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Managerial Efficiency, Managerial Succession and Organizational Performance

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Data envelopment analysis (DEA) is used to create a measure of managerial efficiency in an attempt to reassess the conflicting theories concerning the impact of organizational performance on manager succession, and the counter-theories concerning the impact of manager succession on organizational performance. The analysis uses data for 147 college basketball teams from 1984 to 1991. The results indicate that winning, not efficiency, is the key criterion used in determining managerial retention. Yet when managers of losing teams are dismissed the teams tend to do even worse. If, however, the efficiency of the new manager is greater than that of the former, the disruptive effect of succession is minimized. Because administrators appear to focus on winning, not efficiency, they will often select new managers who are less efficient than departed managers. These results are unique to this literature and indicate promise for the use of DEA in analyses of the internal efficiencies of organizations. © 1997 by John Wiley & Sons, Ltd.

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INTRODUCTION

Managers perform several functions that are often deemed critical to the performance of organizations. Thus, when organizations exhibit poor performance, there is a common notion that dismissing and replacing the manager will lead to improved performance. While that has intuitive appeal, both the assertion that 'performance causes succession' and the counter-assertion that 'succession causes performance' are subject to theoretical and empirical debate.

Amid this controversy is the problem of measuring managerial performance. Managerial performance measures in business are often difficult to define, use distorted or proprietary data, or are determined, in part, by forces outside managerial control. We use data envelopment analysis (DEA) to introduce a 'new' measure of managerial performance to this debate. DEA estimates the efficiency of a given manager relative to the efficiency of all managers in the industry. This efficiency measure also determines the difference between the actual performance of the manager and what could have been achieved under 'best practice' decisions. We believe this innovative measure of managerial efficiency helps to shed new light on the old, yet puzzling relationships between succession and performance.

For this reexamination of the 'performance causes succession' and the 'succession causes performance' hypotheses we use NCAA Division I college basketball data over the period 1984-91. There are a number of reasons why basketball is a useful and convenient point of departure for our measure of managerial efficiency. First, data on inputs and output are readily available, and provide easy-to-interpret proxies for the productivity relationships that exist in the industry. Second, the dimensions of basketball coaching parallel those of business managers. The coaching function includes personnel decisions (recruiting, training, scheduling), motivation of personnel (allocating playing time), and strategic planning (devising and altering offensive and defensive schemes). Finally, basketball is a sport with essentially one coach. This reduces the contaminating

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influences other coaches might have on organizational performance, as may occur in baseball and football where larger coaching staffs are the norm.[1]

LITERATURE REVIEW

There is no dispute that managers will be replaced for poor performance as long as they are held accountable for their actions (Brown, 1982; Crain, 1977; Salancik and Pfeffer, 1980). The principal–agent problem, however, which is at the core of any model of organizations, suggests that accountability may not always exist (Fama, 1980). Managers and stakeholders may have divergent goals, and if there is no mechanism by which managers are dissuaded from acting in their own interests, managers will be free to maximize returns to themselves rather than to fulfill the performance goals of stakeholders. Under such conditions managerial shirking and/or incompetence may ensue without managerial succession (i.e. turnover). Recent analyses indicate that powerful managers are held less accountable. When managers are either members or chairs of the board of directors, organizational performance does not affect managerial succession (Fizel *et al.*, 1990a,b); Dyl, 1988; Gomez-Meija *et al.*, 1987).

How would the performance of the organization change if the manager was replaced? One theory suggests that managerial turnover is disruptive to the organization. Gouldner (1954) observed that the appearance of new managers in a gypsum plant altered accepted and expected patterns of organizational behavior, causing a deterioration in morale and productivity. Moreover, the negative succession–performance relationship may ultimately create a 'vicious circle.' Focusing on professional baseball managers, Grusky (1963, 1964) found that managerial dismissal was more likely in poorly performing teams and that once the new manager took over, the team's performance deteriorated further. The disruptive hypothesis receives additional support from Carroll's (1984) study of US newspaper publishers and Brown's (1982) study of professional football coaches.

A second theory suggests that managerial succession has no effect on performance. With roots in Aldrich's (1979) population ecology theory, this position sees organizational success as solely the result of environmental forces. Managers may lose their jobs following poor performance, but this is regarded as a scapegoating process. Gamson and Scotch (1964) note in their study of baseball managers that fired managers typically enjoy attractive employment prospects with other teams. This implies that team owners recognize that terminations are often ritualistic demonstrations of concern to lower-level employees. Brown (1982) and Lieberson and O'Connor (1972) find a similar scapegoating effect in professional football and large corporations.

Finally, Guest (1962) hypothesizes that a new manager will improve performance. This hypothesis assumes that there is either a 'novelty' effect associated with the new manager or the new manager is more competent than the departing one. Studies have disaggregated manager competence from manager succession *per se* to address each component of this hypothesis. Smith *et al.* (1984) in a study of Methodist ministers and Pfeffer and Davis-Blake (1986) in a study of professional basketball coaches found a positive relationship between the ability of the new manager and organizational performance; but succession, in and of itself, had no impact on performance. In contrast, Virany *et al.* (1992) established that both succession *per se* and the characteristics of the new manager altered performance.

Thus, to date no universal relationship appears to exist between succession and performance. These conflicting results may illustrate that the succession–performance relationship is dependent on the characteristics of the organizations under study. These results, however, also raise questions about the validity of previously used performance measures as well as the decision processes used to hire and fire managers. This paper addresses the former by using a measure of efficiency that explicitly addresses the manager's ability to transform inputs into output, and in so doing implicitly addresses the calculus college administrators use in determining which coaches should be hired and retained.

