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Do Colleges Get What They Pay For? Evidence on Football Coach Pay and Team Performance

Gary J. Colbert[1] and E. Woodrow Eckard[1]

Abstract

We use a data set of Football Bowl Subdivision (Division-IA) universities to investigate the hypothesis that higher coach pay leads to improved team performance. Our analysis finds that pay and team performance are positively correlated and that, when schools change coaches, higher pay is associated with improved performance. The evidence suggests that additional rating points are increasingly valuable, perhaps over US$1 million for top teams. Our descriptive analysis reveals the median 2011 head coach pay of US$1.2 million, significant increases over our 2006-2011 study period, and large disparities among schools and conferences. We conclude that administrators perceive highly ranked football teams have significant value.

Keywords

college football, coach pay, team performance, hiring decisions

Introduction

For some time, college coaches' pay has been the subject of scrutiny and criticism that has increased of late with greater publicity of the pay magnitude and growth. For example, approximately one half of all head football coaches at Football Bowl

[1] University of Colorado Denver, Denver, CO, USA

Corresponding Author:
E. Woodrow Eckard, University of Colorado Denver, 1475 Lawrence Street, Denver, CO 80202, USA.
Email: woody.eckard@ucdenver.edu

Subdivision (FBS) schools are now paid over $1 million annually. Indeed, at some elite programs the head coach pay exceeds $3 million. Perhaps to add perspective to the issue, critics are quick to point out that an elite football coach's pay often exceeds that of his university president.

Coaches' pay is also regarded as an important part of the larger problem of athletic department budgets. For example, Zimbalist (2010a) using 2007-2008 data reports that only a small number (25 of 119) of FBS athletic departments manage to generate a surplus of revenue over expenditures. Moreover, the gap between expenses and revenues is growing at most schools, and this is happening in a period of serious budgetary difficulties. Even the National Collegiate Athletic Association (NCAA) itself and the presidents of the FBS schools have questioned the sustainability of the current trajectory of college sports finances (Knight Commission, 2009). Other important questions can be linked to the debate about coaches' pay. For example, there is the rather unseemly dimension of college athletics whereby, aside from athletic scholarships, the NCAA prohibits college football players from receiving pay for the very valuable product they produce, while at the same time their head coaches are paid by conventional standards stunningly large sums. Indeed, it can be argued that coaches' pay is greater under the NCAA's cartel system, where players' pay is tightly restricted and they select schools largely based on the coach (Farmer & Pecorino, 2010). The result is that player rents are to a significant degree transferred to the coaches, athletic programs, and the schools.

Although anecdotes of large pay are published regularly, until recently little has been known about the full distribution of football coach pay. Even scanter evidence exists about the relationship between pay and performance outcomes. One example is Zimbalist (2010a, 2010b) who argues that compensation paid to head football and basketball coaches is perhaps the most egregious example of waste in Division I athletics. He reports that his own regression analysis shows that coaches' salaries are not correlated with team performance but provides no specific statistics or details.

In contrast, Orzag and Israel (2009) provide a more comprehensive analysis of collegiate athletic operating finances. Their report updates their prior studies in 2003 and 2005, all three commissioned by the NCAA. Most relevant to our work, Orzag and Israel investigate whether athletic operating expenditures are associated with measures of success. They find a small significant positive relationship between operating expenditures for football and an increase in the team's winning percentage and its chances of finishing in the top 25 of the Associated Press (AP) football poll. However, they do not find a significant relationship between football coaching salaries and their measures of team success.

Interestingly, Orzag and Israel (2009) find a positive relationship between finishing in the AP football top 25 and increases in revenue. Universities presumably see value in having a football program and greater value in one that has a winning record. Although football is zero sum in the sense that for every winner there is a loser, that need not be the case for the various possible benefits accruing to schools,

particularly with rising demand for college football from a variety of constituents. The potential revenue streams that attach to winning include likely increases in paid attendance and television revenue and lucrative bowl invitations. It might also increase outside support for athletics, general college gifts, and student applications and admissions.[1] Academic studies provide empirical support for such indirect benefits, but the evidence is mixed.[2] Nevertheless, as the Knight Commission (2009) notes, many college presidents believe that football success generates substantial benefits, both direct and indirect.[3]

Over the last two decades, several studies have examined the contribution of managers and coaches to their team's success in various sports as reviewed in Smart, Winfree, and Wolfe (2008). The focus is generally on measures of "efficiency," for example, converting player talent into wins. The results are mixed, that is, it is not clear from the quantitative evidence that managers and coaches are important. These studies generally do not address the role of compensation, and none examine intercollegiate football. An exception regarding pay is Smart et al. (2008). They study Major League Baseball, concluding that "the field manager's contribution to winning is limited" (p. 317) and that neither managerial efficiency nor team performance is related to managerial compensation. More recently, Adler, Berry, and Doherty (2012) assess the effects of changing college football head coaches on subsequent team performance. They find that compared to teams that retained their coach, replacing a coach of a poor performing team has little effect on team winning percentage and that for teams with middling records a coaching change results in worse team performance. Their analysis does not include coach pay.

