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Historical Time Series Perspectives on Competitive Balance in NCAA Division I Basketball

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Abstract

In this article, we extend the literature on competitive balance to National Collegiate Athletic Association (NCAA) Division I men's basketball. We track historical within-conference balance utilizing measures accounting for game-level uncertainty and consecutive season uncertainty. We find a host of structural changes in competitive balance across the sport that align closely with the GI Bill, racial integration, and the split of the NCAA into three divisions. We also find evidence of short-term improvements in balance following individual conference-level regulation specific to the Ivy League.

Keywords

competitive balance, time series, BP Method, college basketball, NCAA

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Introduction

Background and Literature

The study of competitive balance and uncertainty of outcome in North American professional sport dates back to Rottenberg (1956), with subsequent extensions to international leagues such as the English Premier League (Alavy, Gaskell, Leach, & Szymanski, 2010; Lee & Fort, 2012; Szymanski & Kesenne, 2004), Australian leagues (Booth, 2005), and Asian baseball and basketball leagues (Lee, 2004, 2006; Zheng & Fort, 2015). However, competitive balance research has been limited with respect to *collegiate* sport within the United States. Only a handful of studies have investigated balance in big-time college football (e.g., Bennett & Fizel, 1995; Depken & Wilson, 2004a, 2004b, 2006; Eckard, 1998; Salaga, 2015; Sutter & Winkler, 2003). To our knowledge, there is no empirical work focusing on college basketball. This is true, despite the suggestion provided by Sanderson and Siegfried (2003) that investigating collegiate competitive balance may help us to better understand nonmarket factors in talent distribution across schools (programs). Therefore, in this work, we extend the competitive balance literature to National Collegiate Athletic Association (NCAA) Division I men's basketball.

Recent work examining the long-term behavior of competitive balance has used break point analysis methods as first described in the sports economics literature in Fort and Lee (2006). These methods—largely taking econometric lessons from Lee and Strazicich (2001, 2003, 2004) and Bai and Perron (1998, 2003, 2006)—allow inspection of the properties of time series specifically related to the occurrence of structural changes in levels and trends of the data. An understanding of these properties allows for unbiased estimates using only level data in subsequent panel models, avoiding those portions of the time series where the data are nonstationary due to structural change (Fort & Lee, 2006, 2007; Lee, 2009; Lee & Fort, 2007, 2008, 2012; Mills & Fort, 2014; Zheng & Fort, 2015). Fort and Lee (2006, 2007) identify the importance of tracking competitive balance across time in its own right as well, and these econometric techniques allow for qualitative evaluation of structural change dates concurrent with important events in the history of the time series under review, such as economic shocks, policy changes, racial integration, or technological changes. We adopt this technique for the current research and provide an understanding of the level data properties of time series within NCAA conferences for future panel and cross-sectional models.

This article analyzes the long-run behavior of within-conference competitive balance in NCAA Division I men's basketball. Specifically, we test for structural changes in historical conference-level time series that measure game and consecutive season uncertainty and qualitatively evaluate structural breaks near changes in policy and business structure at both the NCAA and the individual conference levels.

Unique aspects of college basketball advance the understanding of the competitive balance literature and make it worth studying on its own. First, the nature of scholarships and lack of paid contracts highlight the importance of other amenities and nonmarket factors—such as academic quality, facility quality, and coaching quality—that contribute to talent distribution. These factors may be less present in the professional ranks, where market factors are more likely to determine talent distribution. The NCAA can also be used as a platform for auditioning for professional leagues. Therefore, players' team choices are also likely influenced by competition for playing time and quality of competition of opposing teams. Second, as noted in past work on the National Basketball Association (NBA), basketball is unique due to the small roster size—creating a more tractable "superstar effect" (Hausman & Leonard, 1997)—and low supply of basketball-specific talent, such as height (Berri, Brook, Frick, Fenn, & Vicente-Mayoral, 2005). The interplay of these two issues may be particularly important in the face of integration, and at the college level, where institutional requirements have led to players' necessarily playing at least one year of college basketball (or more, earlier in the association's history) before entering the NBA draft.

This article proceeds as follows. In the second section, we identify the data used in our time series analysis and describe various measures of outcome uncertainty. The third section describes the methods used to identify structural breaks in balance, and the fourth section presents and discusses the results of our unit-root and structural break testing. Finally, we provide our conclusions in the fifth section and suggest future research that can be informed with knowledge of break dates in the conference-level competitive balance time series.

Data and Measurement

The data used for this analysis come from College Basketball Reference (http://www.sports-reference.com/) and Dr. John A. Trono's NCAA Men's Basketball Scores Archive and cover the dates from the beginning of the NCAA Tournament (1938-1939) through the completion of the 2012-2013 season. Data are aggregated at the yearly level, with overall and regular season conference records as well as individual game scores included within the data. There are nearly 17,500 individual school-year observations over this time period. We evaluate 12 conferences with series long enough to subject to our time series method.[1]

Due to substantial churning over time, we combine conferences to ensure time series of sufficient length. In combining conferences, if more than 50% of schools in one conference are subsequently integrated into a newly named or newly formed conference in the following season, it is considered a continuation of that conference. For example, the Big 8 and Southwest Conferences merged in 1996 to form the Big 12. Because all eight members of the Big 8 were included in the Big 12, the calculations of balance using the Big 8 series are included in the larger Big 12 series for those years. However, the Southwest Conference is considered dissolved, and these schools' records in prior seasons are not included in the balance calculation for the Big 12.

We account for the multifaceted nature of competitive balance by using multiple measures. First, we evaluate winning percentage dispersion as one aspect of game-level uncertainty by using the widely known ratio of standard deviations (*RSD*) including only regular season intraconference matchups.[2] As *RSD* moves toward a lower bound of 1, there is less dispersion in conference winning percentages and therefore greater within-conference balance. As *RSD* values increase, conference winning percentage dispersion increases and balance decreases.

As an alternative measure of game-level uncertainty, we utilize a version of the Herfindahl–Hirschman Index (*HHI*) to characterize the concentration of wins across teams within a given conference in a given season. First, we follow the approach of Depken (1999):

$$HHI_t = \sum_{i=1}^{n} \left(\frac{w_{it}}{\sum_{i=1}^{n} w_{it}} \right)^2, \tag{1}$$

where t represents the individual conference year, n equals the number of teams in the conference, w_{it} is the conference winning *percentage* for team i in season t in the conference for which the measure is being calculated. However, due to conference churning, n has not been constant over time, which alters the lower bound of the measure. Therefore, to control for changing n, we utilize *dHHI* where $dHHI_t = HHI_t - 1/n$. A decrease in $dHHI_t$ represents less dispersion in conference winning percentages and an increase in within-conference competitive balance. We use conference winning percentages, as opposed to the raw number of wins as is commonly used when calculating *dHHI*, due to changes in the number of conference games played over time and the variation in the number of games played by each team in a given season. The correlation between the use of winning percentage and wins is near unity for each conference and therefore is unlikely to affect break estimates while being more robust to issues with differences in the number of games.

We also assess individual game closeness as an additional measure of game-level uncertainty through the use of the margin of victory ratio (*MVR*) as found in Salaga (2015). This measure is calculated as follows:

$$MVR_t = \frac{1}{G_t} \sum_{g=1}^{G_t} \frac{MV_{g,t}}{TP_{g,t}}, \tag{2}$$

where t is conference year $t = 1, \ldots, T$, $MV_{g,t}$ is the margin of victory in conference game $g = 1, \ldots, G_t$ in year t. To adjust for changing levels of scoring over time, we use the total points scored in conference game g in year t, $TP_{g,t}$. All individual game values in a season are then averaged to produce a single value for a given conference for conference year t. $0 \leq MVR_t \leq 1$, with game uncertainty growing—and contests more balanced—as $MVR_t \rightarrow 0$. Alternatively, as $MVR_t \rightarrow 1$, game uncertainty falls and contests are less balanced. *MVR* is utilized because it accounts for the changing nature of scoring in basketball, offering a clear advantage to simply using average margin of victory. We note that due to data availability issues, the *MVR* time series includes only those years after 1949.

Lastly, we use within-conference winning percentages to evaluate consecutive-season uncertainty, measured by year-to-year conference winning percentage correlation (*Corr1*) similar to the measure originally used by Butler (1995) and by Lee and Fort (2008). The metric is defined as:

$$Corr1_t = Cor\left(W_{i,t}, W_{i,t-1}\right), \tag{3}$$

where $W_{i,t}$ is the conference winning percentage in year t for team i and $W_{i,t-1}$ is its winning percentage in year $t - 1$. We note that series lengths necessarily fall by one year to allow calculation of the *Corr1* measure. $-1 \leq Corr1_t \leq 1$, with lower values suggesting more churning in year-to-year conference standings and better balance for the conference. We again note that all measures are calculated using only within-conference, regular season contests.

Methods

We follow the approach outlined in Fort and Lee (2006) as implemented by Lee and Fort (2005) and Fort and Lee (2007) for those balanced time series with a length of at least 50 years, as very short series lengths are a challenge for our estimation procedures. This constraint leaves us with 12 conferences, which are subjected to the breakpoint method (henceforth, the BP Method).

We first test each competitive balance series against the null of a unit root. The unit root *without* breaks hypothesis is tested using the Augmented Dickey–Fuller (ADF) and Phillips–Perron (PP) tests with both a constant and a trend. The numbers of lags were determined by minimizing the Bayesian Information Criterion (BIC) for the ADF test and by the truncation suggested by Newey and West (1994) for the PP test. Additionally, Leybourne, Mills, and Newbold (1998) highlight the possibility of spurious rejections of unit-root presence with Dickey–Fuller tests when breaks are near the beginning of a nonstationary series. We therefore employ the two-break minimum Lagrange Multiplier (LM) unit-root test irrespective of the results from the ADF and PP tests (Perron, 1989; Lee & Strazicich, 2001, 2003, 2004) for robustness. Following results from this procedure, we employ a one-break minimum LM unit-root test (Lee & Strazicich, 2001) for series that are not rejected at the highest level with the two-break test.

