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ARTICLE

Does Prior NFL Head Coaching Experience Improve Team Performance?

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Sports franchises often value prior head coaching experience as they evaluate head coaching candidates. This paper empirically tests whether prior head coaching experience affects team performance in the National Football League. Accounting for individual coach effects and other relevant factors, I find that team performance is significantly worse beyond a given coach's initial head coaching spell. These results hold for a variety of outcome measures. While coaches with the lowest levels of success in their initial head coaching spell have the most pronounced negative experience effects, significant negative effects are estimated for coaches at all levels of initial success. One explanation for these results is that human capital acquired through head coaching experience is to a large extent firm specific, so while learning does occur within a given head coaching job, it does not carry over to future coaching spells. This can lead to an erosion of any relative human capital advantage.

Keywords: coach dismissals, organizational change, sports economics

In the National Football League (NFL), coaching changes are quite common. In fact, between the years 1995 and 2012, an average of 22% of NFL teams experienced a coaching change during a given year (the Monday after the NFL's regular season ends is referred to as "Black Monday" because of the number of coaches who are fired after disappointing seasons). With this high degree of coaching turnover and the increasingly high stakes associated with winning in the NFL,[1] understanding what factors are associated with coaching success is very important to those involved in the management of NFL teams. One characteristic of central importance is previous head coaching experience. A track record as an NFL coach is something that teams are often willing to pay for. In fact, in 2014, the average salary of the nine NFL coaches with at least one prior head coaching job was $5.9 million, while the average salary of a coach in his first head coaching job was $4.8 million.[2] This paper examines how previous NFL head coaching experience, specifically whether a given coach has had a previous head coaching job, affects team performance. By examining team performance between 1995 and 2012 and accounting for coach-specific fixed effects, I find that coaches have less success on average once they are beyond their initial head coaching spells. Significant learning effects seem to be confined within a particular coaching spell. One explanation for these results is that the human capital accumulated through head coaching experience is largely firm specific. This, coupled with improvements in the managerial efficiency of new entrants into this labor market, would cause any relative human capital advantage a coach may have to diminish as he moves on to subsequent head coaching positions.

The rest of the paper is organized as follows. The second section provides the background for the analysis, discussing relevant theoretical and empirical literature. The third section describes the data and empirical models. The fourth section presents a discussion of the results. The fifth section concludes.

Background

Since the main relationship analyzed in this paper is the one between prior head coaching experience and team success in the NFL, the focus is on learning by doing as the mechanism through which human capital accumulates. As such, it draws on the human capital literature and the learning-by-doing literature, as well as the series of papers within sports economics dealing with managerial efficiency and manager characteristics.

Underlying the entire analysis is the assumption that coaches can materially impact team performance, and the literature has shown that this is indeed the case. Models of managerial efficiency, where the role of the manager is to convert various inputs related to winning into actual wins, have shown substantial variation in efficiency

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between managers in a variety of contexts. Both Porter and Scully (1982) and Kahn (1993) show that managerial quality matters in Major League Baseball, while Clement and McCormick (1989) show that it matters in college basketball. Furthermore, Goff (2013) shows that a coach's impact on team success is greater in the NFL than in Major League Baseball, a finding that suggests that the NFL is an appropriate setting to perform this analysis.

There is a great deal of literature on learning, much of it documenting the existence of learning curves in a variety of settings. Thompson (2012) provides a recent review of this literature on learning curves, and Aktas, de Bodt, and Roll (2013) have shown significant learning effects for the leaders of organizations. The central idea is that workers become more productively efficient as their cumulative output increases. The standard formulation of this relationship involves the rate of cost reduction declining with cumulative production, moving asymptotically toward zero (Thompson, 2012).

While, on their own, standard learning effects should theoretically improve the performance of a coach's teams in his second spell and beyond, there are a number of other considerations. The first is that the rate at which these learning effects diminish differs across a variety of settings, as demonstrated in examples found in Jovanovic and Nyarko (1995). Thus, there is some doubt about their relative importance in this context. There is also the question of whether the human capital accumulation that occurs through learning is general or firm specific, a distinction made by Becker (1964). Glenn, McGarrity, and Weller (2001) have shown that patterns in the trades of baseball players support the idea that firm-specific human capital accumulation matters in that context. Given the fact that football involves relatively more interaction among teammates and coaches, one might reasonably expect the firm specificity of the human capital to be even greater in this context. To the extent that coaches are obtaining firm-specific human capital through their experiences, that experience will be less useful in future head coaching jobs. Furthermore, the composition of the rest of the coaching market changes over time. Just as Orazem and Vodopivec (2009) empirically document, competition encourages inefficient entities to leave the market and relatively efficient entities to enter and survive. Thus, one can think of the "coaching technology" that converts productive inputs into wins as improving over time (i.e., new and surviving coaches employing strategic or managerial tactics that have some positive value). Along these lines, Jensen, McGuckin, and Stiroh (2001) have shown that newer plants (i.e., plants that have enjoyed a lower level of learning-by-doing benefits) with new technology have productivity that is comparable to older plants with older technology. This is important in this context because it suggests that any relative human capital advantage a coach might possess could erode over time as new coaches entering head coaching positions employ this newer "coaching technology."

