

# Legends of the Fall: A Historical Ranking System Using a Logistic Transformation of Pairwise Comparisons\*

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**Abstract** The present study extends earlier work by Clement and McCormick (1989) on managerial quality in college basketball by employing an empirical procedure that utilizes win-loss information from pairwise matchups of coaches in college football. A logistic transformation of the outcomes of these matchups provides a coaching (managerial) quality parameter in each case that can be used to rank the coaches (managers) encountered in our panel dataset. In terms of individuals, the top five coaches in the SEC since 1992 are Urban Meyer, Nick Saban, Mark Richt, Steve Spurrier, and Les Miles. Among those SEC schools that have had multiple head football coaches since 1992, Florida has been home to the most productive coaches. Finally, the technique used here is adaptable to “competition” in non-sports settings, such as that between mutual fund managers, real estate brokers and even trial lawyers.

*Keywords:* sports economics, managerial quality, logistic transformation

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“He can take his'n and beat your'n and take your'n and beat his'n.” – O.A. “Bum” Phillips, former coach of the Houston Oilers, referring to legendary Alabama coach, Paul “Bear” Bryant.

## 1. Introduction

At the time of their publication on managerial quality in sports, Clement and McCormick (1989) noted that there was only “a small literature” on the application of economics to sports. Among the works cited there, a non-trivial portion had not been published. Over the last 20 years, the economics of sports genre has grown significantly, such that it now encompasses a plethora of published journal articles, multiple textbooks, and at least one economics journal devoted to the sub-field.<sup>1</sup>

Amidst this burgeoning branch of economics, the Clement and McCormick (1989) analysis of managerial quality in sports continues to be an area of interest to researchers.<sup>2</sup> Following Clement and McCormick (1989), Singell (1991), Scully (1994), Hadley, Poitras, Ruggiero and Knowles (2000) and Fee, Hadlock and Pierce (2006) each examined some aspect of coaching (managerial) quality in sports, ranging from the relationship between coaching (managerial) efficiency and coaching tenure across three major sports (i.e., football, basketball and baseball) to the transition of players into coaching in professional baseball. One study estimates that the value of efficient coaching is three to four additional victories in a given National Football League season (Hadley *et al.*, 2000), while another finds that the likelihood of an external promotion in professional football is strongly related to measures of coaching performance, yet only weakly related to measures of team or player performance. Similarly, using a series of regression equations that relate college basketball players' various skills to their playing time over a season, the earlier study by Clement and

McCormick (1989) finds that a college basketball coach's ability to efficiently allocate playing time across players on his team is positively related to that coach's winning percentage. One of the more appealing elements of the statistical framework used by Clement and McCormick is that it produces what is essentially a coaching quality or managerial efficiency parameter that is used by the authors to rank college basketball coaches on the basis of coaching (managerial) quality.

The present paper extends the Clement and McCormick (1989) study by employing an empirical procedure that utilizes win-loss information from pairwise matchups of coaches in college football. A logistic transformation of the outcomes of these matchups, from which coaching (managerial) quality can be inferred, also provides a coaching (managerial) quality parameter in each case that can be used to rank the coaches (managers) encountered in our panel dataset. Our framework and the coaching (managerial) quality parameter are both described in the following section, after which our data and results are discussed.

## 2. Statistical Framework

Our analysis follows the general statistical framework in Beard and Caudill (2009), though our analysis is of individual coaches/managers rather than teams/organizations, and, as explained in greater detail in the next section, we examine managerial performance using a time-series of cross-sections (i.e., a panel), where as Beard and Caudill (2009) examined organizational performance using a single cross-section of data. We assume that each coach has a fixed rating given by  $r_i$ . The probability that coach  $i$  defeats coach  $j$  is given by

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

As in Zermelo (1929), the log-likelihood function is a product of probabilities like the one given is (1) above, 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 coach  $i$  defeats coach  $j$ , and  $n$  is the number of coaches. In many cases the variable  $w$  takes the value of zero (i.e., where coach  $i$  never defeated coach  $j$ , or where the two coaches never competed against one-another), though there are also many cases where its value exceeds zero.