For each conference balance series in which a unit root is rejected, or rejected with break points, we apply the approach of Bai and Perron (1998, 2003, 2006) to ascertain the statistical significance and behavior of the breaks, allowing changes in both levels and trends as first described in Perron (1989). This method simultaneously tests for structural changes using a sequential testing method and fits a regression model with coefficients interpreted similarly to ordinary least squares. Allowing for changes in both level and trend makes our models pure structural change models (Bai & Perron, 2003), rather than partial structural change models, which are often used when more predictor variables are included in the regression (Lee & Fort, 2008; Mills & Fort, 2014). We perform the BP Method on each conference balance measure as a separate regression. The following regression model is estimated using the method:

$$y_t = x_t'\alpha_j + z_t'\beta_j + u_t, \qquad j = 1, \ldots, m+1, \tag{4}$$

Where y_t is the dependent variable—*RSD*, *dHHI*, *MVR*, or *Corr1*—at time t, x_t and z_t are the time variable and a constant, respectively, and α_j and β_j are the corresponding unknown trend and intercept coefficients. Indices $(T_1, \ldots, T_m)$ are treated as unknown break points to be estimated through the Bai and Perron approach that separate j regimes. Coefficients for both x_t and z_t—in this case the trend and level of the data—are allowed to vary across regimes, with no further covariates entering these models. We estimate models with homogeneous error estimates across regimes for the statistical tests with the trimming parameter $\varepsilon = .10$, ensuring that any regime between break points contains five years or more (Bai & Perron, 2006).

Results and Discussion

Unit-Root Results

The results of the ADF and PP tests can be found in Tables 1–4 for *RSD, dHHI, MVR,* and *Corr1*, respectively. Results for the two-break and one-break LM tests for the same measures appear in Tables 5–8. The one-break test was not required for any conference *Corr1* series, as they were all found to be stationary with the two-break test at the highest level of statistical significance.

To summarize, the presence of a unit root is rejected for all *RSD* series—by agreement of both the ADF and PP tests—with the exception of the WAC. All but three conferences—the WAC, MAC, and MVC—were rejected by both tests for *dHHI*. Rejection was nearly unanimous for *Corr1* as well, with the exception of just the OVC. Lastly, there was less agreement in the *MVR* tests, as the unit-root hypothesis was uniformly rejected in only 6 of the 12 conferences.

Continuing to the unit root with breaks tests, the presence of a unit root with two breaks is rejected for all *RSD, MVR*, and *Corr1* series with the exception of the WCC *RSD* series, Ivy League *dHHI* series, and the ACC, MAC, and WCC *MVR* series. These were subsequently subjected to the one-break test, which rejected the presence of a unit root with at least one break for all remaining series. Therefore, we

Table 1. ADF and PP Tests for *RSD*.

Conference		ACC	Big 12	Big Ten	Pac-12	SEC	Ivy
T (seasons)		59	74	74	74	74	74
ADF (*p*)	Constant	−4.788 (1)***	−5.856 (1)***	−4.991 (1)***	−5.577 (1)***	−5.159 (1)***	−3.744 (1)***
ADF (*p*)	Trend	−5.392 (1)***	−6.041 (1)***	−5.186 (1)***	−5.701 (1)***	−5.688 (1)***	−3.713 (1)**
PP (*l*)	Constant	−6.155 (3)***	−7.502 (3)***	−6.287 (3)***	−7.575 (3)***	−7.509 (3)***	−6.031 (3)***
PP (*l*)	Trend	−6.863 (3)***	−7.570 (3)***	−6.437 (3)***	−7.691 (3)***	−7.853 (3)***	−5.989 (3)***
Conference		**MAC**	**MVC**	**OVC**	**Southern**	**WAC**	**WCC**
T (seasons)		66	74	64	74	74	60
ADF (*p*)	Constant	−5.330 (1)***	−5.321 (1)***	−3.759 (3)***	−5.876 (1)***	−3.489 (1)**	−5.091 (1)***
ADF (*p*)	Trend	−5.334 (1)***	−5.538 (1)***	−4.354 (1)***	−5.879 (1)***	−3.461 (1)*	−5.168 (1)***
PP (*l*)	Constant	−6.389 (3)***	−7.863 (3)***	−4.627 (3)***	−7.192 (3)***	−5.079 (3)***	−6.060 (3)***
PP (*l*)	Trend	−6.343 (3)***	−8.099 (3)***	−5.602 (3)***	−7.164 (3)***	−5.043 (3)***	−6.060 (3)***

Note. *RSDs* = Ratio of standard deviations; *p* = the number of lags; *l* = lag truncation; ADF = Augmented Dickey–Fuller; PP = Phillips–Perron; ACC = Atlantic Coast Conference; SEC = Southeastern Conference; MAC = Mid-American Conference; MVC = Missouri Valley Conference; OVC = Ohio Valley Conference; WAC = Western Athletic Conference; WCC = West Coast Conference.
*Significant at 90% critical level. **Significant at 95% critical level. ***Significant at 99% critical level.

Table 2. ADF and PP Tests for *dHHI*.

Conference		ACC	Big 12	Big Ten	Pac-12	SEC	Ivy
T (seasons)		58	73	73	73	73	73
ADF (p)	Constant	−3.503 (1)**	−4.384 (1)***	−4.922 (1)***	−2.119 (3)	−4.801 (1)***	−3.502 (1)**
ADF (p)	Trend	−5.158 (1)***	−5.513 (1)***	−5.296 (1)***	−4.856 (1)***	−6.323 (1)***	−3.784 (1)**
PP (l)	Constant	−4.508 (3)***	−5.588 (3)***	−6.526 (3)***	−7.565 (3)***	−6.918 (3)***	−4.962 (3)***
PP (l)	Trend	−6.250 (3)***	−7.229 (3)***	−6.833 (3)***	−8.070 (3)***	−8.148 (3)***	−5.301 (3)***
Conference		**MAC**	**MVC**	**OVC**	**Southern**	**WAC**	**WCC**
T (seasons)		65	73	57	73	73	59
ADF (p)	Constant	−1.930 (4)	−2.132 (5)	−4.762 (1)***	−2.549 (3)	−2.735 (3)*	−5.005 (1)***
ADF (p)	Trend	−3.847 (1)**	−1.826 (5)	−4.972 (1)***	−4.693 (1)***	−3.181 (3)*	−4.966 (1)***
PP (l)	Constant	−4.023 (3)***	−4.040 (3)***	−6.203 (3)***	−5.723 (3)***	−3.681 (3)***	−5.429 (3)***
PP (l)	Trend	−6.562 (3)***	−7.029 (3)***	−6.873 (3)***	−5.920 (3)***	−4.292 (3)***	−6.021 (3)***

Note. *dHHI* = deviation of the Herfindahl–Hirschman Index; p = the number of lags; l = lag truncation; ADF = Augmented Dickey–Fuller; PP = Phillips–Perron; ACC = Atlantic Coast Conference; SEC = Southeastern Conference; MAC = Mid-American Conference; MVC = Missouri Valley Conference; OVC = Ohio Valley Conference; WAC = Western Athletic Conference; WCC = West Coast Conference.
*Significant at 90% critical level. **Significant at 95% critical level. ***Significant at 99% critical level.

Table 3. ADF and PP Tests for *MVR*.

Conference		ACC	Big 12	Big Ten	Pac-12	SEC	Ivy
T (seasons)		58	63	63	63	63	63
ADF (p)	Constant	−3.636 (1)***	−3.402 (2)**	−2.203 (2)	−4.553 (1)***	−3.406 (2)**	−2.341 (2)
ADF (p)	Trend	−3.553 (1)**	−3.678 (2)**	−4.038 (2)**	−4.524 (1)***	−2.999 (1)	−2.247 (2)
PP (l)	Constant	−4.749 (3)***	−5.319 (3)***	−3.984 (3)***	−6.027 (3)***	−4.176 (3)***	−5.135 (3)***
PP (l)	Trend	−4.626 (3)***	−5.317 (3)***	−5.355 (3)***	−6.060 (3)***	−4.292 (3)***	−5.203 (3)***
Conference		**MAC**	**MVC**	**OVC**	**Southern**	**WAC**	**WCC**
T (seasons)		63	63	61	63	63	60
ADF (p)	Constant	−4.737 (1)***	−3.382 (1)**	−4.446 (1)***	−2.988 (1)**	−3.357 (1)**	−5.091 (1)***
ADF (p)	Trend	−4.679 (1)***	−3.241 (1)*	−4.465 (1)***	−3.028 (1)	−3.407 (1)*	−5.168 (1)***
PP (l)	Constant	−6.337 (3)***	−3.777 (3)***	−5.136 (3)***	−4.047 (3)***	−4.916 (3)***	−6.060 (3)***
PP (l)	Trend	−6.191 (3)***	−3.646 (3)**	−5.134 (3)***	−4.378 (3)***	−5.033 (3)***	−6.060 (3)***

Note. *MVR* = margin of victory ratio; p = the number of lags; l = lag truncation; ADF = Augmented Dickey–Fuller; PP = Phillips–Perron; ACC = Atlantic Coast Conference; SEC = Southeastern Conference; MAC = Mid-American Conference; MVC = Missouri Valley Conference; OVC = Ohio Valley Conference; WAC = Western Athletic Conference; WCC = West Coast Conference.

*Significant at 90% critical level. **Significant at 95% critical level. ***Significant at 99% critical level.

Table 4. ADF and PP Tests for *Corr1*.