Previous empirical results concerning the relationship between coaching experience and team success are somewhat mixed.[3] The managerial efficiency model in Hadley, Poitras, Ruggiero, and Knowles (2000) considers experience (as measured in years) as a factor, finding that it significantly improves the efficiency of NFL coaches. However, Goff and Wisley (2006) document the presence of a managerial life cycle in the NFL, finding that once a coach reaches a certain age, team performance declines. In basketball, Pfeffer and Davis-Blake (1986) show that previous experience has a positive effect on team performance when one coach succeeds another in the National Basketball Association (NBA), while Fizel and D'Itry (1997) find an insignificant correlation between managerial efficiency and experience in college basketball.

It is worth noting that the empirical literature on coaching succession effects is mixed as well. In the NFL, Brown (1982) finds coaching changes have no effect on team performance during the period of 1970–1978, while Roach (2013) finds a negative effect in recent years. In other settings, between-seasons coaching changes have been shown to have a variety of effects: Pfeffer and Davis-Blake (1986) do not find an effect per se of coaching changes on team performance in the NBA (though other coaching characteristics, like experience, do seem to matter); Fizel and D'Itry (1997) find a negative succession effect in college basketball; and M.P. Allen, Panian, and Lotz (1979) find a positive succession effect in professional baseball.[4] To the extent that these negative succession effects exist, they imply an improvement in expected team performance occurring, at least over some interval, within a coach's tenure with a team, and learning is a logical mechanism by which this improvement can be explained.

Data and Empirical Specifications

This paper uses data from pro-football-reference.com on the regular-season performance of NFL teams from 1995 to 2012 and associated data on the head coaches of those teams. Each observation corresponds to a team-season. The first outcome variable considered is a team's win total. Given that winning games is the clear objective of NFL coaches and the basis upon which organizations and fans evaluate performance, it is the natural starting point for analyzing team performance in this analysis. Two other outcome measures, which are certainly related to winning games, are also used in this analysis to give a more complete picture of how prior coaching experience relates to team performance. These are the team's point differential (the number of points the team scored during the season minus the number of points the team allowed) and a dummy variable indicating whether a team made the playoffs in a given year.

The additional measures of team performance are especially important when looking at NFL seasons, which are only 16 games long. With such a small sample of games in a given season, luck, injuries, and other idiosyncratic shocks can have a substantial impact on a team's win total. The way that points scored and points allowed translate into wins and losses is a process that

is subject to those idiosyncratic shocks. Using a team's point differential as the dependent variable strips out that particular idiosyncratic element within a given team-season. So, while wins and point differential have a positive correlation, point differential can provide a more precise description of underlying team performance. Including the playoff dummy in the analysis is a way of addressing the fact that there is a nonlinearity in the value of increasing win totals. Reaching the playoffs is certainly valuable from the team's perspective (at a minimum, it gives the franchise valuable additional games, but it also raises the profile of the team and improves fan interest levels, which has value even if that value is more difficult to quantify). The value of reaching the playoffs introduces a nonlinearity in the value of team improvement, where a team's improvement from 5 wins to 8 wins (8 wins likely means missing the playoffs) is less valuable than an improvement from 8 to 11 wins (11 wins likely means a team makes the playoffs). Thus, while wins are likely the true objective of a coach,[5] the other outcome measures provide a complementary view of the nature of these experience effects.

Descriptive Analysis

Table 1 provides descriptive statistics for two subsets of the data. The first subset restricts attention to team-seasons associated with the first 3 years of a given coach's tenure. This is the subset that is used in the regression models presented in the analysis because it mitigates issues related to duration bias in coaching. That is, coaches with more on-field success are less likely to be fired and thus have longer tenures, as is shown in Scully (1994). Thus, any benefits from learning over the course of a coach's tenure are conflated with this effect. Limiting the sample to the first 3 years of a coach's tenure with a given team mitigates the effect of this duration bias (over three fourths of coaches in the sample are not fired before their third seasons, so the main source of the duration bias—the decision to fire a coach—is not a pronounced issue here) while retaining a sufficient number of observations to identify the effect of prior experience on team performance. The second subset includes all team-seasons regardless of the coach's tenure.[6]

In addition to the outcome variables, Table 1 describes an index of a team's strength of schedule in a particular year (this variable has a zero mean, and a higher number indicates stronger competition).[7] This factor varies from team to team within a given year as well as across years. I have also included variables related to a team's leading passer in a given season, as quarterback play has been shown to have a significant impact on team performance, as in Goff and Tollison (2009), for example. As a proxy for quarterback quality, I have used the quarterback's career passer rating, rather than his rating in a given season, because that is more likely to give a more accurate representation of the true quality level of the quarterback. In particular, the endogeneity in the relationship between a coach's impact on team performance and the quality of quarterback play is likely to be more pronounced in a given season, and therefore the use of the career passer rating mitigates these endogeneity