A comprehensive database of head football coach pay recently made available by *US Today* allows us to investigate the effect of coach pay on team success. We assume university administrators are rational agents who enter into (and terminate) contracts expecting a positive relationship between pay and performance, and it is the team's on-the-field success that matters most. We hypothesize that pay is related to coaching ability and therefore a more highly paid coach leads to improved team performance.

We find that coach pay and team performance, as measured by the Sagarin computer ratings, are positively correlated. The pay–performance relationship is economically and statistically significant in multivariate models that include relevant control covariates. We also find that in instances of coaching changes, higher pay is associated with improved team performance, supporting a causal interpretation. Our results suggest that university administrators perceive significant value associated with highly ranked football teams.

The remainder of the article is organized as follows. First, *USA Today*'s coach pay data are described. The second section presents a cross-sectional empirical analysis of the relationship between pay and team rating. Next is an analysis of coaching changes and the associated changes in pay and rating, followed by a "marginal analysis" of the relationships we uncover. The last section summarizes and concludes.

USA Today College Football Coach Salary Database

Recently, *USA Today* made available online its latest college football coach salary database (*USA Today*, 2011). It covers the 120 FBS schools (formerly known as Division 1-A) for the years 2006-2011, excluding 2008 when no data were collected. Data were obtained via requests to each of the FBS schools. As these are the first comprehensive, publically available data on head football coach pay, we provide a detailed descriptive analysis subsequently.

The database includes categories defined as "school pay," "other pay," "total pay," and "maximum bonus." School pay includes base salary and other income per the contract that is paid or guaranteed by the university or affiliated organizations. Other pay includes athletically related income from other sources as self-reported by the coaches on an outside income report. Total pay is the sum of school pay and other pay. Contracts are typically multiyear, although they can be renegotiated at any time. Between 2007 and 2009, *USA Today* changed its methodology slightly for classifying some pay amounts as school pay versus other pay. Total pay is unaffected by this change. The maximum bonus is the greatest amount the coach is awarded if all specified goals are met and includes all potential performance-related compensation. We focus on total pay in the analysis that follows.

Four private schools did not report data for any year, and three other schools did not report other pay, thereby preventing the calculation of total pay. These seven schools are necessarily excluded from the analysis that follows. We also exclude the three military academies due to their unusual mission and funding. That leaves a sample of 110 schools. Across the 5 years of data, there are 66 instances where, for particular years, schools did not report any compensation data or omitted other pay.[4] As a result, we are left with 484 school-year observations.

FBS conferences and schools are part of the Bowl Championship Series (BCS) system that divides conferences and hence their schools into two categories. Automatic qualifying (AQ) schools belong to one of the six conferences whose champion is automatically awarded a slot in one of the four premier BCS bowl games. The remaining five conferences and their schools are nonautomatic qualifying (non-AQ); that is, they are BCS-bowl-eligible only under special circumstance. Of the 110 FBS schools in our analysis, 63 are AQ and 47 are non-AQ.[5]

Table 1 reports descriptive statistics by year for the 484 observations. Henceforth, we refer to total pay simply as "pay." For all FBS schools, the mean (median) inflation-adjusted pay increased from $1.03 million ($0.92 million) in 2006 to $1.48 million ($1.19 million) in 2011.[6] AQ and non-AQ schools are reported separately to illustrate their differences. For the AQ schools from 2006 to 2011, we see a large overall increase in the mean (median) pay from $1.50 million ($1.34 million) to $2.37 million ($2.27 million), increases of 58% and 69%, respectively. For the non-AQ schools from 2006 to 2011, we also observe an overall increase in the mean and median pay (22% and 7%, respectively), albeit considerably more moderate than for AQ schools.[7] Note

Table 1. Head Coach Pay Data Statistics by Year.

Year	Mean	Median	St. Dev.	Minimum	Maximum
AQ schools					
2006	1.50	1.34	.69	.41	3.85
2007	1.59	1.36	.78	.32	3.93
2009	2.08	1.93	.96	.63	4.51
2010	2.24	1.88	1.15	.62	6.18
2011	2.37	2.27	1.00	.60	5.19
Non-AQ schools					
2006	.44	.39	.29	.14	1.40
2007	.46	.38	.30	.16	1.33
2009	.55	.42	.33	.20	1.45
2010	.60	.42	.43	.20	2.21
2011	.54	.41	.30	.20	1.52
AQ and non-AQ schools combined					
2006	1.03	.92	.76	.14	3.85
2007	1.11	1.00	.83	.16	3.93
2009	1.39	1.18	1.06	.20	4.51
2010	1.46	1.20	1.20	.20	6.18
2011	1.48	1.19	1.18	.20	5.19

Notes. AQ = automatic qualifying. St. Dev. = standard deviation. $N = 484$ school-year observations. Pay is total pay measured in millions of 2011 dollars.

that the "Great Recession" of 2008-2009, while creating financial hardship for many schools, is barely discernible in the steady rise of coaches' pay.