Conference		ACC	Big 12	Big Ten	Pac-12	SEC	Ivy
T (seasons)		58	73	73	73	73	73
ADF (p)	Constant	−4.613 (1)***	−3.661 (3)***	−4.931 (1)***	−3.564 (1)***	−4.603 (1)***	−4.838 (1)***
ADF (p)	Trend	−4.802 (1)***	−4.100 (3)**	−5.274 (1)***	−3.779 (3)**	−4.930 (1)***	−4.872 (1)***
PP (l)	Constant	−6.417 (3)***	−10.628 (3)***	−5.922 (3)***	−6.360 (3)***	−6.801 (3)***	−5.744 (3)***
PP (l)	Trend	−6.673 (3)***	−11.333 (3)***	−6.216 (3)***	−6.656 (3)***	−7.056 (3)***	−5.768 (3)***
Conference		**MAC**	**MVC**	**OVC**	**Southern**	**WAC**	**WCC**
T (seasons)		65	73	63	73	73	59
ADF (p)	Constant	−4.081 (1)***	−4.756 (1)***	−2.405 (4)	−4.134 (1)***	−4.680 (1)***	−4.561 (1)***
ADF (p)	Trend	−4.060 (1)**	−4.780 (1)***	−5.628 (2)***	−4.275 (1)***	−4.637 (1)***	−4.572 (1)***
PP (l)	Constant	−6.434 (3)***	−6.839 (3)***	−7.284 (3)***	−6.097 (3)***	−7.304 (3)***	−6.185 (3)***
PP (l)	Trend	−6.457 (3)***	−6.862 (3)***	−7.671 (3)***	−6.152 (3)***	−7.258 (3)***	−6.153 (3)***

Note. Corr1 = correlation; p = the number of lags; l = lag truncation; ADF = Augmented Dickey–Fuller; PP = Phillips–Perron; ACC = Atlantic Coast Conference; SEC = Southeastern Conference; MAC = Mid-American Conference; MVC = Missouri Valley Conference; OVC = Ohio Valley Conference; WAC = Western Athletic Conference; WCC = West Coast Conference.

*Significant at 90% critical level. **Significant at 95% critical level. ***Significant at 99% critical level.

Table 5. LM-Two and LM-One Unit-Root Test for *RSD*.

Conference	$\hat{k}$	$\hat{T}_b$	$\hat{t}_{\gamma j}$	LM-2 Test Statistic	Critical Value Break Points
ACC	0	1976, 1987	2.948***, −4.340***	−7.436***	$\lambda = (0.76, 0.90)$
Big 12	0	1990, 2002	−0.035, −3.795***	−8.159***	$\lambda = (0.72, 0.88)$
Big Ten	7	1973, 2004	8.367***, 1.502	−16.638***	$\lambda = (0.49, 0.91)$
Pac-12	7	1973, 2004	8.703***, 1.556	−16.606***	$\lambda = (0.49, 0.91)$
SEC	7	1973, 2004	8.408***, 1.443	−16.457***	$\lambda = (0.49, 0.91)$
Ivy	0	1973, 1986	−0.030, 0.354	−7.691***	$\lambda = (0.49, 0.66)$
MAC	0	1977, 1994	−4.182***, 1.500	−7.295***	$\lambda = (0.48, 0.74)$
MVC	0	1950, 1958	−2.475**, −0.285	−9.103***	$\lambda = (0.18, 0.28)$
OVC	0	1959, 1997	−1.574, 2.247**	−7.890***	$\lambda = (0.19, 0.78)$
Southern	0	1960, 1977	1.695*, 0.241	−8.052***	$\lambda = (0.31, 0.54)$
WAC	0	1962, 1980	−4.889***, −1.179	−8.498***	$\lambda = (0.34, 0.58)$
WCC	0	1972, 1992	−4.049***, 0.427	−5.324*	$\lambda = (0.35, 0.68)$
Conference	$\hat{k}$	$\hat{T}_b$	$\hat{t}_{\gamma j}$	LM-1 Test Statistic	Critical Value Break Points
WCC	4	1970	−3.910***	−4.497**	$\lambda = 0.32$

Note. RSD = ratio of standard deviations; ACC = Atlantic Coast Conference; SEC = Southeastern Conference; MAC = Mid-American Conference; MVC = Missouri Valley Conference; OVC = Ohio Valley Conference; WAC = Western Athletic Conference; WCC = West Coast Conference. $\hat{k}$ is the optimal number of lagged first-difference terms included in the unit-root test to correct for serial correlation. $\hat{T}_b$ denotes the estimated break points. $\hat{t}_{\gamma j}$ is the value of DT_{jt} for $j = 1,2$. See J. Lee and Strazicich (2003) table 2 for critical values.
*Significant at 90% critical level. **Significant at 95% critical level. ***Significant at 99% critical level.

estimate the size and location of break points for all conference-level balance series using the BP Method.

BP Method Results

A number of conference series did not have any structural changes estimated using the sequential testing from the BP Method.[3] Therefore, no structural change regression model is estimated for these conferences. For those series with detected structural changes, structural change regression coefficient estimates are exhibited in Tables 9–12 for *RSD, dHHI, MVR*, and *Corr1*, respectively. Note that, while the trend coefficients (α_j) can be read directly from the table, the structural shifts are not particularly intuitive beyond β_1 (the initial intercept for the regression line). Therefore, visualizations are provided to gauge the size and direction of structural shifts of the data (Figures 1–10).

Table 13 presents the estimated break dates and their respective 90% confidence intervals. For *RSD*, break points were found in the SEC, Ivy League, OVC, Southern Conference, and WAC. A single structural change was detected in each of these

Table 6. LM-Two and LM-One Unit-Root Test for *dHHI*.

Conference	$\hat{k}$	$\hat{T}_b$	$\hat{t}_{\gamma j}$	LM-2 Test Statistic	Critical Value Break Points
ACC	0	1972, 1979	−0.681, 2.663**	−6.971***	$\lambda = (0.34, 0.46)$
Big 12	0	1949, 1984	−4.732***, −1.300	−7.612***	$\lambda = (0.16, 0.64)$
Big Ten	0	1965, 1976	−1.970**, 0.204	−7.102***	$\lambda = (0.38, 0.53)$
Pac-12	0	1954, 1973	4.879***, −1.141	−9.498***	$\lambda = (0.23, 0.49)$
SEC	0	1963, 1980	−5.828***, 1.917*	−8.800***	$\lambda = (0.35, 0.58)$
Ivy	0	1951, 1978	0.539, −3.159***	−6.111**	$\lambda = (0.19, 0.55)$
MAC	0	1961, 1981	5.212***, 0.628	−8.841***	$\lambda = (0.24, 0.55)$
MVC	8	1950, 1977	−7.242***, −5.975***	−8.786***	$\lambda = (0.18, 0.54)$
OVC	0	1984, 1990	0.160, −2.122**	−6.964***	$\lambda = (0.53, 0.63)$
Southern	6	1958, 1970	−4.231***, 5.674***	−7.062***	$\lambda = (0.28, 0.45)$
WAC	8	1950, 1965	−1.140, −6.471***	−7.296***	$\lambda = (0.18, 0.38)$
WCC	1	1997, 2003	0.660, −2.519**	−7.382***	$\lambda = (0.76, 0.86)$

Conference	$\hat{k}$	$\hat{T}_b$	$\hat{t}_{\gamma j}$	LM-1 Test Statistic	Critical Value Break Points
Ivy	8	1979	−3.815***	−5.143***	$\lambda = 0.57$

Note. *dHHI* = deviation of the Herfindahl–Hirschman Index; ACC = Atlantic Coast Conference; SEC = Southeastern Conference; MAC = Mid-American Conference; MVC = Missouri Valley Conference; OVC = Ohio Valley Conference; WAC = Western Athletic Conference; WCC = West Coast Conference. $\hat{k}$ is the optimal number of lagged first-difference terms included in the unit-root test to correct for serial correlation. $\hat{T}_b$ denotes the estimated break points. $\hat{t}_{\gamma j}$ is the value of DT_{jt} for j = 1,2. See J. Lee and Strazicich (2003) table 2 for critical values.
*Significant at 90% critical level. **Significant at 95% critical level. ***Significant at 99% critical level.

balance series, with the exception of the WAC, which has two detected breaks. At least one instance of structural change was found in all *dHHI* conference series, with the exception of the ACC, SEC, and OVC. The Ivy League, WAC, and WCC were estimated to have two structural breaks. The *Corr1* series with a single structural change detected include the MAC and the Southern Conference, while the Pac-12, Ivy League, and WAC have two breaks. At least one break was detected in all 12 conference *MVR* series.

Because a primary purpose of this research is to qualitatively evaluate the dates of structural changes in competitive balance measures as they related to relevant historical events in Table 14, we organize breaks into concurrent periods in Table 13. We classify a break as concurrent if the confidence interval of a break date in an individual series overlaps with the confidence interval of at least one other break date. This allows us to determine commonality between conferences with respect to structural changes.

Five breaks (see Table 13) align closely with the implementation of the Servicemen's Readjustment Act (GI Bill) in 1946. In four of the five cases (all of which are

Table 7. LM-Two and LM-One Unit-Root Test for *MVR*.

