

Structural changes and competitive balance in the Korean professional baseball league

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Abstract

The purpose of this study was to examine the effect of structural changes on competitive balance in the Korean Professional Baseball League (KPBL). The study used standard deviation of winning percentages (SDWP) and Gini coefficient to measure competitive balance in the KPBL. Both measures were used as dependent variables in the model. The independent variables were the effect of free agency, amateur draft, the introduction of foreign players, a number of games in a regular season, and short-term shock due to an expansion of the league. The data consist of all regular seasons in the KPBL (1982-2016). The results of this study showed that only free agency and the number of games each team plays in a regular season were statistically significant in both SDWP and Gini models. The study found a significant decrease in standard deviation of winning percentages (SDWP) and Gini coefficient after the introduction of free agency in the KPBL. Also, competitive balance was increased as the number of games each team plays increase. However, this study did not find other structural changes to affect competitive balance in the KPBL. It may be due to the limited number of sample size based on the relatively short history of the KPBL(35 years). Since competitive balance is important for both the sport league and sport fans, baseball teams and the league should focus on maintaining and improving competitive balance in the KPBL.

Key words: competitive balance, Korean professional baseball league, free agency, structural changes, draft

Introduction

Since Rottenberg (1956) proposed his seminal paper, entitled to "The baseball players' labor market", competitive balance has been considered as a central topic in the literature of sport economics. Competitive balance can be

understood as the degree of equality of the playing strength of sport teams (Owen, Ryan, & Weatherston, 2007) or "every well-run club has a regularly recurring reasonable hope of reaching postseason play" (Levin, Mitchell, Volcker, & Will, 2000, p.6). Thus, it is argued that the concept of competitive balance is related to the uncertainty of outcome in sport leagues (Fort & Maxcy, 2003). It means that it is very difficult to predict the outcome of a sport game in both a regular season and a

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post-season game if each team has equal or similar capability in a sport league (El-Hodiri & Quirk, 1971). Therefore, if a sport league is perfectly balanced, the winning potential of each team is same as .5 so that the prediction of the outcome of a sport event is almost impossible.

Since competitive balance affects the uncertainty of outcome in a sport league, both competitive balance and the uncertainty of outcome affect attendance demands of sport fans (Fort & Maxcy, 2003). Many researchers found that competitive imbalance in the Major League Baseball (MLB) had a negative impact on the attendance demand of fans and financial viability of professional sport teams and leagues under the assumption of the uncertainty of outcome, because sport fans can easily predict the outcome of a game due to the unbalanced team capability (Depken, 1999; Eckard, 2001; Humpreys, 2002). If a sport league is not well balanced, an outcome of a game can be easily predicted and fans may lose their interests in the game and also the league. Ultimately, it may lead the decline of the attendance (Schmidt & Berri, 2001). Rascher(1999) demonstrated that fans prefer to see the home team's probability of winning is 0.55. It suggested that a home team with a high probability of winning a game will see a decline in the fan attendance, indicating that uncertainty of outcome is an important determinant of demand. Eckard(2001) argued that imbalance of a sufficient level in competitive balance may drive the demand actually for professional sport leagues down. Sport fans continuously support their favorite teams with a hope that their teams will advance to the postseason games and finally win the championship. However, there is no the strong and the weak in sport permanently because of various factors such as injuries, the advent of new star players and rookies. Particularly, the uncertainty of outcome is very important for sport fans and consumers because it was identified as one of the most important motives for sport consumers and fans to attend and consume a sporting event (Funk, Mahony, & Ridinger, 2002; Funk, Ridinger, & Moorman, 2003; Trail & James, 2001). From the perspectives of sport league officials and administrators, maintaining and

promoting competitive balance of a sport league are critical in order to increase the sport fan base and maximize the attendance demand and the revenue of the sport league (Rohm, Chatterjee, & Habibullar, 2004).