PROCEDURES

The following four subsections outline the procedures employed in this research and the sources of data. The first procedure described is DEA, which is used to measure managerial efficiency. Subsequently, we describe two regression models. The first is used to identify the performance factors that are instrumental in motivating managerial succession. The second provides a short-run forecast of future organizational outcomes based on the relative performances of the new and replaced manager. Together, these models

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allow us to determine if the factors that prompt succession are consistent with the factors that lead to better future organizational performance. Finally, a description of the data is provided.

Estimating Managerial Efficiency

Basketball utilizes a production process where team output is measured as winning percentage, W, and is partially a function of the players' talents and skills, T. As the level of talent increases, so should a team's winning percentage. Accurate evaluation of coaching efficiency must also account for the playing power of opponents, P, in order to draw a distinction between coaches who wade through paper-thin opposition to glittering win–loss records while other, perhaps more efficient, coaches may have anguishing seasons simply because they faced too much adversity for the talent they oversee. An increase in P represents an increase in opposition power or the difficulty of schedule played by a given team. Formally we say that winning percentage, W, is a function of player talent, T, and opposition power, P,

$$W = f(T, 1/P) \tag{1}$$

where $1/P$ is used so that $\partial W/\partial T > 0$ and $\partial W/\partial(1/P) > 70$.[2]

The manager or coach is the economic agent responsible for transforming inputs into wins. In addition to identifying talent, the coach must develop the players, organize and allocate playing time through the use of appropriate player combinations, and create and select strategies that affect the outcome of games. The quality of these decisions determines the coach's performance.

Empirical estimates of efficiency, E, are made using DEA, originally developed by Farrell (1957), and Charnes *et al.* (1978). DEA compares the efficiency of a given manager relative to the efficiency of the most efficient managers in the sample. Efficiency is characterized by a frontier isoquant that identifies the lowest input use for a given level of output, or the maximum output for given levels of inputs.

Conceptually, DEA begins by identifying managers using the fewest inputs while producing a given level of output. The 'best practice' isoquant is then formed by connecting these points with piecewise linear segments. Although DEA encompasses a variety of modeling formulations, we employ a computationally efficient approach introduced by Boles (1967) to estimate efficiency. In this method the production function $W = f(T, 1/P)$ may be expressed in intensive form as $W/W = 1 = f[T/W, (1/P)/W]$ (i.e. the frontier production function), and may be depicted by the unit isoquant, W/W, shown in Fig. 1. If all managers are efficient decision makers, their performance could be depicted as points along the isoquant, as is the case for managers A, B and C. Managers such as D who fail to maximize output for their set of inputs, or use excessive inputs to achieve a given output, will lie above the isoquant. Managerial inefficiency can then be measured by the distance each manager is from the frontier isoquant.

For example, the efficiency of manager D is calculated as the ratio of the most efficient input utilization or performance within the sample of managers, line segment OD', to the actual performance of manager D, OD. Since the actual amount of inputs utilized exceeds those of an analogous output level on the efficient frontier, the efficiency, E, for manager D is less than 100%, indicating substandard performance. The same procedure can be used to assess the efficiency of manager C. In this case the ratio of efficient to actual performance is OC/OC, making the managerial efficiency equal to one, demonstrating that manager C is utilizing his or her resources at 100% efficiency (relative to all other managers in the sample).

In the Boles formulation, as applied here, the efficiency indices are estimated by solving a series of linear programs (LPs), one for each of the coaches. These will be indexed by k, for a total of K LPs.

In the description of the objective function and the constraint matrix, we will use the j subscript to refer to each of J coaches ($J = K$). The i index will indicate the inputs available to the coaches, where there are a total of I types of inputs. Inputs are expressed relative to the single output, the winning percentage of each coach, W_j. Thus,

$$f_{ij} = \frac{F_{ij}}{W_j} \qquad \begin{matrix} i = 1, 2, \ldots, I \\ j = 1, 2, \ldots, J \end{matrix} \tag{2}$$

where:

f_{ij} = standard utilization per unit of output achieved with input i for coach j
F_{ij} = level of input type i for the jth coach
W_j = output level (winning percentage) for the jth coach.

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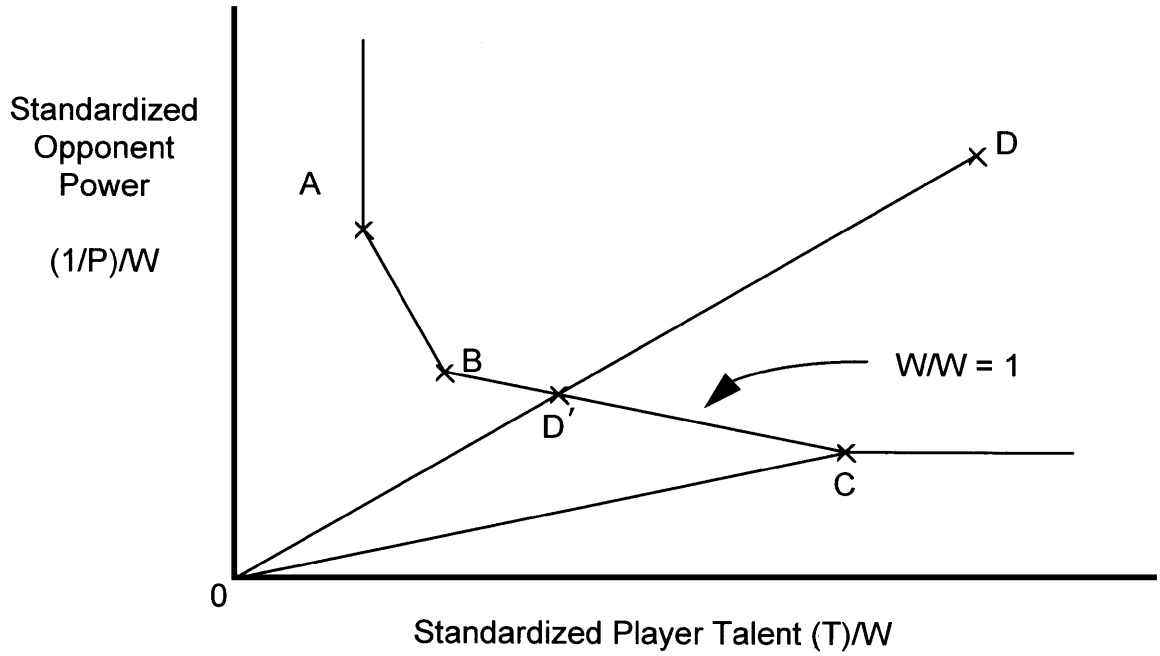