Table 1 reveals a stunningly large difference between the AQ and non-AQ schools. For example, in 2011 the AQ mean pay of $2.37 million was 4.4 times the non-AQ mean of $540,000. In contrast, in 2006, the AQ schools' mean of $1.50 million was 3.4 times the comparable non-AQ value, indicating that the difference between AQ and non-AQ schools is widening. Inspection of the minimum AQ and the maximum non-AQ values indicates that some non-AQ school pay exceeds the lowest AQ school pay. However, the overlap is small. For example, for 2011, 42 of the 46 schools with pay exceeding $1 million are AQ schools, whereas only 2 of the 40 with pay less than $1 million are AQ schools.

Both the AQ and the non-AQ statistics hint at some underlying year-to-year volatility as illustrated by the extreme observations. For AQ schools, the 10 largest annual pay increases ranged from $1.28 million to $2.12 million and averaged $1.74 million, whereas the 10 largest pay decreases ranged from −$2.84 million to −$560,000 and averaged −$1.09 million. Interestingly, 4 of the 10 largest AQ increases were associated with a coaching change, whereas 9 of the 10 largest AQ decreases were associated with a change. For non-AQ schools, the 10 largest pay increases ranged from $310,000 to $1.65 million and averaged $550,000, whereas the 10 largest pay decreases ranged from −$80,000 to −$630,000 and averaged −$225,000. Coaching changes were

Table 2. Head Coach Pay Data Statistics by Conference.

	Mean	Median	St. Dev.	Minimum	Maximum
AQ conferences					
SEC	2.47	2.20	1.10	.81	6.18
Big 12	2.12	1.89	1.13	.82	5.32
Big Ten	1.91	1.62	1.00	.32	4.01
ACC	1.78	1.88	.58	.41	3.03
PAC-10/12	1.44	1.34	.67	.54	3.10
Big East	1.41	1.39	.48	.55	2.30
AQ overall	1.91	1.80	.97	.32	6.18
Non-AQ conferences					
Mt. West	.77	.72	.31	.46	1.69
CUSA	.76	.62	.38	.39	2.21
WAC	.60	.42	.36	.23	1.54
Sun Belt	.31	.30	.10	.14	.59
MAC	.30	.32	.09	.16	.48
Non-AQ overall	.52	.40	.34	.14	2.21
AQ and non-AQ combined	1.28	1.03	1.02	.14	6.18

Notes. AQ = automatic qualifying; St. Dev. = standard deviation. $N = 483$ school-year observations. Because it is independent of a football conference, Notre Dame's 1-year observation is not included above. Pay is total pay measured in millions of 2011 dollars.

associated with 3 of the 10 largest non-AQ pay increases and 3 of the 10 largest non-AQ pay decreases.

Table 2 reports descriptive statistics for the school-year observations by conference, which are displayed in order of mean pay. Among AQ conferences, the lowest paying (Big East) has a mean (median) value that is 57% (63%) of the highest paying conference (Southeastern). Consistent with Table 1, there is also a large difference between the AQ and the non-AQ conferences. No non-AQ conference approaches the AQ conferences in average or median pay. There is also considerable variation among the non-AQ conferences.

In summary, we note three important conclusions from this descriptive analysis. First, there is a stunningly large increase in (inflation adjusted) pay over time for the AQ schools in particular. Second, there is a considerable difference between AQ and non-AQ school/conference pay as well as between conferences within each group and among schools within conferences. Finally, there is considerable underlying change in individual pay year to year, some of which is associated with coaching changes.

Pay and Ratings: Cross-Sectional Analysis

Our goal is to determine the effect of higher coach pay on football team performance. We assume that schools compete among themselves in an active labor market for coaches, with rational administrators who make unbiased estimates of coaches' marginal

revenue products. We therefore hypothesize that pay is an imperfect but unbiased proxy for coaching skill, which in turn should be related to performance as measured by team rating. Thus, the amount schools are willing to pay at the margin for additional skill units (dPay) equals the associated expected increment in rating points (dRating) times the value (V) of the additional points as perceived by school administrators:

$$\text{dPay} = V \times \text{dRating}. \quad (1)$$

Note that the equation implies that the amount paid for additional rating points increases as their value increases. Equation 1 can be rewritten:

$$\text{dRating}/\text{dPay} = 1/V, \quad (2)$$

which implies that given increments of pay yield fewer additional rating points as the value of the points increases. Our main focus is on estimating the effect of pay on performance (dRating/dPay). Evidence of a positive relation supports the hypothesis that colleges get what they pay for.