Since Rottenberg's(1956) paper, many researchers addressed the issues of competitive balance in the North American professional sport leagues including Major League Baseball (Butler, 1995; Depken, 1999; Eckard, 2001; Fishman, 2003; Humpreys, 2002; Lee, 2010; Miller, 2007; Schmidt & Berri, 2002; Soebbing, 2010), National Basketball Association (Berri, Schmidt, & Brook, 2004; Guerra, Gonzalez, Manso, & Rodriguez, 2016; Longley & Lacey, 2012; Maxcy & Mondello, 2006), National Football League (Bowman, Lambrinos, & Ashman, 2012; Caporale & Collier, 2015; Larsen, Fenn, & Spenner, 2006; Lenten, 2015; Maxcy & Mondello, 2006), and National Hockey League (Maxcy & Mondello, 2006). Recently, researches on competitive balance have focused on various sport leagues and events in the world such as grand-slam tennis (Corral, 2009), NCAA Division I Basketball (Mills & Salaga, 2015), English Premier League (Sass, 2016), Spanish professional basketball (Guerra, Gonzalez, Manso, & Rodriguez, 2016), French soccer league (Terrien, Scelles, & Durand, 2016), Portuguese soccer league (Mourao & Cima, 2015), and Commonwealth Games (Ramchandani & Wilson, 2014). However, there are a few researches in competitive balance of Korean professional sport leagues (Cha, Kim, Kim, & Yoon, 2014; Jeong & Koh, 2012; Lee, 2002; Oh, Han, & Choi, 2014). Baseball is a very popular sport in East Asia including Japan, Korea, and Chinese Taipei and the Korean professional baseball league (KPBL) is the most popular professional sport league in Korea. In addition, KPBL has the longest history (36 years) among four major professional team sport leagues in Korea including baseball, soccer, basketball, and volleyball. Since time-series data are required in order to examine competitive balance in a sport league, the KPBL is appropriate for the study. Also, it was observed that a certain team such as Kia Tigers and Samsung Lions continuously win the championships for a certain period in the KPBL history while certain teams

have not advanced to the postseason play for a long time. It means that KPBL may be competitive imbalanced and thus it is necessary to examine competitive balance in the KPBL. Therefore, the purpose of this study is to examine how structural changes influence competitive balance in the Korea Professional Baseball League (KPBL).

THE KOREAN PROFESSIONAL BASEBALL LEAGUE (KPBL)

The Korean Professional Baseball League (KPBL) was established in 1982 with six teams and each team played 80 games in a regular season. Four additional teams joined in the KPBL in 1986, 1990, 2013, and 2015. Each team had played 133 games in a regular season until the 2012 season but each team played 128 games in the 2013 season because the NC Dinos joined in the KPBL. Now each team plays 144 games with 10 teams in the KPBL. After the regular season, five teams play in the postseason. The pennant race winner advances to the championship directly, which is a best-of-seven series for the national championship, called "Korean Series". The second ranked goes to the playoff, which is a best-of-five series with the winner of a semi-playoff between the third and the winner of a wild card game. The fourth ranked goes to the wild card game, which is the maximum two games with fifth ranked team in the regular season. If fourth ranked wins or ties at least one game, the team advances to the semi-playoff. Only if the fifth ranked team wins two games, the team advances to the semi-playoff.

After KBO's (Korea Baseball Organization) brand identity has been integrated into the KBO League, the KPBL is officially named KBO League in 2015. According to the KPBL (2017), the overall attendance of the KPBL in 2016 was over 8.33 million which was the largest number in the KPBL history because of the increase of the total number of games based on the expansion of the league. Recently, two new teams, Changwon NC Dinos established in 2011 and kt wiz established in 2013 joined in the KPBL in the 2013 and 2015 season, respectively. Many experts anticipated that

new teams might be the last standing team in the KPBL for the first couple seasons and it would influence competitive balance of the KPBL negatively because of the limited experience of players in the new team. Surprisingly, the Dinos finished their first season as the seventh ranked team out of nine teams with the winning percentages of .419 and advanced to the postseason in 2014, 2015, and 2016 seasons. However, kt wiz was ranked in the last place for 2015 and 2016 seasons consecutively as expected.

Now, the KPBL has a history of thirty-six years since 1982 and it is the most popular professional sport league in Korea. During that period, the KPBL had introduced a series of new systems to promote the quality of the league and to enhance the competitive balance of the league. Firstly, the reverse-order amateur draft was introduced in 1987. Secondly, foreign players were introduced to the league in 1998 and each team can have two foreign players. From 2014 each team can have three players but only two players can play at the game and one of them should be a field player. Thirdly, free agency was introduced in 1999. Lastly, a number of games each team play in a regular season have been increased after the KPBL has been expanded. Six teams play 80 games in the first regular season and then ten teams play 144 games now.

Review of Literature

Previous studies have identified various factors affecting competitive balance in a professional sport league such as free agency (Butler, 1999; Depken, 1999; Eckard, 2001; Fishman, 2003; Maxcy & Mondello, 2006), draft of amateur players (Butler, 1999; Grier & Tollison, 1994), market size (Schmidt & Berri, 2002), expansion (Fort & Lee, 2007; Lee & Fort, 2005), foreign players (Fenn, Allmen, Brook, & Preissing, 2005; Lee & Fort, 2005; Schmidt & Berri, 2003), luxury tax (Ajilore, 2005), salary cap (Kesenne, 2000), and revenue sharing (Kesenne, 2005; 2006; Miller, 2007; Szymanski & Kesenne, 2004). However, some factors such as salary cap and luxury tax

cannot be applied to examine if they influence competitive balance in the KPBL because those systems were not yet introduced in the KPBL. It is necessary to look at each factor which can be applied to competitive balance in the KPBL. The following section provides a more detailed discussion of structural changes which may influence competitive balance in the KPBL.

