E C O N O M I C S B U L L E T I N

The adjusted churn: an index of competitive balance for sports leagues based on changes in team standings over time

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Abstract

This paper introduces an index called the adjusted churn, designed to measure competitive balance in sports leagues based on changes in team standings over time. This is a simple yet powerful index that varies between zero and one. A value of zero indicates no change in league standings from year to year and therefore minimal competitive balance. A value of one indicates the maximum possible turnover in league standings from year to year and therefore a high level of competitive balance. Application of this index to Major League Baseball suggests that there has been a significant decline in competitive balance in MLB since the 1990s with the most severe decline occurring in the American League. This index also indicates minimal competitive balance for the American League Eastern Division of MLB from 1998 to 2003

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1. Introduction

Over the past several decades, competitive balance has become an increasingly prominent topic in the economics of professional sports in general and of Major League Baseball in particular. Defining and measuring competitive balance has been problematic. Various measures of competitive balance have been suggested, some of which have measured competitive balance for a single season and others of which have measured competitive balance across seasons (see below). One potential measure of competitive balance is the change in league standings over time.

In one of the earliest analyses of the economics of professional sports, Neale (1964) suggested that, in professional baseball, an important utility stream was generated by the "league standing effect:"

> Of itself there is excitement in the daily changes in the standings or the daily changes in possibilities of changes in standings. The closer the standings and within any range of standings the more frequently the standings change, the larger will be the gate receipts. (3)

If the league standing effect measures only daily changes in standings within a particular season, it is subject to the criticism that, like many of the other measures of competitive balance, it fails to capture changes in competitive balance that manifest themselves across more than one season.

We would therefore argue that Neale's insight, while valuable, is myopic. The vitality of professional sports leagues depends not only upon daily changes in the standings, but the potential for changes in the standings from year to year. In this paper, we propose a measure of competitive balance that captures these changes in the final standings of a league or division from season to season.

2. Previous Research

Most of the early studies of competitive balance (as well as many recent studies) have focused upon the dispersion of winning percentages among teams during a particular year. This dispersion has been measured in a number of different ways, including the standard deviation (SD) of winning percentages (Schmidt and Berri 2002), the Gini coefficient (Utt and Fort 2002; Schmidt and Berri 2002, 2003), and the Hirfindahl-Herschman index (HHI), and the Index of Dissimilarity (Mizak and Stair 2004). This research is subject to the criticism outlined above—that it fails to capture changes in competitive balance that manifest themselves across seasons.

Much of the more recent research has introduced measures of competitive balance that record variations in the relative performance of teams over two or more seasons. Most of these articles use variation in wins or winning percentage over time to examine changes in team performance over time. Butler (1995) measured not only the standard deviation of team winning percentages within a season, but also the correlation between each team's winning percentage between consecutive seasons. He found that "free agency, a more narrow distribution of market sizes, and a compression of baseball talent all served to promote competitiveness

across seasons" (50). Eckard (2001) calculated HHIs based on team shares of championships defined as the highest winning percentage in a league. He calculated a "time variance" (i.e., "the mean of individual teams' annual win percent variances about their own period mean") (433). He observed an increase in competitive balance after the advent of free agency in 1976. Humphreys (2002) devised a "Competitive Balance Ratio" (CBR)—the ratio of the average standard deviation of each team's won-lost percentage across seasons to the average standard deviation in won-lost percentages across teams in each season. He found that the CBR is positively and significantly related to major league attendance. None of these studies uses the change in team standings over time as an indicator of competitive balance.

A report of the Commissioner's Blue Ribbon Panel on Baseball Economics (2000) asserted that "[p]roper competitive balance will not exist until every well-run club has a regularly recurring reasonable hope of reaching postseason play" (5). Hadley, Ciecka, and Krautmann (2005) take their cue from this report and focus not on winning percentages but on final team standings to measure competitive balance. Each season, teams are designated as "winners" (if they qualify for the playoffs) or "losers" (if they do not). They use a Markov process to estimate the probabilities that, from one season to the next, 1) a winner will remain a winner, 2) a winner will become a loser, 3) a loser will become a winner, and 4) a loser will remain a loser. By comparing these probabilities for the "prestrike era" (pre-1994) and the "poststrike era" (post-1994) they conclude that "there was a marked change in competitive balance after the 1994 strike, at least in regard to the transition between winning and losing states" (384).

