come up with a better policy analysis. That's the main contribution of our paper to the literature along with optimal talent level recommendations that generates the maximum demand for the league. The TV rating data we use is at national level and game day attendance data is a very rich panel data that spans 14 years.

The rest of the paper proceeds as follows. Section 2 introduces the theoretical model. Section 3 describes the data used in the paper. In Section 4, we use reduced form regressions and random coefficient models for both sets of data to estimate demand and discuss the results. Section 5 concludes.

2. Model

This section first presents a simple theoretical model for sports demand both in terms of stadium attendance and TV ratings. The model we describe will be the actual demand equation we will use to estimate.

In general the audience cares about a game's potential characteristics such as how close the game will be, likelihood of their team winning the game, the week the game is played and other factors. We can represent the first two characteristics in terms of the talent levels of the teams. Let t_1 be the home team's talent level and t_2 be the visiting team's talent level. Probability of home team winning has to be positively correlated with home team's talent level. Without loss of generality assume that

$$Win_{1,2} = \left(\frac{t_1}{t_1 + t_2}\right)^{\alpha} \tag{1}$$

where $0 < \alpha < 1$. This assures us that probability of winning is an increasing and concave function of t_1. Probability of winning for the visiting team is defined similarly.

Closeness of the game has to be correlated with the talent difference of the teams. Without loss of generality assume that

$$Close_{1,2} = e^{\beta|t_1 - t_2|} \tag{2}$$

where $-1 \leq \beta < 0$.

The TV ratings for a particular game will be the product of winning probability and closeness. Similarly, stadium attendance will be a product of winning probability and closeness. Here, α is the elasticity of demand with respect to winning probability, and β is the elasticity of demand with respect to closeness.

We assume that there are two types of cities, big cities and small cities. In an environment like this it's normal to assume that team types are also correlated with the city types. Teams in big cities should be able to bring more demand and more revenue. Therefore we are going to assume that big city teams will have t_1 talent and small city teams have t_2 talent. This model is equivalent to the model where there is one big city team and one small city team facing each other certain percentages of times in each other's stadium. Without loss of generality we can assume that they face each other ω_1 times at the big city team's turf, and ω_2 times at the small city team's turf. We can assume that $\omega_1 + \omega_2 = 1$, moreover we will normalize the total talent to 1, $t_1 + t_2 = 1$. Even though total talent used by the league can be less than 1 we will assume that it will be binding. In other words, everyone in the talent pool will be employed.[1] Let the size of the big city be n_1 and the size of the small city be n_2.

Under these assumptions total demand for stadium attendance will be the sum of demand from small cities and large cities:

$$Att = n_1\omega_1\left(\frac{t_1}{t_1 + t_2}\right)^{\alpha_1}\left(\frac{t_2}{t_1 + t_2}\right)^{\alpha_2} e^{\beta_1|t_1 - t_2|} + n_2\omega_2\left(\frac{t_1}{t_1 + t_2}\right)^{\alpha_3}\left(\frac{t_2}{t_1 + t_2}\right)^{\alpha_4} e^{\beta_2|t_1 - t_2|}. \tag{3}$$

[1] Players have a union and one of the objectives of the union is to make sure every player is employed. Teams have to have number of players in their rosters to make sure that they can field a team for every game during the season. Every player that's in the pool at the beginning of the season will be allocated to a team.