First, many scholars have examined the effect of free agency on competitive balance in professional sport leagues. The reserve clause refers to the system that allowed teams to retain a player's rights indefinitely (Balfour & Porter, 1991). Owners argued that free agency would lead to league domination by teams with the largest markets, destroying competitive balance in the sport league. For example, large market teams such as New York Yankees and Los Angeles Dodgers can buy more players with high performance. However, Coasian logic would suggest that player allocation would not be affected by free agency and the basic agreement introduced free agency to the MLB in 1976 (Fishman, 2003). Since Rottenberg's invariance principle(1956) proposed that the introduction of free agency would not affect competitive balance, several empirical studies examined the impact of free agency on competitive balance in the MLB. Scully(1989) found some evidences of an increase in competitive balance in the National League (NL) but no support for a change in the American League (AL). On the other hand, Depken(1999) found that free agency adversely affected competitive balance in the AL but no significant influence in the NL. Eckard(2001) found the introduction of free agency improved competitive balance in the MLB. Vrooman(1995) concluded that free agency in the MLB may lead moderate competitive balance, although large market teams can have a clear revenue advantage for free agency based on the general theory, which argued that "the evidence points to the conclusion that the rules structure of professional sports is relatively ineffective in balancing playing strengths, and that the imbalance is due to the differences in the drawing potentials of franchises" (Quirk & El Hodiri, 1974, p.58). On the other hand, Fishman(2003) concluded that free agency had a negative effect on

competitive balance in the MLB. Maxcy and Mondello(2006) examined the effect of free agency on competitive balance in North American professional team sports leagues and concluded that competitive balance in the National Football League(NFL) and the National Hockey League(NHL) had been improved but competitive balance in the National Basketball Association(NBA) had decreased since the introduction of free agency. Thus, previous studies showed the evidence which the introduction of free agency had an impact on competitive balance of a sport league.

Second, amateur draft can be a good factor to influence competitive balance in a sport league. It was found that amateur draft significantly influence competitive balance in the National Football League (Grier & Tollison, 1994; Larsenm Fenn, & Spenner, 2006; Maxcy & Mondello, 2006), National Basketball Association, National Hockey League (Maxcy & Mondello) and Major League Baseball (Butler, 1994). While amateur draft promoted competitive balance in the NFL and the MLB, it was not significantly related to competitive balance in the NHL (Maxcy & Mondello). The finding from Maxcy and Mondello supports the Coarse theorem in which changes in player property rights should not influence competitive balance(Fenn, Allmen, Brook, & Preissing, 2005). In 1987, the KPBL introduced reverse-order amateur draft, in which the worst ranked team in the previous season has the priority to pick a rookie in the draft. Although the influences of amateur draft on competitive balance are different based on a sport league, it is clear that amateur draft for the distribution of talent players to teams in a sport league should have a positive impact on competitive balance in a sport league. Thus, it might help to resolve the imbalance in the league.

Third, foreign players may influence competitive balance in a sport league. In 1947, Jackie Robinson of the Brooklyn Dodgers changed the racial composition of the MLB because he was the first African American player in the MLB. After 1947, teams in the MLB realized that a global search for talent was necessary in the teams wished to remain competitive. Globalization of a sport league is now evident. A lot of players in the MLB are from

Dominican Republic, Puerto Rico, Venezuela, Cuba, Mexico, Japan, and Korea. Also, many international players joined in the NBA, the NHL, the Major League Soccer(MLS), and the English Premier League(EPL). A 29.8 percent of the MLB rosters on the opening day of the 2017 season were foreign-born players (Associated Press, 2017). Schmidt and Berri (2003) examined both the impact of league institutions as well as the Gould hypothesis, which asserts that the distribution of wins in the MLB is primarily a function of size of the underlying population of talent. According to Berri, Brook, Frick, Fenn, and Vicente-Mayoral(2005), NBA showed competitive imbalance because of the short supply of tall people. NBA announced 113 international players from 41 countries were included on the opening rosters for the 2016-17 season (NBA.com, 2017). It means NBA pursues competitive balance by recruiting international players. Fort and Lee(2007) showed competitive balances in the NBA and the NHL were enhanced after European players joined in the leagues. The institution of foreign players was introduced to the KPBL in 1998 and each team can have two foreign players. Recently, some foreign players who joined in the KPBL had played in the MLB and some of them can come back to the MLB or go to the Japanese Professional Baseball League after several seasons in the KPBL based on their performance. Foreign players in the KPBL were expected to show a higher level of performance and to enhance the quality of the league through the spilt-over effect, with which domestic players could learn the advanced skills from them. Thus, it is assumed that the institution of foreign players in the KPBL may extend the labor pool and then it can influence competitive balance positively.

