

OSU and LSU

Easy to Spell but Do They Belong?

Using the Method of Paired Comparisons to Evaluate the BCS Rankings

And the NCAA Football Championship Game

2007-8

Steven B. Caudill

Department of Economics

Auburn University, AL. 36830

Fax (334) 844-4615

Email: caudisb@auburn.edu

December, 2007

*The author is grateful to Jesse Adams for helpful research assistance.

OSU and LSU

Abstract

This paper used the Bradley-Terry method of paired comparisons, previously used by Beard and Caudill (2007), to examine the 2007 NCAA football season. We find that the BCS did get it right: OSU number one and LSU number two. Our method also indicates that LSU played a much more difficult schedule than OSU and that the SEC is clearly the strongest conference in the land.

Keywords: college football, ranking, Bradley-Terry

JEL: L830, C100

OSU and LSU

Introduction

The 2007 football season has been perhaps the most chaotic ever. As the season progressed it seemed that top team after top team fell victim to upset. In fact, Stewart Mandel, writing for SI.com on December 19, summarized the mess;

Over the course of a three-month regular season, 13 top five teams lost to unranked opponents. Nearly half those victims (six) were ranked No. 2 at the time. The year began with the first win by a I-AA team over a ranked I-A team (Appalachian State over Michigan) and ended with 28-point underdog Pittsburgh (4-7) stunning West Virginia (10-1) on the Mountaineers' home field.

There were three occasions (Oct. 13, Nov. 23-24 and Dec. 1) in which both the No. 1 and 2 teams lost in the same weekend, and another weekend (Sept. 28-29) in which five of the top 10 went down. On Sept. 22, Syracuse -- a 36.5-point underdog -- set a record for the biggest upset by point spread when it knocked off Louisville, only to be eclipsed two weeks later by Stanford.

In the aftermath of all this chaos, the BCS was to choose opponents for the national championship game. The BCS chose one-loss Ohio State from the Big 10 conference and two-loss LSU from the SEC to play in the national championship game. These selections were not without controversy. Both teams lost their next-to-last games and, as one commentator put it, "We have two teams playing for the national championship with shorter winning streaks than Notre Dame" (This year perennial football power, Notre Dame, set many school records for futility). OSU critics complained about the weak schedule and LSU critics complained that, in the final BCS ranking, LSU jumped over teams that either won their last game or had finished their season (Georgia, Kansas and VPI). A strong case was made by the Oklahoma fans. Oklahoma was ranked behind LSU

going into the final week, but in their last game of the season Oklahoma defeated then number one Missouri *for the second time this season*.

Did the BCS get it right this year? Is the SEC really the strongest conference? The objective of this paper is to provide answers to these questions using the Bradley-Terry method of paired comparisons, previously used by Beard and Caudill (2007) to examine the 2003-4 NCAA football season. This method uses only information on wins and losses. We find that, according to our method of ranking teams, the BCS did get it right: OSU number one and LSU number two. Our method also indicates that LSU played a much more difficult schedule than OSU and that the SEC is clearly the strongest conference.

The Bradley-Terry Model

In this paper, we use the Bradley-Terry approach of Keener (1993) previously used by Beard and Caudill (2007), to rank football teams for the 2003-4 season. A brief discussion of our version of the Bradley-Terry (1952) follows but more details can be found in Beard and Caudill (2007).

We assume each team has a fixed strength or rating given by r_i . The probability that team i defeats team j is given by

$$P_{ij} = \frac{r_i}{r_i + r_j} \quad (1)$$

Following Zermelo (1929), the loglikelihood function is a product of probabilities like those given in equation (1) or

$$\log L = \sum_{i=1}^n \sum_{j=1}^n w_{ij} \log P_{ij}, \quad (2)$$

where w_{ij} is a variable equal to the number of times team i defeats team j and n is the number of teams. In most cases the variable, w , is a dummy, or 0-1, variable but conferences tournaments occasionally lead to a team with two wins over an opponent during the season.

We impose a normalization on the model to confine the strength numbers, r , to the unit interval. In particular, we use the logistic transformation for r or

$$r_i = \exp(\theta_i) / [1 + \exp(\theta_i)] \quad (3)$$

Higher strength numbers indicate superior teams.

Data and Results

The data used to estimate this model are the results of football games played during the 2007 year, prior to any bowl games. We elected to only include teams from major conferences previously examined (Beard and Caudill (2007)). Our data consists of games played by teams in the following conferences: ACC, Big 12, Big East, Big Ten, Conference USA, MAC, Mountain West, Pac10, SEC, and WAC. This season only SMU was omitted from the sample, having no wins against teams in any of the conferences under study. The paired comparison method cannot be used with undefeated or winless teams in the sample. Our final sample included 100 teams.

