Consumer Behavior Knowledge for Effective Sports and Event Marketing

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To Debi Eisert, who is always a good sport, and

To Ben Scheinbaum, who continues to nurture the passion for sports

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Assessing the Existential Validity of the Bowl Championship Series Rankings

Thomas J. Reynolds

Introduction

The preoccupation of the *number 1-ness* in America is perhaps best evidenced in the competitive arena of athletics. Starting as preschoolers, America's youth are conditioned that there must be a champion for the athletic season to be complete. From a cultural perspective, championships are simply seen as the universal goals to which we all should strive. Winning the championship defines a successful season.

This fundamental orientation toward athletics continues to strengthen the older the child becomes. Along with the trophies, the media emphasize and reinforce this explicit assumption that, if we compete, there *must* be one crowned as champion. Over the course of time, this all-American cultural perspective simply becomes the collective, unstated basis of our latent, unquestioned belief that we must formally identify a champion for each competitive sport each year.

As the amateur competition moves to the collegiate level, we see tournament champions, conference champions, and, yes, national champions. The scores of collegiate sports complete their season with the single determination of a national champion, which is typically the result of a postseason tournament of regional or conference champions. Again, the American sports consumer psyche demands a champion, and part of the mission of competitive athletic administration is to provide the mechanism, or structure, to determine *the* champion.

In most sports, the determination of a national champion involves selecting participants and a competitive venue that, when fully played out, will yield one winner—one champion. Think about the flip side of

this for a moment: Requiring that there *must* be one winner necessarily means that every other participant *must* be a nonwinner. (It might well be said that the reality of this last perspective defeats much of the true essence of sports.)

This template for postseason tournament play, directed toward crowning a single champion, functions well across any sport, individual or team, for which there can be multiple competitions played within a relatively short time period. Unfortunately, the high-profile, high-economic-value sport that does not fit this mold is major college football (National Collegiate Athletic Association [NCAA] Division I). Because of a unique combination of the extremely physical demands and the time required to rest after competition, along with the critical strategic aspect that requires the development and practice of an opponent-specific game plan, big-time college football does not lend itself easily to tournament play. Thus, we have a conundrum in declaring a national champion, which has resulted in a monopolistic economic opportunity taken advantage of by those member conferences controlling the selection of teams for the major postseason bowls, the Bowl Championship Series (BCS).

Ostensibly, the birth of the BCS was driven by the idea to provide a computational methodology for pairing the top two college football teams in a championship game at season end. The BCS formulation is comprised of a combination of expert opinion and computer algorithms that yields an overall ranking of teams that would serve to determine the two top teams as well as the other teams to play in the highly lucrative BCS-designated bowls. The very existence of the BCS is predicated on the fundamental assumption that the rankings they produce are valid; that is, they accurately represent some "true order" of the level of potential performance of each team. This true order, of course, is not known, but how valid the rankings are at any point in time can be assessed by measuring how well a given set of ranks predicts wins and losses in subsequent games. This concept of predictive or criterion validity (Cronbach, 1970, p. 122) provides an empirical framework for evaluating the existential validity of the BCS rankings by providing an estimate of its relative contribution to representing the "true order" represented by wins and losses. In particular, one such ranking method, which is significantly less complicated and more commonsensical than the current BCS formulation, serves as a benchmark level to assess the incremental predictive validity contribution provided by the BCS system. This conceptually straightforward approach to developing team rankings, termed the R methodology, is based only on a team's on-field performance factoring in the quality of the opponents they defeat.

By comparing the increase in predictive validity of the BCS system to the R methodology, we can assess the existential validity of the BCS ranking methodology, that is, whether the increase is significant enough to justify its existence.

Background

In the 1930s, the fathers of college football realized some postseason recognition was deserved, and this took the form of a few bowl games, pitting outstanding teams from different geographic areas against one another. Given the limited travel schedule of most teams until the 1960s, these bowl games permitted questions to be answered regarding which regional "championship" teams were the best. These bowl games became the centerpiece of the New Year's media programming and were greatly anticipated and universally enjoyed by all involved: players, attending fans, and television viewers alike. The results of these bowl games were then digested by experts, who produced an ordering of teams to yield a number 1 team, the national champion. And, because there were two separate polls, coaches and media, two teams on occasion could lay claim to the mythical national championship.