Given our data, we use a two-step empirical strategy. The first is a cross-sectional multiple regression analysis that allows us to account for factors other than pay that might affect team performance. This approach can potentially identify a correlation between pay and performance but cannot establish causality. The second step, presented in the next section, examines coaching changes, which is possible given that we have multiple annual observations for almost all schools in our sample. This analysis seeks to determine whether hiring a new coach at higher (lower) pay leads to increased (decreased) team performance. Differencing allows us to address the causality issue, albeit with a reduced sample size.

Our dependent variable for both analyses is team performance, which we measure using the end-of-season Sagarin computer ratings (Sagarin, 2011). These ratings have the advantage relative to the AP and other standard football polls of being available for all FBS schools. Also, unlike the polls, the Sagarin ratings are cardinal rather than ordinal. We do not use season victories or winning percentage because of the confounding effect of intraconference play. Schools within a conference have similar football ambitions, and there are significant differences among conferences in the strength of their members. Typically, about two thirds of the 12-game regular season schedule consists of intraconference games. Thus, a school from a strong conference with (say) six wins could well be better than another school with nine wins from a weak conference. The Sagarin computer algorithm includes a strength-of-schedule adjustment that in effect accounts for differences in conference strength.

Our main independent variable of interest, coach pay (Pay), is the (inflation adjusted) total pay from the *USA Today* database described previously.[8] In our cross-sectional analysis, Pay is the average head coach total pay for our 110 schools during our study period. This focuses on the "long-run" relation, while our analysis of coaching changes in the next section takes advantage of our annual observations.

An analysis of variance (ANOVA) indicates that between-school variance in pay is much larger than within-school variance.[9] Similarly, our dependent variable Rating is the average Sagarin rating for each school over our sample period. This has the advantage of "smoothing out" unrepresentative single-year performance.[10] Also, an ANOVA indicates that the between-school rating variance is significantly larger than the within-school variance.[11]

The coach, while an important influence on performance, is but one of several complementary inputs into the production of a winning team. The common underlying factor is a school's commitment to having top-ranked football teams. We must account for this in order to minimize missing variable bias in estimating the impact of coach pay on performance.

Given available data, we use four proxies for a school's football commitment. The first is stadium seating capacity (Capacity). Schools expecting perennial success will generally have larger stadiums to accommodate the resulting increased ticket demand. The second proxy is annual football program operating expenditures, net of head coach pay (Net Expenditures).[12] Higher expenditures enable a larger and/or better staff of assistant coaches and other football program support personnel. This might also be a proxy for better training equipment and facilities, assuming that better facilities require increased staff and other related operating expenses. The third commitment proxy is membership in an AQ BCS conference (AQ BCS, a zero-one dummy). Most AQ schools have ambitions of competing at a high level nationally, including perhaps for the national championship. Conference membership is defined as of 2011 and is relatively stable during our study period. The last proxy is "tradition," that is, a school's past football success. This creates expectations among alumni and other fans, which in turn pressures school administrators to continue the success. Our tradition measure is the number of ranking points accumulated in the final AP football poll (AP Points) for the three decades prior to our study period (1976-2005).[13] The four commitment control variables are constant for each school during our study period.[14]

The main missing variable in our analysis is a direct measure of player quality. Top football players are attracted by schools that compete in the top conferences and have strong traditions, top facilities including large stadiums, and significant financial support. In other words, all of the four program commitment controls defined earlier should be positively correlated with team quality.[15] However, perhaps the most important quality determinant is the head coach. A critical coaching skill is the ability to recruit top players and to hire staff with similarly strong recruiting skills. In fact, as noted previously, the head coach is often a key factor in a player's decision to matriculate. Thus, for any given set of controls, better coaches mean better players.

Table 3 provides summary statistics for the 110 FBS schools with at least 1 year of available pay data. The performance measure Rating has a mean (median) of 70.8 (71.4) varying from 51.4 to 92.7.[16] The variable Pay has a mean (median) of $1.26 ($1.10) million, varying from $204,000 to $4.18 million. For each school, Rating

Table 3. Summary Statistics.

