Evidence from Professional Basketball on Intrafirm Profit Opportunities and Managerial Slack:
To Three or Not to Three[1]

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Rules of the National Basketball Association allow the coach of each team to make alternative investment decisions throughout the course of a game and season. Among his many other chores, a coach must decide how many two-point shots to take relative to the more difficult but higher valued three-point shots. The existence of this option creates an interesting vehicle to study the management of intrafirm, alternative investment opportunities. We have assembled data on 23 NBA teams over seven years, and we have found that not all coaches are equally qualified when it comes to managing these options. Second, some coaches appear to get better at this chore with experience, but this effect takes considerable time. Third, coaches who most nearly equate the expected rates of return on the two alternative investment options, win the most games. Last, coaches who are fired by one team and subsequently rehired by another more nearly equate the expected values of the two options at the new job. A cursory examination of college football coaches's decisions to go for one or two extra points lends support to the thesis. These results are far from definitive, but they do suggest that profit opportunities may exist for long periods of time even within successful organizations. Managerial bundling is offered as an explanation for this result.

I. Introduction

This paper has two main points. First, the question of the existence of managerial slack is important.[2] The ability of managers to shirk has been the subject of massive research, but recently Michael Jensen has raised the discussion to new levels.[3] Second, sports data provide an interesting and important laboratory to the economic analyst, yielding a wealth of data not generally available in other arenas. Moreover, sporting events mirror the economy. Players and coaches, like their producing and consuming counterparts in the regular economy, are subject to the forces of competition, entry and exit, collusion, rules, crime, and law enforcement. Thus, we propose to address the first point using the sports as life metaphor.

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[1] We acknowledge the helpful comments of Richard Day, Ken French, Mike Maloney, Mark Mitchell, Jeff Netter, Phil Porter, Sam Peltzman, Skip Sauer, Bob Tollison, and an anonymous referee. Thanks also go to Sujahl Badami for research assistance. Special thanks go to seminar participants at the Simon GSB at the University of Rochester, John Long, Kevin Murphy, Cliff Smith, and Ross Watts in particular.

[2] For instance, see the works collected in Williamson (1986) and Alchian (1977). In many ways, the bulk of the property rights literature is concerned with the issue as well. For more recent discussion of the relation between pay and performance see Ehrenberg and Bognano (1990), Jensen and Murphy (1989), and the special issue of the *Industrial and Labor Relations Review*, "Do Compensation Policies Matter?" (1990).

[3] See Jensen (1986) and (1989).

If managerial slack exists, as so many suggest, then we should be able to systematically uncover it, and according to our second argument above, we should be able to find it in sports events. Moreover, if we find it in sports, we are led to believe that it exists in other settings in roughly the same extent. Therein lies the goal of our paper.

Recent research suggests that sports organizations and events offer a cheap vehicle for understanding processes and organizations because so much high quality data are created as a natural by-product of the game.[4] In addition, this wealth of highly accurate and detailed data allows investigations difficult if not impossible in most other business enterprises. Moreover, since so much of economics is the study of competition, it is natural that we study sports. The outcome of our investigation may help shed light on the question of just how fast profit opportunities are erased, if at all. Sports may not be the perfect place to study the question of managerial slack, but it certainly seems a reasonable one.

Our goal here is to quantify the extent of managerial ability to exploit profit opportunities. One school of thought says that intense competition between firms and managers erases all profit opportunities, but lacking in this theory is discussion about the timing of this process. Are managers required to instantly and constantly monitor all markets to insure that the risk-adjusted, marginal rate of return on all investments is identical? Alternative theories of management say that agency and transactions costs combined with lumpy inputs may create gaps between the returns to alternative investment opportunities which are neither quickly nor easily erased. Therein lies the basis of our paper. Most managers have simultaneous investment opportunities inside their firms that, by necessity, are not available to the general market. The question we ask here is, are forces present that make these managers perfectly equate the marginal rates of return on these alternatives; if so, how fast do these forces work; or, alternatively, is the structure of management so organized that some managers need not flawlessly work every margin? That is, are there *private* organizational structures that do not perfectly reward performance, enabling managers to survive in their jobs without maximizing the present value of the net cash flows to the enterprise in their charge?[5]

II. The On-Court Alternative Investment Opportunities

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[4] Goff and Tollison (1990) have compiled a set of papers on this theme. For more on the topic, see El-Hodiri and Quirk (1971), Scully (1974), Hunt and Lewis (1976), Holahan (1978), Zak, Huang, and Siegfried (1979), Daly and Moore (1981), Lehn (1982), Porter and Scully (1982), McCormick and Tollison (1984 and 1986), Zuber, Gander, and Bowers (1985), Fleisher et al. (1988), White (1986), Kahn and Sherer (1988), Sauer et al. (1988), Sauer (1988), Whitney (1988), Clement and McCormick (1989), Goff, Shughart, and Tollison (1990), Higgins and Tollison (1990), Nardinelli and Simon (1990), and Ehrenberg and Bognanno (1990) among many others.

[5] Of course, there is a large literature explaining how governmental, not-for-profit, and labor-managed organizational structures fail to perform this chore.

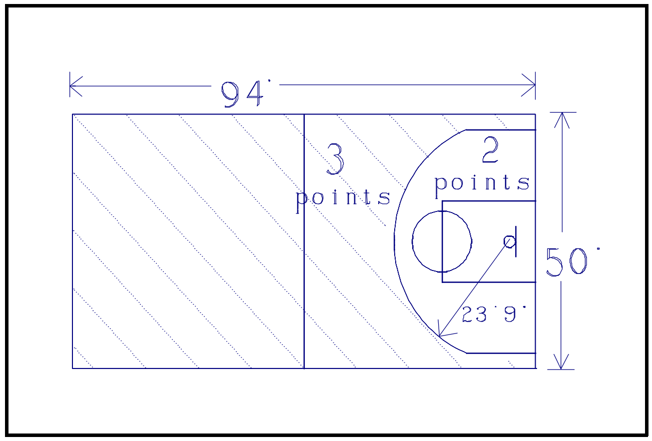

Figure 1 The NBA Court

The National Basketball Association now comprises 25 teams playing 82 regular games per season. Since the beginning of the 1979-1980 season, NBA teams have faced the option of shooting a regular shot, from within 23 feet 9 inches of the basket for two points, or attempting a more difficult shot from outside 23 feet 9 inches which, if good, is worth three points.[6] Figure 1 depicts the alternative investments available to NBA teams. Data encompassing the 1980-81 season through the 1986-87 seasons on two and three point rates of return are summarized for the entire league in Table 1.

During the seven year sample period investigated, the two-point shot is generally the more profitable option. For the league as a whole, the gap between the average rates of return is narrowing over time and the diminution is primarily, if not exclusively due to better three-point shooting, a point discussed in more detail later. At first glance, it seems reasonable to assert that a necessary condition for point maximization is that teams exploit the profit opportunities present when the marginal rates of return on the two shots are unequal. Yet we see an amazing distribution of differences in expected value of the two investment opportunities over teams and time in the NBA. At one end of the spectrum, the 1982-83 Los Angeles Lakers headed by second year coach Pat Riley scored 1.067 points on average for each two-point shot they took while they only scored 0.31 points for each three-point field goal they attempted, a difference of 3/4 of a point. At the other extreme, the 1980-81 San Diego Clippers coached by Paul Silas perfectly equated the expected values of the two shot opportunities; on average, they earned 0.973 points for each two or three-point shot. It is worth noting that the 82-83 Lakers only shot 96 three-point shots, slightly more than one per game and only 1.3% of all shots taken from the floor. Interestingly, the 80-81 Clippers took 407 three-point shots (almost 5 per game) amounting to 5.6% of all the shots they took from the field.