Over the years, bowl games continued to experience great success. As a result, the economic forces that drive the decision making of community leaders began to serve as the basis of organizing new bowl games, with the hope of sharing in the media attention (which should read as dollars) for their respective cities. Fast-forward three quarters of a century to today: We see a rise from a single-digit number of bowl games to over 30. The reality is that the economics do not support many of the bowls, resulting in some bowls in which the teams actually have to guarantee ticket sales and sponsorships to participate. In fact, simply having a record of six wins (i.e., essentially average) is all that is required to play in a postseason bowl game.

The proliferation of bowl games has significantly reduced their importance, essentially resulting in a multitude of mediocre teams playing in half-full stadiums to provide low-rated filler entertainment for the multichannel media environment. Are all bowl games really special? Maybe perhaps a dozen or so are, but certainly not anywhere near the more than 30 today. The marketing problem, then, may be defined as making the bowl scheme a more financially viable business (not to mention fairer). To address this economic issue, one must first ask: What role do bowl games offer toward producing a national champion? Should one bowl

game determine the national champion? This, of course, is the current underlying assumption of the BCS. But, why then play the other bowl games, which have no direct impact on determining who ultimately will be named *the* national champion? Perhaps therein lies the answer to the marketing problem of providing additional interest to the secondary bowls while providing a framework to crown the national champion.

This unsatisfied need for crowning one definitive national champion resulted in a significant business opportunity, which was recognized by the six major football conferences (Atlantic Coast, Big East, Big 12, PAC-10, Big 10, and Southeastern Conference) as a source of additional revenue that they could receive on an ongoing basis. In 1998, these conferences organized to design the BCS system to control the selection of teams to the four major postseason bowls (Rose, Sugar, Orange, and Fiesta) under the auspices of guaranteeing that the top two teams of college football, determined by their tripartite rating system, combining expert opinion and computer rankings, would play every year in a national championship game. It is important that the BCS had the self-serving proviso that each conference would have at least one team participating, thus guaranteeing a big payday for each. In regard to the self-serving nature of the BCS conferences automatically being included in the premier bowl games, it has been posited that the reason it is not subject to Sherman antitrust litigation is the ranking "service" it provides for the public (Carroll, 2004).[1]

Currently, the BCS ranking methodology, which has been revised multiple times since its inception to address perceived inequities, is calculated by averaging the ranks obtained from three sources: the Harris Interactive poll (subjective), *USA Today* poll (subjective), and a summary of the six objective computer polls (Anderson & Hester, Richard Billingsley, Colley Matrix, Kenneth Massey, Jeff Sagarin, and Peter Wolfe).

[1] After a threatened antitrust lawsuit in 2003 by the president of Tulane University, a non-BCS conference school, in 2004 five other second-tier conferences coincidentally were included with the original six in the BCS with specific stipulations including (a) that one of the five new member conference champions would appear annually in a BCS bowl; (b) a guaranteed payout of 9% per year would be split among the five new members, beginning with the 2006 season; and (c) a provision as to how an additional team in one of the five nonfounder conferences could qualify to participate in a BCS bowl based on their end of season ranking using the BCS ranking system. (For a complete history of the BCS, see History tab at http://www.bcsfootball.org)

R Methodology: An Unbiased, Performance-Only Benchmark

A benchmark solution to produce a ranking of teams should be conceptually simple to understand and implement and be basically a function of the performance of each team on the field, as opposed to being based on subjective rankings (which are potentially prone to several types of bias) and proprietary computational algorithms, which in combination precisely define the current tripartite BCS rating system. A conceptually simple, methodologically transparent measure based only on on-field performance, then, may be defined as a function of the number of games a team won and by what margin (50%), combined with the quality of the respective competitor the team beat (50%). There is no subjectivity to this performance-only approach to determine team rankings or any other consideration of secondary statistics or variables, such as home field advantage. This benchmark R methodology to quantify team performance may be considered a best estimate of a team's potential because this formulation does not explicitly penalize a team for the games it lost, except by virtue of the fact that there was a missed opportunity to gain wins (see Appendix for details).

Thus, a simple equation that will yield an overall quality rating R_i for each team i, developed from games against Division I-A opponents, is

$$R_i = .5W_{i(1)} + .333W_{i(2)} + .167W_{i(3)} \tag{10.1}$$

where $W_{i(1)}$ is a summary value reflecting the percentage of team wins, including a conservative adjustment for margin of victory, which is also applied to $W_{i(2)}$ and $W_{i(3)}$ in quantifying the quality of the opponent beaten by a combination of implied victories over the direct j teams they beat (first order) and the indirect k teams j beat (second order), respectively.