Variable	*N*	Mean	Median	St. Dev.	Min	Max
Rating	110	70.8	71.4	10.3	51.4	92.7
Pay	110	1.26	1.10	0.916	0.204	4.18
AQ_BCS	110	0.57	1	0.50	0	1
Capacity	110	53.3	50.2	23.2	15.8	109.9
Net_Exp	110	11.6	10.3	6.03	2.57	31.1
AP_Pts	110	80.3	28.5	115.6	0	473

Notes. AP = Associated Press; AQ = automatic qualifying; BCS = Bowl Championship Series; Exp = expenditure; Max = maximum; Min = minimum; St. Dev. = standard deviation. Pay and Net_Exp measured in millions of 2011 dollars. Capacity measured in thousands of seats.

and Pay are the means over the years with available pay data. The mean of AQ BCS indicates that 57% of the sample schools are members of AQ BCS conferences. The mean (median) stadium capacity is 53,300 (50,200), varying from 15,800 to 109,900. Net Expenditures has a mean (median) of $11.6 ($10.3) million, varying from $2.57 million to $31.1 million. Note that mean and median head coach pay is more than 10% of mean and median of all other football-related expenditures. Last, the "tradition" variable AP Points has a mean (median) of 80.3 (28.5) and varies from 0 to 473.[17]

The key relation between Pay and our performance measure Rating is shown in Figure 1. A positive relation is evident, the pairwise correlation is +0.783, and it appears to be nonlinear with possible "diminishing returns" to higher pay. Note also that the vertical scatter of the data points is similar for low and high pay, indicating that heteroscedasticity appears to be absent.

The four nonpay commitment control variables have substantial pairwise positive correlations with our key independent variable Pay and with each other.[18] This is caused by their common underlying determinant: a school's commitment to having top-ranked football teams. These correlations suggest that multicollinearity might be present to an extent that could undermine our ability to estimate the pay–performance relation. We assess this potential problem using the variance inflation factor (VIF). The VIF for our main independent variable Pay is 3.15, well below the standard rule-of-thumb value of 10 above which multicollinearity is considered to be serious.

We estimate the Rating–Pay relation by regressing Rating on Pay and the four football commitment control variables. Our specifications involve a quadratic form for pay (i.e., Pay and Pay^2) to capture possible nonlinearity, as suggested in Figure 1. We use ordinary least squares estimation with clustered robust standard errors (Nichols & Schaffer, 2007) on conference clusters to account for the nonrandom assignment of schools to conferences.[19]

Table 4 presents the results. The first equation includes only Pay and Pay^2 as independent variables. Both are highly significant with the expected signs. The R^2

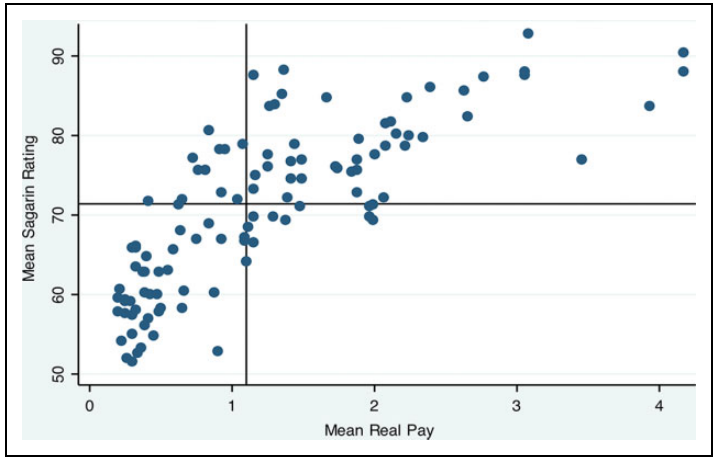

Figure 1. Cach pay versus sagarin rating.

Table 4. Regression Results—Dependent Variable: Rating ($N = 110$).

Independent Variable	Coefficient (*t* statistic)	Coefficient (*t* statistic)
Pay	17.4(9.00)**	12.1(3.03)*
Pay^2	−2.43(−4.55)**	−1.86(−2.27)*
AQ_BCS	–	1.41 (0.49)
Capacity	–	−0.021 (−0.29)
Net_Exp	–	0.422(4.54)**
AP_Pts	–	0.011 (1.62)
Constant	54.8(48.5)**	54.6(30.0)**
R^2	.681**	.722**

Note. AP = Associated Press; AQ = automatic qualifying; BCS = Bowl Championship Series; Exp = expenditure. *t* statistics based on clustered robust standard errors (conference clusters).
*5% significance. **1% significance.

indicates that they account for 68.1% of the variation in Rating. The second equation in Table 4 adds the four commitment control variables. Among the controls, only Net Expenditures is statistically significant. The coefficient on Pay is reduced to 12.1, from 17.4 in the first equation, but retains statistical significance at almost the 1% level ($p = .011$).[20] Pay^2 also retains significance, at the 5% level, supporting the quadratic specification.[21] Its negative sign is consistent with diminishing returns to increased pay, as suggested by Figure 1. Constant additional pay increments produce progressively smaller rating increments, that is, performance increases. Stated alternatively, top-ranked teams pay more for additional rating points in terms of higher pay. We discuss this issue further below.

Pay and Ratings: Coaching Changes

The regressions of Table 4 provide evidence that pay and performance are significantly correlated, consistent with the hypothesis that pay is related to coaching ability, and that therefore more highly paid coaches may lead to improved performance. Nevertheless, these cross-sectional regressions are inconclusive regarding the direction of causality.