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,

$$r_i = \frac{\exp(\theta_i)}{1 + \exp(\theta_i)} . \quad (3)$$

The likelihood function above must be maximized over the  $n$ -dimensional parameter vector,  $\theta$ . Maximization is accomplished using the algorithm of Berndt, Hall, Hall and Hausman (1974), which has advantage of requiring only the first derivatives of the likelihood function. To illustrate the

algorithm in Berndt, *et al.* (1974), the parameter vector is denoted by column vector  $\theta$ . Given starting values for these parameters, the algorithm in Berndt, *et al.* (1974) updates the parameter vector, as presented in Maddala (1977: 179), Greene (1993: 348) and Cameron and Trivedi (2005: 343), by

$$\theta_{t+1} = \theta_t + \left[ \sum_{i=1}^n \frac{\partial \log L_i(\theta_t)}{\partial \theta} \frac{\partial \log L_i(\theta_t)'}{\partial \theta} \right]^{-1} \frac{\partial \log L_i(\theta_t)}{\partial \theta}. \quad (4)$$

As starting values we used the logarithm of the odds of winning percentages for each coach. Application of the logistic transformation resulted in starting power ratings,  $r_i$ , equal to a coach's winning percentage. Once the parameter values have converged the estimated covariance matrix is given by,

$$Cov(\theta) = \left[ \sum_{i=1}^n \frac{\partial \log L_i}{\partial \theta} \frac{\partial \log L_i'}{\partial \theta} \right]^{-1}, \quad (5)$$

evaluated at the converged values of the parameter vector.

One problem with using the method of paired comparisons to rank teams in sports like college football, as opposed to participants in sports like chess or tennis, is the problem of inadequate “mixing” on the part of the participants. In chess and tennis, individual participants compete against one another multiple times during a given season. The same cannot be said in college football. Teams rarely play each other twice and although over two hundred teams compete for the championship, the typical team competes against, at most, nine or ten of these championship-eligible teams. One could make the case that the football competition is not adequately mixed to use the method of paired comparisons to determine the strongest *team*, as has been done by Beard and Caudill (2009) and others.

The actual use of the team as a unit to be ranked is problematic on other fronts as well. For instance, it is highly likely that the “team” changes from game to game during a season, as players sit out due to injury or suspension. However, the coach is a constant during the season (the rare midseason firing aside), so that one could argue that it is more appropriate to employ the method of paired comparisons to rank college football coaches instead of college football teams.<sup>3</sup> In the present study we extend this idea to rank coaches based on *career* games against other coaches. Teams during a season or career may change but the coach, learning aside, remains the same. Using the method of paired comparisons described above, our study is the first to offer an historical ranking of college football coaches.<sup>4</sup>

### 3. Data, Results and Concluding Comments

Data used to estimate these values come from head-to-head matchups of SEC coaches over the 1992-2008 period.<sup>5</sup> The starting point, 1992, was chosen because (1) that is the year that the SEC expanded to include the current 12-team composition, and (2) that is the year that the SEC began playing an end-of-season conference championship game.<sup>6</sup> Because there were no coaches who were undefeated *or* winless during the time frame, both situations that prohibit use of a pairwise comparisons approach, we did not have to omit any data.<sup>7</sup>

The results of our statistical approach to measuring historical coaching quality are presented in Table 1. Not surprisingly, fresh from his 2008 Bowl Championship Series (BCS) national championship, Florida head coach Urban Meyer sits atop the historical ranking. In just four years at the helm (2005-08), Meyer's UF teams have won two SEC championships and two BCS national championships. These followed Meyer's undefeated season as the head coach at the University of Utah in 2004.

To round out the top five, Meyer is followed by Mark Richt (Georgia), Nick Saban (LSU and Alabama), Steve Spurrier (Florida and South Carolina) and Les Miles (LSU). With the exception of Richt, each of these coaches has won a national championship with an SEC school since the beginning of the 1992 season. Spurrier managed Florida to five SEC titles between 1992 and 2001, while Richt has won two SEC titles during his recent tenure at Georgia. The highest rated coaches who failed to win either an SEC or national championship while at an SEC school are Ron Zook (8<sup>th</sup>), who succeeded Spurrier at Florida, and Dennis Franchione (9<sup>th</sup>), who was the head coach at Alabama for two seasons (2001-02). The lowest ranked coach to have won an SEC title is Mike Dubose, who coached at Alabama from 1997 through 2000, and won the SEC title in 1999. Dubose is ranked 15<sup>th</sup> among SEC football coaches since 1992. The lowest ranked coach to have won a national championship is Gene Stallings (6<sup>th</sup>), who preceded Dubose at Alabama. Stallings, whose tenure at Alabama began in 1990 and continued through 1996, won the national championship in 1992 on the basis of an undefeated season.