Professional sport leagues have expanded several times and there are some reasons why expansion of a sport league may influence competitive balance. Schmidt (2001) argued that there is intense pressure for the new teams to become competitive quickly while fans do not expect they are competitive in their first season. The incentive to develop young talented players and new facilities that new teams generally need to work with may lead to increase the competitiveness of teams. Thus, he found expansion of

the MLB caused the increase of competitive balance in the MLB. On the other hand, Lee and Fort (2005) argued that expansion is generally considered to reduce competitive balance in a sport league because new teams are generally weak. However, they found expansions in the National League (NL) showed decrease in competitive balance but expansions in the American League (AL) showed the unusual increase in competitive balance. Additionally, Fort and Lee (2007) found expansion in the NBA caused decrease in competitive balance but Schmidt (2001) found greater competitive balance after expansions in the MLB. Horowitz (1997) noted that expansions may reduce competitive balance in the short-term but enhance competitive balance in the long-term. Expansion and the number of games each team plays are significantly associated. While the KPBL began with six teams which play 80 games in the first regular season, now ten teams play 144 games in a regular season due to expansions. A number of games each team plays in a regular season may influence competitive balance in a sport league. More games between teams in a regular season can give opportunities to understand and analyze its opponents. Then, each team might implement better strategies to win as teams play the greater number of games each other. Since it is clear that expansions in a sport league may influence competitive balance positively or negatively and a number of games are related to expansions in a sport league, it is assumed that expansions and a number of games have an impact on competitive balance in the KPBL. Based on the review of literature, the purpose of this study was to examine the effects of structural changes on competitive balance in the KPBL.

Methods

Model and Data

There are various methods to measure competitive balance in a sport league including the standard deviation of winning percentages (SDWP) (Balfour & Porter, 1991;

Butler, 1995; Fort & Quirk, 1995; Humphreys, 2002; Maxcy, 2002; Quirk & Fort, 1992), Herfindahl-Hirschman Index (HHI) type concentration of winning percent of the teams at the top or bottom of the standing (Eckard, 2001; Humphreys, 2002), Gini coefficient of winning percents (Schmidt, 2001; Schmidt & Berri, 2001), competitive balance ratio (CBR) (Humphreys, 2002), Markov process (Hadley, Ciecka, & Krautmann, 2005), ANOVA-based measure (Eckard, 2001), index of dissimilarity (Mizak & Stair, 2004), and the relative-entropy measure of information theory (Horowitz, 1997). Each method has its own strengths and weaknesses to measure dynamic aspects of competitive balance in team sport leagues. Since the analysis of the distribution of wins within a sport league is theoretically similar to the analysis of the distribution of income within a population (Schmidt & Berri, 2001), the Gini coefficient is a common unit of measurement where questions of inequality are central. The strength of the Gini coefficient is that it possesses a defined range, with 0 which indicates perfect equality and 1 indicates perfect inequality. Thus, a coefficient of 0 would show perfect equality which means each team won 50% of its games, that is, where wins are evenly distributed. The larger the Gini coefficient, the lower the degree of competitive balance in a sport league. The most widely used measure of competitive balance in sports leagues is the standard deviation of winning percentages (SDWP). The strength of this measure is particularly easy to calculate and therefore convenient. The index is useful for comparing competitive balance in a professional sport league with that of college sport or other professional sport leagues because it has intuitive appeal and it is used extensively in competitive balance literature on professional sports and college sports (Baird, 2004). Based on the notion that the standard deviation of winning percentages (SDWP) and the Gini coefficient are the most commonly used measures of competitive balance, both measures are applied in the current study. Since this study aims to examine the effect of structural changes on competitive balance in the KPBL, two regression models employ five independent variables including the effect of free agency, the reverse-order

amateur draft, the introduction of foreign player, the number of games between teams in a regular season, and the short-term shock due to expansion to capture the systematic changes of the KPBL and each measure of competitive balance such as SDWP and the Gini coefficient was used as the dependent variable in each regression model. The data consist of all regular seasons in the KPBL (1982-2016).