Table 1 Expected Payoffs, 2 & 3 Point Shots in the National Basketball Association 1980-87

Season	Average 2-Pt. Shooting %	Average 3-Pt. Shooting %	Average Value of 2-Pt. Shot	Average Value of 3-Pt. Shot
80-81	0.4914	0.2293	0.9829	0.6879
81-82	0.4971	0.2527	0.9943	0.7580
82-83	0.4917	0.2310	0.9833	0.6929
83-84	0.4985	0.2482	0.9970	0.7446
84-85	0.4988	0.2736	0.9976	0.8209
85-86	0.4954	0.2683	0.9908	0.8048

As we shall see later in the paper, the decision to take three-point shots is only partly based on relative prices and the status of the

[6] NBA Rule 1, Section Id says "Three-point field goal area which has parallel lines 3 feet from the sidelines, extending from baseline, and an arc of 23 feet 9 inches from the middle of the basket which intersects the parallel lines." Rule 5, Section Ib continues, "A goal from the field counts 2 points unless attempted from beyond the 3pt. line which counts 3 points." Note (4) adds, "For successful 3 point field goal player must have one or both feet on the floor and be beyond the 3 point line when he attempts shot. After release of ball he may land on line or in 2 point area."

game. We will present what to us is fairly convincing evidence that the ratio of three-point shots attempted relative to two-point shots attempted is not based solely on the relative effectiveness of the two opportunities or game conditions; relative prices and game situations only explain about two-thirds of the variation in the mix of two and three-point shots attempted. Clearly other things matter. Based on evidence presented here, we are inclined to believe that managerial efficiency is one of these.

III. Managing the Investment Options

Producing wins on the basketball court given a set of players requires training, monitoring, and strategic decision making. Coaches evaluate talent and allocate playing time accordingly, and they design offensive and defensive strategies. Clearly, teams that shoot, rebound, block shots, handle the ball well, avoid fouling, and play effective defense will be the most effective.[7] Analyzing all these chores simultaneously is a task well beyond the bounds of this paper. Instead, our goal here is to model the shot-mix decision and to investigate whether coaches are perfectly managing the option.

Clearly coaches have a great impact on the actual play of teams. They determine who participates in given situations. They set plays and determine strategy throughout the course of games by the lineup choice and play selection. In addition, they are often seen counseling individuals for improper adherence to orders or jobs well done. Coaches are an integral part of the game. Their salaries stand as evidence to this point.

Imagine a simplistic version of a basketball game that roughly corresponds to the general business problem faced by managers. Throughout the course of a game, a number of situations present themselves. Situation 1: Player A_1 with the ball is guarded by player B_1 at the free-throw line. All other players are in the backcourt. Situation 2: Player A_1 with the ball is guarded by players B_1 and B_2 at the free-throw line. All other players are in the backcourt. Situations too many to enumerate exist like this, but presume there is a finite number of them, *n*. In each case an opportunity exists. Player A_1 can shoot a two-point shot, he can retreat beyond the three-point line and attempt a shot from there, or he can dribble around waiting for his teammates to arrive from downcourt. Ignoring the non-shot options, in each of these *n* scenarios, there is an expected value of a two-point shot and an expected value of a three-point shot. This creates the managerial problem of (1) defining the situations where the two-point shot is preferred, and (2) communicating with and properly motivating the players to take the two-point shot when it is more valuable and the three-point shot in the remaining cases.

In sum, in the naive world just described, points scored are only maximized when the expected value of a two-point and the expected value of a three-point shot are equal at the margin. However, a number of explanations come to mind for the conscious decision of a coach not to equate the expected values of the alternative investment options in the more complicated, real situation. First, for one reason or another, he may not be risk neutral. As a general principle, we do not expect this force to be powerful in most organizations, but, when large

[7] See Clement and McCormick (1989) for empirical confirmation of this conjecture in the context of college basketball.

stakes of wealth are involved and the coach and owner find it expensive to diversify their portfolios, as they might in a sports franchise, we are unwilling to completely rule out that possibility. This is especially true when the ownership claims are not usually divisible into small marketable units. Since the three-point shot is a more risky venture, risk averse coaches will choose to shoot relatively more two-point shots, risk lovers the opposite. Relatedly, as a game comes to its close, the team that is far behind with a remote chance to win, faces a bankruptcy-like situation; time is running out and defeat is imminent. In situations like this the usual managerial response is to gamble by taking high payoff, high risk investments. For teams about to lose, the cost of taking too many three-point shots, lost opportunities to take easier two-point shots, is less important, and this leads them to forsake the higher expected payoff two-point shot and attempt too many three-point field goals late in a game. Along similar lines, teams far ahead may be less inclined to worry about working every margin, and they too may casually or unwisely invest, taking either too few or too many three-point shots relatively speaking.[8] Moreover, as each of the first three quarters of a game nears its finish, it may prove wise to launch a long-distance three-point shot when insufficient time remains to get into position to shoot a two-point shot. In these rare cases, there is no option, and, looking at the expected values, the team will appear to take too many three-point shots.

In addition, the choice of a two or three-point shot may be more complex than it appears on the surface. It may be easier or less expensive for some teams to launch one type shot rather than the other. For example, if a team has very good guards and weak inside people, getting the ball inside to take a two-point shot may impose costs absent in the decision to take a three-point shot. Alternatively, since three-point shots are long range, rebounds there may not bounce the same as rebounds from two-point shots. Thus, teams more proficient in one type rebound versus the other are *not inclined* to equate the expected values of the two shot opportunities. This point obviously generalizes to many different team skills. And of course we are all aware of the comedic value of extra tall players such as 7′6" Manute Bol taking 30 foot shots, but these occurrences are sufficiently rare as to be ignored.

If we put aside these potentialities, the inequality of expected values of the two investment opportunities has but two explanations. First, some managers are incompetent. Then, if the appropriate organizational structure is in place they should soon either be replaced or change their behavior. Alternatively of course, if the proper motivational incentives are not in place, if managerial slack exists, this non-wealth maximizing state of affairs can persist until schemes are developed to correct the problem. Since management encompasses many attributes and qualities, that is management is lumpy, these Darwinian forces may not work rapidly or even

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[8] It has been suggested to us that teams are also inclined to take too many three-point shots when the 24-second clock is approaching zero. On the surface this argument is wrong. Teams are no more inclined to take ill-advised three-point shots than they are poorly conceived two-point shots when the shot-clock is about to expire. As time on the 24-second clock expires, a team takes any shot it can get off be it two or three. In both cases, the expected value of the shot declines due to the time constraint. The issue turns on the location of the basketball and whether the ball is usually in the two or three-point zone when the clock approaches zero. If in fact the ball is more likely to be in three-point territory when the clock hits zero, then too many three's will be attempted. Otherwise, too many two's will be made. We are not aware of any evidence on this point and are inclined to believe that the locational density of the basketball is not biased in favor of three-point shots.

at all to erase the differential in the expected rates of return so long as the existing bundle of manager skills dominates the next best alternative. That is, the head coach may not be perfect, but he may be better than anyone else available for the job. However, it still remains true, as long as profit opportunities are present, those managers most capable of spotting and exploiting them will be more successful than those less proficient, and as techniques are developed to erase managerial slack, it should decrease with the passing of time.[9]

IV. Winning as a Goal

Basketball offers the economic analyst a rare opportunity to quantify managerial decision making in dimensions difficult or impossible to investigate for other firms. In particular, the yearly accounting basis of winning in basketball leagues allows for the investigation of investment opportunities and their profitability. Definitionally, outscoring the opponent results in a win. Consequently, other things the same, teams want to employ the most profitable scoring strategy.

Professional sports franchises are complex organizations, the goals of which are not necessarily apparent. Indeed, contrary to the standard profit maximization assumption, one notion of franchise ownership is that teams are operated for hedonistic reasons, and the nature of the leagues perpetuates the viability of teams as toys of their owners.[10] Whether or not the teams are operated for profit is, however, of little consequence here. Instead, we investigate managerial effectiveness with respect to producing wins regardless of the owner's goals. Whether the owner is a win or value maximizer is not important for our analysis under the presumption that value is strongly correlated with winning. Naturally it would be useful if we could measure the economic value of basketball teams, but current prices do not permit this inquiry.[11]

A. *Winning and Equating the Value of the Two Shot Options*

A team wins a game when it outscores its opponent.

Win = 1 if (Points Scored) > (Points Allowed);

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[9] This is precisely Jensen's explanation for the emergence of the LBO as an important constraint on managerial slack.

[10] The Boston Celtics are currently the only publicly held NBA franchise.

[11] We did investigate the relation between winning and one economic variable closely related to winning, that is, attendance at games. To determine if there is a relation between winning and attendance, we estimated a home attendance equation in levels and logs using data from each of the 23 teams over the period 1981-1987. The estimates are available from us. We observe a positive and significant relation between winning and home attendance. The win elasticity of home attendance is approximately 0.48. Winning one additional game per year at the average (42 instead of 41, a 2.44% increase) raises attendance by about 1.2%. This finding reassures us that winning may not be everything in terms of value, but it is a reasonable proxy. We are reminded of the famous saying by Vince Lombardi, "Winning isn't the most important thing, it's the only thing."