Thus, there are three components used to compute the inferential quality of the performance ranking of a given football team: a weighted-by-victory-margin percentage of teams they beat $W_{(1)}$s (50%), the performance-weighted quality of the teams they defeated $W_{(2)}$s (33.3%), and the performance-weighted quality of the teams their defeated opponents beat $W_{(3)}$s (16.7%) (see Appendix for a detailed specification of the R methodology). The standardization Z of the three components of Equation 10.1 is computed to put the measures on the same scale so the weights will reflect their predetermined contribution to a summary measure that provides the basis for generating the rankings for all the teams.

$$Z_{Ri} = .5Z_{Wi(1)} + .333Z_{Wi(2)} + .167Z_{Wi(3)} \quad (10.2)$$

Using this method, teams can then be rank ordered by their Z_{Rs}, or overall ratings, beginning after roughly the seventh or eighth week of the season when the first BCS ranking appears. (As is readily apparent from this "best estimate" team performance measure, teams that win against quality opponents score higher.)

Predictive Validity of BCS and R Method Benchmark

The existential validity of the BCS tripartite rating system can be assessed by quantifying the increase in predictive validity it provides from the benchmark statistical methodology that is only based on the strength of the wins of a team in combination with the quality of their performance against the opponents they beat. All of the data from the inception of the BCS (1998 to 2009 seasons) were used to assess the increase in validity in two ways: (a) predicting regular season game outcomes based on the top-ranked teams of the prior week (15 initially, growing to 25 teams in later years) for both the BCS and the R benchmark methodologies, respectively, and (b) using the end-of-season top-ranked teams for the BCS to select bowl games to determine the predictability of both models. The summary data for both methods of assessing predictive validity are presented in Table 10.1.

In terms of the (a) regular season predictions for all 12 years of the BCS, both models predict nearly identically, in the 76–78% range, with the R methodology in fact predicting slightly better. In terms of the bowl game predictions involving (b) the top BCS ranked teams (15 initially expanded to 25 teams in 2003), both models predict nearly identically again (57–58%), although at a somewhat lower level due to the fact that these pairs of teams are more equally matched: They all must have at least six wins to play in a postseason bowl game. Again, the R methodology predicts slightly better for Division I bowl games. And, for the major BCS bowls, the R methodology correctly predicts 59.61% of the 52 games played since the inception of the BCS, as compared to the BCS ranking predictions of 55.77%.

Clearly, this historical analysis reveals that there is no increase whatsoever in predictive validity for the BCS combination of subjective and objective rating systems over the conceptually simple, transparent benchmark alternative of the R methodology. Thus, one can make the statement that the existential validity of the BCS system, that is, the additional contribution it makes to produce a meaningful set of ranks, is zero, which

TABLE 10.1 Predictive Validity of BCS and R Method Rankings, 1998–2008

	Regular Season BCS Ranked[a] vs. R Ranked[a]			All Bowl Games BCS Ranked[a] Teams Only			Only BCS Bowl Games		
	BCS (%)	Games	R (%)	BCS (%)	Games	R (%)	BCS (%)	Games	R (%)
1998	83.8	74	84.9	66.7	9	44.4	75	4	25
1999	80.0	55	82.1	70.0	10	50.0	75	4	50
2000	76.4	55	76.3	80.0	10	70.0	75	4	75
2001	69.7	66	75.7	70.0	10	70.0	50	4	50
2002	76.8	69	78.7	45.4	11	54.5	50	4	75
2003	77.2	101	80.0	60.0	15	73.3	50	4	25
2004	77.1	118	76.8	71.4	14	71.4	100	4	75
2005	77.1	105	76.7	53.3	15	60.0	50	4	100
2006	78.2	124	81.7	70.6	17	64.7	60	5	60
2007	73.3	116	70.6	46.7	15	53.3	40	5	40
2008	73.0	111	78.8	26.7	15	33.3	40	5	60
2009	78.3	129	78.6	26.7	15	33.3	20	5	80
Total 1998–2009	76.66	1123	78.18	1155	57.05	156	58.33	55.77	52	59.61

[a]Top 15 for 1998–2002 and top 25 for 2003–2009.

means that the rating system cannot be considered a procompetitive benefit justifying the existence of the BCS; therefore, it should be subject to antitrust litigation.