According to Rottenberg's invariance principle (1956), the introduction of free agency would have no effect on competitive balance which implies zero coefficient statistically. The institution of free agency was introduced to the KPBL in 1999. The number of players who declared free agency in last year, FA is included as an independent variable to analyze the effect of free agency on competitive balance. In 1987, KPBL introduced reverse-order amateur draft, in which the worst team in last year has the priority to pick a player in the draft. In order to capture the effect of the draft, the model includes DRAFT as a dummy variable. The expected sign of coefficient is negative. In 1998 the institution of foreign player was introduced to the KPBL. In order to capture the impact of the foreign player system on competitive balance, FPLAYER is included as a dummy variable that is equal to one for years when there was the foreign player system. A dummy variable, EXPAN, is added to the model to measure the effect of expansion of the KPBL. The KPBL began with six teams in 1982 and four additional teams joined in the KPBL in 1986, 1990, 2013, and 2015. As the KPBL was expanded with new teams, the number of games between teams in a regular season was increased. Thus, this model employs NGBT which is the number of games between teams to measure the effect of NGBT. If a total number of games in the league increase relative to last year, the variable has the value of 1. Thus, the expected value of the NGBT coefficient is negative. Ordinary least squares (OLS) models were developed.

The model to estimate the effect of independent variables is as follow:

$$SDWP_i = f(FA_i, NFRAG_i, DRAFT_i, FPLAYER_i, EXPAN_i, EXPAN_{i-1}, NGBT_i) \quad (1)$$

$$GINI_i = f(FA_i, NFRAG_i, DRAFT_i, FPLAYER_i, EXPAN_i, EXPAN_{i-1}, NGBT_i) \quad (2)$$

Where: SDWP_i = Standard deviation of winning percentages in year_i

GINI_i = Gini-coefficient in year_i

FA_i = Dummy variable equal to 1 for the presence of free agency

NFRAG_i = Number of players who signed as free agency in year_i

DRAFT_i = Dummy variable equal to 1 for the presence of amateur draft

FPLAYER_i = Dummy variable equal to 1 for the presence of foreign players

EXPAN_i = Dummy variable equal to 1 if KPBL expanded in year_i

EXPAN_{i-1} = Dummy variable equal to 1 if KPBL expanded in year_{i-1}

NGBT_i = Number of games between two teams in year_i

The NFRAG variable accounts for the effect of free agency on competitive balance. The DRAFT variable controls for the reverse-order amateur draft. The FPLAYER variable controls for the presence of foreign players. EXPAN1, EXPAN2, EXPAN3, EXPAN4 are dummy variables which control for the short term effect of league expansions on competitive balance because the KPBL began with six teams and now ten teams. The NGBT accounts for the number of games between teams in a single season.

Results

The results for the KPBL showed that two structural changes including free agency and the number of games each team plays in a regular season were significant in both SDWP and Gini regression models. Since this study used the time series data from 1982 to 2016, it was necessary to verify the stability of the data. If there was a trend or nonstochastic process in the data, the problem of

spurious regression could occur. Therefore, unit root test was required. The Augmented Dickey-Fuller (ADF) test was utilized to determine the presence of unit root (Fuller, 1996). The results were shown in Table 1. ADF statistics of both measures of the SDWP and the Gini were significant. Durbin-Watson test was used to see if autocorrelation exists. D-W statistics for both measures were very close to '2', which means that there was no autocorrelation (Cohen, Cohen, West, & Aiken, 2003).

Table 1. Result of ADF test and D-W test

Measures	ADF test statistic		DW statistic
	t	p	
SDWP	-8.661	.000	2.219
Gini	-9.173	.000	2.211

Table 2 shows descriptive statistics for the SDWP and the Gini coefficient measures. It can be seen that two measures of the SDWP and the Gini were almost same although the values of Gini coefficient were slightly higher than those of SDWP. In 1982, the first year of the KBO league, both measures had the maximum values. SDWP recorded the minimum value in 1983 when the amateur draft system was introduced. The second lowest value of SDWP (.052) recorded in 2001 when the Gini coefficient recorded the minimum value of .053. The standard deviations showed that volatility of the Gini coefficient was larger than that of the SDWP.

Table 2. Descriptive statistics of competitive balance measures

Statistic	SDWP	Gini
Sample Size	35 (1982-2016)	35 (1982-2016)
Mean	.086	.093
Median	.083	.090
Maximum	.176	.196
Minimum	.051	.053
Standard Deviation.	.026	.027

Figure 1 illustrates the movement of two measures of competitive balance over time. Both measures were up and

down around the average value without showing any upward or downward trend. However, the magnitude of change has been decreasing. Standard deviations of both measures after 2004 were less than half of those over the preceding two decades.

