

Lock-In and Team Effects: Recruiting and Success in College Football Athletics

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Abstract

How important is recruiting to a football program's success? While prior research has attempted to answer this question, we utilize an extensive panel set covering 13 years of games along with a two-stage least squares approach to investigate the effects of recruiting on team success. This article also includes new control variables to account for omitted variable bias that prior work may have missed. We also split our sample to investigate whether recruiting displays heterogeneous effects across schools. Additionally, we find evidence that the benefits of recruiting are driven by team-specific effects, indicating that team success may be more heavily derived from the ability of teams to harness and improve their recruits than their ability to utilize each athlete's raw abilities. This leads to important revelations regarding future research into both the value of recruits and what drives a football team's success.

Keywords

football, fixed effects, NCAA

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Introduction

College football has become a massive business with billions of dollars in revenue each year. Through television contracts, merchandising, and ticket sales, many colleges are seeing total revenues in the tens of millions of dollars per team. Run through the National Collegiate Athletic Association (NCAA), a nonprofit association, the competition for football teams to have success is arguably tougher and more lucrative than ever. To this end, a vital part of every college football team's success is thought to derive from the ability of the coaching staff to attract ever higher levels of talented student athletes. Higher rated recruits are expected to correlate with better on-field success. As of 2012, 3 teams spent more than 2 million dollars each on recruiting expenses alone, while 50 teams spent more than 1 million each.¹ The top 25 teams and their football-related recruiting expenses and revenues are shown in Table 1.

Given the large sums of money flowing into football programs, understanding the importance of recruiting on football success can provide more insight into how football programs should be spending their budgets and time. This is especially true for schools that are less likely to compete for the highest valued bowl games, where getting a slightly better recruit may not necessarily provide enough boost to the team's on-field success to catapult them into the higher tier of bowl games.² However, for schools that are more likely to compete in the highest tier end-of-season games, a marginal boost in recruiting may be more valuable if it increases the likelihood of playing in such games.

To this end, we investigate three major points relating recruiting and team success. First, we improve upon the prior literature's work on measuring the effect of recruiting on team winning percentages by utilizing a more advanced econometric technique, increased sample size, and improved control variables. Second, we stratify the school football programs into three evenly sized groups based on their overall win percentages. Each of these groups are then analyzed separately to identify whether there are heterogeneous effects of recruiting on win percentages. Finally, we discuss the importance of including team fixed effects in a panel data setting.

Our findings correspond well with prior literary findings. We find that recruiting has a positive effect on team success as measured by end-of-year win percentage. Our results would suggest that a single standard deviation increase in recruiting ratings would improve the team's win percentage by almost 32%. However, our stratification analysis indicates that this effect is largely limited only to those teams that already have a track record of on-field success. Those teams that average fewer wins per season are noted to receive less benefit for any marginal increase in recruiting rankings. Such a situation would indicate that schools with lower win totals are in effect unable to utilize recruits as well as their more successful opponents. This lock-in effect makes it more difficult for lower ranked schools to increase their wins by a significant amount for any lengthy period of time (in effect, this provides evidence for a mean-reverting win situation for many college programs). Lock-in

Table 1. Top 25 Universities by all Recruitment Spending in 2012.

University	Recruitment Spending (US\$)	Total Revenues	Total Expenses (US\$)
Auburn	2,544,910	105,951,257	96,315,838
Tennessee	2,252,990	102,884,286	101,292,015
Notre Dame	2,048,964	97,112,859	78,526,028
Alabama	1,784,604	124,899,945	108,204,867
Arkansas	1,643,872	99,757,483	82,470,475
Georgia	1,609,077	91,670,613	88,923,561
Michigan	1,608,770	140,131,187	115,200,187
Nebraska	1,567,360	81,631,252	77,037,282
Duke	1,558,233	78,604,895	78,224,565
Florida	1,558,111	120,772,106	105,102,198
Kentucky	1,536,478	88,373,452	84,929,819
North Carolina	1,512,701	82,424,430	81,921,783
Texas Tech	1,475,147	67,928,350	60,346,836
Kansas	1,464,936	70,228,913	78,973,441
Texas	1,457,857	163,295,115	138,269,710
Oklahoma	1,445,034	106,456,616	96,250,328
Penn State	1,428,050	108,252,281	107,389,258
Georgia Tech	1,424,048	63,184,163	61,179,789
Illinois	1,414,649	78,708,250	76,740,736
Washington	1,408,025	82,594,783	73,833,643
Vanderbilt	1,364,617	55,836,373	55,836,373
Oregon	1,339,601	94,635,829	89,709,350
Minnesota	1,314,453	83,619,526	83,619,526
Ohio State	1,289,623	142,043,057	124,419,412
Louisville	1,265,074	87,840,501	84,133,793