Conference	$\hat{k}$	$\hat{T}_b$	$\hat{t}_{\gamma j}$	LM-2 Test Statistic	Critical Value Break Points
ACC	0	1980, 2001	2.621**, 1.669*	−5.684*	$\lambda = (0.47, 0.83)$
Big 12	0	1969, 1998	−3.007***, −0.533	−8.039***	$\lambda = (0.33, 0.79)$
Big Ten	0	1959, 1970	2.024**, 4.149***	−6.482***	$\lambda = (0.17, 0.35)$
Pac-12	0	1972, 1987	−3.324***, 2.709***	−7.379***	$\lambda = (0.38, 0.62)$
SEC	0	1962, 1967	2.617**, −4.138***	−8.311***	$\lambda = (0.22, 0.30)$
Ivy	8	1975, 1991	−5.552***, 4.858***	−6.611***	$\lambda = (0.43, 0.68)$
MAC	0	1962, 1988	5.033***, 1.821*	−6.348**	$\lambda = (0.22, 0.63)$
MVC	6	1963, 1968	2.488**, −4.263***	−6.610***	$\lambda = (0.24, 0.32)$
OVC	2	1964, 1979	−5.690***, 6.553***	−7.784***	$\lambda = (0.23, 0.48)$
Southern	0	1966, 1989	−0.191, 0.840	−6.585***	$\lambda = (0.29, 0.65)$
WAC	0	1960, 1996	−1.827*, 3.584***	−7.504***	$\lambda = (0.19, 0.76)$
WCC	1	1970, 1986	−3.358***, 4.564***	−6.034**	$\lambda = (0.32, 0.58)$
Conference	**$\hat{k}$**	**$\hat{T}_b$**	**$\hat{t}_{\gamma j}$**	**LM-1 Test Statistic**	**Critical Value Break Points**
ACC	0	1997	1.817*	−5.222***	$\lambda = 0.76$
MAC	0	1959	5.201***	−5.623***	$\lambda = 0.17$
WCC	1	1978	3.004***	−5.932***	$\lambda = 0.45$

Note. *MVR* = margin of victory ratio; ACC = Atlantic Coast Conference; SEC = Southeastern Conference; MAC = Mid-American Conference; MVC = Missouri Valley Conference; OVC = Ohio Valley Conference; WAC = Western Athletic Conference; WCC = West Coast Conference. $\hat{k}$ is the optimal number of lagged first-difference terms included in the unit-root test to correct for serial correlation. $\hat{T}_b$ denotes the estimated break points. $\hat{t}_{\gamma j}$ is the value of DT_{jt} for $j = 1,2$. See J. Lee and Strazicich (2003) table 2 for critical values.
*Significant at 90% critical level. **Significant at 95% critical level. ***Significant at 99% critical level.

dHHI), the break is associated with an increase in balance followed by relatively stable metric values. As noted in Salaga (2015), the GI Bill represents a unique period of "free agency" in college athletics. Following World War II, a large number of veterans returned to competition in 1946, with the majority able to attend any program of their choosing. Fierce recruiting battles ensued (Andrews, 1984; Reimann, 2004), as programs eagerly pursued the revenue associated with operating a high-quality program.

Perhaps during this period a larger number of mid-tier and lower tier programs responded to these enhanced incentives and improved their "compensation packages" to recruits. Given that there was little effective NCAA regulation at the time, it is highly likely that power programs were already offering better compensation packages, which resulted in greater imbalance prior to the GI Bill. If this is true, it is possible that winning percentage dispersion improved following the war, and this measure of balance improved in a number of conferences.

Table 8. LM-Two Unit-Root Test for *Corr1*.

Conference	$\hat{k}$	$\hat{T}_b$	$\hat{t}_{\gamma j}$	LM-2 Test Statistic	Critical Value Break Points
ACC	0	1997, 2005	2.792***, −0.470	−7.662***	λ = (0.76, 0.90)
Big 12	0	1966, 1992	5.560***, 5.337***	−10.934***	λ = (0.38, 0.74)
Big Ten	0	1960, 1968	−0.831, 3.945***	−7.022***	λ = (0.30, 0.41)
Pac-12	0	1949, 1997	4.172***, −1.920*	−7.584***	λ = (0.15, 0.81)
SEC	0	1980, 1990	−0.077, 1.213	−8.442***	λ = (0.58, 0.71)
Ivy	0	1982, 2002	2.083**, −3.736***	−7.304***	λ = (0.60, 0.88)
MAC	0	1967, 1978	4.950***, −2.327**	−8.139***	λ = (0.32, 0.49)
MVC	0	1956, 1981	−2.559**, −0.394	−7.746***	λ = (0.25, 0.59)
OVC	3	1962, 1986	−5.366***, −1.025	−6.411***	λ = (0.18, 0.58)
Southern	0	1952, 2003	0.926, −0.723	−6.075***	λ = (0.19, 0.89)
WAC	0	1962, 1971	−4.288***, 6.152***	−9.770***	λ = (0.33, 0.45)
WCC	0	1963, 1998	0.610, 2.115**	−7.165***	λ = (0.19, 0.78)

Note. Corr1 = correlation; ACC = Atlantic Coast Conference; SEC = Southeastern Conference; MAC = Mid-American Conference; MVC = Missouri Valley Conference; OVC = Ohio Valley Conference; WAC = Western Athletic Conference; WCC = West Coast Conference. $\hat{k}$ is the optimal number of lagged first-difference terms included in the unit-root test to correct for serial correlation. $\hat{T}_b$ denotes the estimated break points. $\hat{t}_{\gamma j}$ is the value of DT_{jt} for $j = 1,2$. See J. Lee and Strazicich (2003) table 2 for critical values.

*Significant at 90% critical level. **Significant at 95% critical level. ***Significant at 99% critical level.

The next set of notable breaks all have confidence intervals surrounding the formalization of Athletic Grant-In-Aid (GIA) in 1956. Table 13 shows that seven of the nine breaks proximate to this event are reductions in competitive balance. GIA marked a turning point in student-athlete compensation following years of failed reform. Most notably, the NCAA eliminated direct payments to athletes and their parents by boosters. Instead, boosters paid programs directly, with those payments used to fund athletic grants, which were both capped and monitored by the NCAA (Byers, 1995). Interestingly, the impacts on balance oppose what would intuitively be expected following compensation regulation. Perhaps with direct payments to athletic departments, the most powerful programs provided benefits above and beyond what was regulated by the NCAA. If lower level programs either abided by NCAA guidelines or did not have the financial resources to provide additional benefits, GIA may have been associated with reduced within-conference balance.

As illustrated in Table 13, eight breaks have confidence intervals largely falling in the 1960s and the very early 1970s—the time period coinciding with expanded racial integration in the South. The impact of these breaks on balance are clearly mixed and are not constrained to any specific geographic region. Interestingly, five of the eight breaks categorized here took place in the WAC, with a sixth in the WCC. By the mid-1950s, the majority of NCAA institutions outside the South were integrated. However, the SEC did not see its first African

Table 9. BP Method Structural Change Regression Models for *RSD*.

Conference	α_1	β_1	α_2	β_2	α_3	β_3	$\bar{R}^2(R^2)$
SEC	0.00556*	1.70692***	0.00325	1.41909***			.197
SE	(0.00301)	(0.07773)	(0.00535)	(0.32143)			(.163)
Ivy	0.00818**	1.78948***	0.01936***	0.66128*			.234
SE	(0.00364)	(0.09182)	(0.00594)	(0.35446)			(.201)
OVC	0.09585*	0.29958	0.00451*	1.57938***			.563
SE	(0.04918)	(0.24836)	(0.00264)	(0.10520)			(.542)
Southern	0.0227***	1.59466***	0.00284	1.59524***			.152
SE	(0.00837)	(0.11471)	(0.00253)	(0.12954)			(.116)
WAC	−0.01129	2.02339***	−0.15994***	5.65743***	0.00785**	1.37267***	.501
SE	(0.00995)	(0.11923)	(0.02447)	(0.64098)	(0.00315)	(0.17169)	(.464)

Note. *RSD* = ratio of standard deviations; SEC = Southeastern Conference; OVC = Ohio Valley Conference; WAC = Western Athletic Conference; *SE* = standard deviation; BP = break point.
*Significant at 90% critical level. **Significant at 95% critical level. ***Significant at 99% critical level.

Table 10. BP Method Structural Change Regression Models for *dHHI*.

Conference	α_1	β_1	α_2	β_2	α_3	β_3	$\bar{R}^2(R^2)$
Big 12	0.00259*	0.03333***	−0.00016***	0.02823***			.441
SE	(0.00137)	(0.00693)	(0.00006)	(0.00262)			(.464)
Big Ten	0.00160**	0.01755***	−0.00001	0.01820***			.163
SE	(0.00080)	(0.00404)	(0.00003_	(0.00153)			(.198)
Pac-12	−0.00104**	0.03118***	−0.00029***	0.03634***			.235
SE	(0.00045)	(0.00435)	(0.00007)	(0.00316)			(.266)
Ivy	0.00739***	0.01562**	0.00006	0.03175***	0.00054***	−0.00524	.448
SE	(0.00153)	(0.00773)	(0.00017)	(0.00463)	(0.00020)	(0.01188)	(.485)
MAC	−0.00043***	0.04026***	−0.00005	0.01651***			.641
SE	(0.00016)	(0.00283)	(0.00012)	(0.00602)			(.657)
MVC	0.00243***	0.03329***	−0.00035***	0.03760***			.601
SE	(0.00086)	(0.00585)	(0.00006)	(0.00292)			(.618)
Southern	0.00036***	0.01618***	−0.00026**	0.03333***			.238
SE	(0.00010)	(0.00237)	(0.00012)	(0.00703)			(.270)
WAC	0.01126***	0.01457	−0.00017	0.03385***	0.00004	0.01786***	.597
SE	(0.00208)	(0.00929)	(0.00050)	(0.00864)	(0.00011)	(0.00577)	(.625)
WCC	−0.00053***	0.04214***	−0.00390***	0.22735***	−0.00140	0.11483	.424
SE	(0.00009)	(0.00293)	(0.00123)	(0.06227)	(0.00253)	(0.14394)	(.474)

Note. *dHHI* = deviation of the Herfindahl–Hirschman Index; MAC = Mid-American Conference; MVC = Missouri Valley Conference; WAC = Western Athletic Conference; WCC = West Coast Conference; *SE* = standard deviation; BP = break point.
*Significant at 90% critical level. **Significant at 95% critical level. ***Significant at 99% critical level.

Table 11. BP Method Structural Change Regression Models for *MVR*.

