

# A LEVEL PLAYING FIELD: COMPETITIVE BALANCE IN THE NORTHWOODS LEAGUE

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## ABSTRACT

*The Northwoods league, a summer collegiate baseball league in the US Midwest, has long been thought to show strong competitive balance. The players are unpaid and can only play while maintaining college eligibility so that inter-team competitiveness should be high as teams cannot “buy” talent. We examine several measures of competitive balance to demonstrate the competitiveness of this league across time and compared to major league sports. We find, confirming Schmidt (2002) that league expansion increases competitiveness and that, in general, this league compares quite favorably to major leagues.*

**Keywords:** Competitive Balance, Minor League Internship, Major Leagues.

## INTRODUCTION

As sports fans we like to see close games. Fans rapidly grow bored during a lopsided game, while a closely contest between well matched teams engenders far more excitement. Indeed, many fans dislike seeing the same teams winning championships year after year. Most sports have instituted policies to prevent this type of domination. For instance, in most major league sports new players are drafted by teams in inverse order of team standing so that the team with the worst record has the first choice of incoming players, suggesting that poorly performing teams get the best incoming talent, in an attempt to even out talent distribution. Additionally, there is an effect of large market teams with the increased revenue from market size allowing these teams to essentially “buy” championships with large payrolls (including paying players and staff) and better facilities. Many professional sports leagues have introduced revenue sharing to reduce this advantage.

This paper focuses on the Northwoods Baseball League. This league is one in which we should see as close to true competitive balance as can be found anywhere in sports today, given the very strict rules under which the league operates. It is a collegiate league, made up of college players who play during their summer break and cannot lose college (amateur) status. The players have what is called a “*Minor League Internship*”, rather than act as paid talent so that rich teams cannot “buy” talent. The teams also are only able to have, and train, players during the summer months when players are not actively in college, so the short duration of coaching and training are unlikely to make huge differences across teams. Additionally, each player will have only a small number of years in which they are eligible to play for this league as they will move on after college either to play baseball professionally or drop out of the sport entirely. Therefore, teams are unlikely to be able to build fan loyalty to a particular player, since players are available for a very small number of seasons. With this turnover of players, short seasons, and inconsistent team compositions, this particular league should experience as close to perfect competitive balance as possible in sports today.

The concept of competitive balance was first introduced by Rottenberg (1956), has been discussed and refined in the literature for many years (Schmidt, 2001; and Humphreys, 2002; among many others). This paper examines several measures of competitive balance for an amateur baseball league.

## METHODOLOGY

There are several ways to measure competitive balance. If teams were completely evenly matched, each team would have a 50% chance to win each game, and championships would, therefore, be randomly distributed across teams. Therefore, various measures of competitive balance consist of examining the dispersion from that true competitive balance winning ratio of 50%.

The first of these measures computes the dispersion of winning percentages across all teams within a given year (*Within Season Winning Variation* or  $\sigma_{w,t}$ ). This is the deviation of each team's winning percentage relative to a competitively ideal winning ratio of 50% (0.500). The closer to zero this variation is, the closer to true competitive balance the league would be. The formula for  $\sigma_{w,t}$  for a given year  $t$  is given below:

$$\sigma_{w,t} = \sqrt{\frac{\sum_{i=1}^N (WPCT_{i,t} - 0.500)^2}{N}}$$

where  $WPCT_{i,t}$  is team  $i$ 's winning percentage in year  $t$ , and  $N$  is the number of teams in the league.

The  $\sigma_{w,t}$  is not a perfect measure, as it will be affected by the number of games played. It will tend to be larger the fewer games played, as random strings of wins or loses significantly affect the outcome. However we can compute the *Ideal Standard Deviation* or  $\sigma_I$  that reflects the deviation if each team has a 50% (0.500) winning record. This is

$$\sigma_I = \frac{0.500}{\sqrt{G}}$$

where  $G$  is the number of games played.

Employing a ratio of the  $\sigma_{w,t}$  to the  $\sigma_I$  forms the *Ratio of Within Season Winning Variation, or R*. This ratio enables direct comparisons across leagues regardless of the number of games played. The closer to one this ratio is the more competitive balance.

$$R = \frac{\sigma_w}{\sigma_I}$$

Another measure of competitive balance is the *Between Season Winning Variation* or  $\sigma_{i,T}$  for each team across all seasons. Teams that are consistent (either consistently winning or consistently losing) will have small values whereas teams that are less consistent will have large values in this measure. Therefore, the larger this measure, the less competitive balance. Each team will have a  $\sigma_{i,T}$  as measured by the following formula:

$$\sigma_{i,T} = \sqrt{\frac{\sum_{i=1}^N (WPCT_i - \overline{WPCT})^2}{T}}$$

where  $T$  is the number of season's team  $i$  has been in the league and  $\overline{WPCT}$  is that team's average winning percentage over those  $T$  seasons.

Another common measure of competitive balance is the *Hirfindahl-Hirschman Index*, or  $HHI_i$ . The HHI was first developed to measure market but is also commonly used to measure concentrations of championships relative to the number of teams within a league as follows:

$$HHI_i = \sum_i \left(\frac{c_i}{T}\right)^2$$

where  $c_i$  is the number of first-place finishes for team  $i$ , and  $T$  is the number of seasons.