We address the causality issue by making use of the multiple annual observations of pay and ratings available for almost all sample schools during our 6-year study period. In particular, we examine coaching *changes* to determine whether associated pay changes are positively related to changes in performance. This first difference approach provides a stronger test of causality because other (noncoach) factors that might affect performance, like a school's overall commitment to a top-ranked football program, presumably change little if at all during our 6-year study period.[22] If a school switches to a higher priced (lower priced) coach and its football ratings improve (decline), then it is reasonable to conclude that the new coach caused most, if not all, of the change.

There are 68 schools with sufficient annual pay data that had coaching changes during 2006-2011. Of these schools, 13 had two such changes, and so our sample contains 81 coaching changes. The prechange ratings and pay are calculated as the mean values for the former coach within our 2006-2011 sample period. The postchange pay is for the new coach's first year only.[23] This avoids possible reverse causality introduced if the new coach gets a performance-related (nonbonus) pay increase during our study period. The postchange rating is the mean value for the new coach, including 2012 where appropriate. The mean (median) pay change is +$92,834 (+$71,272) and the mean (median) rating change is −0.41 (−0.52).[24] The relation between pay change and rating change is shown in Figure 2. Note that a number of observations show decreases in pay and performance. The overall correlation is +0.247.

Table 5 reports regression results. The first equation is a simple regression of the rating change on the pay change, measured in $100,000 units. The Pay_Change coefficient is positive and statistically significant at the 5% level ($t = 2.27$). The second equation in Table 5 adds two variables. The first is the team's rating in the year before the coaching change. A regression-to-the-mean effect might exist where teams experiencing unusually low (high) ratings before a coaching change might be expected to experience a performance improvement (decline) regardless of the new coach. Coaching changes associated with unusually high prechange performance are much more likely for low-paying schools, as the high-performing coach gets hired away by a high-pay (highly ranked) school. Thus, the second variable is the prechange mean pay, with the expectation of a positive sign, that is, rating changes are on average expected to be lower for low-paying schools where a negative regression to the mean is more likely. In the second equation of Table 5, the

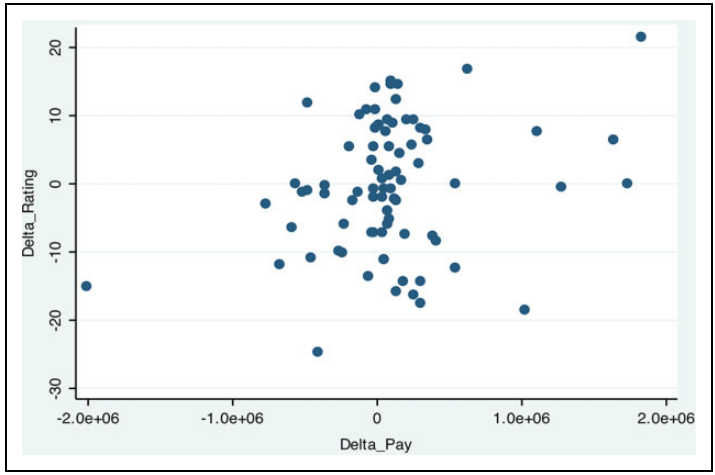

Figure 2. Pay change versus rating change ($N = 81$)

Table 5. Regression Results—Dependent Variable: Rating Change ($N = 81$).

Independent Variable	Coefficient (*t* statistic)	Coefficient (*t* statistic)
Pay_Change	0.448(2.27)*	0.525(3.17)**
Pre_Rating	–	−0.691(−6.05)**
Pre_Pay	–	0.515(3.02)**
Constant	−0.82 (−0.78)	41.3(6.17)**
R^2	.061*	.390**

*5% significance. **1% significance.

prechange rating and pay variables have the expected signs and a high degree of statistical significance.[25] The coefficient on the pay change variable increases in both magnitude and statistical significance as compared to the first equation.[26] The evidence supports the hypothesis that hiring a more expensive coach also means getting a better coach who improves team performance.[27]

Marginal Analysis

The regression results of Tables 4 and 5 indicate that higher pay on average attracts greater coaching skill, which in turn leads to better on-field performance. The relation exhibits diminishing marginal returns to higher pay, that is, a given pay increment yields progressively smaller rating increases at higher pay and rating levels. Estimates of this diminishing "bang-for-buck" (dRating/dPay of Equation 2) are

Table 6. The Marginal Impacts of Additional Pay and Rating Points.

Pay	Rating Level	Points Per Additional US$100,000 Pay	Value Per Additional Point
US$340,000	60.2	1.09	US$92,000
US$1,260,000	73.0	0.74	US$134,000
US$2,180,000	81.6	0.40	US$249,000
US$3,090,000	87.1	0.06	US$1,600,000

of interest. Our theoretical model links diminishing returns to an increasing marginal value for rating points that we can also estimate.