Our rankings are given in Table 1, along with the BCS rankings, the Harris poll, USA Today, and the AP poll. Our rankings indicate that Ohio State is number 1 with a strength number of 0.99620 and LSU is second with a strength number of 0.99249.

These are consistent with the final BCS rankings and all of the other rankings presented.

This result is important because these two teams, OSU and LSU, will play for the national championship on January 7, 2008. For this reason, we wish to focus more closely on how our rankings can be used to compare the respective schedules of these two teams.

On the surface, OSU appears to have a weaker schedule. OSU played several smaller schools in Ohio, lost to the highest rank team they faced (Illinois at number 13 in our ranking), and played one less game than LSU. LSU played in the highly-regarded SEC which, unlike the Big Ten, has a conference championship game thereby guaranteeing a thirteenth game against a formidable opponent.

Let's take a closer look at the schedules and strength of opponents of each team based on our calculations of strength numbers. The schedules and strength numbers of the opponents of OSU and LSU are contained in Table 2. With a score of zero assigned for those teams on the schedule not belonging to any of our included conferences, the OSU schedule has an average strength number of 0.11850, which is about the equivalent of the 36th or 37th ranked team in our ranking. On the other hand, the average strength number for opponents on LSU's schedule is considerably higher at 0.20809, or the equivalent of playing a team ranked 24th or 25th each week.

There other several ways in which the schedules of the two schools can be compared. For example, LSU played and defeated one team ranked in our top ten (VPI). OSU played no teams ranked in our top 10. LSU played three teams in our top fifteen, defeating them all. OSU played two teams in our top 15, winning one and losing one. According to our ranking, the strongest team OSU defeated was number 15 Michigan. LSU defeated three teams more highly ranked than Michigan (5-VPI, 11-Florida, and 14-

Auburn). LSU played five teams in our top 25, winning all five games. OSU played three teams in our top 25, winning two and losing one. Clearly LSU played a tougher schedule.

What about the argument over which conference is strongest? This argument figures in to any discussion of the national championship. As Table 3 indicates, the average strength number is highest for the SEC at 0.302571. This represents the equivalent of an *average* of the 17th ranked team, according to our methods. The Big 12 conference is second at 0.250518. The Big 10 and the ACC are third and fourth, respectively, although they are, for all intents and purposes, equal (Big 10: 0.223264, ACC; 0.222014). The BIG 10's average strength score of 0.223264 is roughly equal to 24th or 25th in our ranking scheme. This, again, provides support for LSU accomplishments last season.

Simulation Results

In order to examine the different effects of the schedules played by OSU and LSU, a simulation is conducted. Using the strength numbers of their opponents to calculate probabilities of winning, we obtain probabilities associated with each number of wins over the season. We calculate the record that a hypothetical team with a strength number of 0.99 would have if our hypothetical team played the OSU and the LSU schedule. The strength number of 0.99 is just below that of OSU (0.99620) and LSU (0.99249), but well ahead of our third-ranked team (Missouri, 0.96086).

The results of the simulation are given in Table 4 and are based on one million random draws. There are many interesting conclusions one can draw from the table,

keeping in mind that LSU plays one more game than OSU. First, the probability of our hypothetical team going undefeated is about 0.28 with OSU's schedule and only 0.10 with LSU's schedule. Our hypothetical team is nearly three times as likely to go undefeated when facing OSU's schedule. This would surely adversely affect LSU's chances of playing for the national championship. There are other ways to view the implications of these simulation results for the likelihood of playing for a national championship. For example, a team with three losses has virtually no chance of playing for the national championship. For our hypothetical team, OSU's schedule yields three or more losses with a probability of 0.0855. The probability of three or more losses when facing the LSU schedule is nearly four times as large at 0.3112. Rarely have two-loss teams been in position to play for the national championship. Facing the OSU schedule, the probability of two or more losses is 0.3190. When facing the LSU schedule, this probability increases to 0.6283. All of these probabilities point to the fact that LSU had a much more difficult road to the national championship game than OSU.

Conclusions

This paper used the Bradley-Terry method of paired comparisons, previously used by Beard and Caudill (2007), to examine the 2007 NCAA football season. We find that the BCS did get it right: OSU number one and LSU number two. Our method also indicates that LSU played a much more difficult schedule than OSU and that the SEC is clearly the strongest conference in the land.