The minimum level of HHI demonstrates a situation where championships are randomly distributed across teams. When the number of years is greater than the number of teams in the league ( $i > T$ ) the minimum value of the  $HHI$  is  $\frac{1}{N}$  where  $N$  is the number of teams, for shorter periods this measure has a minimum of  $\frac{1}{T}$  where  $T$  is the number of seasons. The closer to the minimum, the more competitive the league while a value of 1 suggests perfect imbalance (one team winning all of the championships).

## DATA AND RESULTS

Baseball league was created in 1994 with 5 teams. Each team has a home stadium, and creates revenue The Northwoods mainly from entrance fees and concessions with no games being televised (unlike major league sports). The league expanded to its current 16 teams in 2010, though many of these teams have changed names over time. All told, across the years, there have been 22 locations with teams. We categorize teams by location, regardless of name. Championships have been won by eight of these locations. Table 1 shows the locations (including team names), winning percentages and championships. The most dominant team, the Rochester Honkers, has the highest winning percentage and most league championships and is tied with one other team for the longest tenure in the league.

<b>Team</b>	<b>Years in League (Total)</b>	<b>Regular Season Winning Percentage</b>	<b>League Champions</b>
Rochester Honkers	1994–Present (18)	0.569	1994 1997 1999 2006 2009
St. Cloud River Bats	1997–Present (15)	0.557	1998 2000 2007
Willmar Stingers	2010–Present (2)	0.557	
Madison Mallards	2001–Present (11)	0.546	2004
Kenosha Kroakers	1994–1998 (5)	0.545	
Green Bay Bullfrogs	2007–Present (5)	0.553	
Eau Claire Express	2005–Present (7)	0.526	2010
Waterloo Bucks	1995–Present (17)	0.511	1996 2002
La Crosse Loggers	2003–Present (9)	0.504	
Thunder Bay Border Cats	2003–Present (9)	0.484	2005 2008

<b>Team</b>	<b>Years in League (Total)</b>	<b>Regular Season Winning Percentage</b>	<b>League Champions</b>
Wausau/Wisconsin Woodchucks	1994-Present (18)	0.480	2001 2003
Duluth Huskies	2003-Present (9)	0.484	
Mankato Mashers/MoonDogs	1999-Present (13)	0.493	
Alexandria Beetles	2001-Present (11)	0.498	
Brainerd Mighty Gulls/Blue Thunder/Lunkers	1998-2002 and 2005-Present (12)	0.450	
Manitowoc Skunks	1994-1997 (4)	0.439	
Battle Creek Bombers	2007-Present (5)	0.443	2011
Dubuque Mud Puppies	1994-1996 (3)	0.346	
Minot Greenheads	2000 (1)	0.344	
Grand Forks Channel Cats	1998-2000 (3)	0.335	
Austin Southern Minny Stars	1998-1999 (2)	0.325	
Wisconsin Rapids Rafters	2010-Present (2)	0.314	

Note: Data from Northwoods League (2013, May).

The Within Season Winning Variation or  $\sigma_w$ , the Ideal Standard Deviation  $\sigma_I$  and the Ratio of within Seasons Winning Variation R for each year the league has been in existence is shown in Tables 2A & 2B. The Northwoods league only runs for 2 ½ months, and consists of roughly 65-70 games in recent seasons with as few as 50 games played during the league's inaugural season in 1994, so that the R measure of competitiveness will be more indicative of true competitiveness in this league than  $\sigma_w$ . R shows some large swings, becoming less competitive as expansion teams were added but rapidly converging toward greater balance after the expansion confirming the suggestion by Schmidt (2001) in expanding leagues. In 2002 R reached a low of 1.038, five years after the league expanded from 5 teams to 8 (allowing time for the new teams to become competitive). The expansion at the end of 2009 from 14 to 16 teams saw a jump from R=1.344 to R=1.765, but with a fairly rapid decline to 1.576 by 2011. The Northwoods league shows it is relatively competitive compared to major league sports even in 2011 (shortly after the most recent team expansion) as shown in Table 3, though we note a small R in the English Premier League which represents a small number of very dominant teams.

<b>Year</b>	<b>1994</b>	<b>1995</b>	<b>1996</b>	<b>1997</b>	<b>1998</b>	<b>1999</b>	<b>2000</b>	<b>2001</b>	<b>2002</b>
$\sigma_w$	0.111	0.153	0.112	0.148	0.133	0.157	0.134	0.081	0.065
$\sigma_I$	0.072	0.066	0.065	0.063	0.063	0.063	0.063	0.063	0.063
R	1.546	2.308	1.723	2.352	2.112	2.487	2.123	1.298	1.038
Team	5	6	6	6	8	8	8	8	8

Year	2003	2004	2005	2006	2007	2008	2009	2010	2011
$\sigma_w$	0.104	0.086	0.099	0.103	0.084	0.085	0.082	0.106	0.095
$\sigma_I$	0.063	0.063	0.061	0.061	0.061	0.061	0.061	0.06	0.06
R	1.66	1.37	1.638	1.7	1.37	1.404	1.344	1.765	1.576
Team	10	10	12	12	14	14	14	16	16

League	Within Season Winning Variation $\sigma_w$	Ideal Standard Deviation $\sigma_I$	Ratio of Within Season Winning Variation R
Northwoods	0.094	0.059	1.57
MLB	0.069	0.039	1.77
NFL	0.201	0.125	1.61
NBA	0.158	0.056	2.82
NHL	0.080	0.056	1.43
English Premier League	0.109	0.081	1.34

Note: Data for Northwoods League from Northwoods (2013, May), remainder from Leeds and von Allmen (2014, page 163).