Suggested Research and Strategic Options

Given that the BCS rating system has no existential validity, a determination of which statistical rating system should become the standard to provide rankings should be undertaken. The R methodology predictive validity data presented here can serve as the initial benchmark for assessing the relative contribution of competing systems. Critical to this evaluation, however, is the requirement that all of these potential ranking methods be totally transparent. Many such statistical prediction methodologies have been proposed for producing optimal rank orders of this type (see West & Lamsal, 2008, for an excellent review of these alternative methods). These authors noted that one of the statistical models they reviewed predicted as many as 58.7% of bowl games (Trono, 1988) and a second as high as 76.2% of future games (Pardee, 1999), which at this point in time suggests that they are no better than the R methodology prediction data presented here. It is important that this evaluation of these competing models should not be retrodictive in nature; that is, the models should not have been developed using the same data that will be the basis of the evaluation. And it is worth noting that because the R methodology was only developed to serve as a benchmark and never optimized in any way, this approach could serve as a basis for future statistical extensions.

Three options emerge to provide an unbiased methodology to determine which team is crowned number 1. Option 1 is to institute a playoff system with either four or eight teams that would be selected at the close of the regular season. It is important that the selection of which teams to participate must be unbiased, thus the need for the development of an accepted standard methodology to produce the rankings, not just conference winners. To reinforce this point, consider the 2008 season summary ranking data presented in Table 10.2, for which the biased method of selecting BCS bowl teams is apparent. If the top 10 teams were to go to big-payday BCS bowls even with the BCS system, two schools were overlooked (Texas Tech and Boise State), resulting in a significant financial loss, especially for Boise State ($1.5 vs. more than $17 million) because it is not a member of a first-tier (one of the original six) BCS conference. The R

TABLE 10.2 2008 Final Regular Season Rankings (BCS and R Methodology) With BCS Bowl Matchups

Rank	BCS	BCS Bowl[a]	R Method
1	Oklahoma	**CHAMPIONSHIP**	Oklahoma
2	Florida	**CHAMPIONSHIP**	Florida
3	Texas[b]	**FIESTA**	Texas
4	Alabama	**SUGAR**	**Boise State**
5	USC	**ROSE**	USC
6	**Utah**	**SUGAR**	Penn State
7	Texas Tech	**Cotton (6)**	Texas Tech
8	Penn State	**ROSE**	**Utah**
9	**Boise State**	**Poinsettia (1.5)**	Alabama
10	Ohio State[b]	**FIESTA**	Ohio State
11	TCU	**Poinsettia (1.5)**	Ball State
12	**Cincinnati**	**ORANGE**	TCU
13	Oklahoma State	**Holiday (4.26)**	Pittsburgh
14	Georgia Tech	**Chick-fil-A (5.65)**	Oklahoma State
15	Georgia	**Capital One**	Missouri
16	BYU	**Las Vegas (2)**	North Carolina
17	Oregon	**Holiday (4.26)**	Georgia Tech
18	Michigan State	**Capital One (8.5)**	**Cincinnati**
19	Virginia Tech	**ORANGE**	Georgia
20	Pittsburgh	**Sun (3.8)**	Michigan State
21	Missouri	**Alamo (4.5)**	Virginia Tech
22	Ball State	**GMAC (1.5)**	Florida State
23	Northwestern	**Alamo (4.5)**	BYU
24	Boston College	**Music City (3.2)**	Mississippi
25	Mississippi	**Cotton (6)**	Nebraska

Note: Bolded teams are not from one of the original six BCS conferences.

[a]BCS bowls are in all caps (more than $17 million payout).

[b]$4.5 million payout for second team included from a BSC conference.

methodology, which is not subject to bias, in fact, has two non-BCS teams in the top 8 that should participate in a playoff system.

Of course, the primary hurdle facing this option is to accommodate the scheduling issues with respect to the existing bowl games. However, given the relatively modest prediction level for major bowl games of approximately 60%, a playoff system appears as a desirable and logical alternative.