Conference	α_1	β_1	α_2	β_2	α_3	β_3	$\bar{R}^2\left(R^2\right)$
ACC	−0.00131***	0.09559***	0.00023	0.06658***			.290
SE	(0.00026)	(0.00416)	(0.00020)	(0.00895)			(.327)
Big 12	−0.00087***	0.10079***	0.00045***	0.05486***			.377
SE	(0.00016)	(0.00460)	(0.00015)	(0.00913)			(.407)
Big Ten	−0.00378***	0.13898***	−0.00136***	0.10530***	0.00047***	0.05622***	.596
SE	(0.00080)	(0.01337)	(0.00048)	(0.01384)	(0.00010)	(0.00579)	(.628)
Pac-12	−0.00017	0.08944***	0.00036***	0.05880***			.187
SE	(0.00024)	(0.00612)	(0.00013)	(0.00737)			(.226)
SEC	−0.00108**	0.11512***	0.00041***	0.05214***			.514
SE	(0.00041)	(0.00889)	(0.00012)	(0.00627)			(.537)
Ivy	−0.00003	0.09544***	0.00027	0.05824	−0.00045	0.12125***	.442
SE	(0.00022)	(0.00604)	(0.00083)	(0.03885)	(0.00034)	(0.02137)	(.487)
MAC	−0.01173***	0.18023***	−0.00043***	0.08213***	−0.00020	0.09206***	.689
SE	(0.00153)	(0.01117)	(0.00015)	(0.00425)	(0.00026)	(0.01414)	(.714)
MVC	−0.00582***	0.17275***	−0.00222***	0.14198***	0.00020	0.06452***	.549
SE	(0.00144)	(0.02253)	(0.00029)	(0.00929)	(0.00018)	(0.01057)	(.586)
OVC	0.00029	0.07226***	0.00050***	0.04812***			.298
SE	(0.00050)	(0.00618)	(0.00011)	(0.00464)			(.333)
Southern	−0.00084	0.11891***	0.00124**	0.04180**	0.00043***	0.05008***	.628
SE	(0.00088)	(0.01518)	(0.00061)	(0.01818)	(0.00014)	(0.00771)	(.658)
WAC	−0.00074	0.10968***	0.00027**	0.06028***			.480
SE	(0.00076)	(0.01390)	(0.00010)	(0.00515)			(.505)
WCC	−0.00135**	0.09980***	−0.00274***	0.14033***	0.00069***	0.04977***	.441
SE	(0.00058)	(0.00561)	(0.00058)	(0.01447)	(0.00025)	(0.01181)	(.489)

Note. MVR = margin of victory ratio; ACC = Atlantic Coast Conference; SEC = Southeastern Conference; MAC = Mid-American Conference; MVC = Missouri Valley Conference (MVC); OVC = Ohio Valley Conference; WAC = Western Athletic Conference; WCC = West Coast Conference; SE = standard deviation; BP = break point.

*Significant at 90% critical level. **Significant at 95% critical level. ***Significant at 99% critical level.

Table 12. BP Method Structural Change Regression Models for *Corr1*.

Conference	α_1	β_1	α_2	β_2	α_3	β_3	$\bar{R}^2(R^2)$
Pac-12	−0.11001***	0.83087***	−0.03350*	1.02174***	−0.00469*	0.81477***	.452
SE	(0.02703)	(0.19210)	(0.01820)	(0.33460)	(0.00241)	(0.12406)	(.411)
Ivy	0.00894***	0.42258***	0.02386***	−0.72803*	0.06021**	−3.73128*	.338
SE	(0.00228)	(0.06077)	(0.00691)	(0.38896)	(0.02957)*	(2.08562)	(.288)
MAC	−0.03804***	1.00964***	−0.00098	0.48363***			.212
SE	(0.00941)	(0.15355)	(0.00512)	(0.24733)			(.174)
Southern	−0.08045*	0.65366***	−0.00546***	0.81268***			.332
SE	(0.04091)	(0.22032)	(0.00140)	(0.06388)			(.303)
WAC	−0.00027	0.60860***	−0.04166	1.31550	0.00121	0.48671***	.363
SE	(0.00590)	(0.09285)	(0.04017)	(1.20786)	(0.00281)	(0.15511)	(.315)

Note. Corr1 = correlation; MAC = Mid-American Conference; WAC = Western Athletic Conference; *SE* = standard deviation; BP = break point.
*Significant at 90% critical level. **Significant at 95% critical level. ***Significant at 99% critical level.

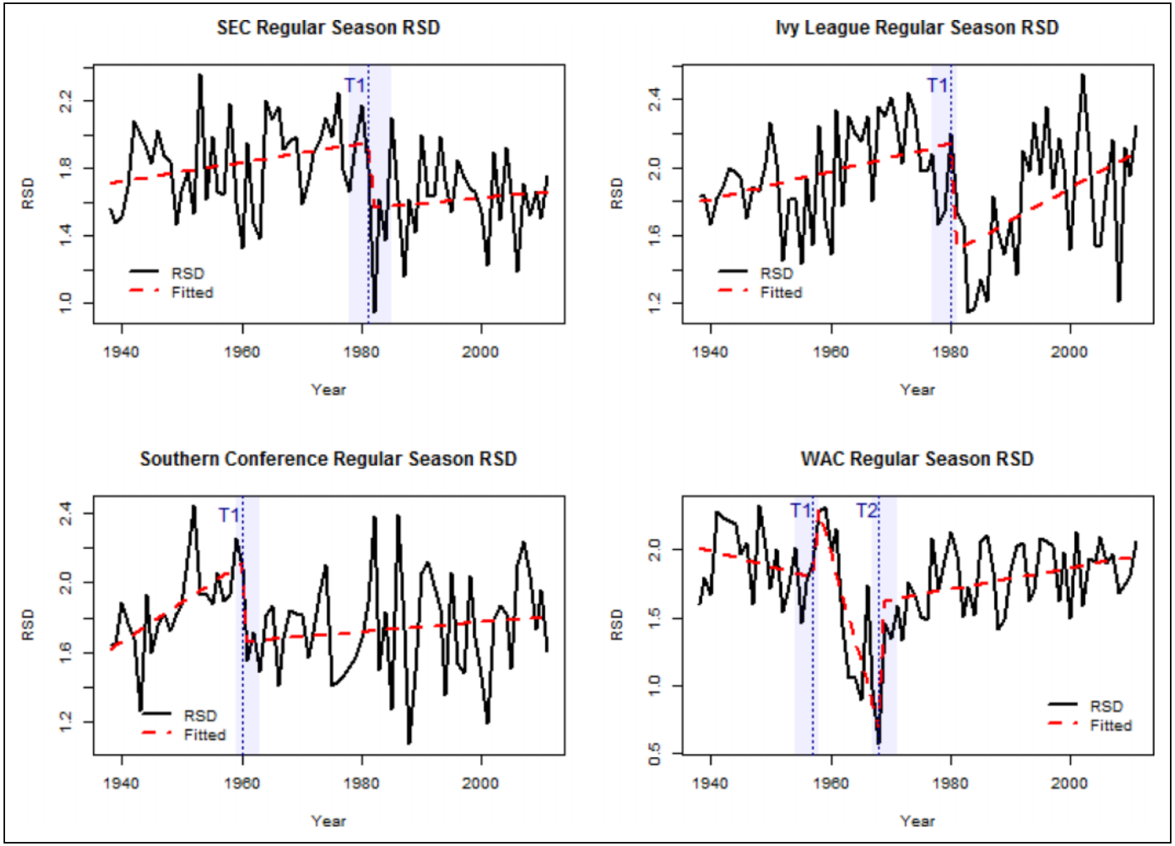

Figure 1. Ratio of standard deviation (RSD) for Southeastern Conference (SEC), Ivy, Southern Conference, and Western Athletic Conference (WAC).

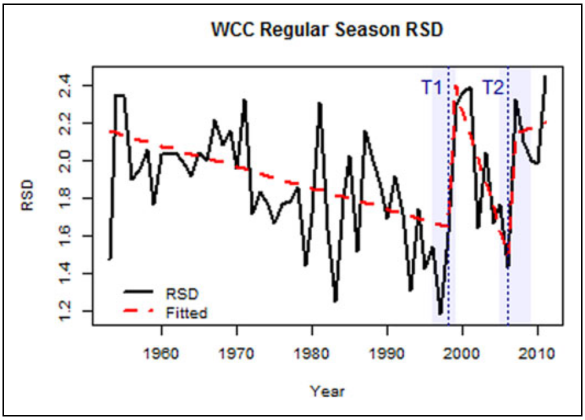

Figure 2. Ratio of standard deviation (*RSD*) for West Coast Conference (WCC).

American basketball player until the 1967-1968 season. Just two seasons earlier, Texas Western University (now University of Texas at El-Paso) won the NCAA championship game with an all-African American starting lineup. During the 1969-1970 season, only 2 of 120 SEC players were African Americans. Mississippi State was the last SEC holdout, finally dressing an African American player in 1972 (Miller & Wiggins, 2004). With an increase in the labor pool for a number of schools that previously did not recruit African American student-athletes, this highlights the possibility of an economic process innovation, as noted in Goff, McCormick, and Tollison (2002).

Integration represents a change in the distribution of talent across programs, as it is clear that specific programs began recruiting African American players at different points in time. If desegregation is associated with the structural changes in balance in the specified conferences, this variation in acceptance across programs could explain the varying direction and timing of the impacts on balance within conferences. It must also be noted that the NCAA split into multiple divisions in 1973, with a number of the confidence interval crossing this date. Therefore, further research on the direct impacts of these two policies on the distribution of talent in college basketball should shed light on the nonmarket factors involved, such as choosing a higher division in order to receive exposure to NBA scouts.