Table 1 Descriptive Statistics

	First 3 Years of Coach's Tenure		All Years of Coach's Tenure	
Variable	**Observations**	***M***	**Observations**	***M***
Wins	299	7.47	475	7.97
Point differential	299	–16.58	475	–0.75
Playoff appearance	299	0.32	475	0.38
Coach's tenure with current team	299	1.88	475	3.55
Total years as head coach	299	3.68	475	5.23
Coach in first head coaching spell	299	0.62	475	0.63
Coach in second head coaching spell	299	0.28	475	0.28
Strength of schedule	299	0.02	475	0.00
Team's 2-year winning percentage before current coach	299	0.42	475	0.42
Quarterback's career passer rating	299	80.59	475	81.65
Passer rating above 90	299	0.17	475	0.18
Passer rating between 85 and 90	299	0.11	475	0.16
Passer rating between 80 and 85	299	0.21	475	0.23
Passer rating between 75 and 80	299	0.28	475	0.21
Passer rating between 70 and 75	299	0.14	475	0.13
Passer rating below 70	299	0.09	475	0.08

Note. All data are from pro-football-reference.com.

concerns.[8] Other key explanatory variables describe the head coach's years of experience,[9] both with his current team and in total, and whether the coach is in his first or second spell as an NFL head coach. Sixty-two percent of the team-seasons in the analysis involved a coach in his first NFL head coaching spell, and 28% of team-seasons involve a coach in his second spell. This leaves roughly 10% of team-seasons for coaches on their third NFL head coaching job or beyond. Given the relatively small number of team-seasons involving a coach beyond his second spell, I include all coaches in their second NFL coaching spell and beyond in the same "previously experienced" group throughout the analysis.

Table 2 provides a descriptive comparison of these two groups during the first 3 years of a given coaching spell. The performances are objectively quite similar (experienced coaches actually have marginally lower win totals but slightly better point differentials and slightly more playoff appearances on average) and indeed are not different in any statistically significant way. The experienced coaches tend to be taking over teams that had marginally better performances before their tenure began, but these differences are insignificant as well.

Table 3 presents the same comparison as Table 2 does, but it focuses on the subset of team-seasons where the head coach would go on to have multiple NFL head coaching spells. Thus, it compares how these coaches did in their first spell to how they did in subsequent spells. Comparing the prior performance of the teams they took over in their initial head coaching job and the prior performance of the teams they took over once they already had head coaching experience, the differences are minimal and insignificant. In spite of these similar starting points, these averages indicate that, beyond their initial coaching spell, these coaches on average fail to reach their previous levels of success. In fact, when win total is used to measure performance, the mean level is significantly lower at the 10% level. Taken together, these descriptive statistics suggest that prior head coaching experience does not improve team performance and that there may actually be a negative experience effect.

Regression Model Specification

To more precisely measure the effect of previous head coaching experience, I use a linear regression model that accounts for a variety of factors that affect team success. The basic regression model, in which I am using *wins* as the outcome measure, takes the form given below (the team is indexed by "*i*," the coach is indexed by "*j*," and the season is indexed by "*t*"). I also run analogous linear specifications of this model using *point differential* in place of *wins* and probit specifications where *playoff* is the dependent variable.

Table 2 Average Team Performance for First-Spell and Experienced Head Coaches, First 3 Years of Tenure

Variable	First Head Coaching Job	Previous Head Coaching Experience	*t*-statistic
Wins	7.49	7.30	0.53
Point differential	–20.80	–15.63	–0.46
Playoffs	0.30	0.34	–0.75
Average wins 2 years before taking over	6.69	7.11	–1.00
Average point differential 2 years before taking over	–40.05	–21.67	–1.26
Average playoff appearances 2 years before taking over	0.21	0.29	–1.32

Note. All data are from pro-football-reference.com.

Table 3 Average Performance of Head Coaches With Multiple Coaching Spells, First 3 Years of Tenure

Variable	First Head Coaching Job	Previous Head Coaching Experience	*t*-statistic
Wins	8.20	7.30	1.84
Point differential	4.12	–15.63	1.24
Playoffs	0.35	0.34	0.14
Average wins 2 years before taking over	6.71	7.11	–0.61
Average point differential 2 years before taking over	–24.61	–21.67	–0.13
Average playoff appearances 2 years before taking over	0.21	0.29	–0.77

Note. All data are from pro-football-reference.com.

$$wins_{ijt} = \beta_0 + \beta_1 (previous\ head\ coaching\ spell_{ijt}) + \beta_2 (2\text{ - year pre-coach win percentage}_{ijt}) + \beta_3 (coach\ tenure_{ijt}) + \beta_4 (strength\ of\ schedule_{ijt}) + \beta_5 (career\ passing\ rating_{ijt}) + \beta_6 (wins_{ijt-1}) + \beta_7 (coach\ dummy_j)\ \varepsilon_{ijt} \quad (1)$$

The coefficient of primary interest is β_1 because that represents the marginal difference in team performance associated with having a coach with prior head coaching experience. Since I am trying to isolate the effect of prior experience, I estimate coach-specific fixed effects in all reported specifications. This separates the innate talent level of the coach (which I assume is captured by the fixed effect) from that coach's experience (because those two factors might be endogenously related). Thus, the estimates of β_1 reflect an average change in team performance that occurs when a given coach moves beyond his initial head coaching job. Employing this type of fixed effect eliminates the issue of having to assume that coaches who only have a single head coaching job do not differ in unobservable ways from coaches who are hired for more than one head coaching job. Thus, unobservable differences in the quality of the pool of potential coaches with prior experience and the pool of potential coaches with no head coaching experience do not confound the estimated results. Having assumed the coach fixed effect captures the true ability level of the coach, the only other identifying assumption I make is that any unobserved complementarities associated with the observed match between coach and team are uncorrelated with the distinction between whether they had a previous coaching spell.[10]