First, we use the regression results of Table 4 to illustrate the marginal impact of pay on rating for hypothetical pay and rating levels. The calculation of a predicted Rating from the second equation of Table 4, given Pay, requires values for the four commitment variables: AQ BCS, Capacity, Net Expenditures, and AP Points. As noted above, all commitment variables have substantial pairwise positive correlations among themselves and with Pay. Thus, to illustrate the marginal impact of pay on rating, we calculate the rating level and its "marginal" change at the mean of Pay and the commitment variables, at 1 standard deviation (*SD*) below their means, and at 1 and 2 *SD*s above their means. Since most schools at 1 *SD* below the mean of these variables are in non-AQ BCS conferences, for this case we set AQ BCS equal to zero. Otherwise AQ BCS equals one.

The results are shown in the third column of Table 6. For example, at 1 *SD* below its mean, Pay equals $340,000 (Table 3), and the corresponding predicted mean Rating is 60.2. Here, a pay increase of (say) $100,000 adds on average of about 1.09 points to a team's ratings.[28] At the mean pay of $1.26 million, the predicted rating is 73.0 and an additional $100,000 adds 0.74 points. At the two higher pay and rating levels in Table 6, the increment in rating points from an additional $100,000 in pay drops to 0.40 and 0.06, respectively. Note that, in Table 5, the coefficient on Pay_-Change indicates that an additional $100,000 in pay adds 0.52 rating points, estimated over all coaching changes in that (smaller) sample.

Another interesting question that can be addressed with our regression results is the dollar value of an additional rating point (V), that is, its expected benefit to a school as perceived by the administrators responsible for coach hiring decisions. The above calculations indicate that a given pay increase yields progressively smaller rating increases at higher rating levels. Alternatively, schools are willing to pay more for additional rating points at higher rating levels. Note that Equation 2 mentioned previously can be rewritten as:

$$V = 1/(\text{dRating}/\text{dPay}), \tag{3}$$

where dRating/dPay is calculated from the second equation of Table 4, as mentioned previously. Equation 3 can be used to estimate V at various rating (and pay) levels.

Illustrative results are shown in the last column of Table 6. The assumptions underlying the selected hypothetical pay and corresponding rating levels are described earlier. At the means of pay and the commitment variables, the predicted mean Rating is 73.0, and an additional rating point is worth about $134,000. At 1 *SD* above the means, Rating equals 81.6 and an additional point is worth about $249,000, nearly double the value at the means. At 2 *SD*s above the means, Rating equals 87.1 and an additional point is worth about $1.6 million, more than 10 times the value at the means. By way of comparison, the 10th ranked team in the Sagarin ratings during our study period average 87.7 rating points, and the 20th ranked team averaged 82.8 points.

The escalating value of additional rating points can be explained by the "jackpot" nature of college football success. At the upper end of the rankings, small increases in performance (a few rating points) can determine eligibility for the highly lucrative BCS bowls, including in particular the national championship game. In addition to the substantial monetary earnings from these games, the resulting notoriety can attract football recruits and possibly generate other indirect benefits. In sharp contrast, at the lower end of the rankings, a few additional rating points produce little reward, financial or otherwise.

Conclusion

We investigate the hypothesis that football coaching ability is related to pay, and therefore a more highly paid coach leads to improved team performance. We find that coach pay and team performance as measured by the Sagarin ratings are positively correlated and that the pay–ratings relationship is statistically significant in multivariate models that include relevant control covariates. We also find that in instances of coaching changes, higher pay is associated with improved team ratings. This result supports a causal relation running from pay to performance. It appears that, in hiring football coaches, colleges on average get what they pay for.

Our empirical results suggest diminishing returns to higher pay, that is, additional pay has a declining marginal impact on ratings. Diminishing returns imply that, at higher rating levels, universities pay more for additional ratings points, that is, they are perceived as increasingly valuable. In particular, our estimates suggest that top 20 teams may be paying in excess of $1 million in higher pay for additional rating points. We speculate that this is caused by the especially high financial and other rewards associated with qualifying for the five BCS bowls, including the national championship game.

Although there are other issues that attach to the coach pay debate, given the empirical evidence presented here, university administrators may be acting rationally in granting large coach pay contracts. The evidence shows that there is a pay and performance relationship. It also shows that administrators *perceive* great value in a top-ranked football team. Nonetheless it remains an open question as to whether the *actual* benefits of team performance exceed the costs of these expensive undertakings.