Lastly, four Ivy League breaks have confidence intervals that cover the 1979-1980 season. Each break is associated with a sharp increase in within-conference balance followed by a gradual decrease in balance following the structural break. This is noteworthy, as in successive years the league issued two separate pieces of regulation aimed at reestablishing the athletics-academics relationship. First, in 1979, the league adopted the "10-Point Statement of Principles" which outlined regulations for student-athlete admissions and financial aid. The following year, the league executed the "Parry-Ryan Report" that reaffirmed rules on

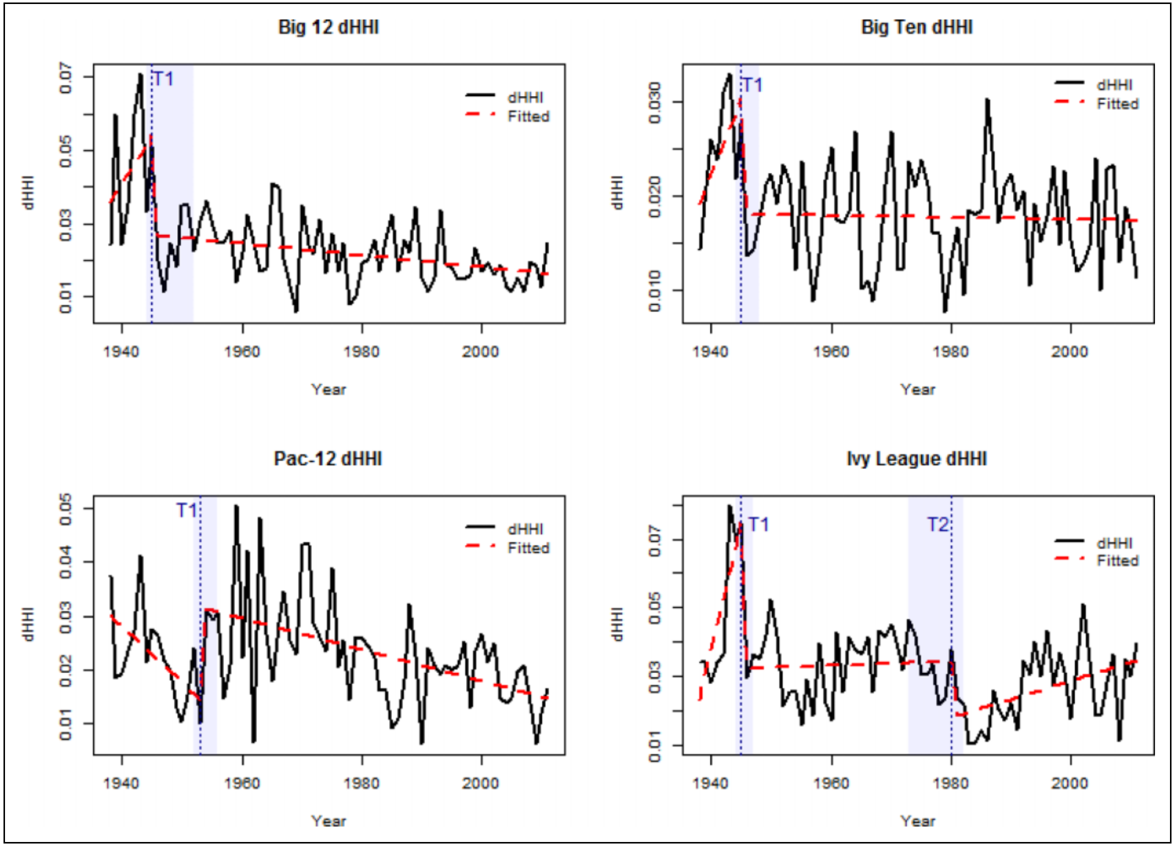

Figure 3. Deviation of the Herfindahl–Hirschman Index (*dHHI*) for Big 12, Big Ten, Pac-12, and Ivy.

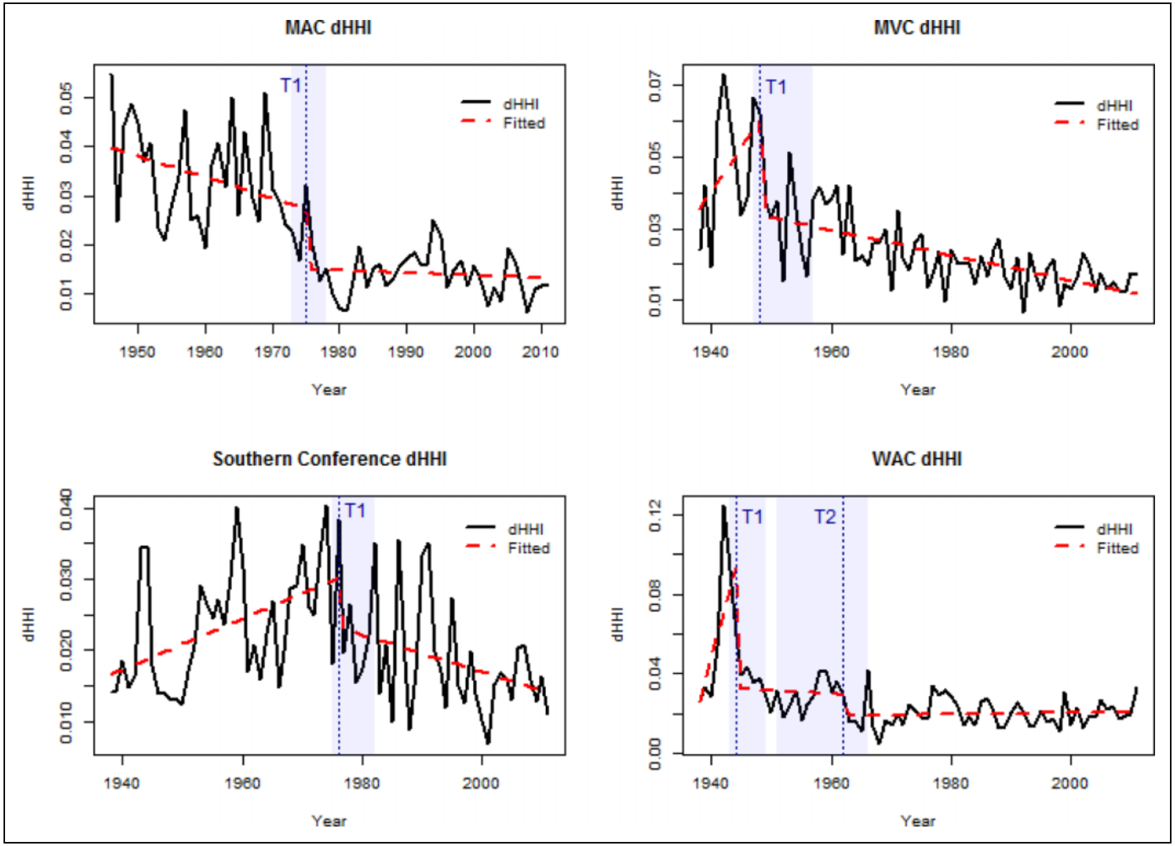

Figure 4. Deviation of the Herfindahl–Hirschman Index (*dHHI*) for Mid-American Conference (MAC), Missouri Valley Conference (MVC), Southern, and Western Athletic Conference (WAC).

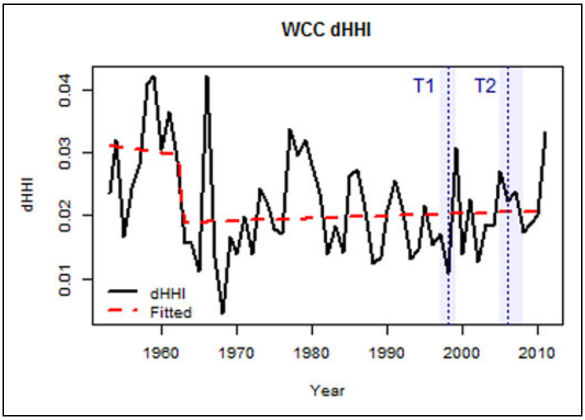

Figure 5. Deviation of the Herfindahl–Hirschman Index (*dHHI*) for West Coast Conference (WCC).

such issues as practice time, scheduling, and competition (Ivy Leauge, 2014). If there was significant within-conference variation regarding uniformity to these guidelines prior to the regulation and the regulation modified behavior as intended, this could explain the improvements in balance seen during this time period. If the regulation was indeed associated with the changes in balance, the behavior of each measure suggests that the regulation had only short-term effects, as the values of all three metrics gradually returned to their prebreak levels.

Summary and Future Research

We track the time series properties of game-level and consecutive season competitive balance measures in NCAA Division I Basketball. Our macro analysis of unit-root properties of these balance series lays the groundwork for future research to conduct more detailed panel analysis on shorter time periods between breaks. However, our findings regarding balance shifts are interesting in their own right as they pertain to conference and NCAA policy as well as the impact of talent distribution in college basketball. We find a host of structural changes that align closely with the GI Bill, the racial integration of college basketball, and the reorganization of the NCAA into three divisions. Since desegregation was a slow and gradual process, it appears that balance within individual conferences may have been impacted by the differential timing of integration across the sport. Evidence also suggests that regulation instituted by the Ivy League in 1979 and 1980 aimed at aligning the goals of athletics and academics may have improved balance within the conference in the short run. We encourage future research to investigate