Note. It should be noted that there is no standard for defining how recruiting expenses should be calculated. Therefore, recruiting expenses for some universities may not be wholly accurate. Most likely, these are underestimating recruitment expenses, since some costs may be classified under different groupings such as coaching staff salaries, staff and administration salaries/benefits, travel, and fund-raising/marketing.

effects in essence indicate that for less successful football programs, it requires a greater amount of effort (and possibly financial support) to attain long-term success than for already established teams.

However, upon controlling for team-specific effects, we find that the benefits of recruiting are largely eliminated. We believe this indicates two possibilities. Either recruit ratings as given a priori are relatively imprecise at determining a recruit's ex ante on-the-field presence or that much of a recruit's impact on a team's success is through the available quality of training facilities, support staff, and coaches. Provided that recruit quality does have a positive correlation with team success, it is unlikely the former is the case. Thus, we argue that questions about football team success should concentrate less on how teams accumulate quality recruits but instead to question what differentiates teams on their ability to utilize the quality of their facilities and coaching staff.

The remainder of the article is organized as follows. The second section will explore prior research on football recruiting and team success. The third section describes the data set used, while the fourth section discusses the article's methodology. Results are reported in the fifth section. The sixth section concludes.

Literature Review

Research into the effects of recruiting on football performance has been a topic of interest recently. With the rise in popularity of college sports and the explosion of publicly available data, it has become easier to investigate recruiting questions. Brown (1993) discusses how valuable football recruits can be to their football programs. Brown argues that the rent capture of a football recruit is equal to the difference between the player's marginal revenue product and the maximum payments allowable by NCAA scholarships. He utilizes a two-stage least squares estimation technique and identifies that football players often "... generate revenues well in excess of their effective wage ...," indicating that a player with possible National Football League (NFL) capabilities can be worth US\$646,150 in annual revenues.

Langelett (2003) investigates the more direct question of whether recruiting has an effect on a team's performance as measured by the team's end-of-year standing in the Bowl Championship Series poll. He also makes use of a two-stage equation to answer this question. Langelett's final analysis indicates that recruiting does, in fact, have a positive effect on a team's performance. The article also notes that teams' freshman classes are, on average, the most important determinant of a team's end-of-year success.³ However, Langelett's analysis does not account for head coaching changes nor for schedule difficulty. Also, as will be discussed in the fourth section, the usage of individual lagged periods may mask much of the effect of recruit quality.

Dumond, Lynch, and Platania (2008) analyze the determinants of a recruit's decision-making process and find that a school's football success plays an important role in a recruit deciding on which school to attend. Both Dumond et al and Langelett (2003) demonstrate the importance of considering how recruiting may be a bidirectional process. On one hand, better recruits may increase a team's performance, however, a team's performance also effects its ability to draw better recruits. This directionality problem lies at the heart of why using a two-stage least squares regression is vital to account for the multiple pathways of causality.

An important consideration when researching the effects of recruiting is also brought up by Bergmen and Logan (2014). Bergmen and Logan note that each school may have different abilities to not only draw in recruits but also train, strengthen, and improve said recruits as well. Therefore, they analyze the importance of school fixed effects on recruiting. Their research indicates that after controlling for school fixed effects, the magnitude of recruiting on team performance falls by as much as 25%. They note that even after including fixed effects,

Table 2. Summary Statistics.