Win = 0 otherwise. (1)

Points scored are determined by a team's offensive skills and the opponent's defensive skills:

$$\text{Points Scored} = f(\text{Field Goal Shooting \%, Free-Throw Shooting \%, Offensive Rebounds, Assists, Turnovers, and Coaching Ability}). \quad (2)$$

Points allowed are decided by defensive skills (and opponent offensive skills):

$$\text{Points Allowed} = g(\text{Fouls, Blocked Shots, Steals, Defensive Rebounds, and Coaching Ability}). \quad (3)$$

Each team plays 82 games per season in the regular schedule. Theoretically then the total number of games won by each team is

$$\text{WINS} = l(\Sigma\, [f(\cdot) - g(\cdot)]). \quad (4)$$

Operationally this means that we estimate the following model of games won:

$$\text{WINS} = \beta_0 + \beta_1 R_1 + \beta_2 R_2 + \beta_3 R_3 + \ldots \beta_9 R_9 + \beta_{10} E + \epsilon, \quad (5)$$

where R_1 = relative offensive rebounding strength,
R_2 = relative assists given,
R_3 = relative fouls made,
R_4 = relative steals made,
R_5 = relative turnovers committed,
R_6 = relative blocked shots made,
R_7 = relative free-throw shooting ability,
R_8 = relative field-goal shooting percentage,
R_9 = relative age of coach,
E = ability to equate expected return on two and three-point shot option,
β_i = a set of coefficients, and
ϵ = an error term.

We have collected seasonal data on points scored, points allowed, offensive rebounds, defensive rebounds, assists, fouls committed, steals, turnovers, blocked shots, free-throw percentage, field-goal percentage, the expected value of two and three-point shots, and coach's age (as a proxy for coaching experience) for each of the 23 teams that were in the NBA during the seven year period between 1980 and 1987. These were obtained from various editions of *Official NBA Guide* published by the Sporting News in Saint Louis, Mo.[12] This yields 161 observations. To account for the quality of opposition, for each team for each season we computed the average skill level of all the *other* teams in the league for field goals, free-throws,

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[12] We measure coaching experience by the number of years a coach has been out of college, basically his age. We also used the number of years he was a head coach in the NBA, but this metric is flawed by our inability to know the number of years he was an assistant coach or a college coach. Hence, we opted for the age variable.

and the like. Then each team's *relative* skill at each of these tasks, R_i, was computed by dividing its actual skills by its opponent's skills.

Evaluating the theory is problematic because we cannot directly measure the marginal rate of return on two or three-point shots. However, we can proxy the marginal rate of return by examining individual player skills. In an attempt to directly measure individual player marginal rates of return on two and three-point shots, we created something we call an inefficiency index for each player.[13] To compute the index we took the difference between a player's expected value on all two-point shots (two times his season average two-point field-goal shooting percentage) and subtracted his expected value on three-point shoots (his season average three-point field-goal shooting percentage times three) and multiplied this difference times the number of three-point shots attempted divided by total field-goals attempted. Call the index I. Then, for the i*th* player on a team the index is given by

$$I_i = [(fgm2/fga2) \cdot 2 - (fgm3/fga3) \cdot 3] \cdot [fga3/(fga3+fga2)] \qquad (6)$$

where fgm2 = two-point field-goals made,
fga2 = two-point field-goals attempted,
fgm3 = three-point field-goals made, and
fga3 = three-point field-goals attempted.

The index neatly captures the unexploited profit opportunity for each player and weights it by the number of poorly invested options (the relative proportion of threes attempted). To compute the team index for a season, we averaged I_i over all players on the team that year. To us, this methodology closely approximates whether a team equates the marginal rates of return on the two shot options. Over the sample of our data, Doug Collins and the 1986-87 Chicago Bulls had the highest value, while Hubie Brown and the 1983-84 New York Knicks had the lowest.

We estimated equation (6), the WINS equation, by ordinary-least-squares using the inefficiency index to capture the ability of a coach to equate the marginal rates of return on two and three-point shots. The results are reported in Table 2, and we think the findings are interesting. The more rebounds a team garners, the more games it wins; teams with more assists win more. Teams that foul a lot lose a lot; the elasticity at the means is -0.4. More steals and fewer turnovers map into more wins. More blocked shots and better shooting percentages are also associated with more wins. All the aforementioned variables are statistically significant with the possible

Table 2 The WINS Equation Using Marginal Values (the Inefficiency Index, I)

Dependent Variable: **Games Won per Season**

F ratio = 27.379 Prob>F = 0.0001 $R^2 = 0.6460$

Variable	Parameter Estimate	Standard Error	t-ratio	Prob>|t|
Intercept	-173.92	29.16	-5.965	0.0001
R1	23.39	7.41	3.156	0.0019
R2	13.93	10.16	1.371	0.1723
R3	-34.27	9.68	-3.542	0.0005
R4	17.27	5.14	3.361	0.0010
R5	-24.14	5.90	-4.092	0.0001
R6	16.17	2.81	5.746	0.0001
R7	18.03	13.12	1.374	0.1715
R8	187.61	25.41	7.383	0.0001
R9	-0.14	2.43	-0.059	0.9530
I	-358.77	181.94	-1.972	0.0505

[13] We also computed the index deleting players who took fewer than ten 3-point shots per season. The results we report below are basically unchanged by this alteration.

exception of assists (R_2) and free-throw shooting (R_7). There is little indication of any relation between winning and coaching experience (R_9). As for the main focus of this study, the evidence suggests that more games are won when the inefficiency index is smaller. The more nearly the two expected values are equal, the more games won. However, the magnitude of the effect is small. The elasticity is approximately -0.072. There is some evidence of managerial slack but not of great magnitude. Given the extent of competition for coaching jobs and the intense scrutiny from fans and owners under which coaches work, a coefficient of much larger magnitude would have to be treated with suspicion. Thus, at least to this point, we see that coaches come close to working the two-three shot margin, but they are not perfect at it.

To verify this result we used team level data to calculate the season average expected value on two and three-point shots. Then we took the absolute and squared difference, call these $|E|$ and E^2 respectively, between the two values:

$$E = V_2 - V_3 \tag{7}$$

where V_2 is the team average shooting percentage on two-point shots times two, and V_3 is the team average shooting percentage on three-point shots times three.

Then we reestimated the coefficients of the WINS equation using $|E|$ and E^2 in lieu of the inefficiency index. The results are reported in Table 3, and they too are consistent with the idea that more games are won when a coach equates the expected value of the two shot options. There is a strong relation between games won and the absolute or squared difference in the expected value of two and three-point shots. Using the absolute difference, the elasticity is -0.07. Overall, the regression explains about 65% of the variability in games won, and the coefficient estimates and significance levels on the other independent variables correspond to the regression using the player inefficiency index.[14]

Table 3 The WINS Equation using Average Expected Values

Dependent Variable: **Games Won Per Season**

F Value = 28.683 Prob>F = 0.0001 R^2 = 0.6566

	Parameter Estimate	Standard Error	t for H_0: Para=0	Prob>|t|
Intercept	-190.07	29.12	-6.526	0.0001
R1	23.09	7.19	3.212	0.0016
R2	11.03	10.03	1.100	0.2732
R3	-32.53	9.49	-3.426	0.0008
R4	18.95	5.08	3.729	0.0003
R5	-22.86	5.84	-3.913	0.0001
R6	16.36	2.77	5.902	0.0001
R7	18.04	12.92	1.397	0.1645
R8	201.38	25.44	7.917	0.0001
R9	0.38	2.37	0.161	0.8720
|E|	-12.44	4.24	-2.936	0.0038

F Value = 28.748 Prob>F = 0.0001 R^2 = 0.6571

	Parameter Estimate	Standard Error	t for H_0: Para=0	Prob>|t|
Intercept	-191.76	29.19	-6.569	0.0001
R1	23.02	7.18	3.207	0.0016
R2	11.76	10.01	1.175	0.2418
R3	-33.21	9.49	-3.499	0.0006
R4	19.42	5.10	3.811	0.0002
R5	-23.66	5.81	-4.075	0.0001
R6	16.26	2.77	5.874	0.0001
R7	18.41	12.91	1.427	0.1558
R8	202.26	25.46	7.944	0.0001
R9	0.04	2.38	0.019	0.9852
E^2	-22.14	7.44	-2.977	0.0034