It is interesting that there are nine SEC schools whose coaches (from 1992-2008) are all present among the top 20 coaches in Table 1. These are Alabama (5), Mississippi (4), Florida (3), Georgia (3), Auburn (2), South Carolina (2), Arkansas (1), Mississippi State (1) and Tennessee (1). Of these, Alabama and Mississippi had the most coaches over this 17-year span, with five and four, respectively. Among those SEC schools that have had multiple head football coaches since 1992, Florida has been home to the most productive coaches.

In closing, it is important to recognize that our procedure for ranking coaches is adaptable to other activities where one-on-one competition occurs (e.g., chess), or where teams participate in post-season competition using a tournament format. Tournament seedings are often produced by committees of mixed interests – some partisan, and others disinterested – and a procedure like the one used here can be used to examine, and draw conclusions from, a tournament's initial seedings. Finally, the technique used here is adaptable to "competition" in non-sports settings, such as that between mutual fund managers, real estate brokers and even trial lawyers.

## Endnotes

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1. A general EconLit search (without specifying fields) of the term "sports" yielded 5,326 entries (Authors, 2009). Some recent papers on college football include Fainmesser, Fershtman and Gandall (2005), Brown, Farrell and Zorn (2007), Campbell, Rogers and Finney (2007) and Fair and Oster (2007). Fort (2006) and Leeds and von Allmen (2007) authored two of the most popular texts in the genre. Finally, the *Journal of Sports Economics* is now in its eleventh year of publication.

2. In terms of economic theory, the Clement and McCormick study has its roots in Alchian and Demsetz (1972) and Cheung (1983), while its roots in terms of sports economics lie in Porter and Scully (1982).
3. We also maintain that coaches today are more like CEOs managing a large staff of assistant coaches. Our ranking gives the head coach all of the credit or blame for the staff because the head coach is in charge of hiring subordinates.
4. It is important to point out that while the logistic transformation of pairwise comparisons technique described here is not new, our use of it (1) to rank college football coaches, and (2) to rank historical outcomes in college football is new.
5. Given the rarity of the situation, data on coaches who were appointed to coach a partially-completed season were not used.
6. The 12 teams of the SEC are Alabama, Arkansas, Auburn, Florida, Georgia, Kentucky, Louisiana State, Mississippi, Mississippi State, South Carolina, Tennessee and Vanderbilt. The conference is comprised of two divisions – the East and the West. Representing the East are Florida, Georgia, Kentucky, South Carolina, Tennessee and Vanderbilt, while the West is represented by Alabama, Arkansas, Auburn, Louisiana State, Mississippi and Mississippi State. The first few conference championship games were played in Legion Field in Birmingham, AL. Since 1994 they have been played in the Georgia Dome in Atlanta, GA.
7. We did, however, exclude data from “interim” coaches who managed an SEC team for only part of a single season. Doing so precluded use of only a handful of observations.

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**Table 1. Top 20 SEC Football Coaches, 1992-2008**

Rank	Name	Affiliation(s)	Power Rating	URS	SEC/Nat'l Titles
1	Urban Meyer	Florida	0.990	0	2/2
2	Mark Richt	Georgia	0.686	0	2/0
3	Nick Saban	LSU, Alabama	0.634	1	2/1
4	Steve Spurrier	Florida, South Carolina	0.582	1	5/1
5	Les Miles	LSU	0.558	1	1/1
6	Phillip Fulmer	Tennessee	0.521	1	2/1
	Gene Stallings	Alabama	0.521	2	1/1
8	Ron Zook	Florida	0.483	0	0/0
9	Dennis Franchione	Alabama	0.401	0	0/0
10	Terry Bowden	Auburn	0.318	1	0/0
11	Tommy Tuberville	Mississippi, Auburn	0.273	1	1/0
12	Jim Donnan	Georgia	0.268	0	0/0
13	Houston Nutt	Arkansas, Mississippi	0.243	0	0/0
14	David Cutcliffe	Mississippi	0.201	0	0/0
15	Mike DuBose	Alabama	0.168	0	1/0
16	Mike Shula	Alabama	0.141	0	0/0
17	Lou Holtz	South Carolina	0.122	0	0/0
18	Ray Goff	Georgia	0.117	0	0/0
19	Billy Brewer	Mississippi	0.100	0	0/0
20	Jackie Sherrill	Mississippi State	0.096	0	0/0

Notes: Coaches are ranked by Power Rating. URS=Undefeated Regular Season. For the purposes of this study, the SEC title game is not counted as part of the regular season. Since 1992, the number of SEC titles and the number of SEC title games won by a given SEC coach are the same.