Uncertainty of Outcome and Attendance: the Case of Japanese Baseball*

Koji Yashiki†

Abstract

This study investigates whether the competitive balance has an impact on the profit maximization in the professional baseball league in Japan. The literature shows that the competitive balance, which contributes to narrowing the gap in the performance among teams and players, is one of the main factors in determining the demand for sports, and documents that the payment system such as setting a ceiling on the salary of players and a redistribution system (Luxury Tax) balance the performance gap in many professional sports. Using the data over 60 years, we find that the competitive balance explains the number of the attendance in the Japanese professional baseball league. The result implies that balancing the performance gap can maximize the profit of the professional league. Furthermore, a time-series analysis reveals that the role of first-year player draft on the competitive balance. This suggests that a well-organized system further contributes to narrow the gap in the performance among teams.

JEL Classification: C32; L83; Z21; Z22 ; Z28

Keywords: baseball statistics; competitive balance; uncertainty of outcome hypothesis

*I am deeply grateful to Nippon Professional Baseball (NPB) who offered valuable comments.

†Yokohama City University, m195813c@yokohama-cu.ac.jp

1 Introduction

Competitive balance is considered one of the determinants of the demand for sports. The competitive balance makes the outcome uncertain in sports games and leagues. Rottenberg (1956) suggests that the fans lose interest in sports that have lost competitive balance and uncertainty of outcome.

In the field of sports management, there are discussions about the subject of consumption in sports. When sports is defined the same entertainment as movies and plays, there are difference features between sports and other entertainment. It means that the benefits that consumers will earn are undeterminable by watching sports (Matsuoka, 2010). There is not a play script or concert program in sports, and even players are unpredictable and uncontrollable. Still, there are many fans who are enthusiastic about sports. They are consuming the uncertainty of the outcome in sports. In other words, it can be thought that consumers are seeking excitement such as "I don't know which one will win" in watching sports.

An empirical analysis of the above discussion has been conducted for more than 60 years. The pioneering work is a study of Major League Baseball (MLB) by Rottenberg (1956). There, it is suggested that uncertainty of outcome increase the interest of fans, which leads to the profits of teams and leagues. Neal (1964) also suggests that the smaller the difference in the relative ranking of the two teams in the match, the more the fans are interested, and the number of attendances increases. Furthermore, it is suggested that the benefits of the competitive balance will spread not only to teams and leagues, but also to the press and related product industries.

These hypotheses are referred to as Uncertainty of Outcome Hypothesis (UOH) and discussed many times. However, many of them are studies on American baseball, football, and European football. And there are very few studies on UOH in Japanese sports. Yashiki et al. (2019) indicate that the study about Japanese professional sports is insufficient. Therefore, this study indicates empirical analysis about UOH of Nippon Professional Baseball (NPB).

2 Data

This study quantified competitive balance and fan interest using attendance and statistical data published by NPB. Following preceding studies, fan's interest is defined by the difference from the previous year in the number of attendances per game (Borland, 1992). Various indicators have been used in previous studies to measure competitive balance. This study adopts three indicators to quantify competitive balance.

The first indicator is standard deviation. The standard deviation of the winning percentage is used to measure competitive balance (Scully, 1989). The winning percentage of team t in period i is implied as $x_{i,t}$, and the average winning ratio in the league in period i is implied as $\bar{x}_t$. The average win rate in the league is $\bar{x}_t \coloneqq .500$ before 2005 when the interleague game was introduced.

$$SD_{\{winning\ percentage\}} = \sqrt{\frac{1}{n}\sum_{n=1}^{n}(x_{i,t} - \bar{x}_t)} \tag{1}$$

Next indicator is Gini index. The Gini index is a measure of economic inequality, and is used in studies about asset distribution and disparity (Schmidt, 2001). In this study, the number of wins in the league is assumed to be assets $y_{i,t}$. Competitive balance is measured by indicating in the Gini index how it is distributed to each team.