The study found a significant decrease in the standard

deviation of winning percentages (SDWP) and the Gini coefficient after the introduction of free agency in the KPBL. Thus, competitive balance was improved after the introduction of free agency. In addition, the results indicated that the number of games between teams in a regular season affected competitive balance. As a result, it might lead to the increase of uncertainty of outcome.

Figure 1. Competitive balance Measures of KBO league, 1982 to 2016

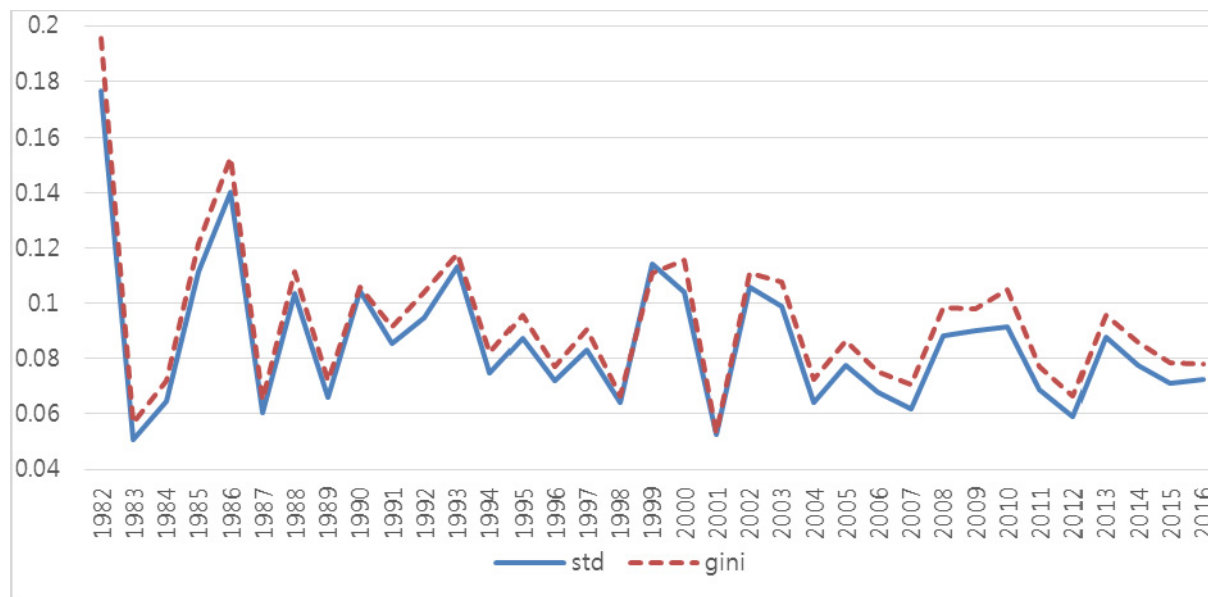


Table 3. Regression explaining competitive balance in the KPBL

Variables	Model 1 (SDWP)		Model 2 (Gini)	
	OLS	M-estimation	OLS	M-estimation
Constant	.283***(3.06)	.278***(3.58)	.298***(3.33)	.294***(3.82)
Free Agency (NFRAG)	-.002**(-2.07)	-.002*(1.83)	-.002*(-1.89)	-.002(1.64)
Amateur Draft (DRAF)	-.028(-1.49)	-.028(-1.53)	-.029(-1.57)	-.034(-1.52)
Foreign Players(FPLAYER)	.009(.72)	.009(.66)	.009(.71)	.009(.63)
Expansion(EXPAN)	-.01(1.04)	-.01(1.09)	-.009(.92)	-.008(-.96)
Number of Games(NGBT)	-.01*(-1.92)	-.01**(-2.05)	-.001**(-2.13)	-.009*(-2.22)
R-square()	.337	-	.333	-

Note: t-statistics are shown in parentheses

* Significant differences for ***p \leq .01, **p \leq .05, *p \leq .1

The results showed that the estimated coefficient of NFRAG was $-.002$ ($p=.049$) in the SDWP model and it was statistically significant at .05 level. The estimated coefficient of NFRAG was $-.002$ ($p=.069$) in the Gini model. It means that the introduction of free agency, statistically, had a significant effect on competitive balance in the KPBL.

The coefficients of the DRAFT variable were $-.028$ ($p=.148$) in the SDWP model and -0.029 ($p=.128$) in the Gini model and they were not significant at the 5 percent level. The negative estimated coefficients mean that standard deviation of winning percentages (SDWP) and the Gini coefficient decreased after introducing the reverse-order amateur draft system to the KPBL. However, it cannot be concluded that the amateur draft system positively influence competitive balance in the KPBL because it was not statistically significant.