Figure 1. Graphical exposition of data envelopment analysis.

The objective of each of the K linear programs is to maximize output X_0^k by considering the impact of distributing the kth coach's resources to the most efficient coaches. In other words, the kth coach is evaluated relative to the performance of the remaining coaches in the sample. If one or more of the remaining coaches is more efficient than the kth coach, this procedure will determine the extra output the efficient coach(es) could produce using the resources available to the kth coach. The ratio of the output produced by the efficient coaches relative to the output produced by the kth coach is captured in X_0^k. If coach k is operating along the efficient frontier, there will be no advantage to reallocating his resources and will be 1. If, however, coach k is less efficient than some of his counterparts in the sample, the value of X_0^k will exceed 1, demonstrating the potential increase in productivity. The efficiency index for each of the coaches, E_k is then $1/X_0^k$.

To recapitulate, if coach k is operating on the efficient frontier X_0^k will be 1, and $E_k(=1/X_0^k)$ will also be 1. This indicates that coach k is 100% efficient. In contrast, suppose that coach k is inefficient and operating above the efficient frontier so that $X_0^k = 1.25$. Coach k's efficiency index would then be 0.80, indicating that coach k is only 80% as efficient as the most efficient coaches in the sample.[3]

This theoretical reallocation is achieved through the decision variables, X_j^k, the output levels that coach j could achieve with the kth coach's inputs. Constraints of the form

$$\sum_{j=1}^{J} f_{ij} X_j^k \leqslant f_{ik} \qquad i = 1, 2, \ldots, I \tag{3}$$

establish the ability of the kth coach to transform each input into wins. The complete formulation for the kth linear program is as follows:

$$\text{Maximize :} \quad X_0^k = \sum_{j=1}^{J} X_j^k \tag{4}$$

$$\text{Subject to :} \quad \sum_{j=1}^{J} f_{ij} X_j^k \leqslant f_{ik} \qquad i = 1, 2, \ldots, I$$

$$X_j^k \geqslant 0 \qquad j = 1, 2, \ldots, J$$

A Model of Performance Causes Succession

The model used to test the 'performance causes succession' relationships is as follows:

$$S = \alpha_0 + \alpha_1 E + \alpha_2 T + \alpha_3 W + \alpha_4 EX + \varepsilon_1 \tag{5}$$

where S indicates managerial succession; E, T and W represent organizational performance benchmarks for efficiency, player recruiting and winning percentages, respectively; EX captures managerial power-

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/reputation via the experience of the coach; α_i's are the parameters to be estimated; and ε represents the random error.

One would ordinarily assume that manager replacement is caused by poor organizational performance, and manager retention is caused by good organizational performance. But, as emphasized earlier, this relationship must address what performance benchmark will be evaluated. In light of this uncertainty about an appropriate benchmark, three different performance measures are used. These measures are managerial efficiency, *E*, player recruiting or talent, *T*, and team winning percentage, *W*. The probability of succession should diminish, the more efficient a coach is, the more talent he has on the team (evidence of good recruiting), and the more the team wins. Hence we expect α_1, α_2 and α_3 to be negative. Since turnover of basketball coaches occurs most frequently after a season is completed, each performance variable is calculated prior to the advent of succession. Although managerial efficiency best captures the productivity of the manager, it remains to be seen whether actual termination decisions give more weight to this measure.

Prior studies have indicated that powerful managers may not be held accountable for poor performance (Fizel *et al.*, 1990a,b). Under such conditions, shirking and incompetence may ensue without managerial turnover. Because such power is more likely to be bestowed upon an experienced coach, we use the coach's experience in years, *EX*, as a proxy for managerial power. A negative association with turnover, $\alpha_4 < 0$, would be expected if such power does circumvent the succession–performance relationship. An experience variable may also capture successions that occurred because of voluntary retirements. This relationship would prompt $\alpha_4 > 0$. Only empirical estimation will determine which role of experience is dominant for the coaching changes included in this sample.

Succession, the dependent variable for this model, is assigned a value of 1 if a coaching change was made during the prior season or between the prior season and the current season. All coaching changes, however, are not the same. Some coaches depart voluntarily as they move to better or more prestigious positions. Other coaches are terminated and have difficulty reentering the profession. The link between succession and performance is apt to be stronger for the involuntary than for the voluntary successions. We supplement the use of a variable capturing all successions, *S*, with two additional succession variables that isolate these contrasting phenomena. For the coaches that voluntarily left one position to take another job we use *SV* and for coaches who left one position and remain unemployed we use *SU*. *SV* equals 1 if the exiting coach took a new coaching position within two years of his departure and 0 otherwise; *SU* will equal 1 if the exiting coach could not find a new position within two years of his replacement and 0 otherwise. Alternative lags between coaching jobs were examined, but two years provided the time horizon within which most dismissed coaches found new jobs if they were to be re-employed. Probit estimation is used because *S*, *SV* and *SU* are dichotomous dependent variables.