Option 2 is potentially more interesting and may have more long-term economic potential as well as the advantage of not being as constrained by the scheduling issues required to implement a playoff system. Given the acceptance of a standard statistical framework, this methodology can be used to determine the final rankings after all the bowl games are completed. The fact is that the better teams play each other in bowl games, and the outcomes of these games are not currently factored in the national championship evaluation, which of course makes no sense. Clearly, this greatly minimizes their importance with respect to the media and fans, which serves to limit their overall financial performance. And, given that there were 34 bowl games in the 2009–2010 season, this economic reality is a major issue. The simple fact is that the amount of information provided by these games could have a significant effect on the overall evaluation of a team's record, especially if one considers how the quality of the opponents is factored at a high level (50%) into the R methodology formulation. For example, consider when all the opponents that Team A beat won their bowl games and the reverse for Team B. The quality of the indices of the opponents of Team A under the R methodology would increase greatly, thereby significantly increasing the overall rating of Team A in comparison to Team B.

It would appear that the outcomes of bowl games would and should add substantially to the determination of the "true order" of team performance. And if these bowl games become an integral part of the selection of a national champion, would not they become better attended and viewed by a much wider audience, especially for those fans for whom the outcome has an effect on the ultimate success of their team?

Herein lies a critical marketing-related insight resulting from this option. By increasing the interest in all bowl games because they directly factor in the final determination of which team is crowned the national champion, the entire bowl system would benefit economically. In fact, using the R methodology as a basis, after the regular season is completed as many as six teams in a recent season have had a statistical chance to win the national championship depending on the combination of bowl outcomes. (Note: With the six possible outcomes of the R methodology for a given game, 34 bowl games have 6^{34} combinations, which is $2.865117999807 \times 10^{26}$.) With the bowl games scheduled for the 2008 season, for example, the University of Texas team (ranked third), for example, could in fact conceivably be number 1 using the R methodology based on the several scenarios of possible bowl outcomes. Thus, using this information to determine the remaining scenarios in which one's favorite team could conceivably become the national champion would draw increased attention and involvement to the entire series of postseason bowls. To further this objective, the Internet could be used to provide the computational mechanism for determining the scenarios to accomplish the highest possible ranking for a given team at any given point in the bowl process. This presents the possibility of creating marketing programs to develop "what-if scenarios" that could literally be updated after each bowl game.

Accepting the idea that the bowl games should be included in the crowning of a national champion because of the increased importance of the minor bowls leads to Option 3, which is a hybrid of the first two options. This option involves first using the bowls as a statistical playoff system, then matching the top two teams as determined statistically at the completion of the traditional bowl system. Option 3, then, permits multiple teams at the end of the regular season to have a chance to become number 1 depending on the bowl outcomes, essentially giving a majority of bowl games a much higher level of interest due to their effect on determining the rating of a given team; it has the additional advantage of a head-to-head matchup with the top two to determine the national champion.

Whichever of the three options is implemented, it is clear that the revenue obtained from the chosen method should not be allocated in the biased manner it has been in the past and currently continues to be.[2]

Synopsis

The existential validity of the BCS method of determining team rankings was assessed using as a benchmark a transparent statistical ranking

[2] For example, the guaranteed payouts for the 2008–2009 season allocated to a conference if it was one the original six (one share each, $17+ million) and to the five second-tier conferences (one share in total), and to Notre Dame ($1.3 million), even if it does not play in a BCS bowl, and to two other independents, Navy and Army ($100,000 each), if they are simply available to play, leave only one school of the 120 in Division I-A, independent Western Kentucky, not part of the BCS payroll. The differential rates of these guaranteed payouts suggest an unfair competitive environment, which can be remedied by a simple performance-only-based system reflected by all of the three unbiased options presented.

methodology using only measures of the quality of wins with regard to the quality of opponents beaten. The BCS ranking methodology was determined over the 12-year term of its existence to provide no increase in terms of predictive validity over the conceptually simple benchmark R methodology and thus has no reason for existence. Thus, the assumption that the procompetitive benefit of the ranking system the BCS provides has merit, which has been noted as the reason the BCS should be exempted from the Sherman Act (Carroll, 2004), is false.

Potential future nonbiased options for determining how a national champion could be determined were presented. These were as follows: a playoff plan using an unbiased statistical model for team selection, a statistically derived ordering of teams producing a national champion after *all* the bowl games are played, and a hybrid approach that combines the two by computing the top two teams to play in a championship game after all the bowl game results are considered using an unbiased statistical analysis format like the R methodology.