[14] An econometric problem exists with ordinary-least-squares estimation of the WINS equation. Within a given year, the residuals across the 23 teams are not independent; they must sum to zero. Hence, OLS is inefficient because information is ignored. In this case, iterative three-stage-least squares is appropriate. We also estimated the parameters of the equation this way, but the results so closely mirror the values in Tables 3 and 4 that they are not reported here. In addition, there is evidence of heteroscedasticity in the residuals in both Tables 3 and 4. Employing the method

Again, more careful attention to the values of the alternative investment options is associated with more business success. This result is not by itself overpowering, but it is suggestive. Based on these two pieces of evidence, coaches who more nearly equate the value of the two and three-point shot options win more games.[15]

B. *A Shortage of Three-Point Shooters?*

The preceding results may be confounded by the fact that teams with large disparities between the expected values of two and three-point shots simply do not have the players who are capable of taking the three-point shots. The three-point shot is a relatively new option in all of basketball, coming to the NBA in 1979. Thus, in the absence of players properly trained to take three-point shots, some coaches simply ignored the option, taking all two-point shots except in those rare cases where time was about to expire on the game or shot clock. This argument is partly bolstered by the fact that the number of three-point shots has grown over time.[16] If this line of reasoning is correct, then unequal expected values are not due to poor coaching or managerial slack, but rather the absence of the appropriate inputs. We took three approaches to address this question.

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suggested by White (1980), we corrected the standard errors for this potential problem. This adjustment has little impact on the analysis.

[15] As Stigler (1974) has noted about political elections, purely winning is not usually the goal in a contest. He argues that maximizing the distance between you and your rival is a more accurate way to characterize competition. Believing the same argument may also apply to athletic contests, rather than estimate the number of games won per season, we specified an average points differential equation. Here we regressed the per game average points scored minus the opponent's score on the same independent variables as in Tables 3 and 4. With trivial exceptions, the results are the same. Most important, as the inefficiency index or the absolute or squared difference between the expected value of a two and three-point shot decreases, point differential increases.

[16] During the 1980-81 season the average team attempted 165 shots. By the 1986-87 season the average number had increased to 387 per team.

First, we computed the annual average difference between the expected value of two and three-point shots across the league. See Table 1. Using this league average as a reference we normalized or divided each individual team's own difference in expected values by the league average for that season. Call the normalized variable N. Then N and N^2 become measures of an individual coach's ability to equate the expected values of the two shots, *accounting for the supply of three-point shooting talent available to the league.* Table 4 reports OLS estimates of the WINS equation using this normalized variable; it is negative and significant. Accounting for the annual trend in three-point shooting across the league, there is a negative relation between the number of games won and the ability or willingness of a coach to equate the expected values of the shot options available to him.

Table 4 The WINS Equation using **Normalized** Expected Values

Dependent Variable: **Number of Games Won per Season**

F Value = 27.342 Prob>F = 0.0001 Root MSE = 7.337 R^2 = 0.6457

	Parameter Estimate	Standard Error	t for H_0: Parameter=0	Prob>|t|
Intercept	-170.446	29.278	-5.822	0.0001
R1	20.639	7.235	2.853	0.0049
R2	13.955	10.164	1.373	0.1718
R3	-34.069	9.672	-3.522	0.0006
R4	17.424	5.137	3.392	0.0009
R5	-25.279	5.880	-4.299	0.0001
R6	15.805	2.813	5.618	0.0001
R7	17.112	13.153	1.301	0.1953
R8	187.575	25.422	7.378	0.0001
R9	-0.155	2.429	-0.064	0.9490
|N|	-15.032	7.757	-1.938	0.0545

F Value = 27.387 Prob>F = 0.0001 Root MSE = 7.333 R^2 = 0.6461

	Parameter Estimate	Standard Error	t for H_0: Parameter=0	Prob>|t|
Intercept	-174.692	29.144	-5.994	0.0001
R1	20.877	7.236	2.885	0.0045
R2	14.457	10.169	1.422	0.1572
R3	-34.754	9.698	-3.584	0.0005
R4	18.071	5.144	3.513	0.0006
R5	-25.299	5.877	-4.304	0.0001
R6	15.606	2.815	5.542	0.0001
R7	17.625	13.128	1.343	0.1814
R8	190.154	25.430	7.478	0.0001
R9	-0.304	2.437	-0.125	0.9006
N^2	-46.108	23.297	-1.979	0.0496

Second, we deleted the teams from the sample who took very few three-point shots. Specifically we deleted all firms who were more than one standard deviation below the sample average of three-point shots attempted. On average across our sample, 3.23% of all shots taken were three-point attempts. The standard deviation is 1.479%. This procedure deletes 17 out of the 161 observations. With this truncated sample we reestimated the previous regressions, and the results replicate. The teams taking few three-point shots are not driving the results.

Third, we estimated the previous regressions allowing separate coefficients for each season on the variables capturing the equality of expected values. Again the results replicate, and importantly in this case, there is no pattern to the coefficients over time. The estimates are stable and statistically equally in each season.

Fourth, as we noted in note 13, we deleted all the players from our sample who took fewer than ten three-point shots. Then we recomputed the inefficiency index for each team and repeated the earlier regressions. Again, there is a negative and significant relation between the index and games won.

The weight of this evidence leads us to believe that a shortage of three-point shooting players is not the primary force behind the difference in expected values. Instead we contend that the results just presented suggest that managerial slack can and does exist. We now turn our attention to the coach's choice between two and three-point shots for additional evidence on this point.

C. *Shot Mix Residuals*

In this section we build an empirical model of the choice between two and three-point shots. Then we attempt to determine if there is a relation between the *residuals* from the model and a coach's winning percentage. Two hypothesis compete. The first says that coaches who do not use the right mix of two and three-point shots are bad coaches, and consequently there is a negative relation between the right mix and winning, but beauty is sometimes in the eye of the beholder. The alternative argument says just the opposite. Coaches who *do* the *unexpected*, the innovative coaches, the smarter than average coaches, will win more games. This second argument implies a positive relation between the what appears to be the wrong mix of twos and threes (as seen through the eyes of casual observers or even less intelligent or lucky coaches) and winning. This latter argument will carry more weight when learning is taking place, when the best strategy is not widely known and accepted.

In a world of free information, the best strategy in any particular situation is widely known, and deviants from the optimal prescription are punished by lower profits, in this case fewer wins; nobody builds fast food restaurants on the back roads away from traffic flows. But, when information is costly, and, moreover, when rules of thumb have not had sufficient time to develop, the survivorship principle has had little time to work, to weed out the poor investment strategies. In this case, not all observed behavior can be attributed to value maximization, especially when relative prices have changed significantly and abruptly and insufficient time has elapsed to allow for research, introspection, and learning. Of course, in the case of three-point shooting, a *new* option has been created, making its relative value most difficult to estimate instantly. In this special case, unexpected behavior *may* reveal the discovery of new and superior methods of production, to be mimicked in the future. Of course, even in this case not all nonconforming behavior is superior or technologically advancing; nevertheless, new discoveries are only made by departing from the norm.

In sum, when relative prices are stable and information is generally distributed and available to all; unconventional behavior is generally linked to below average performance. By contrast, when prices are volatile and information is emerging, unorthodox conduct is more likely to uncover novel and value increasing ways to manage production. Here unusual techniques push the production frontier out; certain eccentric behavior and profits are positively related.

To address this particular issue, we seek to build an empirical model of the decision to attempt three-point field goals. We expect that the relative proportion of three-point shots increases with the ability to shoot them and decreases with the success rate of two-point shots. Moreover, the earlier investigation suggests that learning takes place, and not too rapidly at that. Hence, we expect the proportion of three-point shots increases over time; the three-point field goal was only introduced in 1979. Last, the bankruptcy arguments previously discussed are examined by including games won or average point differential. If the bankruptcy argument holds water, then the three-point shots will decline with wins or average point differential. The ordinary least-squares estimates of several different specifications of the shot mix equation are reported in Table 5. The dependent variable is the ratio of three-points attempted relative to the number of two-point shots attempted in each season.