A Model of Post-Succession Performance Using Characteristics of the Managers

Whereas the 'performance causes succession' model provides insights into why coaches are dismissed, the future performance model seeks to explain the change in performance after a new coach takes over. As stated earlier, Smith (1984), Pfeffer and Davis-Blake (1986), and Virany *et al.* (1992) all find that post-succession performance depends on the characteristics of the new managers. This relationship becomes the foundation of our model of short-run, post-succession performance. That model can be expressed as follows:

$$W_t = \beta_{0V} + \beta_{1V}SV + \beta_{2V}EFNEWSV + \beta_{3V}EXNEWSV + \beta_{5V}W_{(T-1)} + \beta_{6V}T + \varepsilon_{2V} \tag{6a}$$

$$W_t = \beta_{0U} + \beta_{1U}SU + \beta_{2U}EFNEWSU + \beta_{3U}EXNEWSU + \beta_{5U}W_{(T-1)} + \beta_{6U}T + \varepsilon_{2U} \tag{6b}$$

where W_t is team performance measured by winning percentage for the current season; *SV* and *SU* are voluntary and involuntary managerial succession, respectively; *EFNEWSV* and *EFNEWSU* are the efficiency of the new coach relative to the departed coach multiplied by succession type; *EXNEWSV* and *EXNEWSU* are the experience of the new coach relative to the departed coach multiplied by succession type; $W_{(t-1)}$ is team performance in the prior season; *T* is player talent; β_i's are the parameters to be estimated; and ε_{2V} and ε_{2U} represent the random error terms.

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The impact of succession on performance involves both the event of the succession and the characteristics of the coaches involved in the turnover. The dummy variables *SV* and *SU* are assigned a value of 1 when managerial turnover occurs, capturing succession *per se*. The characteristics of the replacement coach are captured by two variables. The first is the efficiency of the new coach, calculated as the ratio of the managerial efficiency of the new coach to the managerial efficiency of the dismissed coach. The DEA-estimated efficiency level for each coach is based on the performance level in the prior season and is defined as *EFNEW*. If the organization hires a more efficient coach, then winning percentage should increase. The second characteristic is the ratio of the experience of the new coach, *EXNEW*, relative to the experience of the dismissed coach. The hypothesis is that a more experienced coach will generate better performance than a less experienced one. Thus, as *EXNEW* increases so should performance, W_t.

The managerial characteristic variables are multiplied by the succession event to create the variables *EFNEWSV* and *EFNEWSU* and the variables *EXNEWSV* and *EXNEWSU*. These variables capture the interaction between succession and managerial ability. For example, the total effect of a voluntary succession (*SV*) on organizational performance is:

$$\frac{\partial W_t}{\partial SV} = \beta_{1V} + \beta_{2V} EFNEW + \beta_{3V} EXNEW \qquad (7a)$$

where β_{1V} captures the effect of succession *per se* on winning percentage and the remaining elements capture the efficiency and experience characteristics of the new coach relative to the former coach. The total effect of an involuntary succession (*SU*) on team winning percentage also involves the event of succession and the characteristics of the coaching replacement:

$$\frac{\partial W_t}{\partial SU} = \beta_{1U} + \beta_{2U} EFNEW + \beta_{3U} EXNEW \qquad (7b)$$

The remaining independent variables, $W_{(t-1)}$ and *T*, are control variables for this model. Scully (1995) has shown that performance in professional sports has a cyclical component even after controlling for coaching and player inputs. Successful teams maintain their success for the short run then become less successful and unsuccessful teams continue with their lack of success in the short run then become more successful.[4] Lagged performance, $W_{(t-1)}$, accounts for this phenomenon. Player talent, *T*, is used to acknowledge that the player composition of the team is at least partially beyond the control of a new coach. Often the process of changing coaches does not allow adequate time for effective recruiting. Even if a new coach recruited effectively in his inaugural season, the majority of the team members would be holdovers recruited by the prior coaching staff.

All models use pooled cross-sectional and time-series data, and are estimated using generalized least squares (GLS). Nerlove (1971) points out that ordinary least squares estimations of pooled data would tend to overestimate the impact of lagged performance. GLS estimates are consistent and efficient.

Data

Winning percentages are culled from annual issues of *NCAA Basketball* (1983–92). Years of coaching experience is also taken from this source.

Player talent is measured using a talent index created by Clark Francis and distributed in his publication *Hoop Scoop* (1983–92). The construction of the talent index begins by assigning every player in NCAA's Division I a rating of 1–10. The assigned score depends on the consensus evaluation of a player's talent when he graduated from high school. If a player improves dramatically in college he can be upgraded. Each player's evaluation is automatically increased as he gains experience. A player rated among the top five in the nation is worth 10 points as a freshman but 13 points as a senior. Next, all but the top ten players on a team roster are eliminated. This adjustment is made because teams seldom play more than ten players on a regular basis. The sum of the value of each of the ten players provides a team's talent rating. These talent ratings have been produced for eleven years. Over this period and in a variety of issues of *Hoop Scoop*, Francis has provided evidence that the 'surprise' teams, those that win many more games in a given season than most prognosticators predict, have been associated with large shifts in their talent ratings. Our measure of player talent therefore seems reliable.

Previous descriptions of production functions for sporting teams have defined player talent in terms of *ex post* performance figures such as points scored, assists, rebounds, turnovers, etc. (Scully, 1992; Clement and McCormick, 1989; Zak *et al.*, 1979).

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Because these variables result from both player talent and coaching decisions, a simultaneity problem exists that may bias estimates of managerial efficiency. In contrast, the *Hoop Scoop* talent rating is an *a priori* measure of talent and provides a unique opportunity to overcome the simultaneity problem.