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
Recruiting	1,356	2.641	0.545	0.7	4.42
WinPer	1,469	0.518	0.225	0	1
OppPer	1,465	0.52	0.057	0.323	0.69
Fire	1,469	0.136	0.343	0	1
Poach	1,469	0.044	0.204	0	1

increased recruit quality still brings better team performance on average. Unfortunately, their Ordinary Least Squares (OLS) regression may miss important time-specific effects that we consider in our research here.

Our article builds upon the prior literature by improving the analytical and data components of the research. We utilize a two-stage least squares regression technique similar to Langelett's methodology, but we include measures for head coaching changes, conference designations, opposition quality, and fixed school effects per Bergmen and Logan (2014). In addition, we utilize a panel data set to facilitate the consideration of time instead of a more traditional cross-sectional approach as well as including data for all Football Bowl Subdivision (FBS) teams over a 12-year span.⁴ A new addition to the literature is also provided by our stratification analysis in an attempt to consider differential effects on recruiting for different tiers of schools.

Data

The recruiting ratings was acquired from Rivals, a company that specializes in college recruiting information. Rivals provided the recruitment ratings for most of the FBS teams in the NCAA. They ranked each recruit on a star-based system from 5 to 1 with 5 stars representing the best recruits available. The class rankings used in our analysis are generated from the average ratings for each year, weighted by the number of recruits within each star ranking. A summary of the data used here can be found in Table 2.

Yearly schedules were acquired from publicly available information provided by the NCAA. For the years 2001 through 2011, the NCAA data were utilized. To supplement the data, additional years (2012-2013) were provided by the Entertainment and Sports Programming Network (ESPN). Each year's schedule was used to calculate every team's win percentage as well as the average win percentage of all of their opponents. To account for team-specific recruiting capabilities, team fixed effect dummies were built based on the NCAA's database. Each team was given its own dummy variable for a total of 113 FBS participants.⁵

Data on head coaching changes and yearly conference alignment were acquired from two Internet-based sources. Head coaching changes were collected from College Football Poll.⁶ Head coaching changes are an important event to consider, given that the choice of a program to get a new head coach may be an indicator of a program's expectations not meeting its on-field performance. New head coaches may also bring different philosophies on recruiting and play calling that might alter the program's recruiting efforts. A head coaching change, however, might also indicate that a school's coach was extremely successful and was drawn away to coach for a larger team or even moving into the NFL. To account for these possibilities, each head coaching change was classified into two categories, namely, fire or poached.⁷ Fired coaches were unable to reach or maintain the program's success as required by the college, thus they were removed from their positions. A poached designation is given if the previous coach was replaced due to the ability of the school to acquire what they perceive as a higher quality coach. It would generally be expected that fired coaches will be likely correlated with negative outcomes, particularly in the time period after their removal since a new coach may attempt to install new playbooks, coordinators, and preferred players. For teams that poach a better coach, however, it becomes difficult to provide an expectation of the variable's outcome. Some poaching hires will likely do well because they are truly of a higher quality. However, some coaches may have also been poached from teams where success was easier to attain and are unable to sustain their record of on-field success. In addition, poached coaches would likely also attempt to introduce their own playstyle and preferred athletes, making it more difficult to be successful in the short run.

Additionally, each college football program is associated with 1 of 13 conferences.⁸ Generally, each conference plays the majority of its schedule against in-conference opponents, with only two or three games played against nonconference opponents. In most years, conference membership was relatively stable. However, in 2012, a major realignment occurred in which the Big East Conference and Western Athletic Conference were each disbanded. Their membership was then distributed among the 11 other conferences including the newly created American Athletic Conference. A few of the older conferences also witnessed membership changes, for example, Nebraska, Colorado, Texas A&M, and Missouri joined the Pacific-12 Conference, Big Ten, and Southeastern Conference, while West Virginia and Texas Christian joined the Big 12 Conference. Switching conferences may be expected to effect recruiting and team success, as we include dummy variables for each team-year's conference alignment.⁹