Marketing Implications of Using the Transparent R Methodology

There are several outcomes and opportunities in using the R formula to compute team rankings. First, and perhaps most important, the R methodology can be easily updated after each bowl game in the public domain to provide the new rankings. Consequently, the importance of the non-BCS bowl games and perhaps some of the BCS games also will increase with the fans and viewers, translating into increased media attention (read this as revenue).

Second, the possibility of playing what-if games, by using this information to determine the remaining scenarios in which one's favorite team could conceivably become the national champion, will draw increased attention and involvement to the entire series of postseason bowls. To further this interest, the Internet could be used to provide the mechanism for determining the scenarios to accomplish the highest possible ranking for a given team at any given point in the bowl process. This presents the possibility of creating marketing programs and contests using this framework.

Third, recall that in utilizing the R formulation the championship title is determined by the results of all bowl games. Therefore, the possibility exists for multiple teams to be named national champion, and there is now the option to select BCS matchups that will maximize the number of potential champions, thereby further increasing fan interest in all bowl games.

Fourth, from a public policy perspective, the monopolistic nature of the team selection for the most lucrative bowls can be eradicated by using such a transparent, nonproprietary methodology. Of course, due to the increased involvement with the non-BCS bowls, increases in media revenue should result in the financial viability of many of these other bowls, including corresponding increases of the size of the financial rewards for other smaller conferences.

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Appendix: R Methodology Computation

The first computational step to develop a measure of team performance is to construct a square matrix W that contains the outcomes for all of the Division I-A teams at a given point in time. The row designations of W(i) define the winning team, and the column j indicates the loser. The row (win)/column (loss) entries in W reflect both the quantity and quality of wins against Division I-A opponents. In this framework, quality, or magnitude of a win, simply refers to three possible margins of victory that are meaningful: 1–8 points = $\sqrt{1}$, 9–16 points = $\sqrt{2}$, and 17 or more points = $\sqrt{3}$. Interestingly, the inclusion of a margin-of-victory statistic is not permitted in the BCS computer algorithms and has led to statisticians calling for a "quantitative boycott of the BCS" (Stern, 2006). However, the reason for the square root adjustment is simply to recognize that a win by more than 8 or 16 points is marginally better than the importance of gaining the win, resulting in possible scores of 1.000, 1.414, and 1.732, respectively. There is no predictive estimate of point spreads with the R methodology, which appears as the primary concern motivating the decision of the BCS to forbid such a commonsense statistic. Thus, a team's first-order performance score is the sum of the square roots of the number of points gained from Division I-A opponents divided by the total number of Division I-A games played—the total number of nonzero entries is the row and column for that team. (Note that non-Division I-A games have no impact on the overall quantity score.)

By using the total number of I-A games as the denominator, a loss, or a failure to gain points, is factored in to the calculation. Thus, the direct measure for the performance $W_{(1)}$ of a given team i can be considered the square root of the average number of "quality" points gained per opportunity. The direct win component may be summarized as

$$W_{i(1)} = \frac{\sum\left(\sqrt{W_{ij}}\right)}{n(W_i)} \tag{10.A1}$$

where W_{ij} corresponds to the margin of victory (1, 2, or 3) for team i over team j, and $n(W_i)$ equals the number of Division I-A games team i played.

The second step in the computation involves developing a summary measure that reflects the "quality of opponents," which refers to the strength of the competition that the team has beaten. This can be computed by determining the respective margin of victory for each W_{ij} (reflecting each opponent j beaten by i) and then multiplying it by the respective margin of victory rescaled (square root) for the first-order wins. This win component $W_{(2)}$, which denotes the quality of the wins, may be summarized as

$$W_{i(2)} = \frac{\left(\sum\left(\sum\sqrt{W_{ij}}\sqrt{W_j}\right)\right)}{n(W_i)} \tag{10.A2}$$

where W_j reflects all the first-order teams that W_i beat, and $n(W_i)$ is the total number of Division I-A games that team i played, then yields an average of competition quality.

This logic can be extended to the second order of implied wins, again taking into account the respective margin of victory from each implied win, as

$$W_{i(3)} = \frac{\left(\sum\left(\sum\sqrt{W_{jk}}\sqrt{W_k}\right)\right)}{n(W_j)} \tag{10.A3}$$

where W_{jk} is the (adjusted) margin of victory of team j over team k, which is multiplied by each (adjusted) margin of victory for W_k wins, and $n(W_j)$ is the total number of Division I-A games team j played.