Opponent strength is derived from the end-of-year 'power' rating created by Wise Research Associates (Wise *et al.*, 1990). The initial information used in this rating system emanates from the polling of coaches and sportswriters used to compile the UPI and AP national basketball team rankings. Using a weighted, weekly composite of these rankings, Wise Research Associates develop a season-long composite of 'ranked' teams. This is extended via a mathematical formula that uses relative standings within a conference—or area of the country for teams not in a conference—to develop a numerical classification for each Division I competitor. They then examine each team's schedule, awarding the point values based on their opponents and for games played on opponents' courts. The result is the power rating. A higher power rating indicates a more difficult schedule and diminished victory opportunities for a given level of player talent. Schedule evaluation systems like the power rating are now used by the NCAA to select teams for the end-of-year NCAA national basketball tournament.

The data set consists of 1116 observations for 147 different teams over the period 1984–91. Because one or more variables were not available for a given team in a given year, all teams are not represented in each of the eight seasons. Most of the omissions are institutions with 'new' or 'minor' basketball programs that were not included in the talent or power ratings. A total of 147 succession events (S) were identified during these years, 100 of which are involuntary successions (SU) and 47 of which are voluntary successions.

DEA efficiency indices and the 'performance causes succession' model are estimated using the entire set of observations. Because the post-succession performance model focuses on performance subsequent to succession, only 969 observations are available for estimation.

ANALYSIS AND INTERPRETATION

The next three subsections parallel those of the Procedures section, presenting the DEA results and the two regression models. In the final subsection we give our conclusions.

Managerial Efficiency

The DEA estimates of managerial efficiency provide provocative insights into managerial performance. First, managerial efficiency furnishes a much different assessment of managerial performance than does winning percentage. The Appendix lists the top ten coaches for each year based on both managerial efficiency and winning percentage. Only about 25% of the coaches show up on both lists in any given year. Table 1 highlights the differences with a presentation of the rank correlations between managerial efficiency and winning percentage. The rank correlations range from 0.40 for 1985 to 0.55 for 1990. The correlation for the entire sample is only 0.48, indicating that decisions based on winning percentage are not synonymous with those based on managerial efficiency.

The most efficient coaches often come from mid-level basketball conferences and teams. Because recruiting quality players is typically more difficult at these institutions, the coaches may have to work more efficiently to win. Also, these coaches may be working to move up the professional hierarchy of coaching. For example, J. Calhoun has been promoted from Northeastern to Connecticut, N. Richardson from Tulsa to Arkansas, A. Russo from Louisiana Tech to Washington, J. Harrick from Pepperdine to UCLA, P. Gillen from Xavier to Providence, T. Penders from Rhode Island to Texas, R. Majerus from Ball State to Utah, D. Versace and S. Albeck from Bradley to the NBA, and so on.

Although coaches of the basketball power institutions appear less frequently in the most efficient lists, J. Chaney of Temple is included in four different years. Also, J. Calhoun, N. Richardson, and R.

Table 1. Rank correlation between managerial efficiency and winning percentage

Year	Pearson rho (n)	Year	Pearson rho (n)
1984	0.51 (147)	1988	0.50 (129)
1985	0.40 (147)	1989	0.44 (143)
1986	0.47 (138)	1990	0.55 (143)
1987	0.50 (128)	1991	0.53 (141)

Total sample ($n = 1116$): Pearson rho = 0.48

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Majerus are among the most efficient coaches both when they were at mid-level and top-level basketball schools.

Second, there is wide dispersion in managerial efficiency ratings, ranging from the expected 100% to only 4%. A distribution of the efficiency estimates by deciles is presented in Table 2. Because only three coaches were 100% efficient, and could possibly be considered outliers, managerial efficiency was estimated again with these observations removed. The resulting distribution changed little with managerial quality still extending from 100% to 13%. Third, the mean value of managerial efficiency is 38%, indicating that the typical coach is very inefficient relative to the practices used by the best coaches in the sample.

Our subsequent examinations of firing and hiring decisions will show whether administrators actually consider productivity or focus on the easily accessible win–loss records. If the latter is true, and the wide dispersion of managerial quality is ignored, organizations that change coaches could experience large fluctuations in performance. One example is a situation where a coach of average productivity is replaced by one of the few efficient coaches and organization performance could increase substantially. By contrast, accidentally removing a relatively efficient coach and replacing him with a relatively inefficient coach could cause performance to plummet.

Finally, Scully (1992) identifies a learning curve for baseball managers where the efficiency of the manager increases with managerial experience. No comparable relationship for college basketball coaches is available to explain the dispersion in managerial efficiency. A correlation between managerial efficiency and experience of -0.15 is insignificant. Regressions using linear, quadratic and log specifications of the potential relationship between efficiency and experience also produced insignificant results.

Table 2. Distribution of Managerial Efficiency Estimates

Estimates	Observations	Estimates	Observations
0.901–1.00	7	0.401–0.500	208
0.801–0.900	9	0.301–0.400	327
0.701–0.800	29	0.201–0.300	281
0.601–0.700	65	0.101–0.200	82
0.501–0.600	106	0.01–0.100	2

Mean estimate = 0.38 Std deviation = 0.15

Performance Causes Succession

The estimated 'performance causes succession' models using all successions (*S*), involuntary successions (*SU*), and voluntary successions (*SV*) are reported in Table 3. Model 1 captures the effects of what we believe to be the dominant performance variables—managerial efficiency and player talent. Player talent identifies the success of managers in recruiting good players to the basketball program. Managerial efficiency demonstrates the ability of the manager to mold and meld that talent into a winning team. Increases in player talent and managerial quality do significantly reduce the probability of managerial removal for *S* and *SU* managers. But there is no statistically significant relationship between these performance benchmarks and the probability that a coach will leave voluntarily to attain a new job, *SV*. The weaker relationship between performance and succession was expected for the analysis of voluntary managerial turnover since the new opportunities for these coaches probably results from good recent performance.