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Notes

1. For example, one report on the University of Alabama's recent football success intimates that the coach, Nick Saban, who is the highest paid coach in all college football, is a bargain, as tuition, the student body, and capital campaign revenue have grown significantly, correlated with the program's winning success under his leadership (http://sports.yahoo.com/news/magic-nick-saban-everyone-wants-alabama-155022258.html).
2. Getz and Siegfried (2012) and Goff (2004) provide reviews of relevant studies. Also see Pope and Pope (2012).
3. The Commission report states "A significant majority of FBS presidents believe that athletics success provides substantial benefits to their institutions. ... [C]ompeting at [the FBS] level is seen to carry considerable financial as well as less tangible benefits." (pp. 11, 41).
4. Forty-five instances were cases where the school, including several public schools, did not report other pay to *USA Today*. Some public state schools are not obligated under state law to release data on coach compensation; some of these chose to report complete data in some years but not in others.
5. Notre Dame, though afforded automatic qualifying (AQ) status, is an independent not associated with an athletic conference for football. The pay data they report (for 2007 only) is included in our analysis.
6. All dollar-denominated variables here and throughout are adjusted to 2011 dollars using the All Urban Consumer Price Index.
7. The overall non-AQ mean and median decreases from 2010 to 2011 shown in Table 1 can be attributed to the omission of Southern Methodist (SMU) and Texas Christian (TCU) in 2011. SMU did not report data for 2011 after reporting pay of $2.21 million in 2010. TCU also did not report data for 2011 after reporting pay of $1.69 million in 2010.
8. As discussed earlier, the database also includes a maximum bonus. A possible alternative measure is total pay plus maximum bonus. But the two variables are highly correlated (correlation = 0.97). For this reason we chose to focus our analysis on total pay alone.

9. The analysis of variance (ANOVA) test yields an F statistic of 19.28 ($p < .0001$).
10. In the relatively short football season, idiosyncratic factors can significantly influence a team's won–lost record. These can include weather, injuries to key players, home-away draws, and variations in the strength of opponents.
11. An ANOVA test yields an F statistic of 10.7 ($p < .001$).
12. We have data for a single year (2009) obtained from the National Collegiate Athletic Association. We assume that these expenditures at each school are relatively stable during our study period.
13. We use the Associated Press (AP) rankings because they extend further back in time than do the Sagarin ratings. For most of the 1976-2005 period, the AP reported the top 25 teams. The top-ranked school gets 25 ranking points, the number two school 24 points, and so on.
14. Their pairwise correlations with the mean Sagarin ratings range from +0.625 to +0.775.
15. For example, Dumond, Lynch, and Platania (2008) report evidence that Bowl Championship Series membership and national rankings are positively correlated with top football recruits' school selection decision.
16. During our sample period, individual FBS team single season ratings vary from about 40 to 105.
17. AP Points is 0 for 35 schools.
18. The control variables' pairwise correlations with pay range from +0.680 to +0.788, and among themselves the correlations range from +0.541 to +0.833.
19. An ANOVA test indicates that the between-conference variance in pay is much greater than the within-conference variance ($F = 53.29$, $p < .0001$).
20. In unreported results available upon request, we investigated whether the relation is stable over time by estimating annual regressions. The results indicate that the key relation between Pay and Rating has been stable over our 6-year study period.
21. Based on a Cook's D critical value of $4/(n - k - 1)$, there are eight influential observations (i.e., "outliers"). Rerunning the regression without these observations yields coefficients (t statistics) on Pay and Pay^2 of 9.63 (3.35) and −1.41 (−1.93), respectively.
22. Our four commitment control variables are constant for each school.
23. We use 2009 pay data for 13 coaches new in 2008, the year with no pay data.
24. A simple linear time trend regression yields an average annual pay increase during 2006-2011 of $99,085 ($t = 4.00$).
25. In unreported regressions available upon request, we attempted to determine whether diminishing returns are evident in the coaching change regressions by interacting Pay_Change and Pre_Pay. However, these two variables are so highly correlated (+0.93) that resulting multicolinearity precludes finding useful results. We also investigated whether the relation is stable over time by interacting Pay_Change with a "time" dummy equal to unity for the latter part of our study period. The results indicate a stable relationship.
26. Based on a Cook's D critical value of $4/(n - k - 1)$, there are three influential observations. Rerunning the regression without these "outliers" yields coefficients (t statistics) on Pay_Change, Pre_Rating, and Pre_Pay of 0.455 (2.55), −0.682 (−6.06), and 4.76 (2.82), respectively.

27. Our results differ from those of Smart et al. (2008) for Major League Baseball (MLB) field managers, as reported above. The explanation may lie in the substantially more expansive responsibilities of the head football coach. In addition to his on-field leadership role, like the MLB field manager, he also has "CEO" responsibilities akin to the MLB general manager for recruiting players, hiring assistant coaches and other staff, and making other important resource allocation decisions.
28. Based on the second equation in Table 4, dRating/dPay = 12.1 − 3.72Pay.

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Author Biographies

Gary J. Colbert is an Associate Professor of accounting in the Business School at the University of Colorado Denver.

E. Woodrow Eckard is a Professor of economics in the Business School at the University of Colorado Denver.