$$GINI_{\{win\}} = \frac{1}{2n^2\bar{y}}\sum_{i=1}^{n}\sum_{j=1}^{n}|y_{i,t} - y_{j,t}| \tag{2}$$

Final indicator is Herfindahl-Hirschman Index (HHI). HHI is an index that measures the level of market concentration, and can be obtained by summing the squared market share of each company in a certain industry (Depken, 1999). In this study, HHI is derived by considering the number of winning of championship in the past 10 years as $z_{i,t}$.

$$HHI_{\{champion\}} = \sum_{n=1}^{n} z_{i,t}^2 \tag{3}$$

The above are variables used to measure competitive balance. However, the standard deviation and Gini coefficient are reconsidered based on the discussion of preceding studies. Schmidt (2001) suggests that fans look forward to next year even if this season's results are disappointment. Therefore, it is argued that fans will not be interested in a year if the competitive balance is not maintained. Based on this, the standard deviation and Gini index for multiple years are newly adopted as variables.

Furthermore, we use the following variables that can affect the attendance. This discussion will proceed according to Bradbury (2019). It introduces determinants of team and league revenue. Therefore, following three variables are applied.

- Performance: Power of team. This study uses winning percentage.
- Market: The size of the market where the team is based. This study uses the population of prefecture where the team's stadium is located.
- Stadium: Attraction and capacity of the stadium. This study uses a dummy variable which equals 1 for the years when a new stadium or a large-scale renovation takes place.

Finally, sports is considered entertainment. Therefore, it will also be affected by watching costs and other macro factors. Therefore, the real price obtained by dividing the average ticket price by CPI is added as a variable.

3 Approach

This study analyzes the panel data. The model is as follows.

$$\Delta log(ATT_{i,t}) = \alpha + \beta Xi, t + \gamma \Delta log(ATT_{i,t-1}) + \lambda_k \sum_{k=1}^{k} x_{k,i,t} + \epsilon_{i,t} \tag{4}$$

ATT: Attendance, X: Variables indicating competitive balance, x: Control variable

References

Borland, Jef, and Jenny Lye (1992) Attendance at Australian Rules football: A panel study, *Applied Economics* 24, pp.1035–1058,

Bradbury, John Charles, (1992) Determinants of Revenue in Sports Leagues: an Emplical Assesment, *Economic Inquiry* 57, pp.121–140,

Depken II, Craig A., (1992) Free-Agency and the Competitiveness of Major League Baseball, *Review of Industrial Organization* 14, pp.205–217,

Matsuoka, Hirotaka, (2010) Reexamination of the Concept of Sport Management, *Japanese Journal of Sport Management* 2, pp.33–45,

Neal, Walter C., (1964) The Peculiar Economics of Professional Sports, *Quarterly Journal of Economics* 78, pp.1–14,

Rottenberg, Simon, (1956) The baseball players' labor market, *journal of political economy* 3, pp.242–258,

Schmidt, Martin B., and David J. Berri (1956) Competitive Balance and Attendance: The Case of Major League Baseball, *Journal of Sports Economics* 2, pp.145–167,

Scully, Gerald W., (1989) The Business of Major League Baseball, *Chicago, IL: University of Chicago Press.*

Yashiki, Koji, Takuya Iinuma, and Yoshiyuki Nakazono (2019) Moneyball Revisited: An Economic Evaluation of Performance and Wage in the Japanese Case, mimeo.

Table 1: Summary Statistics

	ATTENDANCE	WPC	WIN	LOSE	DROW	SD	SD_3	SD_5	GINI	HHI
Mean	20714	0.500	65	65	5	0.082	0.078	0.077	0.082	42
Median	18883	0.504	65	65	4	0.078	0.078	0.077	0.079	36
Maximum	54552	0.713	94	103	19	0.162	0.142	0.126	0.163	82
Minimum	2777	0.238	29	37	0	0.021	0.045	0.048	0.020	22
Std. Dev.	11538	0.080	10.9	11.1	3.7	0.028	0.019	0.014	0.029	15
Observations	768	762	762	762	762	762	738	714	762	556