Coaching tenure or years of service is added to model 2. The positive coefficients for this variable in the total succession and involuntary succession samples suggest that long-tenured coaches are more likely to be dismissed. In other words, coaches with more years of service are held more accountable for organizational performance than their shorter-tenured colleagues. Since increased tenure does not indicate power that can be translated into lower rates of succession, prior concerns about principal-agent problem in college basketball appear unfounded.

Model 3 uses all performance proxies in conjunction with years of service. The results with respect to years of service are unchanged. Also, there continues to be little association between performance and succession for coaches departing for better jobs, *SV*. For all successions, *S*, and dismissed coaches, *SU*, however, the effects of team winning percentage on succession overwhelms the impact of managerial efficiency. This is simply 'bottom line' personnel decision making. Managerial productivity is overlooked in favor of 'did we win?' Perhaps armchair analysts would find this conclusion obvious, but what is important to address is whether or not past winning percentages are also a good predictor of future changes in winning percentages.

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Table 3. The Effect of Performance on Succession (Dependent Variables = 1 if Manager Terminated)

Variables	(1a)	(1b)	(2a)	(2b)	(3a)	(3b)
	SU	*SE*	*SU*	*SE*	*SU*	*SE*
Constant	−0.133	−1.316[a]	−0.066	−1.371[a]	−0.534	−1.042[c]
	(0.35)	(2.76)	(0.17)	(2.62)	(1.09)	(1.57)
Managerial efficiency	−1.450[a]	−0.133	−1.345[a]	0.153	0.568	11.214
E	(2.94)	(0.23)	(2.64)	(0.24)	(0.58)	(1.00)
Player talent	−0.016[b]	_ 0.008	_0.006	0.005	0.014	_0.003
T	(2.57)	(0.98)	(0.93)	(0.59)	(1.40)	(0.24)
Coach experience	—	—	−0.056[a]	−0.075[a]	−0.055[a]	−0.068[a]
EX			(5.85)	(5.04)	(5.09)	(4.20)
Winning percentage	—	—	—	—	−1.980[a]	0.833
W					(2.97)	(1.01)
Chi-square likelihood ratio test	10.022[a]	1.230	51.506[a]	36.828[a]	198.368[a]	109.962[a]

Notes: figures in parentheses are the absolute values of the *t*-statistics; levels of significance of 1%, 5% and 10% are indicated by a, b and c, respectively; all are two-tailed tests.

Post-Succession Performance and Characteristics of Coaches

What happens to team performance once a coaching change has been made? The control variables, $W_{(t-1)}$ and *T*, are positive, significant and robust across all models, as presented in Table 4. As expected, more wins in the past and more available talent both generate better winning percentages. The focal point of our analysis, however, is the variables that capture the effect of succession.

The coefficients associated with *SV* and *SU* indicate that the succession event *per se* is disruptive, causing subsequent performance to decline. This result is robust across all models, except (1b), and for both types of succession. The magnitude of the effect is small in model (1a), amounting to approximately one to two fewer wins per 30-game season. In models (2a), (2b), (3a) and (3c) the disruptive effect is approximately eight to nine fewer wins per season. Possibly the omission of the manager efficiency

Table 4. The Effect of Succession on Performance (Dependent Variable = Winning Percentage)

Variables	(1a)	(1b)	(2a)	(2b)	(3a)	(3b)
Constant	0.241[a]	0.232[a]	0.231[a]	0.225[a]	0.231[a]	0.225[a]
	(13.45)	(13.53)	(13.12)	(13.25)	(13.14)	(13.26)
Prior win percent	0.372[a]	0.383[a]	0.401[a]	0.401[a]	0.400[a]	0.400[a]
$W_{(t-1)}$	(11.57)	(12.05)	(12.63)	(12.66)	(12.61)	(12.63)
Player talent	0.003[a]	0.003[a]	0.003[a]	0.003[a]	0.003[a]	0.003[a]
T	(9.99)	(10.04)	(9.67)	(9.88)	(9.70)	(9.88)
Succession	−0.029[c]	—	−0.282[a]	—	−0.288[a]	—
SU	(1.78)		(6.42)		(6.53)	
Succession	—	−0.026	—	−0.305[a]	—	−0.307[a]
SE		(1.10)		(4.61)		(4.64)
Efficiency new coach x Succession: *EFNEWSU*	—	—	0.229[a] (6.21)	—	0.244[a] (6.35)	—
Efficiency new coach x Succession: *EFNEWSE*	—	—	—	0.281[a] (4.51)	—	0.273[a] (4.32)
Experience new coach x Succession: *EXNEWSU*	—	—	—	—	−0.012 (1.38)	—
Experience new coach x Succession: EXNEWSE	—	—	—	—	—	(0.72) (0.72)
Adjusted R^2	0.370	0.369	0.399	0.385	0.401	0.384
F-statistic	151.86[a]	150.90[a]	129.12[a]	121.11[a]	103.82[a]	96.94[a]

Notes: figures in parentheses are the absolute values of the *t*-statistics; levels of significance of 1%, 5% and 10% are indicated by a, b and c, respectively; all are two-tailed tests.

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variable in equation (1a) biased the succession coefficients toward zero.

These results are consistent with the literature suggesting that the appearance of new coaches can alter expected and accepted patterns of organizational behavior. College basketball often involves close personal relationships between coaches and the players they have recruited and worked to develop. The new coaches that replace these familiar mentors have different personalities, expectations, and basketball systems. Therefore, it is not surprising to find the young players adversely affected by coaching changes.