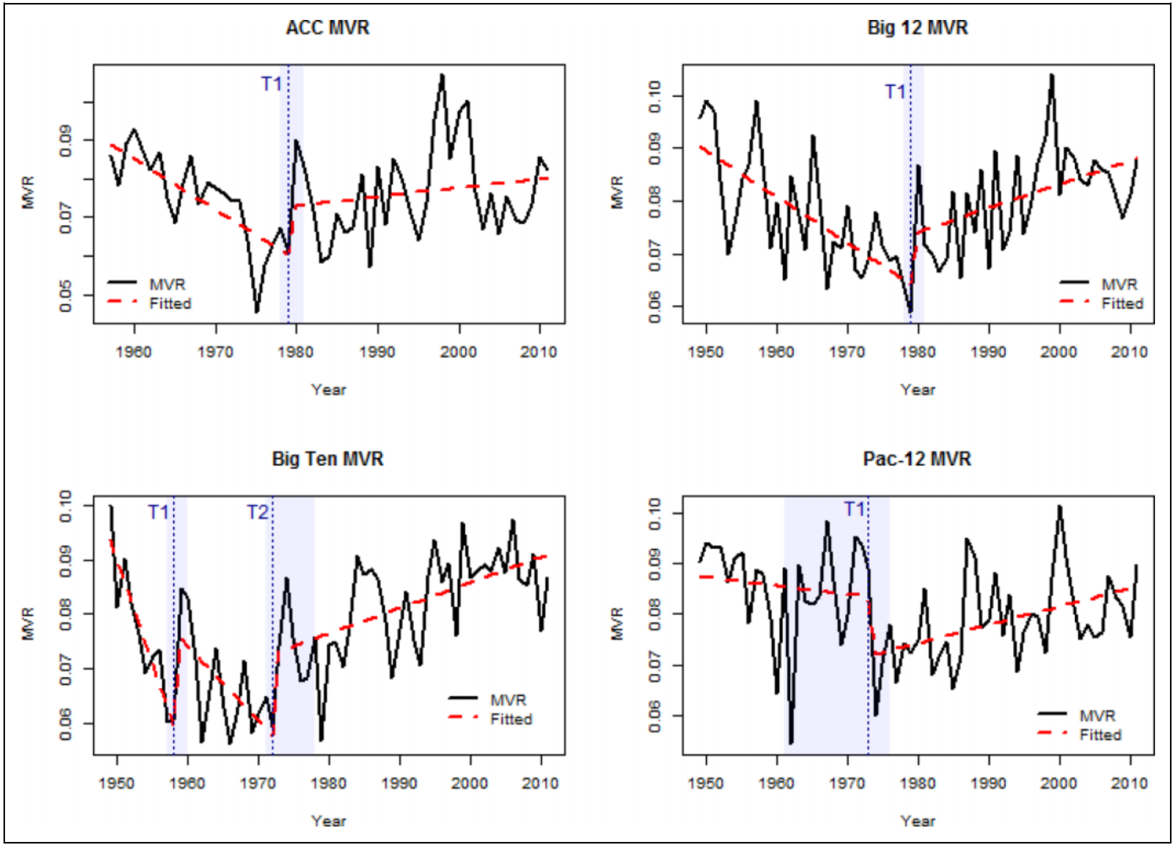

Figure 6. Margin of victory ratio (*MVR*) for Atlantic Coast Conference (ACC), Big 12, Big Ten, and Pac-12.

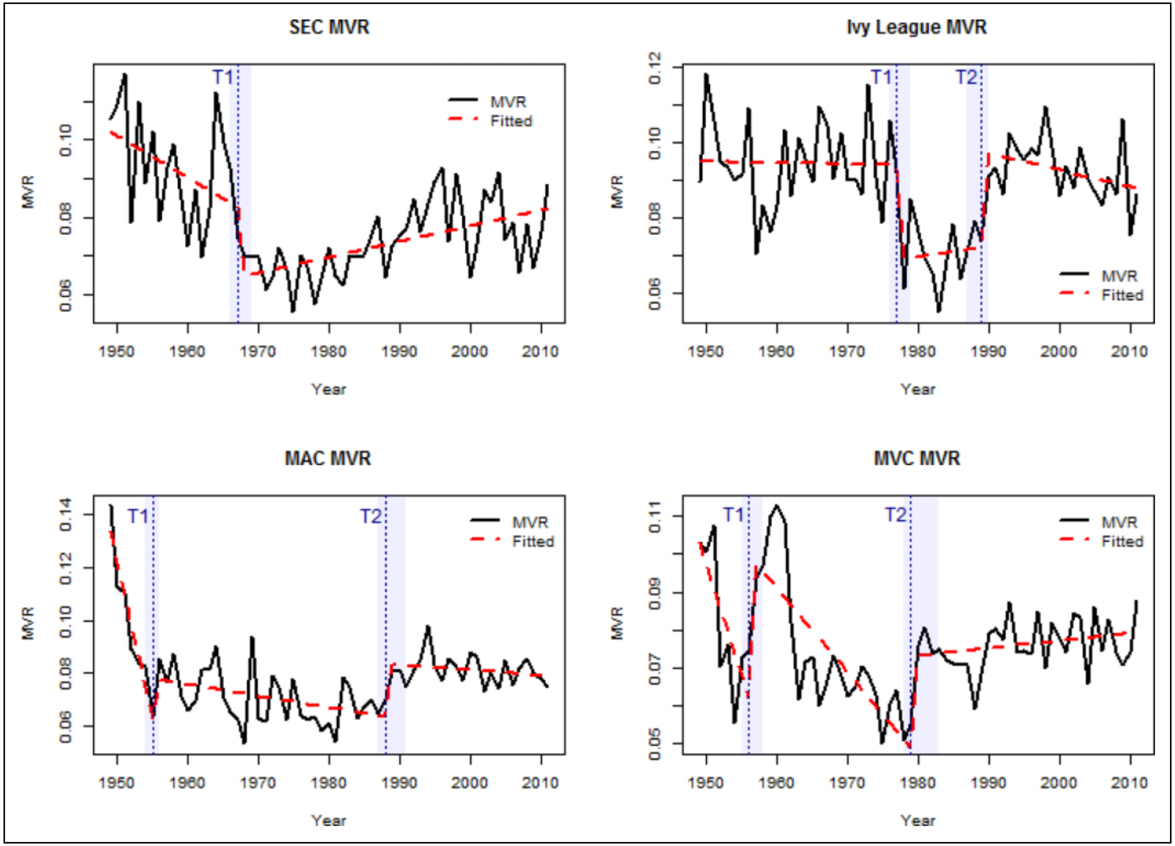

Figure 7. Margin of victory ratio (*MVR*) for Southeastern Conference (SEC), Ivy, Mid-American Conference (MAC), and Missouri Valley Conference (MVC).

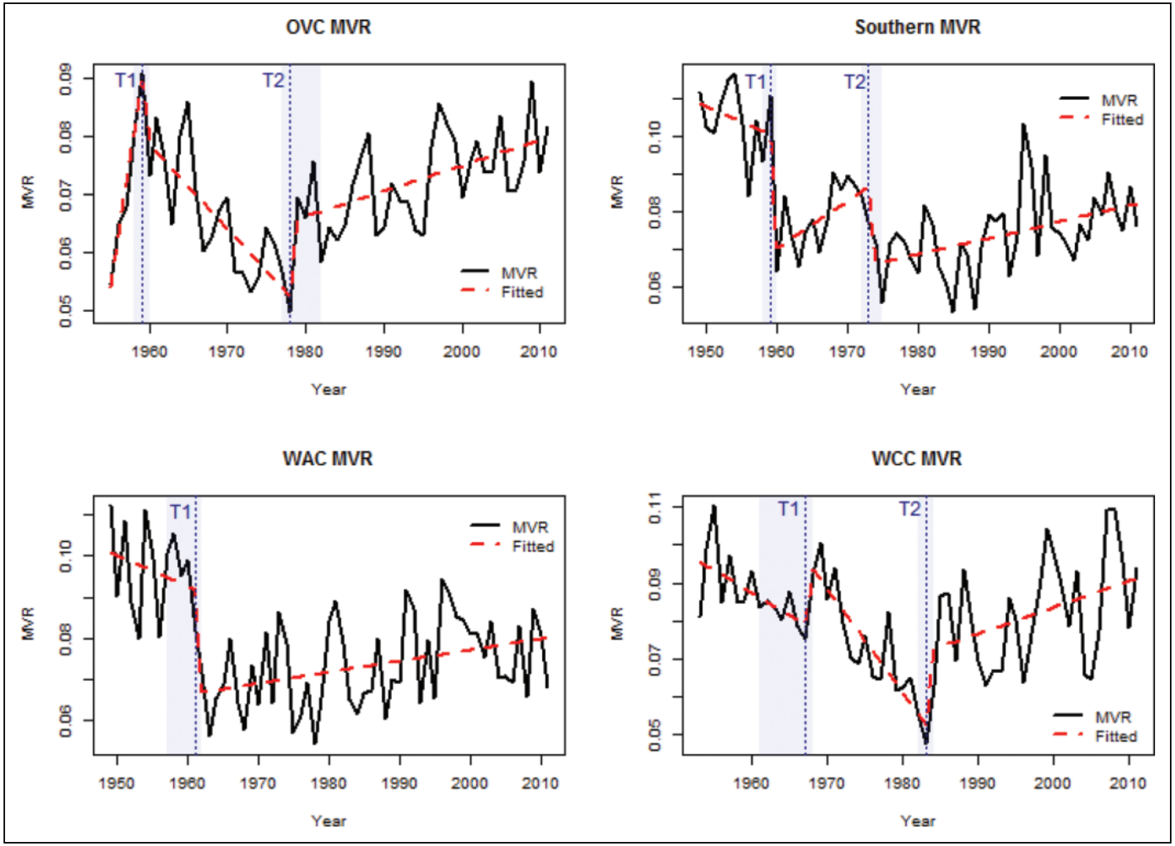

Figure 8. Margin of victory ratio (*MVR*) for Ohio Valley Conference (OVC), Southern, Western Athletic Conference (WAC), and West Coast Conference (WCC).