Table 5 Three-Point Shots Attempted

Dependent Variable: **Relative Proportion of 3-Point Shots Attempted**

F Ratio = 69.312 Prob>F = 0.0001 R^2 = 0.6399

Variable	Parameter Estimate	Standard Error	t for H_0: Parameter=0	Prob > |t|
Intercept	-0.024955	0.02589158	-0.964	0.0001
Average V_2*	0.004777	0.02759084	0.173	0.8628
Average V_3*	0.053955	0.00496652	10.864	0.0001
Time	0.002966	0.0037963	7.814	0.0001
Games Won	-0.0000196	0.00007518	-0.261	0.7944

F Ratio = 66.795 Prob>F = 0.0001 R^2 = 0.5607

Variable	Parameter Estimate	Standard Error	t for H_0: Parameter=0	Prob > |t|
Intercept	0.043293	0.0049722	8.707	0.0001
Ratio V_2/V_3*	-0.020576	0.00247558	-8.311	0.0001
Time	0.00337	0.00041104	8.199	0.0001
Games Won	0.000079833	0.00006556	1.218	0.2252

F Ratio = 67.918 Prob>F = 0.0001 R^2 = 0.5648

Variable	Parameter Estimate	Standard Error	t for H_0: Parameter=0	Prob > |t|
Intercept	0.046543	0.00421356	11.046	0.0001
Ratio V_2/V_3*	-0.020561	0.00246362	-8.346	0.0001
Time	0.00003371	0.00040711	8.240	0.0001
Average Pt. Diff.	0.000318	0.00018415	1.725	0.0864

F Ratio = 69.319 Prob>F = 0.0001 R^2 = 0.6400

Variable	Parameter Estimate	Standard Error	t for H_0: Parameter=0	Prob > |t|
Intercept	-0.016354	0.02834191	-0.577	0.0001
Av. 2-Pt Shoot %	-0.008981	0.05644700	-0.159	0.8738
Av. 3-Pt Shoot %	0.160785	0.01495301	10.753	0.0001
Time	0.00002977	0.00037981	7.838	0.0001
Average Pt. Diff.	0.000060726	0.00021765	0.279	0.7806

*V_2 and V_3 are the expected values of 2 and 3 point shots respectively.

We see several things. First, since the entire league incorporated the possibility of a three-point field goal at one time, the time variable actually stands for the overall human capital experience in dealing with the new coaching option.[17] As experience increases, coaches take more three-point shots. Second, as the relative value of a three-point shot increases, more three-point shots are taken; not surprisingly, three-point shots obey the first law of demand. There is weak evidence that winning teams, other things the same, take relatively more three-point shots, but this result depends on model specification. In some respects this is a satisfying result. Teams displaying overall competence, are simultaneously the best at managing the two or three-point

[17] Indeed, substituting coaching experience for year yields similar estimates. However, the results are somewhat better and the explanatory power of the model is a good bit higher using time. Coaches are not the only ones who learn about the proper mix of two and three-point shots. Players, general managers, and owners also matter.

shot option. Moreover, the bankruptcy argument, that teams engage in non-value maximizing behavior when defeat is imminent, is not supported by these results.[18]

Table 6 The WINS Equation Using Shot-Mix Residuals

Dependent Variable: **Games Won per Season**

F ratio = 26.503 Prob>F = 0.0001 $R^2 = 0.6386$

	Parameter Estimate	Standard Error	t ratio	Prob>|t|
Intercept	-177.681	29.549	-6.013	0.0001
R1	20.569	7.320	2.810	0.0056
R2	14.753	10.392	1.420	0.1578
R3	-32.296	9.751	-3.312	0.0012
R4	17.181	5.199	3.304	0.0012
R5	-24.588	5.977	-4.113	0.0001
R6	16.133	2.851	5.659	0.0001
R7	19.285	13.251	1.455	0.1477
R8	186.652	25.729	7.255	0.0001
R9	0.353	2.437	0.145	0.8848
|Shot-Mix ε|	87.473	103.843	0.842	0.4009

F ratio = 27.023 Prob>F = 0.0001 $R^2 = 0.6431$

	Parameter Estimate	Standard Error	t ratio	Prob>|t|
Intercept	-177.628	29.292	-6.064	0.0001
R1	21.070	7.280	2.894	0.0044
R2	15.695	10.300	1.524	0.1297
R3	-32.036	9.689	-3.306	0.0012
R4	17.155	5.160	3.325	0.0011
R5	-24.266	5.928	-4.093	0.0001
R6	16.338	2.834	5.764	0.0001
R7	19.080	13.165	1.449	0.1493
R8	184.822	25.595	7.221	0.0001
R9	0.174	2.425	0.072	0.9428
Shot-Mix ε^2	6906.865	4287.019	1.611	0.1093

The residuals from the shot-mix equation are price adjusted for the two-investment options. In a full-information, stable environment we expect that coaches who *do not* base their decisions on these prices will suffer, but as we have just argued, and since the three-point shot option was only introduced in 1979, full adjustment to relative prices may not be perfect. The first argument implies that coaches with large residuals in the shot-mix equation will lose more games than their contemporaries, ceteris paribus. The second argument is less straightforward. Brilliant coaches who uniquely discover how to properly manage the new three-point option *will not* necessarily make the same choices, given a set of relative prices, as their contemporaries. Here large residuals are associated with more games won. Of course, stupid or incompetent coaches will also have large residuals, presumably on the wrong side of the line, which mutes our ability to uncover this relation. Nevertheless, we took the residuals from the fourth specification in Table 5, ever so slightly the best specification we estimated, and included them in the WINS equation. The results are reported in Table 6. The first specification employs the absolute value of the residual, and the second uses the squared residual. The evidence supports the learning hypothesis. Larger residuals are linked with more games won, other things the same. However, the estimate is only weakly significant.

D. *The Bankruptcy or Duress Hypothesis*[19]

It is sometimes asserted that "three-point shots, more so than two-point shots, tend to be taken under circumstances of special duress," what we have called the bankruptcy situation. According to this line of argument several situations create duress.

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[18] We also estimated the equation using the absolute and squared point differential to see if there was a symmetric effect, but the results suggested not. In both cases, the variable capturing the effect of point differential was insignificant.

[19] This section relies heavily on the suggestions of an anonymous referee. Quotation marks and indentations have been used to denote his specific comments.

The first part of this argument goes something like this:

> As the 24 second clock is about to expire, the player with the ball must shoot precipitously, wherever he is, despite the lower shooting percentage associated with forced shots. Since the ball is often outside the three-point line, such forced shots are often outside the line. Since shots in general are seldom taken from outside the line, clock-beating shots are a larger fraction of all three-point shots than of all two-point shots.

Naturally this argument falls on hard times if the ball finds itself in two-point land, compared to outside the line, with the same relative frequency as the relative number of two-point to three-point shots. Indeed our casual inspection of NBA games suggests the basketball is far more likely to be in two-point shooting range as the 24 second clock is about to expire, but absent our presentation of systematic evidence, the theoretical conjecture still remains.

The duress thesis also argues:

> As the quarter is about to expire, a long shot is often taken to beat the buzzer, despite the low shooting percentage for such shots. Since three-point shots are infrequent overall (say, eight per game), such beat-the-buzzer shots (say, one per game) can be quantitatively important to the points per shot statistic.

This argument is correct so far as it goes, but ignores NBA rules specifically designed to prevent this waste of NBA talent. In the last two minutes of every quarter, the game clock stops on a scored basket, permitting players to position themselves for the next play. Moreover, after a time out in this situation, the team with the ball can put it into play at half court, further reducing the need to attempt a ridiculous shot. For sure, there are the so-called "Hail Mary" shots, but again our casual inspection suggests that they are far less than the maximum four per game.

The most theoretical compelling version of the bankruptcy argument concerns the end-game situation when

> A team substantially behind has no choice but to attempt strategies with low average payoffs but positive probabilities of catching up quickly, that is, three-point shots. Such teams engage in what would normally be excessive numbers of fouls, quick shots, and three-point shots. Such desperation three-point shots are efficient from the viewpoint of winning, even though they may yield low expected points per shot.

We present several pieces of evidence to address the bankruptcy/duress thesis. Most importantly, as reported in Table 5, the number of three-point shots attempted, adjusting for the relative shooting percentages, is *not* a function of games won or average point differential. If the last and most important of the duress hypothesis scenarios were the driving force behind our result, we would expect to find a negative relation between three-point shots and games won or average point differential. To repeat, we do not. In fact, in one of the specifications, the *positive* coefficient on average point differential borders on statistical significance.