In contrast, performance subsequent to succession improves when the managerial efficiency of the new coach exceeds that of the prior coach. Not surprisingly, this effect is found to be larger for coaches progressing in their careers, *EFNEWSV*, than for terminated coaches, *EFNEWSU*, whose careers have stalled or ended. In the former case, hiring a more efficient replacement, is to hire a better coach than the already productive coach who is departing. In the latter case, the new coach is more productive but relative to the lower standard established by the departing coach.

New and better coaches can improve team performance but never by enough to offset the disruptive effects of succession *per se*. In other words, the total effect of *SE* and *SU* on performance, as outlined by Eqns (7a) and (7b) and estimated using the mean values of *EXNEW* and *EFNEW* and the relevant parameter estimates from Table 4, is negative. Specifically, the evaluation of Eqns (7a) and (7b) is as follows:

$$\frac{\partial W_t}{\partial SV} = \beta_{1V} + \beta_{2V} EFNEW + \beta_{3V} EXNEW \qquad (7a)$$

$$\text{or} \quad \frac{\partial W_t}{\partial SV} = -0.307 + 0.273(0.032) + 0.012(0.032) = -0.2943;$$

$$\frac{\partial W_t}{\partial SU} = \beta_{1U} + \beta_{2U} EFNEW + \beta_{3U} EXNEW \qquad (7b)$$

$$\text{or} \quad \frac{\partial W_t}{\partial SU} = -0.288 + 0.244(0.108) + 0(0.103) = -0.2616;$$

where β_{3U} is insignificant and represented by zero. The net effect of succession, whether *SV* or *SU*, is about seven to eight additional losses per season.

The experience of the new coaches, relative to the departed coaches, has no significant effect on performance. Personnel decisions should ignore experience as a decision criterion in favor of focusing on managerial efficiency. Experience is not related to productive management.

CONCLUSIONS

Good organizational performance decreased the probability of managerial turnover in college basketball, as one would expect. Although recruiting prowess and managerial efficiency appeared to be important determinants of managerial succession, the function of efficiency was overwhelmed by the inclusion of winning percentage. Simply put, basketball coaches retain their jobs if they win. Also, they can lose their jobs if they do not win even if they are very efficient.

When managerial succession does occur, the subsequent performance of the organization typically declines. This extent of diminished performance due to the succession event *per se* can be minimized but not overcome if the new coach is more efficient than the old coach. However obvious this may seem, it is important to reemphasize that our study indicates that winning percentage is a more dominant retention criterion than is efficiency. Because there are few highly efficient coaches and great differences in the ranking of coaches when using winning percentage versus managerial efficiency, administrators who select new coaches based on winning percentages are often going to select new coaches who are less efficient that the departed coach. Such a hiring process will exacerbate the performance loss associated with the succession event.

A more appropriate guide to hiring decisions is an evaluation of relative efficiency. Granted, one would not expect all administrative personnel to use DEA techniques to measure the relative efficiency of their staff, but the use of a similar calculus in the decision-making process would be preferred to using simple, bottom-line criteria. In fact the efficiency calculus is more intuitive than the DEA model might suggest. DEA simply examines the internal and external environment within which the manager works, and then assesses how well the manager has done relative to others in a similar environment. Thus, it is possible for a manager to be efficient with a modest bottom line if he has limited resources, faces stiff competition or is in an industry where firms typically earn modest returns. It is also possible for a manager to be inefficient with a high bottom line if he has extensive resources, little competition or is in an industry where firms typically earn high returns. The gist of this

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APPENDIX A: RANKINGS OF TOP TEN MANAGERS BY YEAR AND PERFORMANCE CRITERION

	Managerial efficiency			Team winning percentage	
	Name	Institution	Year	Name	Institution
*1.	J. Calhoun	Northeastern	1984	J. Thompson	Georgetown
2.	K. Mackey	Cleveland St.		D. Smith	North Carolina
3.	C. Ellis	South Alabama		R. Meyer	DePaul
*4.	J. Chaney	Temple		N. Richardson	Tulsa
5.	J.D. Barnett	Va. Commonwealth		G. Lewis	Houston
6.	B. Donewald	Illinois St.		B. Tubbs	Oklahoma
7.	A. Russo	Louisiana Tech		J. Hall	Kentucky
8.	C. Williams	Santa Clara		J. Calhoun	Northeastern
*9.	N. Richardson	Tulsa		J. Chaney	Temple
10.	B. Oates	St. Mary's		L. Henson	Illinois
1.	H. Egan	San Diego	1985	J. Thompson	Georgetown
2.	J. Calhoun	Northeastern		A. Russo	Louisiana Tech
3.	B. Donewald	Illinois St.		D. Kirk	Memphis St.
4.	J. Harrick	Pepperdine		L. Carneseca	St. Johns
*5.	J. Chaney	Temple		J. Tarkanian	UNLV
6.	B. Grant	Fresno St.		B. Frieder	Michigan
7.	J. Sexson	Butler		B. Tubbs	Oklahoma
8.	B. Oates	St. Mary's		G. Sullivan	Loyola-Chicago
*9.	A. Russo	Louisiana Tech		J.D. Barnett	Va. Commonwealth
10.	R. Macky	Cleveland St.		J. Chaney	Temple
*1.	J. Calhoun	Northeastern	1986	M. Kryzewski	Duke
2.	J. Harrick	Pepperdine		D. Versace	Bradley
3.	H. Egan	San Diego		L. Brown	Kansas
*4.	P. Gillen	Xavier		E. Sutton	Kentucky
5.	D. Haskins	Texas-El Paso		K. Mackey	Cleveland St.
*6.	D. Versace	Bradley		J. Tarkanian	UNLV
7.	J. Brandenburg	Wyoming		L. Carneseca	St. Johns
8.	S. Metcalf	Texas A&M		B. Frieder	Michigan
9.	J. Chaney	Temple		J. Calhoun	Northeastern
10.	K. Mackey	Cleveland St.		P. Gillen	Xavier
2.	L. Anderson	BYU	1987	J. Meyer	DePaul
3.	J. MacDonald	Kent St.		J. Chaney	Temple
4.	C. Coles	Central Michigan		D. Smith	North Carolina
5.	T. Eagles	Louisiana Tech		B. Knight	Indiana
6.	J. Brandenburg	Wyoming		T. Davis	Iowa
7.	K. Fogel	Northeastern		J. Thompson	Georgetown
*8.	J. Chaney	Temple		W. Sanderson	Alabama
9.	K. Mackey	Cleveland St.		G. Keady	Purdue
10.	G. Catlett	W. Virginia		J. Boeheim	Syracuse