We follow the lead of Hadley, *et. al.* in focusing our attention on final standings rather than winning percentages. But we propose to broaden their approach to measure any changes in a team's position in the standings over time rather than simply considering whether a team qualifies for postseason play.

3. The Adjusted Churn

The churn is an index which attempts to measure the degree of competitiveness in sports by measuring the turnover in standings from one year to the next. In a sense the churn is analogous to a slope. Measures used in the past like standard deviations, Ginis, or Indices of Dissimilarity are static measures in the sense that they only address one year. For example, a Gini coefficient calculated for wins in 2000 in Major League baseball would measure the disparity in victories for the year 2000. In contrast, the churn for 2000 measures the change in standings from 1999 to 2000.

Let C denote the league's year-to-year average team movement in the standings, where C_t (Churn) is computed as:

$$C_t = \sum_{i=1}^{n} \left| f_{i,t} - f_{i,t-1} \right| \Big/ n \qquad (1)$$

Where C_t is the churn in team standings for year t, $|f_{i,t} - f_{i,t-1}|$ is the absolute value of the *i*-th team's change in finish from season t-1 to season t, and n is the number of teams.

A simple example will illustrate how the churn is calculated: suppose that the change in standings from one season to another in a particular division is as follows:

Team	2006 final rank	2007 final rank	$\|f_{i,t} - f_{i,t-1}\|$
A	1	4	3
B	2	3	1
C	3	2	1
D	4	1	3

In the above data $\sum|f_{i,t} - f_{i,t-1}| = 8$. The churn for 2007 = 8/4 = 2. This is the maximum value of the churn given a league size of 4 teams. It can be shown that in a league with an even number (X) of teams, C will vary between 0 and ½X. For leagues with an odd number (*Y*) of entries, C varies between 0 and $\left(Y^2 - 1\right)/2Y$. Note that years involving league expansion (or contraction) must be excluded since there will be insufficient data for the team(s) in question.

The maximum potential value of the churn varies depending on league size. Since league size (and hence the coefficient's upper bound) varies over time, and even across divisions in some leagues, inter-temporal and interdivision comparisons require that the churn coefficient, C, be divided by its maximum value. In the above example, the churn divided by its maximum value would equal 1. Hence forth the churn/maximum will be referred to as the adjusted churn. The adjusted churn is the measure that we will use to indicate the degree of change in league standings over time. It allows us to compare the degree of competitive balance in league or divisions with different numbers of teams.

An adjusted churn equal to zero indicates no change in league or division standings from one year to the next and implies minimal competitive balance in that league or division. An adjusted churn equal to one indicates the maximum possible change in league standings from one year to the next and implies a high level of competitive balance over time.

The American League Eastern Division, the home of the Yankees, Red Sox, Orioles, Blue Jays, and Devil Rays is famous (or infamous) for competitive disparity. Table I contains the adjusted churn for the American League East from 1995-2007. The adjusted churn was equal to zero for the American League East every year from 1998-2003. This indicates that there was no change in the final standings over these years and infers minimal competitive balance in the American League East over this time period.

Table I: Adjusted Churn, American League Eastern Division 1995-2007

Year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Adjusted Churn	0.67	0.50	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.33	0.17	0.33