Secondly, as we reported in footnote 13, deleting all players who took just a few three-point shots does not affect our primary analysis. To further investigate this point, we selected the player from each team in each season who took the most three-point shots. These individuals, being the order statistic, are least likely to be taking the bulk of their shots under duress. Then we computed the absolute difference between the expected value of the two-point shots taken by this person and the absolute value of the three-point shots taken by the same player. The average of this difference across the sample is 0.20, and the t-statistic testing the difference from zero is 14.8, highly significant. That is, for the player taking the most three-point shots on each team, the expected value of his three-point shots is *not* equal to the expected value of his own two-point shots. Furthermore, we examined only those players who took more than 97 three-point shots (the mean of the sample), and repeated the means test. The mean of the absolute difference between V_2 and V_3 in the upper half of the big three-point shooters is 0.16, and the t-statistic is 9.66, again highly significant. There is no equality of the expected values even in the sample of players least likely to be taking relatively many "Hail Mary" three-point shots.

For a last look at this thesis, we computed the expected value of two-point shooting for the player on each team who took the most two-point shots, call him TWO. Similarly, the player taking the most three's, as previously described, can be called THREE. Then the expected value of two-point shots taken by TWO and the expected value of three-point shots taken by THREE also assesses the issue of bankruptcy or duress. The average absolute value of the difference between these two metrics across all teams for all years in our sample is 0.2499, and the t-statistic is 20.09. The expected value of the two-point shots of the player taking the most two-point shots on a team *is not* equal to the expected value of the three-point shots taken by the most prolific three-point shooter. To us this suggests that the bankruptcy/distress theory is not the explanation of our results. In addition, evidence below on coaching reassignment further damages the thesis.

The weight of the evidence presented so far suggests that some coaches survive without working every margin, but is that correct? Or, put differently, do coaches survive who are not capable of matching the expected rates of return on alternative investments?

First examine the record of Pat Riley, recently retired coach of the Los Angeles Lakers. See Table 7. Note what has happened over the years as Coach Riley gained experience. First, the absolute difference in the expected values of the two shot options has monotonically declined except from the 81-82 season to the next, and, at the same time, the number of games won has remained constant or increased except in one case, from the 82-83 season to the next. Note too that the number of three-point shots attempted has grown considerably. This pattern suggests a very lengthy learning schedule. At least in this one case, it took quite a long while to equate the expected values of the two investment options. And, importantly, here we have one the most successful teams in the league. The long time to arbitrage cannot be explained on grounds of general incompetence. This is a well-run team.

Table 7 The record of Pat Riley

Year	V_2[1]	V_3[2]	$\lvert V_2-V_3 \rvert$	Games Won	3-Pt. Shots Attempted
81-82[3]	1.0428	0.4148	0.6279	57	94
82-83	1.0663	0.3125	0.7538	58	96
83-84	1.0808	0.7699	0.3109	54	226
84-85	1.1099	0.9152	0.1946	62	295
85-86	1.0660	1.0122	0.0538	62	409
86-87	1.0520	1.1006	0.0486	65	447

[1] The expected value of a 2-point shot
[2] The expected value of a 3-point shot

V. Dismissals and Subsequent Behavior

If the preceding discussion is correct, then coaches who do not appropriately equate the expected value of two and three-point shots should be dismissed with greater frequency than coaches who more carefully monitor this option. Moreover, coaches who are disciplined for failing to take advantage of the arbitrage opportunity should, when given a second chance, respond favorably. We address this second conjecture empirically. Over the term of our data 14 coaches have left one team and been hired by another. Of these, 12 have, by public accounts of the facts, been fired, and two have quit to take better jobs. The data are presented in Table 8.

Table 8 Coaches Who have Changed Jobs

Coach	Old Team	Season	$\lvert V_2-V_3 \rvert$[1]	New Team	Season	$\lvert V_2-V_3 \rvert$	Change in $\lvert V_2-V_3 \rvert$	Status
Bill Fitch	Boston	82-83	.369	Houston	83-84	.418	0.0495	Quit
C. Fitzsimmons	Kansas City	83-84	.159	San Antonio	84-85	.224	0.0654	Fired
George Karl	Cleveland	84-85	.100	Golden State	86-87	.019	-0.0816	Fired
Hubie Brown	Atlanta	80-81	.601	New York	82-83	.217	-0.3844	Fired
Jack Ramsey	Portland	83-84	.440	Indiana	86-87	.066	-0.3739	Fired
Kevin Loughery	Atlanta	82-83	.232	Chicago	83-84	.446	0.2131	Fired
Kevin Loughery	Chicago	84-85	.474	Washington	86-87	.331	-0.143	Fired
Lenny Wilkens	Seattle	83-84	.410	Cleveland	86-87	.245	-0.1658	Fired
Paul Westhead[2]	Los Angeles	80-81	.490	Chicago	82-83	.329	-0.1611	Fired
Stan Albeck	San Antonio	82-83	.109	New Jersey	83-84	.381	0.2720	Quit
Stan Albeck	New Jersey	84-85	.299	Chicago	85-86	.148	-0.1512	Fired
Tom Nissalke	Utah	80-81	.215	Cleveland	82-83	.187	-0.0273	Fired

[1] V_2 = expected value of a 2 point shot; V_3 = the expected value of a 3 point shot.
[2] Paul Westhead coached 11 games for the Lakers in the 81-82 season before departing.

We expect two things. First, we do not think the two coaches who were lured away are being disciplined, quite the opposite; their services where highly valued. Presumably with their old teams they were employing the appropriate strategy in most regards, and, other things the same, they should not change their coaching style. On the other hand, the coaches who were fired are more inclined to be introspective and inquisitive about the causal reasons they were dismissed, and they should more likely change the things they were doing wrong. In the context of two and three-point shooting, the fired coaches should more nearly equate the expected values at their new jobs, while the quitting coaches should continue to do whatever they were doing.

Table 9 reports the *t*-test of the differences between the two classes of coaches. The first part of the table examines the change in the absolute value of the differences in expected values from the last year on the fired job to the first year on the new job. The second part of the table looks at the first difference of the squared difference. The third part of the table examines the change in the absolute difference for the coach compared to the average change in the absolute difference for the league over the contemporaneous period between the old and new teams. That is, for George Karl who left Cleveland at the end of the 1984-85 season and resurfaced at Golden State in 1986-87, we compared the change in his absolute difference, -0.0816, with the change in the whole league from 1984-85 to 1986-87. This last technique takes into account changes from year to year experienced by the whole league. The results are the same in all three cases. The difference in the expected value declines for the fired coaches, but not for the quitting coaches. Coaches who lost their jobs involuntarily and were subsequently rehired did a better job equating the expected value of two and three-point shots with their new team than their old team.[20] We choose to believe that this is a result of being disciplined by senior management, but of course other explanations are also consistent with this result. The inability to equate the expected values of the two and three-point shot alternatives for the fired coaches could just be an instrumental variable or a symptom of a coach who has lost control of this team, and hence the reason for his dismissal. But, nevertheless, we see that whether it is a response to disciplining or just instrumentally linked, fired coaches do a better job, according to this metric, when they are rehired, than they did in the period just preceding their discharge.

Table 9 Test of Differences Between Quitting and Fired Coaches

***Variable*: |E(2pts.) - E(3pts.)|**

STATUS	N	Mean	Std. Dev.	Std. Error
FIRED	10	-0.12102	0.18109	0.05727
QUIT	2	0.16076	0.15734	0.11126

Variances	t	df	Prob>|t|
Unequal	-2.2519	1.6	0.1997
Equal	-2.0339	10.0	0.0694

For H_0: Equal Variances: F'=1.32, df=(9,1), Prob>F'=1.00

***Variable*: (E(2pts.) - E(3pts.))^2**

STATUS	N	Mean	Std. Dev.	Std. Error
FIRED	10	-0.07786	0.12604	0.03986
QUIT	2	0.08617	0.06678	0.04722

Variances	t	df	Prob>|t|
Unequal	-2.6546	2.8	0.0858
Equal	-1.7440	10.0	0.1118

For H_0: Equal Variances: F'=3.56, df=(9,1), Prob>F'=0.782

***Variable*: |E(2pts.) - E(3pts.)| - League |E(2pts.) - E(3pts.)|**

STATUS	N	Mean	Std. Dev.	Std. Error
FIRED	10	-0.087996	0.19421	0.061413
QUIT	2	0.225536	0.15735	0.111260

Variances	t	df	Prob>|t|
Unequal	-2.4671	1.7	0.1680
Equal	-2.1210	10.0	0.0599

For H_0: Equal Variances: F'=1.52, df=(9,1), Prob>F'=1.000

[20] We can also compare the change in a fired coaches behavior with the overall annual change for the 89 observations where there was no dismissal or retirement. The average change in the absolute value of the difference in expected values for this class of coach is -0.036. The t-statistic comparing the fired coaches average change with the continuing coaches is -1.44 with 97 degrees of freedom, significant at the 10% level.