In addition to the individual coach fixed effects, there are a number of other factors for which the regression model must account. For instance, the team's level of performance in the years preceding the coach's arrival could affect performance going forward. This could relate to team-specific personnel or organizational issues. Since some situations might breed success more readily than others, I control for the team's winning percentage in the 2 years before the beginning of the coach's tenure. This is essentially a proxy for the state of the team before a new coach's arrival. In addition, strength of schedule and quarterback quality (as measured through career passer rating) are used as controls. In some specifications, I control for quarterback quality using the passer rating itself. In others, I control for it using dummy variables associated with various levels of this rating to account for potential nonlinearity in its impact.

Another consideration is that forces causing team performance to revert to league-average levels (that is, 8 wins and a point differential of zero) are strong in the NFL, but the performance of the previous season has been shown to be positively correlated with a team's performance in a given year (Roach, 2013). The inclusion of a measure of a team's performance in the previous year helps account for the pattern by which on-field success evolves, on average, over time because of factors such as changes in player quality over time, injuries, and luck.[11] This is separate from the variable accounting for the team's winning percentage before the coach's tenure began as this variable changes from year to year.

Finally, since a coach's tenure with a team could conceivably affect team performance, either through an initial succession effect related to a coaching change or through learning effects, I have included coaching tenure variables as covariates (because the models are restricted to 3 years of tenure, I use dummy variables representing the coach's tenure). The coefficients on these variables describe a learning curve within a particular coaching spell. Robust standard errors are clustered at the team level in all specifications.

Results

Main Results

The main results of the regression model given in Equation (1) are presented in Table 4. The results in this table (and in subsequent tables) are based on the sample that is limited to the first 3 years of a coach's tenure to reduce any duration bias. In all specifications, holding all else constant, prior head coaching experience has a significant negative effect on team performance. The interpretation of these estimates is that for a given head coach, the effect of being in a head coaching job beyond that coach's initial one is, on average, 1.9 fewer wins per season, a point differential that is 50 points worse, and a 21 percentage point reduction in the likelihood of making the playoffs.[12] A team's strength of schedule and the quality of their quarterback are highly significant as well, and the signs on these coefficients are in the expected direction (more difficult schedule reduces performance, higher quality quarterback improves performance). In this specification and most others, the coefficients suggest some learning effects within a coaching spell (the dummies for the second year and third year of a coach's tenure are positive), but the estimates are not significantly different from zero.

Robustness Checks

I perform a number of robustness checks to complement and strengthen the main results. The first such robustness check includes covariates to account for possible nonlinearity in the effect associated with the team's quality before a coach's arrival. Rather than using the team's winning percentage in the 2 years before a coach's arrival, I break this variable into quartiles and use dummy variables for those quartiles as the covariates. The results are presented in Table 5. Indeed, the point estimates on these quartile dummies indicate that the success of a new coach likely does not depend in a linear way on this prior winning percentage. While taking over a team in the first (lowest) quartile of prior performance tends to be associated with lower team performance going forward, taking over a team in the third quartile (rather than the fourth, or highest, quartile) is associated with the greatest success going forward. In particular, the likelihood

Table 4 Effects of Previous Head Coaching Spell on Team Performance

Dependent Variable	(1) *wins*	(2) *wins*	(3) *point differential*	(4) *point differential*	(5) *playoff*	(6) *playoff*
Previous head coaching spell	–2.003***	–1.892***	–56.01***	–49.75**	–0.223***	–0.208**
	(0.463)	(0.499)	(16.26)	(19.12)	(0.0841)	(0.0967)
Team winning percentage before coach	1.547	0.139	17.08	–32.68	0.415	0.217
	(2.733)	(2.842)	(87.54)	(90.66)	(0.330)	(0.390)
Tenure = 2	0.379	0.398	14.88	14.74	0.0831	0.0709
	(0.410)	(0.422)	(11.74)	(12.27)	(0.0930)	(0.0925)
Tenure = 3	0.129	0.186	7.013	8.007	–0.0383	–0.0282
	(0.507)	(0.504)	(14.06)	(14.31)	(0.126)	(0.117)
Strength of schedule	–0.422***	–0.458***	–14.26***	–15.40***	–0.0975***	–0.0999***
	(0.132)	(0.135)	(4.756)	(4.836)	(0.0220)	(0.0213)
Passer rating	0.127***		4.671***		0.0167***	
	(0.0254)		(0.698)		(0.00540)	
Passer rating above 90		4.649***		168.8***		0.594***
		(1.080)		(32.73)		(0.0508)
Passer rating between 85 and 90		3.149***		110.9***		0.392***
		(1.124)		(26.06)		(0.119)
Passer rating between 80 and 85		2.297***		77.91***		0.434***
		(0.688)		(25.86)		(0.0662)
Passer rating between 75 and 80		3.212***		104.4***		0.437***
		(0.789)		(24.69)		(0.0624)
Passer rating between 70 and 75		1.695**		59.99**		0.373***
		(0.810)		(24.50)		(0.127)
Last year wins	–0.0757	–0.0666				
	(0.0959)	(0.0960)				
Last year point differential			–0.0183	0.00595	0.000299	0.000289
			(0.0827)	(0.0831)	(0.000610)	(0.000633)
R^2	0.577	0.588	0.614	0.623		
Adjusted R^2	0.336	0.341	0.394	0.396		
Pseudo R^2					0.239	0.262
N	299	299	299	299	192	192