Perhaps a more accurate measure of competitive balance, given the recent expansion activity in this league, is likely to be the *Between Season Variation* or  $\sigma_{i,T}$ . This measure's advantage is that it computes each team separately across time. The smaller this variation, the more consistent the teams winning/losing record over time. If all wins were randomly distributed, then all teams would have little variation across time. Teams that were in the league for a very small number of years will have skewed results however, for instance the Minot Greenheads who were only in the league for a single year have a 0.00 variation. The longer the teams were in existence the more consistent this measure will be. Table 4 shows quite small winning variations in general, though another caveat for this measure is that it only measures consistency, so that a team that always wins will also have a very small variation leading us to examine the last measure of competitiveness, the HHI that measures the distribution of championships.

Team	Between Season Variation ( $\sigma_{i,T}$ )
Rochester Honkers	0.162
St. Cloud River Bats	0.238
Willmar Stingers	0.000
Madison Mallards	0.077
Kenosha Kroakers	0.266
Green Bay Bullfrogs	0.066
Eau Claire Express	0.091
Waterloo Bucks	0.238
La Crosse Loggers	0.075

Thunder Bay Border Cats	0.085
Wausau/Wisconsin Woodchucks	0.098
Duluth Huskies	0.085
Mankato Mashers/MoonDogs	0.079
Alexandria Beetles	0.073
Brainerd Mighty Gulls/Blue Thunder/Lunkers	0.058
Manitowoc Skunks	0.298
Battle Creek Bombers	0.124
Dubuque Mud Puppies	0.104
Minot Greenheads	0.000
Grand Forks Channel Cats	0.051
Austin Southern Minny Stars	0.008
Wisconsin Rapids Rafters	0.028

Table 5 shows the distribution of championships in a selection of major league sports and the Northwoods league over a 10 year period, suggesting a minimum HHI=0.10. The Premier Soccer League has the highest concentration of winners and HHI=0.38 while the NHL has the lowest with HHI=0.13, though the Northwoods league is quite competitive with an HHI=0.14 (over the entire existence of this league the HHI measures .0138). In terms of the Northwoods league, with its changing composition of teams, it is no real surprise that the teams that have been in the league the longest tend to have the best winning records and amass the most championships.

<b>Table 5</b>					
<b>DISTRIBUTION OF CHAMPIONSHIPS AND HIRFINDAHL-HIRSCHMAN INDEX BY LEAGUE, 2001-2 TO 2011-2</b>					
<b>National Basketball Association NBA</b>	<b>National Hockey League NHL*</b>	<b>National Football League NFL</b>	<b>Major League Baseball MLB</b>	<b>Premier League</b>	<b>Northwoods League</b>
Spurs-3 Lakers-3 Celtics-1 Heat-1 Pistons-1 Mavericks-1	Red Wings-2 Devils-1 Avalanche-1 Ducks-1 Hurricanes-1 Lightning-1 Bruins-1 Blackhawks-1 Penguins-1	Patriots-2 Giants-2 Steelers-2 Bucs-1 Colts-1 Saints-1 Packers-1	Red Sox-2 Cardinals-2 Angels-1 Yankees-1 Giants-1 White Sox-1 Marlins-1 Phillies-1	Manchester Unite -5 Chelsea-3 Arsenal-2	Rochester-2 Thunder Bay-2 Wisconsin-1 Waterloo-1 Eau Claire-1 Madison-1 St Cloud-1 Battlecreek-1
HHI=0.22	HHI=0.13	HHI=0.16	HHI=0.15	HHI=0.38	HHI=0.14

Notes: Data begins in 1997-1998, no NHL championship in 2004-2005.

Data for Northwoods League from Northwoods (2013, May), remainder from Leeds and Von (2014).

### CONCLUDING REMARKS

Our results support Schmidt (2001) showing that expansion within a league leads to increased levels of competitiveness. Table 2 shows that expansion in the Northwoods league, particularly three or more years after a team is added that R (Ratio of Within Season Winning Variation) falls toward 1 (perfect competition). In the history of this league, jumps at the end of

1997, 2002, 2005 and again at 2006 and 2009 all showed this pattern. By comparison to other leagues, the Northwoods league is more competitive, according to this R as well as the HHI (or Hirfindahl-Hirschman Index) than all but the National Hockey League through 2012.

We conclude that the Northwoods league shows strong levels of competitive balance as compared to major league sports and confirms the results of Schmidt (2001) suggesting that expansion within a league leads to increased levels of competitiveness.

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