VI. Some Additional Evidence

A. *The Distribution of Two-Point Shots Across Players*

Arguably, a more intense intrafirm investment problem than the appropriate choice of two and three-point shots involves the proper distribution of two-point shots across players. To determine if the previous analysis is robust across this more (?) complicated problem, we computed a two-point inefficiency index across teams for the period of our analysis. To accomplish this, *for players who shot less than the team average* on two-point field-goal attempts, we multiplied the number of two-point field goals they attempted times the difference between their own shooting percentage and the team's average. Then we averaged this variable for each team for each year and regressed the number of games won on the previously discussed independent variables and this index, call it I2. The index is everywhere negative and, as it gets closer to zero from below, the better is the coach at not investing in low quality two-point shot options across players on the team. The results are reported in Table 10, and the closer the index is to zero, the larger it is, the more games won. The coefficient is not significantly different from zero, but it is suggestive. In some respects it is not surprising that the relation between winning and the proper distribution of 2-point shots across players is weak. This problem has been a part of basketball coaching since the inception of the game, and hence sufficient time has elapsed for rules of thumb and management principles to develop for use by coaches at all levels of the game. This contrasts with the relatively short time that coaches have had to deal with the two or three-point shot option. This is additional evidence that closer attention to detail pays rewards, and, moreover, a marginal opportunity to improve is likely present for most teams by more carefully distributing shots to players with better shooting percentages.

Table 10 The WINS Equation and 2-Point Shots Across Players

Dependent Variable: ***Games Won per Season***

F Ratio = 26.786 Prob>F = 0.0001 R^2 = 0.6410

	Parameter Estimate	Standard Error	t-ratio	Prob>|t|
Intercept	-166.79	30.11	-5.540	0.0001
R1	20.52	7.28	2.817	0.0055
R2	15.56	10.36	1.502	0.1352
R3	-30.34	9.87	-3.074	0.0025
R4	16.62	5.21	3.190	0.0017
R5	-25.88	5.94	-4.354	0.0001
R6	16.22	2.84	5.712	0.0001
R7	18.22	13.22	1.379	0.1701
R8	173.37	27.91	6.212	0.0001
R9	0.31	2.43	0.128	0.8985
I2	0.38	0.28	1.317	0.1898

B. *The Choice in College Football of Attempting a One or Two-Point Extra Point Conversion*

The mass of the evidence presented so far can be interpreted to mean that intra-firm profit opportunities are not rapidly erased. To further investigate this timing question we collected data on the option of attempting a one or two-point extra point in college football. Since 1958 college coaches have had the choice, after scoring a touchdown, of attempting a kick through the uprights worth one point or advancing the ball into the endzone on one play for two points. Table 11 reports the annual average across all Division I schools in the National Collegiate Athletic Association. Note that the single largest number of two-point attempts in the history of the sport was made in the first year the option was introduced, while the second largest number was in the second year. It could be argued that in the beginning, coaches had a distorted impression of the value of the two-point option.

Table 11 Extra Point Attempts in College Football

		1-Point			2-Point		
Year	Games	Att.	Made	Succ. Prop.	Att.	Made	Succ. Prop.
1958	578	1295	889	0.686	1371	613	0.447
1959	578	1552	1170	0.754	1045	421	0.403
1960	596	1849	1448	0.783	790	345	0.437
1961	574	1842	1473	0.800	706	312	0.442
1962	602	1987	1549	0.780	757	341	0.450
1963	605	2057	1659	0.807	595	256	0.430
1964	613	2053	1704	0.830	469	189	0.403
1965	619	2460	2083	0.847	331	134	0.405
1966	626	2530	2167	0.857	410	165	0.402
1967	611	2629	2252	0.857	397	160	0.403
1968	615	3090	2629	0.851	456	181	0.397
1969	621	3168	2781	0.878	432	170	0.394
1970	667	3255	2875	0.883	522	246	0.471
1971	726	3466	3081	0.889	433	173	0.400
1972	720	3390	3018	0.890	497	219	0.441
1973	741	3637	3258	0.896	435	180	0.414
1974	749	3490	3146	0.901	455	211	0.464
1975	785	3598	3266	0.908	440	171	0.389
1976	796	3579	3240	0.905	502	203	0.404
1977	849	4041	3668	0.908	495	209	0.422
1978	816	3808	3490	0.916	498	208	0.418
1979	811	3702	3418	0.923	424	176	0.415
1980	810	3785	3480	0.919	442	170	0.385
1981	788	3655	3387	0.927	403	172	0.427
1982	599	2920	2761	0.946	320	120	0.375
1983	631	3080	2886	0.937	356	151	0.424
1984	626	2962	2789	0.942	370	173	0.468
1985	623	3068	2911	0.949	345	121	0.351
1986	619	3132	2999	0.958	330	131	0.397
1987	615	3094	2935	0.949	375	163	0.435

Source: *1988 NCAA Football*, NCAA.

Our goal here is to address this question: How long did it take for coaches to adjust to the new investment opportunity? The preceding analysis suggests that adaptation to the two-point extra-point attempt option may have been quite lengthy. To investigate this matter, consider the coaching decision to go for one or two extra points as a function of their relative prices, that is, the probability of success on the two separate types of extra point conversions. The regression results of several different specifications are reported in Table 12.

The first specification in Table 12 is ordinary-least squares without a time variable. There is evidence of autocorrelation in the residuals that is addressed by including time, a first-order, autocorrelated transformation, and first differencing. In all cases, extra point conversions obey the first law of demand. As the relative success of two-point attempts decreases, when the probability of a one-point conversion increases, coaches attempt relatively fewer two-point conversions. Although the coefficient on two-point success is positive, the coefficient is not statistically significant.[21] The regressions explain a surprisingly large fraction of the variation in the proportion of two-point extra-point attempts compared to the R^2 from the comparable equation in the basketball sample; apparently the relative success rates on one and two-point attempts are more compelling to college football coaches than the analogous relative prices are to

[21] This may be due to the fact that there is very little variation in the probability of success on two-point attempts. The lowest success proportion on two-point attempts is 0.351 and the highest is only 0.471.

professional basketball overseers. This is consistent with the idea that learning has been taking place. The option in college football has existed since 1958, while the basketball option was only introduced in 1979.

Table 12 Proportion of 2-Point Extra Point Attempts

Dependent Variable: **Relative Proportion of 2-Point Extra-Point Attempts**

Variable	Parameter Estimate	Standard Error	t for H_0: Para.=0	Prob>|t|
Ordinary least Squares				
F ratio = 69.901 prob>F = 0.001 R^2 = 0.838 Durbin-Watson D = 0.288				
Intercept	1.27558	0.18049	7.067	0.0001
1-Pt. Success %	-1.35898	0.12145	-11.189	0.0001
2-Pt. Success %	0.17863	0.28649	0.624	0.5382
F ratio = 173.61 prob>F = 0.0001 R^2 = 0.953 Durbin Watson D = 1.685				
Intercept	-19.10001	2.57893	-7.406	0.0001
1-Pt. Success %	-2.74185	0.18732	-14.637	0.0001
2-Pt. Success %	0.06016	0.15893	0.379	0.7081
Year	0.01096	0.00139	7.907	0.0001
First-Order Autocorrelation Regression				
Rho	-0.15016	0.19773	-0.759	
Intercept	-17.73494	2.84318	-6.238	0.0001
1-Pt. Success %	-2.64293	0.20269	-13.039	0.0001
2-Pt. Success %	0.02914	0.15200	0.192	0.8495
Year	0.01023	0.00153	6.703	0.0001
First Difference Regression				
F Ratio = 18.414 prob>F = 0.0001 R^2 = 0.5862				
Intercept	-0.00013	0.00472	-0.028	0.9778
1-Pt. Success %	-1.15325	0.26803	-5.718	0.0001
2-Pt. Success %	0.04717	0.09784	0.482	0.6337

The alacrity of coaches to adjust to the new investment option is surprising. *Adjusting for the differences in the probabilities of a successful one or two-point attempt*, two-point attempts have grown at the average rate of 1.1 percentage points per year, which is a 6.9% annual rate of change. Moreover, the residuals display a pattern consistent with long-term learning. Examine Figure 2 where the OLS residuals from the specification including time are plotted. Figure 3 graphs the estimated OLS residual variance; observe that it decreases with the passage of time. Based on these two graphs, we conclude that coaches have become more