Note. Robust standard errors are given in parentheses. All standard errors clustered at franchise level. Individual coach dummies are included in all specifications. "Wins" variables are transformed by subtracting 8 from the team's win total. Thus, these variables range from -8 to 8 instead of 0 to 16. "Team winning percentage before coach" is a 2-year average for the years immediately preceding the current coach's becoming the head coach of record. The variable "passer rating" is the career passer rating of the quarterback who amassed the most yards for a team in a given year. When passer rating category dummies are used, the omitted group is those with a passer rating below 70. When the binary variable "playoff" is the dependent variable, a probit model is run, and marginal effects are reported. *$p < 0.1$. **$p < .05$. ***$p < .01$.

Table 5 Effects of Previous Head Coaching Spell on Team Performance With Team Performance Before Coach Arrival Separated by Quartile

Dependent Variable	(1) *wins*	(2) *wins*	(3) *point differential*	(4) *point differential*	(5) *playoff*	(6) *playoff*
Previous head coaching spell	–2.067***	–1.930***	–59.23***	–52.14***	–0.246***	–0.217***
	(0.430)	(0.457)	(14.93)	(16.88)	(0.0615)	(0.0810)
Lowest quartile team winning percentage before coach	–0.445	–0.322	14.42	12.66	–0.125	–0.120
	(1.113)	(1.057)	(41.61)	(37.23)	(0.299)	(0.280)
Second-quartile team winning percentage before coach	0.214	–0.381	20.07	–5.598	0.0661	–0.0280
	(0.768)	(0.783)	(34.26)	(32.43)	(0.189)	(0.197)
Third-quartile team winning percentage before coach	1.514	1.270	62.89	51.58	0.424***	0.390***
	(0.996)	(0.983)	(40.35)	(39.61)	(0.113)	(0.126)
Highest quartile team winning percentage before coach	0.477	0.0811	31.06	11.19	0.194	0.117
	(1.313)	(1.381)	(44.59)	(45.06)	(0.268)	(0.280)
Tenure = 2	0.359	0.386	14.65	14.88	0.0865	0.0751
	(0.404)	(0.418)	(11.43)	(12.09)	(0.0893)	(0.0887)
Tenure = 3	0.148	0.226	8.537	10.31	–0.0414	–0.0309
	(0.511)	(0.503)	(13.86)	(14.08)	(0.122)	(0.110)
Strength of schedule	–0.428***	–0.453***	–14.50***	–15.27***	–0.0984***	–0.0957***
	(0.134)	(0.135)	(4.859)	(4.917)	(0.0207)	(0.0197)
Passer rating	0.130***		4.683***		0.0207***	
	(0.0239)		(0.696)		(0.00690)	

(continued)

Table 5 *(continued)*

Dependent Variable	(1) *wins*	(2) *wins*	(3) *point differential*	(4) *point differential*	(5) *playoff*	(6) *playoff*
Passer rating above 90		4.793***		172.4***		0.591***
		(1.054)		(33.98)		(0.0435)
Passer rating between 85 and 90		3.054***		105.9***		0.400***
		(1.105)		(25.14)		(0.116)
Passer rating between 80 and 85		2.188***		73.53***		0.431***
		(0.690)		(26.31)		(0.0719)
Passer rating between 75 and 80		3.165***		103.0***		0.426***
		(0.761)		(25.41)		(0.0740)
Passer rating between 70 and 75		1.800**		64.44**		0.365***
		(0.831)		(24.96)		(0.120)
Last year wins	–0.0815	–0.0795				
	(0.0941)	(0.0945)				
Last year point differential			–0.0325	–0.0187	0.000164	0.000170
			(0.0806)	(0.0813)	(0.000603)	(0.000599)
R^2	0.591	0.604	0.627	0.639		
Adjusted R^2	0.347	0.354	0.404	0.411		
Pseudo R^2					0.273	0.295
N	309	309	309	309	199	199

Note. Robust standard errors are given in parentheses. All standard errors clustered at franchise level. Individual coach dummies are included in all specifications. "Wins" variables are transformed by subtracting 8 from the team's win total. Thus, these variables range from –8 to 8 instead of 0 to 16. "Team winning percentage before coach" is a 2-year average for the years immediately preceding the current coach's becoming the head coach of record. The variable "passer rating" is the career passer rating of the quarterback who amassed the most yards for a team in a given year. When passer rating category dummies are used, the omitted group is those with a passer rating below 70. When the binary variable "playoff" is the dependent variable, a probit model is run, and marginal effects are reported. *$p < 0.1$. **$p < .05$. ***$p < .01$.