Table 1
Paired Comparison, Strength Number, and Other Rankings

Rank	Present Study	BCS	Harris	USA Today	AP
1	Ohio State (0.99620)*	Ohio State	Ohio State	Ohio State	Ohio State
2	LSU (0.99249)	LSU	LSU	LSU	LSU
3	Missouri (0.96086)	Virginia Tech	Oklahoma	Oklahoma	Oklahoma
4	Kansas (0.77650)	Oklahoma	Georgia	Georgia	Georgia
5	Virginia Tech (0.74430)	Georgia	USC	Virginia Tech	Virginia Tech
6	Georgia (0.63504)	Missouri	Virginia Tech	USC	USC
7	Oklahoma (0.62831)	USC	Missouri	Missouri	Missouri
8	Boston Coll. (0.60612)	Kansas	Kansas	Kansas	Kansas
9	West Virginia (0.50175)	West Virginia	West Virginia	West Virginia	Florida
10	BYU (0.47325)	Hawaii	Hawaii	Hawaii	Hawaii
11	Florida (0.43899)	Arizona State	Florida	Arizona State	West Virginia
12	USC (0.41546)	Florida	Arizona State	Florida	Arizona State
13	Illinois (0.37215)	Illinois	Illinois	Illinois	Illinois
14	Auburn (.36849)	Boston College	Boston College	Boston College	Boston College
15	Michigan (0.33735)	Clemson	Wisconsin	Wisconsin	Clemson
16	Clemson (0.33486)	Tennessee	Clemson	Clemson	Tennessee
17	South Florida (0.30237)	BYU	Texas	Texas	Texas
18	Wisconsin (0.27559)	Wisconsin	BYU	Tennessee	Wisconsin
19	Tennessee (0.27456)	Texas	Tennessee	BYU	BYU
20	Arizona State (0.27356)	Virginia	Cincinnati	Virginia	Cincinnati
21	Virginia	South Florida	Virginia	Auburn	Virginia

	(0.25614)				
22	Cincinnati (0.24302)	Cincinnati	Boise State	Boise State	Auburn
23	Miss. State (0.24260)	Auburn	Auburn	Cincinnati	South Florida
24	Connecticut (0.24210)	Boise State	South Florida	Arkansas	Boise State
25	Oregon State (0.17855)	UConn	Arkansas	South Florida	Arkansas

*Strength numbers in parentheses.

Table 2
Schedules and Opponent Strength Numbers

OSU Opponent	LSU Opponent
Youngstown State (0)	Mississippi State (0.24260)
Akron (0.00406)	VPI (0.74430)
Washington (0.03793)	MTSU (0)
Northwestern (0.02766)	South Carolina (0.09993)
Minnesota (0.00421)	Tulane (0.00225)
Purdue (0.08482)	Florida (0.43899)
Kent State (0.00130)	Kentucky (0.16637)
Michigan State (0.09973)	Auburn (0.36849)
Penn State (0.17716)	Alabama (0.18133)
Wisconsin (0.27559)	Louisiana Tech (0)
Illinois (0.37215)	Mississippi (0.01203)
Michigan (0.33735)	Arkansas (0.17439)
_____	Tennessee (0.27456)
Average = 0.11850	Average = 0.20809

Table 3
Conference Ranking by Average Strength Number

Conference	Average Strength
SEC	0.302571
Big 12	0.250518
BIG 10	0.223264
ACC	0.222014
BIG EAST	0.188010
PAC 10	0.144515
MOUNTAIN WEST	0.101973
CONFERENCE USA	0.022751
MAC	0.006987

Table 4
 Simulated Probabilities of Won-Loss Records
 for Hypothetical Team

Facing OSU Schedule	Probability	Facing LSU Schedule	Probability
12-0	.2792	13-0	.0999
11-1	.4018	12-1	.2717
10-2	.2335	11-2	.3171
9-3	.0718	10-3	.2046
8-4	.0124	9-4	.0816
7-5	.0012	8-5	.0210
6-6	.0001	7-6	.0036
5-7	.0000	6-7	.0004
4-8	.0000	5-8	.0000
3-9	.0000	4-9	.0000
2-10	.0000	3-10	.0000
1-11	.0000	2-11	.0000
0-12	.0000	1-12	.0000
		0-13	.0000

References

- Beard, T.R. and S.B. Caudill (2007), "Who's Number One? Ranking College Football Teams for the 2003 Season,"
- Bradley, R.A., and Terry, M.E. (1952), "The Rank Analysis of Incomplete Block Diagrams. I. The Method of Paired Comparisons," *Biometrika*, 39, 324-345.
- Keener, J.P. (1993), "The Perron-Frobenius Theorem and the Rating of Football Teams," *SIAM Review*, 35, 80-93.
- Mandel, Stewart : A Spate of Weekly Upsets made '07 a Memorable Year," www.sportsillustrated.cnn.com (12/14/2007).
- Zermelo, E. (1929), "Die Berechnung der Turnier-Ergebnisse als ein Maximum-problem der Wahrscheinlichkeitsrechnung," *Math. Z.*, 29, 436-460.