The FPLAYER variable's coefficients were $.009$ ($p=.477$) in the SDWP model and $.009$ ($p=.486$) in the Gini model and they were statistically insignificant. Thus, the results indicated that foreign players did not have an impact on competitive balance in the KPBL.

The coefficients of EXPANi-1 variable were $-.01$ ($p=.305$) in the SDWP model and $-.009$ ($p=.366$) in the Gini model but they were statistically not significant. It showed that expansions of the league did not influence competitive balance in the KPBL.

The estimated coefficients of the NGBT variable were $-.01$ ($p=.065$) in the SDWP model and $-.001$ ($p=.042$) in the Gini model. It was consistent with its expected sign of the estimated coefficient. It showed that the number of games teams play in a regular season significantly and positively influenced on competitive balance in the KPBL.

Robust approaches refer to "a family of techniques that use alternatives to the ordinary least squares (OLS) method to estimate the regression coefficients" (Cohen, Cohen, West, & Aiken, 2003, p.417). One alternative estimator is M-estimation, (Huber, 1981) which uses a variant of weighted least squares regression and it can provide better results than OLS when cases with high discrepancy (Cohen, Cohen, West, & Aiken). Thus, M-estimation was

performed to check robustness. M-estimation also produced similar results of OLS. Only NGBT(number of games) and NFRAG(free agency) had an impact on competitive balance in the KPBL. In the SDWP model, the estimated coefficient of NGBT was $-.01$ ($p<.05$) with a p-value of .04 and the estimated coefficient of NFRAG was $-.002$ ($p=.06$). In the Gini model, the estimated coefficient of NGBT was $-.01$ ($p<.05$) with a p-value of .03 and the estimated coefficient of NFRAG was $-.002$ ($p=.107$). Other variables including foreign players, amateur draft, and expansions were not statistically significant and thus they had no impact on competitive balance in the KPBL.

Discussion

Theoretical implication

This study examined the relationship between structural changes and competitive balance in the KPBL and competitive balance was measured in terms of SDWP and Gini-coefficient. However, it was found that only two structural changes significantly influenced competitive balance in the KPBL. With regards to the institution of free agency, the study attempted to test if Rottenberg's invariance principle (1956) was supported in the KPBL. According to Fort (2006), invariance principle refers to "the distribution of talent in a league is invariant to who gets the revenues generated by the players; talent moves to its highest valued use in the league whether player or owners receive(the revenues the player generates)" (p. 272). The study showed a statistically significant change in the standard deviation of winning percentages(SDWP) and Gini coefficient in the KPBL. Thus, it suggested free agency had a significant effect on competitive balance in the KPBL and the invariance principle was not supported in the case of the KPBL. It supported Oh and Han's study(2014) which found the free agency system had a positive impact on improving competitive balance in the KPBL. While Horowitz's study (1997) in the MLB supported the invariance principle but Eckard(2001) and

Vrooman(1995) found the introduction of free agency improved competitive balance in the MLB. Additionally, free agency improved competitive balance in the NFL and the NHL(Maxcy & Mondello, 2006). It is possible to explain the reason why the invariance principle was not supported in the KPBL was the free agency system in the KPBL. The free agency system in the KPBL is not free but complicated. When a team signs a contract with a free agent, the team should pay 450% of his salary of last year or pay 300% of his salary of last year with one player as indemnification. This difficult condition limits free agent players move to other teams but it makes a few free agency deals which help to improve competitive balance in the KPBL. In order to promote the free agent market, the KPBL should change the rule for the free agency to eliminate or relax the indemnification.

Practical implication

The result indicated that the reverse-order amateur draft was not influential in competitive balance in the KPBL. Since the coefficients on DRAFT were negative, it is assumed that amateur draft might have a positive impact on competitive balance in the KPBL. However, it cannot be concluded that the amateur draft system positively influence competitive balance in the KPBL because it was not statistically significant. It supported previous studies in the MLB (Butler, 1995; Fishman, 2003), which showed the coefficient on DRAFT was negative, but was insignificant. Thus, it was concluded that the amateur draft did not have an impact on competitive balance although it was assumed by intuition that the amateur draft had a negative impact on standard deviation of winning percentages (SDWP) and the Gini coefficient and thus a positive impact on competitive balance in the KPBL. It may be due to inexperience of rookies because only a few rookies can be included on the roster at their first season and a few of them can play in the season. Since many of them showed their talents and skills they have after adapting to the professional baseball league, the amateur draft might not have an immediate impact on competitive balance in the

league.