of making the playoffs when taking over a third-quartile team is significantly higher. When accounting for this nonlinear effect, the coefficient on the prior experience variable does not materially change. These estimates remain very close (they are actually marginally stronger) to the estimates from Table 4.[13]

The second robustness check involves how experience is defined in the model. While I use a binary indicator for prior experience in the main analysis, one might argue that cumulative years of head coaching experience (across all coaching spells) could be used for that purpose. Table 6 shows results where this cumulative experience in years and the square of that number replace the binary indicator of prior experience. The underlying central result holds: Prior head coaching experience has a significant negative effect on team performance. While the quadratic experience term is insignificant, the coefficient on the linear experience term indicates that an additional year of experience reduces a team's expected win total by 0.4 wins, reduces point differential by 9 points, and reduces the likelihood of making the playoffs by more than 5 percentage points. In several of the specifications in this table, there is a positive and significant tenure effect, suggesting a significant learning curve within a given coaching spell. The relative size of the point estimates suggest that this within-job learning curve has concave shape, a finding that is consistent with the literature on learning curves.

The final robustness check involves classifying coaches into quartiles based on their winning percentage in their initial head coaching spell. This tests whether a coach who experienced great success in his first spell can maintain that level of performance in another coaching situation (as well as whether coaches who did less well in their initial coaching spell should expect to improve relative to those levels). Table 7 presents these results. The negative point estimates on the experience effect are present for each group, and indeed each of these interaction terms is negative and statistically significant in multiple specifications. While this negative effect is clear regardless of the success level in a coach's initial spell, the coaches in the lowest quartile for winning percentage in their initial coaching spell tend to see the largest and most significant negative experience effects. These coaches have expected win totals that are close to 4 games lower (and point differentials that are roughly 130 points worse) than what would be expected in their initial coaching spell (by comparison, the point estimates for the experience effect for coaches in other quartiles is between 1 and 2 fewer wins in a given season).

Discussion

There are a number of theoretical reasons for the presence of this negative experience effect. First of all, the size and complexity of individual NFL teams can presumably make one job look very different from another. This type of complexity might severely limit the transfer of learning from previous head coaching jobs. That is, the firm specificity of the human capital acquired through experience could limit the value of that experience in a new setting. Furthermore, the competition among NFL teams (and teams in other sports) is zero-sum. Thus, if newer, inexperienced coaches are improving in some sense (using new tools or strategic techniques that have some value), and less efficient coaches are leaving the market, the performance of experienced coaches may suffer as a result of their competition's improving.

Conclusion and Future Research

Using regression analysis with individual coach fixed effects, this paper has shown that NFL coaches have less successful teams on average in the coaching spells following their initial head coaching job. This finding holds for a variety of outcome measures (wins, point differential, and playoff appearances) and a variety of empirical specifications. The average experience effect is roughly 1.9 fewer wins per season and a point differential that is 50 points worse on average over the course of a season. This negative experience effect is present for coaches regardless of their level of success in their initial coaching spell, but it is especially pronounced for coaches who fared most poorly in their initial coaching spells. Even though there appear to be some positive learning effects within a given coaching job, the results suggest that this could be firm-specific learning that does not transfer to subsequent head coaching spells. With market dynamics that induce improvements in their competition, this can lead to a relative decline in performance for experienced coaches.

These findings suggest that if on-field performance is the key consideration in the management of a sports franchise,[14] teams (football teams, in particular) should not be willing to pay huge premiums for head coaching experience. Those premiums are essentially payments for prior successes that are, on average, unlikely to be matched. Given the finding of a negative experience effect, it would be appropriate for managers to consider the theoretical channels by which that negative effect might evince itself (an unwillingness of experienced coaches to adapt to changing conditions or new information, e.g.) and assess the extent to which it applies to their particular coaches or coaching situations. Managers should realize that the human capital accumulated by coaches over their careers may be largely firm specific, failing to carry over to new situations, and this possibility would seem especially noteworthy for larger and more complex organizations. Future research could certainly advance the understanding of the nature of these experience effects. Employing matching techniques could certainly be useful in comparing inexperienced coaches to experienced ones. In addition, a more detailed analysis of the observable characteristics of the coaches could shed light on the circumstances under which these effects are most pronounced.