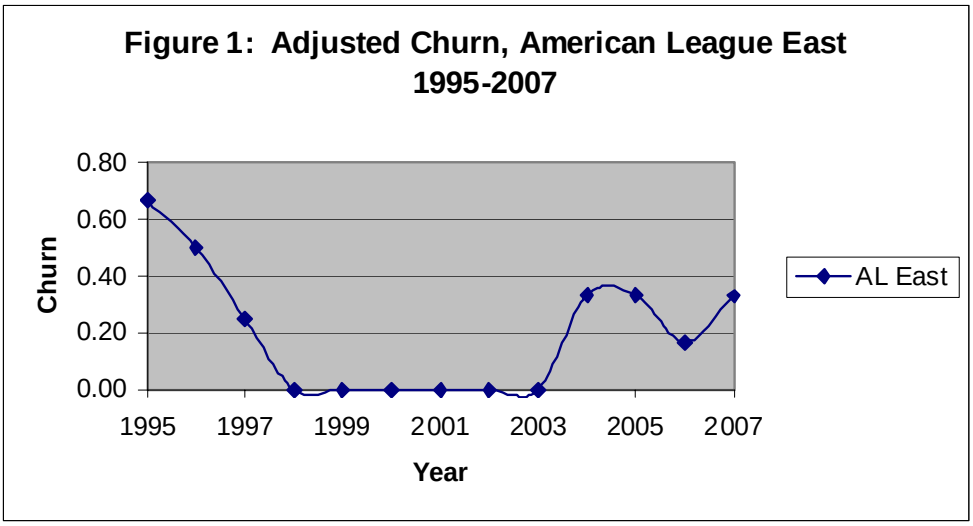
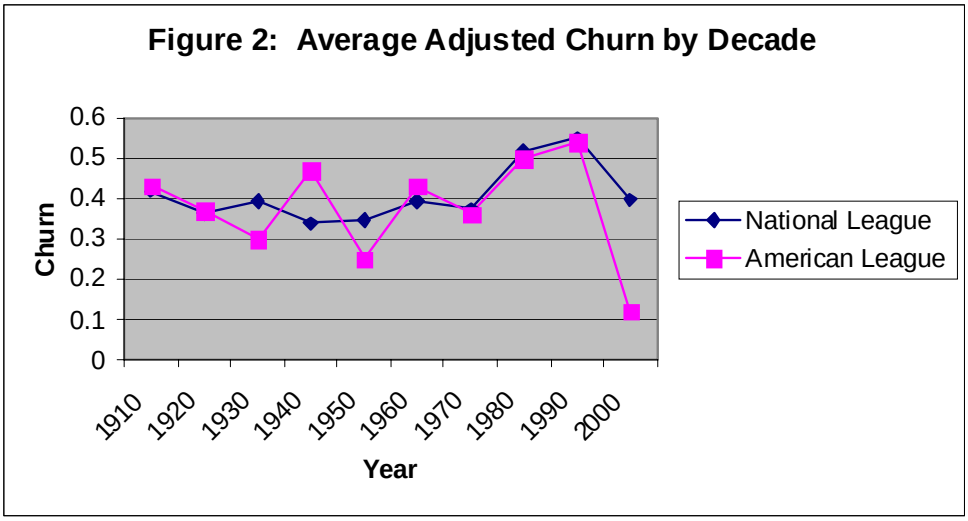


Table II contains the average adjusted churn by decade for each league. For this analysis, teams were not separated by division.

Table II: Average Adjusted Churn by Decade		
Decade	National League	American League
1910-19	0.4188	0.4313
1920-29	0.3625	0.3688
1930-39	0.3938	0.3
1940-49	0.3375	0.4688
1950-59	0.3469	0.25
1960-69	0.3914	0.4303
1970-79	0.3726	0.3614
1980-89	0.5167	0.4977
1990-99	0.549	0.541
2000-07	0.3963	0.1203



This data indicates that there has been a decline in competitive balance in both leagues since the 1990s. However, the churn indicates that the decline in competitive balance has been more extreme in the American League than in the National League. We note that this has occurred despite the implementation of a luxury tax in 1997.

4. Conclusions

This paper introduces a new index called the adjusted churn to measure competitive balance in sports leagues over time. Decade averages of the adjusted churn in Major League Baseball since 1910 indicate that competitive balance has declined since 1999 in both leagues and more severely in the American League. The potential uses of this index seem myriad. Its application can be extended to other leagues, both professional and amateur. Correlations of the adjusted churn to payroll and other statistics also provide interesting opportunities for future research.

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