Method

There are two major considerations to take into account when analyzing the effect of recruiting on football success. As Langelett (2003) described, a bidirectional

problem exists in which recruiting and team success influence each other. As such, we utilize a two-stage least squares regression technique defined as follows:

$$\text{Recruiting}_{i,t} = \text{WinPer}_{i,t-1 \rightarrow t-2} + \text{Fire}_{i,t-1} + \text{Poach}_{i,t-1} + T_i + C_i + \varepsilon_{i,t}, \quad (1)$$

$$\text{WinPer}_{i,t} = \text{Recruiting}_{i,t-1 \rightarrow t-5} + \text{Fire}_{i,t-1} + \text{Poach}_{i,t-1} + \text{OppPer}_{i,t} + T_i + C_i + \mu_{i,t}, \quad (2)$$

Where $\text{Recruiting}_{i,t}$ is a variable indicating the recruiting class rating of team i at time t .¹⁰ $\text{WinPer}_{i,t}$ is defined as team i 's year t win percentage, while $\text{WinPer}_{i,t-1 \rightarrow t-2}$ contains each lagged win percentage of team i over the prior 2 years. Two distinct lags are used to reflect the likelihood that upon entering a player's junior year in high school, players with college football aspirations may be paying extra attention to program success. We expect a positive correlation between a team's success and recruit ratings. $\text{Fire}_{i,t-1}$ is a dummy variable indicating 1 if a team has fired its head coach in year t , while $\text{Poach}_{i,t-1}$ is a second dummy variable designated as a 1 if the team poached a coach from another team or division. T^i is a set of dummy variables for each team. The T variable accounts for school-specific fixed effects as mentioned by Bergmen and Logan. To account for conference-specific effects, a dummy variable indicating each team's conference alignment is included as C^i . Finally, $\text{OppPer}_{i,t}$ measures team i 's oppositional win percentage in year t . The variable is a single averaged win percentage for all opponents that team i plays during the year. This controls for difficulty in schedule by accounting for the fact that certain teams may play a schedule with tougher opponents than another team. To calculate this, we do not include any games against Football Championship Subdivision (FCS) teams. FCS teams play in a different division of college football with only a handful playing FBS teams each year. Without full schedules for those teams, it was not possible to calculate their win percentages, so they were not included in the $\text{OppPer}_{i,t}$ variable.¹¹

The variable of interest is $\text{Recruiting}_{i,t-1 \rightarrow t-5}$ which indicates the 5-year trailing moving average of recruit ratings.¹² The moving average is used as a moving average will better capture the total ability of a team at any specific point in time rather than the use of lags which are more appropriately used to answer questions about specific class effects (i.e., are freshman or seniors more important to a team's success). Here, we want to isolate the specific effects of increasing the total quality of the recruits a team has available. The trailing moving average provides for a single value that indicates the quality of recruits at a team. The outcome variable of interest, $\text{Recruiting}_{i,t-1 \rightarrow t-5}$, is expected to show a positive correlation, indicating that if a team can improve its recruit rating, then a team will likely experience greater on-field success.

In order for the two-stage least squares estimation technique to be valid, it must meet the exclusion restriction. Our argument centers on how recruits make decisions on their school of choice. As Dumond et al. (2008) note, two important determinants of a recruit's decision to attend a school is the team's conference alignment and its success. This is modeled in Equation 1. However, we note that recruits are unlikely

Table 3. Split Sample Regression Results.

Variable	Lower Win Sample	Higher Win Sample
Recruiting	0.42 (0.232)	0.305*** (0.075)
Coaching Change	-0.059* (0.027)	-0.082*** (0.019)
OppPer	-1.81*** (0.133)	-1.327*** (0.326)
Controls		
Conference	X	X
Observations	399	392
R ²	.28	.19

Note. Standard deviations in parentheses.

* $p < 0.10$. ** $p < 0.05$. *** $p < 0.01$.

to be paying attention to a team's opposition. Instead, an athlete is likely to make a decision on attending any specific school based on its success, which may be impacted by the quality of opposition. Thus, we include difficulty in schedule in Equation 2 but not in Equation 1.