Table 6 Effects of Cumulative Head Coaching Experience on Team Performance

Dependent Variable	(1) *wins*	(2) *wins*	(3) *point differential*	(4) *point differential*	(5) *playoff*	(6) *playoff*
Cumulative head coaching experience	–0.462**	–0.395**	–11.69**	–8.939	–0.0673*	–0.0560*
	(0.180)	(0.169)	(5.467)	(5.462)	(0.0370)	(0.0338)
Cumulative head coaching experience squared	0.0135	0.00956	0.208	0.0379	0.00270	0.00233
	(0.0136)	(0.0133)	(0.407)	(0.417)	(0.00219)	(0.00215)
Team winning percentage before coach	0.639	–0.832	–11.49	–60.64	0.304	0.0697
	(2.572)	(2.661)	(79.73)	(82.65)	(0.333)	(0.398)
Tenure = 2	0.750*	0.715*	24.81**	22.75*	0.125	0.105
	(0.401)	(0.408)	(11.57)	(11.91)	(0.0915)	(0.0914)
Tenure = 3	0.820	0.797	26.39*	24.68	0.0391	0.0308
	(0.509)	(0.506)	(14.04)	(14.61)	(0.123)	(0.116)
Strength of schedule	–0.426***	–0.452***	–14.18***	–14.86***	–0.1000***	–0.102***
	(0.130)	(0.137)	(4.687)	(4.889)	(0.0220)	(0.0210)
Passer rating	0.136***		5.004***		0.0180***	
	(0.0239)		(0.695)		(0.00554)	
Passer rating above 90		4.963***		180.2***		0.598***
		(1.061)		(33.48)		(0.0464)
Passer rating between 85 and 90		3.548***		124.4***		0.408***
		(1.042)		(22.75)		(0.108)
Passer rating between 80 and 85		2.308***		77.82***		0.434***
		(0.685)		(24.97)		(0.0662)
Passer rating between 75 and 80		3.064***		99.21***		0.434***
		(0.818)		(25.16)		(0.0683)
Passer rating between 70 and 75		1.766**		61.36**		0.382***
		(0.804)		(24.29)		(0.117)
Last year wins	–0.0828	–0.0723				
	(0.0939)	(0.0939)				
Last year point differential			–0.0294	–0.00973	0.000324	0.000359
			(0.0809)	(0.0835)	(0.000620)	(0.000631)
R^2	0.579	0.590	0.619	0.629		
Adjusted R^2	0.337	0.340	0.399	0.402		
Pseudo R^2					0.244	0.264
N	299	299	299	299	192	192

Note. Robust standard errors are given in parentheses. All standard errors clustered at franchise level. Individual coach dummies are included in all specifications. "Wins" variables are transformed by subtracting 8 from the team's win total. Thus, these variables range from –8 to 8 instead of 0 to 16. "Team winning percentage before coach" is a 2-year average for the years immediately preceding the current coach's becoming the head coach of record. The variable "passer rating" is the career passer rating of the quarterback who amassed the most yards for a team in a given year. When passer rating category dummies are used, the omitted group is those with a passer rating below 70. When the binary variable "playoff" is the dependent variable, a probit model is run, and marginal effects are reported. *$p < 0.1$. **$p < .05$. ***$p < .01$.

Table 7 Effects of Previous Head Coaching Spell on Team Performance by Previous Success Quartiles

Dependent Variable	(1) *wins*	(2) *wins*	(3) *point differential*	(4) *point differential*	(5) *playoff*	(6) *playoff*
(Previous head coaching spell)*(lowest quartile first spell winning percentage)	–3.836***	–4.107***	–126.0***	–131.7***	–0.455***	–0.456***
	(1.061)	(0.939)	(42.21)	(38.17)	(0.00886)	(0.00767)
(Previous head coaching spell)*(second-quartile first spell winning percentage)	–1.708*	–1.261*	–34.69*	–15.97	–0.0580	0.00405
	(0.843)	(0.710)	(20.32)	(17.71)	(0.145)	(0.130)
(Previous head coaching spell)*(third-quartile first spell winning percentage)	–1.338	–1.531	–72.06**	–78.12*	–0.236*	–0.240*
	(0.901)	(1.074)	(30.83)	(40.22)	(0.122)	(0.140)
(Previous head coaching spell)*(highest quartile first spell winning percentage)	–1.758**	–1.453	–14.77	–2.256	–0.316***	–0.348***
	(0.805)	(0.938)	(23.42)	(28.66)	(0.0453)	(0.0439)
Team winning percentage before coach	2.162	0.687	48.49	–5.777	0.546	0.420
	(2.666)	(2.779)	(82.27)	(89.45)	(0.353)	(0.389)
Tenure = 2	0.371	0.386	14.67	14.40	0.0954	0.0875
	(0.417)	(0.432)	(11.92)	(12.59)	(0.0947)	(0.0944)
Tenure = 3	0.123	0.188	8.096	9.617	–0.0231	–0.00949
	(0.519)	(0.513)	(14.22)	(14.27)	(0.130)	(0.119)
Strength of schedule	–0.434***	–0.464***	–13.87**	–14.87***	–0.103***	–0.106***
	(0.144)	(0.145)	(5.102)	(5.041)	(0.0246)	(0.0231)
Passer Rating	0.124***		4.849***		0.0168***	
	(0.0250)		(0.717)		(0.00559)	

(continued)

Table 7 *(continued)*

Dependent Variable	(1) *wins*	(2) *wins*	(3) *point differential*	(4) *point differential*	(5) *playoff*	(6) *playoff*
Passer rating above 90		4.764***		182.1***		0.578***
		(1.096)		(34.16)		(0.0473)
Passer rating between 85 and 90		3.169***		115.8***		0.370***
		(1.090)		(25.47)		(0.120)
Passer rating between 80 and 85		2.475***		84.79***		0.421***
		(0.702)		(23.71)		(0.0588)
Passer rating between 75 and 80		3.324***		113.0***		0.435***
		(0.816)		(24.80)		(0.0613)
Passer rating between 70 and 75		1.816**		64.75**		0.365***
		(0.844)		(24.84)		(0.120)
Last year wins	–0.0709	–0.0641				
	(0.0983)	(0.0991)				
Last year point differential			–0.0345	–0.0142	0.000266	0.000255
			(0.0846)	(0.0859)	(0.000620)	(0.000641)
R^2	0.581	0.595	0.621	0.634		
Adjusted R^2	0.333	0.340	0.396	0.405		
Pseudo R^2					0.249	0.276
N	299	299	299	299	192	192