(*continued*)

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APPENDIX A (*continued*)

	Managerial efficiency			Team winning percentage	
	Name	Institution	Year	Name	Institution
1.	B. Braun	E. Michigan	1988	J. Chaney	Temple
2.	T. Eagles	Louisiana Tech		L. Olson	Arizona
*3.	P. Gillen	Xavier		B. Tubbs	Oklahoma
*4.	S. Albeck	Bradley		G. Keady	Purdue
*5.	L. Anderson	BYU		P. Gillen	Xavier
6.	K. Mackey	Cleveland St.		S. Albeck	Bradley
*7.	B. Dees	Wyoming		J. Tarkanian	UNLV
8.	T. Penders	Rhode Island		E. Sutton	Kentucky
9.	G. Ida	Baylor		B. Dees	Wyoming
10.	N. Richardson	Arkansas		L. Anderson	BYU
*1.	R. Majerus	Ball St.	1989	R. Majerus	Ball St.
*2.	L. Nance	St. Mary's		L. Olson	Arizona
3.	J. Crews	Evansville		L. Henson	Illinois
4.	J. Pimm	UC-Santa Barbara		J. Thompson	Georgetown
5.	T. Eagles	Louisiana Tech		G. Catlett	W. Virginia
6.	T. Arrow	S. Alabama		B. Tubbs	Oklahoma
*7.	S. Morris	LaSalle		L. Nance	St. Mary's
8.	N. McCarthy	New Mexico St.		R. Haddad	Jacksonville
*9.	R. Haddad	Jacksonville		P. Carlesimo	Seton Hall
10.	T. Barone	Creighton		S. Morris	LaSalle
*1.	N. McCarthy	New Mexico St.	1990	S. Morris	LaSalle
2.	J. MacDonald	Kent St.		J. Tarkanian	UNLV
*3.	S. Morris	LaSalle		N. Richardson	Arkansas
4.	R. Herrin	S. Illinois		R. Williams	Kansas
5.	J. Loyd	Louisiana Tech		P. Gillen	Xavier
6.	B. Grant	Colorado St.		B. Tubbs	Oklahoma
*7.	P. Gillin	Xavier		N. McCarthy	New Mexico St.
8.	D. Hunsacher	Ball St.		J. Calhoun	Connecticut
9.	R. Reid	BYU		J. Heathcote	Michigan St.
10.	B. Parkhill	Penn St.		P. Westhead	Loyola Marymount
1.	B. Braun	E. Michigan	1991	J. Tarkanian	UNLV
*2.	R. Majerus	Utah		N. Richardson	Arkansas
*3.	J. Molinari	N. Illinois		R. Majerus	Utah
4.	B. Collier	Butler		R. Ayers	Ohio St.
5.	H. Egan	San Diego		B. Knight	Indiana
6.	K. Fogel	Northeastern		D. Smith	North Carolina
7.	M. Ida	Texas Christian		M. Kryzewski	Duke
8.	T. Barone	Creighton		J. Boeheim	Syracuse
9.	D. Hunsacher	Ball St.		J. Molinari	N. Illinois
10.	N. McCarthy	New Mexico St.		P. Carlesimo	Seton Hall

Correlation managerial efficiency and winning percentage = 0.505.
* On both lists in given year.

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paper is to look at manager productivity, not firm returns, for determining if managerial succession is appropriate.

NOTES

1. Although a head basketball coach may be most talented in recruiting and game strategy and rely on his one or two assistants for teaching the fundamental to players, he is closer to the production process than if he had eight to eleven assistants such as in football. Perhaps, in either football or basketball, one could argue that the hiring of assistants and delegating of tasks to assistants is just another managerial decision that coaches must make. Under that premise the number of assistants is irrelevant to the efficiency calculation.
2. Clearly, some schools may be interested in results other than winning percentage such as conference championships, invitation to NCAA tournaments, and winning conference tournaments. Nevertheless, these outcomes all are the result of, or result in, winning. Thus, winning percentage is an excellent output proxy. Also, NCAA tournament invitations are based on a combination of win percentage and strength of schedule which validates our use of the power input proxy.
3. DEA efficiency estimates capture only technical efficiency, the relationship of inputs to outputs. The choice of input use based on input prices and an input budget is not addressed. Following the dictates of NCAA recruiting procedures, one could, however, argue that price of college players is similar across basketball schools. Also, analysis of coaching efficiency relative to compensation is precluded because compensation data are not available.
4. Specifically, for professional basketball Scully (1995) finds positive correlations with values lagged one year, negative correlations with values lagged two and three years, and then positive correlations with values lagged four and five years. On p. 94 he states that this pattern 'is similar to the patterns for [professional] baseball and football.'

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