A second method will utilize the same regression technique but instead will split the sample into two evenly sized groups based on sample period win percentage. Each team has its average win percentage calculated for the entire sample, then they are split into halves. Each tier runs a two-stage least squares regression using Equations 1 and 2. This technique allows for exploration regarding the value of recruiting to each group. The reason why this might be a valuable tool for analysis is that there have been some studies indicating that NCAA rules and regulations create lock-in effects in which certain tiers of teams can utilize better recruits more effectively than others.¹³ For this model, we expect to see different magnitudes on Equation 2's *Recruiting* variable for each tier. If lock-in effects exist, then it is expected to find statistically insignificant effects for the less successful teams.

Results

We first split the sample to test for lock-in effects. Table 3 presents these findings. The primary variable of interest is the coefficient on *Recruiting*. Both halves of the sample report positive correlations between recruiting quality and team success. As hypothesized, the results for the lower half of FBS teams find this relation to be statistically insignificant. This indicates that for those teams for whom consistent on-field success does not occur are, on average, unlikely to see any benefit from increasing their recruit quality. However, more successful teams do see a statistically significant beneficial effect from pulling in more highly rated recruit classes. This

Table 4. OLS and Two Stage Least Squares (2SLS) regression results.

Variable	(OLS) (1)	(2SLS) (2)	(2SLS) (3)
Recruiting	0.256*** (0.021)	0.571*** (0.050)	-0.774 (0.401)
Fire	-0.112*** (0.020)	-0.101*** (0.027)	-0.076** (0.021)
Poach	0.044 (0.038)	0.021 (0.043)	-0.015 (0.037)
OppPer	-1.773*** (0.097)	-1.499*** (0.106)	-1.577*** (0.179)
Controls			
Conference	X	X	X
Team			X
Observations	904	791	791
R ²	.33	.37	.58

Note. Standard deviations in parentheses.

* $p < 0.10$. ** $p < 0.05$. *** $p < 0.01$.

lends to credence to the prior research discussing the possibility of lock-in effects among peer groups in football teams.

Such a finding may be counterintuitive, given that one might expect diminishing marginal returns to dominate for athletics. In other words, the marginal effect of a good recruit on a team already full of quality recruits might be expected to be less than the effect of a relatively lower quality team landing a better recruit. We believe there are two main reasons this effect might not hold. For one, recruit ratings may not feature constant marginal differences between ratings. The athletic difference between a two-star and a three-star recruit may be much lower than the difference between a four-star and a five-star recruit. In particular, given that the vast majority of athletes are ranked in the two- or three-star range, higher rated players may be more appropriately thought of as extreme examples or outliers. Thus, for better teams that average three- and four-star recruits that manage to land a five star may receive a bigger benefit than a team that averages two- and three-star recruits but manages to sign a four-star recruit. Additionally, athletes may face agglomeration spillover effects. A good wide receiver signing to a team that has a lower quality quarterback may fail to achieve their expected on-field success compared to the same wide receiver signing to a team with a higher quality quarterback. Better teams may be able to provide more beneficial interathlete spillovers for personal (and thus possibly, team) success.

Table 4 provides the key findings for the research presented here. The cross-sectional results of only using Equation 2 can be found in Model (1). Head coaching changes are found to be negatively correlated with team success when the coach has been fired, indicating that (at least in the short term) firing a coach will lead to a 10% lower end-of-year win percentage. Poached coaches, though, have a statistically insignificant effect indicating that it may be difficult to predict whether a poached

coach will have success with their new team. Opposition win percentage is inversely associated with own team win percentage. This finding is expected as it provides evidence that a team facing a more difficult schedule will likely win fewer games over the course of a season. Model (1) would associate a standard deviation increase in difficulty of schedule would likely lead to a 10% lower win percentage (approximately one extra lost game for that season).

Models (2) and (3) utilize the more nuanced two-stage least squares methodology.¹⁴ Without accounting for team-specific effects, we continue to find evidence of the importance of recruiting, with the magnitude doubling in size after accounting for bidirectional causality. Both fired coaching changes and opposition win percentage continue to be significant in both size and magnitude. This corresponds well to both Langelett and Bergmen's findings. However, upon controlling for team-specific fixed effects, the effect of recruiting turns insignificant.¹⁵ In essence, team-specific unobservables account for much of each team's success. Such a finding, while surprising, provides for a new avenue of consideration in future research. These results would suggest that recruiting raw ability is less important than the utilization of the team's facilities and/or coaching capabilities. In other words, team success may be more akin to the discussion of the effects of nature versus nurture. In our case, these findings represent a push toward the importance of nurturing in the effects of team performance from recruits.