The study failed to find the effect of foreign players on competitive balance in the KPBL. The institution of foreign players was introduced to the KPBL in order to improve the quality of the league and to stimulate the competition since 1998. Each team can have two foreign players in 1998. From 2014 each team can have three players but only two of them can play at the game and one of them should be a positional player rather than a pitcher. Also, the new teams such as NC Dinos and kt wiz were allowed to have one more foreign player until their second season. Foreign players were expected to show a higher level of performance than domestic players and to solve the imbalance problem in the KPBL. However, the results showed the introduction of foreign players to the KPBL did not improve competitive balance. It may be explained that many foreign players failed adapting to new environments in the KPBL including cultural differences, baseball styles of a team (e.g., big ball vs. small ball), and different strike zone, even though some foreign players showed better performance than domestic players. Depending on their ability to adaptating to the new environment, the KPBL, their levels of performance totally vary. Some showed higher performance and made some personal titles such as number of hit, batting average, homerun, ERA(earned run average), strikeouts, and winning while others were terminated during the season and substituted by the others. Since the coefficients on FPLAYER were positive, it could be assumed that the institution of foreign players might have a negative impact on competitive balance although it was not statistically significant. However, it is concluded that the institution of foreign player should not have an impact on competitive balance in the KPBL based on the results. It can be explained that foreign players may play an important role for their teams in 1998 and 1999 seasons in terms of competitive balance but it is difficult to measure independent effect of the foreign players on competitive balance because the free agency system was introduced in 2000. Thus, the introduction of foreign players to the KPBL had no impact on competitive balance in the KPBL.

Generally, expansion may decrease competitive balance in a sport league because new team is not competitive (Lee & Fort, 2005). In fact, the KPBL expanded four times. The first expansion was 1986 and the standing of a new team (Eagles) was 7th out of 7 teams with 0.29 winning percentages. Second new team (Ssangbangwool Raiders) was formed in 1991 and ranked in 7th out of 8 teams. Third new team (NC Dinos) was established in 2013 and ranked in 7th out of 9 teams. Fourth team (kt wiz) was joined in 2015 and ranked in 10th out of 10 teams. Based on the fact which indicated new teams were not competitive in their first season, it is assumed that expansion had a negative impact on competitive balance in the KPBL. However, it was said that expansion was not influential in competitive balance in the KPBL based on the results. Fort and Lee (2007) argued that the influx of international players in sport leagues might offset the negative effect of expansions in the NBA while widening the labor pool in a sport league such as the influx of international talented players should enhance competitive balance (Schmidt & Berri, 2003). New teams had two draft picks at the first round of the amateur draft and five draft picks after the second round. In addition, they were allowed to pick other teams' one player who was excluded from the 20 player roster of a team in order to be competitive quickly. After the introduction of foreign players, NC Dinos and kt wiz were allowed to have four foreign players for their first two seasons. All these efforts may help new teams to be competitive quickly and expansion did not have an impact on competitive balance. On the other hand, the study found the number of games between two teams in a regular season had a positive impact on competitive balance in the KPBL. The greater number of games between two teams, the more opportunities to understand an opponent and to prepare a better strategy for win. It may lead the percentages of winning between two teams to converge to 0.5. This inference was supported by the model of competitive balance in the KPBL.

Limitations and future research

The purpose of the study was to examine the effect of structural changes on competitive balance in the KPBL. Competitive balance was measured in terms of SDWP and Gini-coefficient and the study found only two systematic changes such as the free agency and the number of games to influence competitive balance in the KPBL. It may be due to the limited number of sample size. Since the KPBL has relatively short history (35 years), the sample size is limited. The limited sample size may cause to fail finding significant systematic changes to influence competitive balance in the KPBL. Since the current study used SDWP and the Gini to measure competitive balance, it is recommended that future research should use other methods such as Hirfindahl-Hirschman Indexes (HHIs), the competitive balance ratio (CBR), Lorenz Curves, the adjusted Gini coefficient, and the ratio of actual to idealized standard deviation (RSD) to measure competitive balance in the KPBL. The different methods to measure competitive balance may result in different findings from this study.

Since competitive balance is important for both a sport league and sport fans, teams and the league should make an effort to maintain and promote competitive balance in KPBL by introducing other institutions such as salary cap, luxury tax, and revenue sharing in order to capture attendance demand of fans and make the financial success. In addition, future research should examine the relationship between market size and competitive balance, payroll and performance disparity, home advantages and competitive balance, and competitive balance and attendance in the KPBL with regard to competitive balance research. Competitive balance in other professional team sport leagues in Korea such as soccer, basketball, and volleyball should be examined in the future.

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