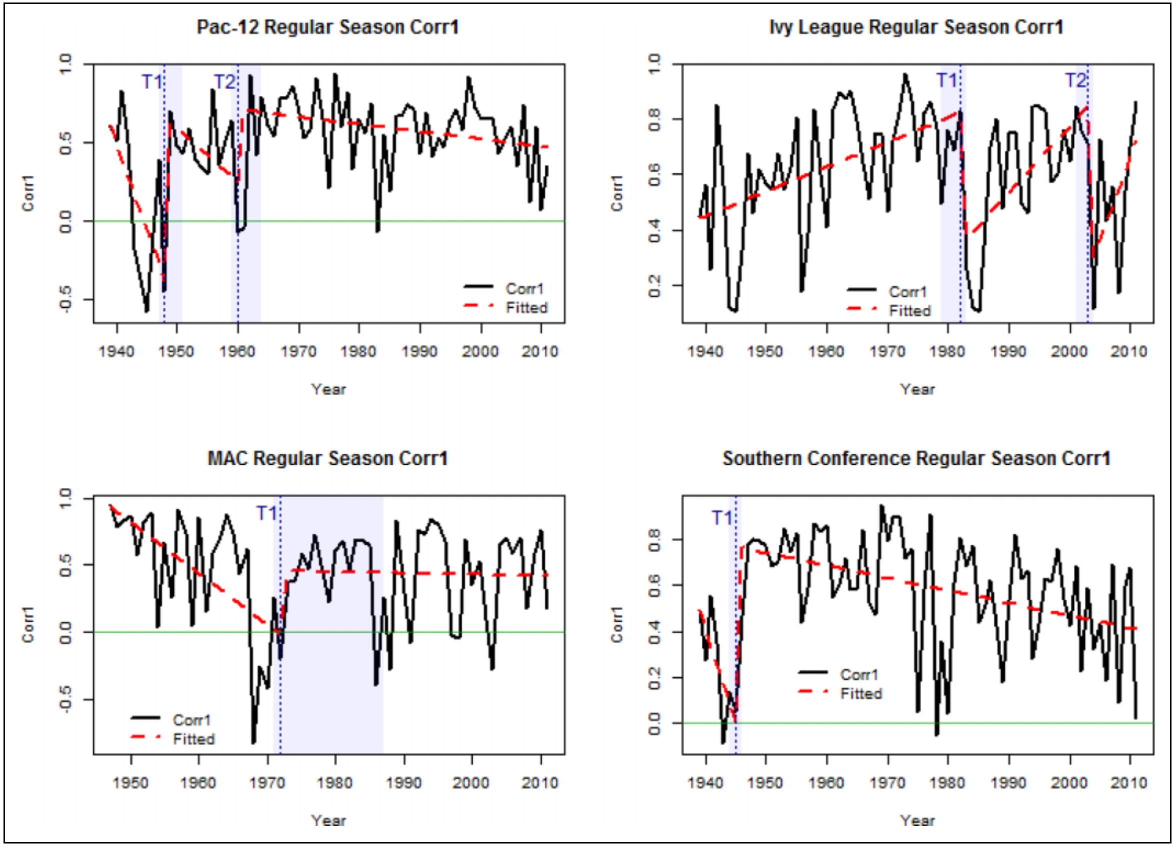

Figure 9. Correlation (*Corr1*) for Pac-12, Ivy, Mid-American Conference (MAC), and Southern Conference.

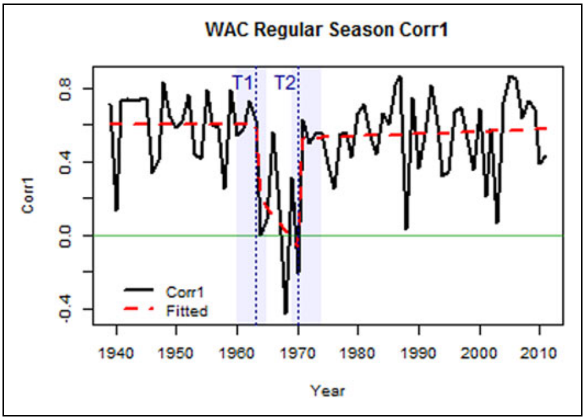

Figure 10. Correlation (*Corr1*) for Western Athletic Conference (WAC).

Table 13. Structural Breaks and Historical Events.

Conference	Metric	Break	90% CIs	Increase/Decrease in Balance	Historical Events
WAC	*dHHI*	1944	[43, 49]	Increase	
Southern	*Corr1*	1945	[44, 46]	Decrease	
Ivy	*dHHI*	1945	[44, 47]	Increase	
Big Ten	*dHHI*	1945	[44, 48]	Increase	GI Bill implemented
Big 12	*dHHI*	1945	[44, 52]	Increase	
Pac-12	*Corr1*	1948	[47, 51]	Decrease	
MVC	*dHHI*	1948	[47, 57]	Increase	
Pac-12	*dHHI*	1953	[52, 56]	Decrease	
OVC	*RSD*	1955	[55, 56]	Decrease	
MAC	*MVR*	1955	[54, 56]	Decrease	
MVC	*MVR*	1956	[55, 58]	Decrease	
WAC	*RSD*	1957	[54, 58]	Decrease	Grant-In-Aid
Big Ten	*MVR*	1958	[57, 60]	Decrease	Formalized
Southern	*MVR*	1959	[58, 60]	Increase	
Southern	*RSD*	1960	[59, 63]	Increase	
Pac-12	*Corr1*	1960	[59, 64]	Decrease	
WAC	*MVR*	1961	[57, 62]	Increase	
WAC	*dHHI*	1962	[51, 66]	Increase	
WAC	*Corr1*	1963	[60, 65]	Increase	
OVC	*MVR*	1966	[65, 70]	Increase	Racial integration
SEC	*MVR*	1967	[66, 69]	Increase	In the South
WCC	*MVR*	1967	[62, 68]	Decrease	
WAC	*RSD*	1968	[67, 71]	Decrease	
WAC	*Corr1*	1970	[69, 74]	Decrease	

(continued)

Table 13. (continued)

Conference	Metric	Break	90% CIs	Increase/Decrease in Balance	Historical Events
MAC	*Corr I*	1972	[71, 87]	Decrease	
Big Ten	*MVR*	1972	[71, 78]	Decrease	
Pac-12	*MVR*	1973	[61, 76]	Increase	Split of NCAA
Southern	*MVR*	1973	[72, 75]	Increase	Into three divisions
MAC	*dHHI*	1975	[73, 78]	Increase	
Southern	*dHHI*	1976	[75, 82]	Increase	
Ivy	*MVR*	1977	[76, 79]	Increase	Ivy League regulation
ACC	*MVR*	1979	[78, 81]	Decrease	
Big 12	*MVR*	1979	[78, 81]	Decrease	
MVC	*MVR*	1979	[78, 83]	Decrease	
Ivy	*RSD*	1980	[77, 81]	Increase	Ivy League
Ivy	*dHHI*	1980	[73, 82]	Increase	Regulation
SEC	*RSD*	1981	[78, 85]	Increase	
Ivy	*Corr I*	1982	[79, 83]	Increase	Ivy League regulation
WCC	*MVR*	1983	[82, 84]	Decrease	
MAC	*MVR*	1988	[87, 91]	Decrease	
Ivy	*MVR*	1989	[87, 90]	Decrease	
WCC	*dHHI*	1998	[97, 99]	Decrease	
Ivy	*Corr I*	2003	[01, 04]	Increase	
WCC	*dHHI*	2006	[05, 08]	Decrease	

Note. dHHI = deviation of the Herfindahl–Hirschman Index; *Corr I* = correlation; ACC = Atlantic Coast Conference; SEC = Southeastern Conference; MAC = Mid-American Conference; MVC = Missouri Valley Conference; OVC = Ohio Valley Conference; WAC = Western Athletic Conference; WCC = West Coast Conference; MVR = margin of victory ratio; RSD = ratio of standard deviation; NCAA = National Collegiate Athletic Association; GI Bill = "The Servicemen's Readjustment Act of 1944.

Table 14. Summary of Relevant Historical Events.

Historical Event	Year
GI Bill implemented	1946
12-Point Code (Failed Regulation)	1952
Brown vs. Board of Education decision	1954
Grant-in-Aid (GIA) formalized	1956
Most programs outside of South now desegregated	Mid-1950s
Billy Jones (Maryland) is first African American player to play in ACC	1965
Texas Western wins National Championship with all African American starting Five	1966
Perry Wallace (Vanderbilt) is first African American player to play in ACC	1967
Dunk is made illegal	1967

(continued)

Table 14. (continued)

Historical Event	Year
All ACC teams have at least one African American player on roster	1971
All SEC teams have at least one African American player on roster	1972
NCAA splits into three divisions (I, II, and III)	1973
Dunk is made legal again	1976
10-Point statement of principles (Ivy League Only)	1979
Parry-Ryan report (Ivy League Only)	1980
NCAA introduces 45-second shot clock	1985
Three-point line introduced	1986
NCAA reduces shot clock to 35 seconds	1993
NBA teams begin drafting players directly from high school	1995
NBA teams no longer allowed to draft players directly from high school	2006

Note. ACC = Atlantic Coast Conference; GI Bill = The Servicemen's Readjustment Act of 1944; SEC = Southeastern Conference; NBA = national basketball association; NCAA = National Collegiate Athletic Association.

competitive balance within the sport at the micro-level to assess whether these findings hold for the specific policies of interest.

The most natural extension is to this work is in college football. Did this sport experience similar balance changes in the face of desegregation, conference-level regulation, and the GI Bill? Further, while North American professional sports are not organized like the NCAA, teams across international leagues often compete with one another. Understanding the differential effects of policies implemented by FIFA or UEFA—Financial Fair Play, for example—on balance within and across world leagues would be a fitting extension to this research, particularly with respect to differential structural changes in balance concurrent with policies implemented at different times.

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1. Conferences include the Atlantic Coast Conference (ACC), Big 12, Big Ten, Pac-12, Southeastern Conference (SEC), Ivy League (Ivy), Mid-American Conference (MAC), Missouri Valley Conference (MVC), Ohio Valley Conference (OVC), Southern Conference, Western Athletic Conference (WAC), and West Coast Conference (WCC).
2. We select ratio of standard deviations in part to allow for comparison against existing empirical literature as the vast majority utilizes this measure.
3. Sequential test results are omitted due to space concerns and are available on request by the authors.

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