Note. Robust standard errors are given in parentheses. All standard errors clustered at franchise level. Individual coach dummies are included in all specifications. "Wins" variables are transformed by subtracting 8 from the team's win total. Thus, these variables range from –8 to 8 instead of 0 to 16. "Team winning percentage before coach" is a 2-year average for the years immediately preceding the current coach's becoming the head coach of record. The variable "passer rating" is the career passer rating of the quarterback who amassed the most yards for a team in a given year. When passer rating category dummies are used, the omitted group is those with a passer rating below 70. When the binary variable "playoff" is the dependent variable, a probit model is run, and marginal effects are reported. *$p < 0.1$. **$p < .05$. ***$p < .01$.

Endnotes

[1]The average value of NFL franchises continues to rise, up 23% between 2013 and 2014 according to Forbes (Ozanian, 2014), meaning that the gains and losses from on-field performance are magnified.

[2]Coaching salary data were retrieved from http://coacheshotseat.com/NFLCoachesSalaries.htm on January 5, 2015.

[3]Papers that have considered other observable characteristics of NFL coaches, in particular race, have had mixed results as well. Madden (2004) finds the race has an effect on winning; Malone, Couch, and Barrett (2008) and Goff and Tollison (2009) find no significant race effects; and Madden and Ruther (2011) find that differences in performances across races disappeared after the Rooney Rule was implemented in 2002.

[4]It is also worth noting that the success dynamics may differ between internal and external promotions, as indicated in Fee, Hadlock, and Pierce (2006), but that most NFL head coaching changes considered here involve an external promotion.

[5]For instance, a team leading a game may simply take a knee on its final few plays to end the game rather than try to score more points and increase its point differential.

[6]Both subsets also exclude observations where the coach's tenure began before the 1995 season and situations where the coach is taking over an expansion team.

[7]The *strength of schedule* variable is based on the Simple Rating System, an explanation of which is given in Pro Football Reference Blog (2006). The Simple Rating System gives a value for each team that represents how many points better a given team is than a league average team on a per game basis (a negative value indicates that a team is worse than a league average team). The *strength of schedule* variable is average of the Simple Rating System values of a team's opponents in a given year.

[8]For instance, if a coach devises a strategy that is well suited to a quarterback who has been historically below average and brings an above-average performance out of that player, that should reflect on the coach as well as the quarterback. If the passer rating for that season is used as a covariate, the effect of the coach is biased downward.

[9]Here and throughout, when I refer to a coach's experience, I mean the number of years he has been an NFL head coach. I do not account for years spent as an assistant coach or coordinator in the NFL or years as a head coach at other levels. I consider the coach who began the year with the team as the coach for a given team-season, even if that coach was replaced midseason.

[10]The additional information that comes with having an observable track record as a head coach might make identifying complementarities between a coach and an organization (which are econometrically unobservable from the perspective of this analysis but certainly things that organizations are trying to evaluate in their search process) easier than it would be absent that track record. If that is indeed the case, any bias in the results would overstate the benefits of hiring a coach with prior head coaching experience. Thus, the measured negative experience effect is in spite of any such bias, not because of it.

[11]The variable *wins* is transformed by subtracting off that mean level (which is 8 wins), and so this variable ranges from –8 to 8 rather than from 0 to 16 (which would be the range had the transformation not been done). This is done so that any mean-reversion effects are capture by the lagged value of *wins*. When *point differential* is used as a performance measure, no such transformation is necessary.

[12]Results from the specifications that use all years of a coach's tenure are similar to these reported results, both in terms of magnitude and statistical significance. These specifications involve using tenure and tenure squared as covariates (as is done in W.D. Allen & Chadwick, 2012), rather than dummies for years of tenure, and an additional interaction term between tenure and the team's performance before the new coaches arrival. The estimates range from –1.3 to –1.6 wins per season, a point differential that is between 40 and 50 points lower, and a 15–19 percentage point reduction in the likelihood of making a playoff appearance. These marginal reductions in magnitudes are likely attributable, at least in part, to duration bias.

[13]In specifications where I interact the prior experience variable with categorical dummies based on the team's winning percentage before the coach's arrival, the reduced precision of the estimates prevents me from drawing conclusions about differences in the experience effect across these groups based on prior team success. Future research will hopefully explore this dynamic more fully (with either additional data or by employing a different technique, such as matching).

[14]There are a number of reasons why teams might still be willing to pay a premium for a coach with prior experience even if, on average, that coach will have less success than in his initial head coaching job. It may be easier to sell fans on the future of the organization if a team brings in a recognizable name. Furthermore, demonstrating a willingness to invest a relatively large amount of money in a known coaching commodity (rather than paying an inexperienced coach less money) might be a positive signal about other potential investments in the franchise, which may also boost fan support.

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