One may argue that our results are more heavily driven by Rival's recruit rankings, providing less predictive power than expected. However, without team effects, the findings indicate a relatively strong correlation between recruit quality and team success. Additionally, if individual success can be identified as being drafted in the first round of the NFL, then Rival's ratings are still well capable of identifying quality football players. For example, in the 2014 NFL draft, 32 players were selected in the first round of which 14 were juniors.¹⁶ As a percentage of their high school year class (2011), the junior represented 11% of the 2011 class's five-star recruits, 1.5% of their four-star players, and 0.27% of the three-star recruits. Rival's recruit ratings would appear to correlate with the possibility of first round draft status, indicating that they are at least somewhat predictive of player's on-the-field potential.

Conclusion

In this article, we expand upon the prior literature investigating the effect of recruiting on college football team success. By introducing a split sample analysis, our research indicates the possibility of lock-in effects among college teams. Less successful teams, on average, tend to derive less benefit from quality recruits compared to more successful teams. This may be due to a lower capacity to utilize recruit abilities.

We also find that much of the prior findings may be driven by misspecification in econometric modeling techniques. Specifically, the inclusion of both a two-stage

least squares panel regression technique and with team-specific control variables yields results that run counter to prior findings. These results are demonstrated to be largely the result of team-specific control variables soaking up the effect of recruit quality.

However, these results also open up new avenues of possible research. The findings presented here indicate that future research into football team success may derive more benefit from focusing on team-specific characteristics as opposed to recruit quality. Coaching quality and team facilities are both examples of less studied factors that may influence team success and the ability of recruits to perform on the field.

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Notes

1. See CSM0810 Report provided by ESPN.
2. The sample period under discussion utilizes data during which the National Collegiate Athletic Association (NCAA)'s postseason consisted of single games at the end of the year, with the Bowl Championship Series games providing the largest cash prizes for participation.
3. See also Caro (2012).
4. Football Bowl Subdivision (FBS) is the designation provided to all former Division-1A schools.
5. As of 2013, there were 124 FBS teams; however, some were newly promoted and thus did not have data for the entire period, while others were missing some of the control variable data. Therefore, any teams without the full 13 years of data were dropped after calculating opponent's win percentage.
6. See <http://www.collegefootballpoll.com>.
7. These designations were given based on a combination of team performance (i.e., losing seasons) and news reports detailing the circumstances of the change.
8. A few are listed as unaffiliated schools. Such schools were aggregated into an unaffiliated category.
9. Moving from one conference to another will tend to alter the viewing audience leading to a change in recruiting patterns. For example, Nebraska's move to the Big Ten Conference led to its televised games being predominantly shown in Mid-Western homes, whereas when it was a Big 12 team, its television appearances tended to be shown in the Great

Plains and South Central areas. Recruits in each area may be more drawn toward teams that they can watch with more regularity.

10. The recruiting class rating is derived from the average rating of all recruits to each school. In effect, it is an average recruiting rating.
11. Thus, wins and losses against Football Championship Subdivision teams are included in calculating the $WinPer_{i,t}$ variable but not the $OppPer_{i,t}$.
12. Five years are used as there are generally 5 years of classes on a football team, namely, red-shirt freshman, freshman, sophomore, junior, and senior.
13. See Eckard (1998) and Sutter and Winkler (2003).
14. Tests for heteroskedasticity find no indication of its occurrence.
15. These results are relatively robust, finding insignificance regardless of whether recruit ratings are entered as separate lags, first-differenced lags, using growth rates of the trailing moving average, or even accounting for recruiting hotbeds through state dummy variables. In addition, analysis of variance (ANOVA) and multivariate ANOVA find there to be a significant amount of variation even after controlling for team effects.
16. National Football League eligibility requires that players be at least 3 years removed from high school to be drafted. As such, the earliest a college player could declare for the draft is as a third-year player (junior or red-shirt sophomore).

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