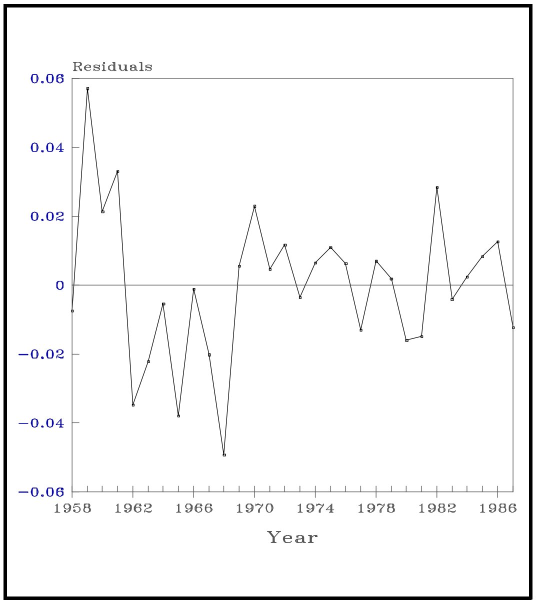

Figure 3 Two Point Attempts--Residuals from OLS

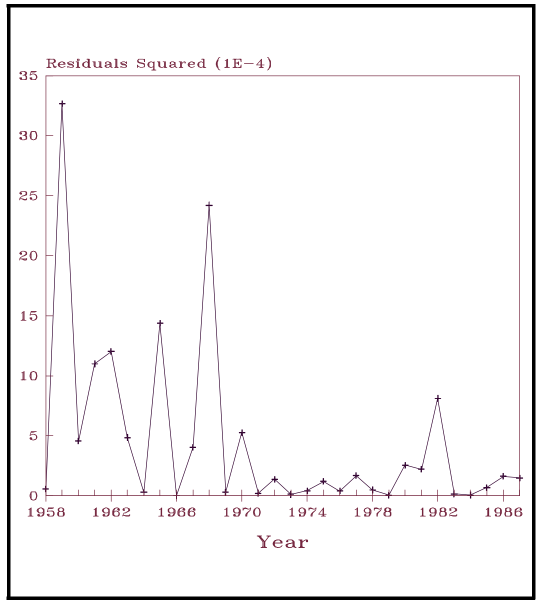

Figure 3 Two-Point Attempts--OLS Residual Variance

capable of dealing with alternative investment options.[22] When the new option was first introduced, there was considerable noise in the choices made by coaches, but over time the model of relative prices comes to explain a greater fraction of the decisions. To us the long term, at least ten years, it took before the learning was complete is interesting. It appears that it is only by 1970 that residual variance is stable. We interpret this to mean that even though coaches now generally base the one or two-point conversion attempt on the expected probabilities of success and game conditions, in the 10-12 year period prior to 1970, *there was considerable misunderstanding of the relative worth of the two options*. This example also serves to make the point about managerial bundling. Extra points are not the most important part of most college football games. With the emergence of a new option for coaches to choose, some did a better job than others. But even the coaches who did a relatively poor job may have been the best suited for the overall job at hand. Replacing a coach just because he took a few ill-advised two-point extra-point attempts could easily lead to a worse team. However, now that sufficient time has elapsed for most coaches to have learned better ways to deal with the one or two-point option, we see convergence of the expected values.

It has been suggested to us that game conditions dictate the choice of two versus three-point shots or one versus two extra points. That may be true, but it is very unlikely that game conditions were so different in 1958 and 1959 that coaches took two and a half times as many two-point extra-point attempts while in 1987 the numbers are nearly reversed. Surely kicking accuracy accounts for part of this difference as our results indicate, but misjudgment of the probabilities of success seem to be playing a role as well.

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[22] We also regressed the estimated residual variance from the OLS model (including time) on time. The coefficient is negative and significant:

$$\varepsilon^2 = 0.07735 - 0.000038986 \bullet YEAR.$$

F ratio = 7.161 prob>F = 0.0123 $R^2 = 0.2037$

If our point about managerial slack, bundling, and the emergence of new opportunity generalizes, and we can think of no reason why it should not, adjustment to new circumstances is not an instantaneous event. Then, it does not seem unreasonable to conclude that when a new intrafirm investment option appears, some otherwise qualified managers take a long time to properly adjust to that alternative, and hence it may be wrong to conclude that profit opportunities do not exist. Naturally, some managers are more proficient discovering ways of dealing with additional opportunities, and they are the ones who set the market.[23]

It would be unwise to conclude too much from these findings. For instance, the presence of profit opportunities should not be mistaken for gross managerial inefficiency. Recall the small magnitude of the relation between the inefficiency index and the number of games won. Moreover, coaches perform a lot of chores. We have only examined one. In the one we looked at, we found some evidence of slack, but this does not mean that some other coach could have done a better job *overall*. Management comes bundled. Nothing we report should be interpreted to mean that the managerial labor market is inefficient. All we are saying is that the world is not perfect.

VII. Conclusions and Suggestions for Further Research

The literature on managerial slack is far from complete. Recent research on the managerial labor market and the market for corporate control are powerful evidence to the point. In this paper we have investigated one potential profit opportunity available to basketball managers *which, in general, is not available to outside parties,* as is usually the case in a well functioning financial market. A few years back Ronald Coase wrote,

> "... while consideration of what would happen in a world of zero transaction costs can give us valuable insights, these insights are, in my view, without value except as steps on the way to the analysis of the real world of positive transaction costs. We do not do well to devote ourselves to a detailed study of the world of zero transactions costs, like augurs divining the future by the minute inspection of the entrails of a goose." Coase (1981, p.187)

The financial markets and managerial labor markets that so many of us study has transactions costs. It is only through analysis of its processes that we can uncover many of the implications of competition. In general, the work reported here suggests several empirical regularities. First, not all coaches are equally qualified when it comes to managing changing investment opportunities inside their organization. Second, some coaches appear to get better at this chore with experience, but this effect takes considerable time. Third, coaches who most nearly equate the expected rates of return on the two alternative investment options, win the most games. Last, coaches who are fired appear to do a better job managing the investment possibilities when they are rehired at a new job. These results are far from definitive, but, bolstered by a similar result from college football, they do suggest that profit opportunities may exist for long periods of time within successful organizations.

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[23] It bears noting that our results are found in a slightly non-conventional organizational setting. Most NBA franchises are closely held, and only one is publicly traded. In the case of college football, there are no truly private universities in the property rights sense. Hence, the market for corporate control that might work rapidly to erase such profit gains as we have identified may not work so smoothly in the cases we examine as it does in general.

Our results from sports have implications for other industries. When technology or relative prices change, managers must make adjustments. Our results suggest that this transition is neither instant nor homogeneous across firms. The ability to adapt to new environments is an important managerial function. Take for instance the recent history of airlines operating under competition. For almost 50 years the major airlines in the U.S. were not faced with the rigors of free and open competition. The CAB routinely assigned routes and deterred the entry of rivals. Starting in the late 1970's a new day arrived, and managers well versed in working in a regulated environment were forced to deal with a different set of problems. As history would have it, some firms took a very long time to unravel these mysteries, the prolonged survival but ultimate bankruptcy and liquidation of Eastern Airlines being a notable example. Our argument is that Eastern simply could not figure out how to deal with competition. Specifically, under regulation, their employees had been overpaid, an untenable situation under competition.[24] Yet even though there was a takeover and major realignment of management, it still took almost 10 years for the firm and industry to come to grips with this situation, according to our estimates, very nearly the same length of time it took college football coaches to properly manage the one and two-point extra point attempt.

If, as our study suggests, managerial slack can persist, a number of conclusions merit further research. First, there is always a way to make more money. In virtually all the cases we examined, there was a differential between the expected rates of return on alternative investments. But, of course, there is no free lunch. Hence, the expanse of revenue opportunities is a function of search costs. As relative prices change, new revenue opportunities are created. Some create a profit opportunity for (i) smart people, people who can rapidly process the new information and make the right decision and (ii) people in the right place at the right time, both of whom will make abnormal returns, quasi-rents if you will. Second, learning is allowed in the management pool; competition does not instantly drive incompetence to zero. It is not essential for a newcomer to step in and immediately perform perfectly. The profit or value maximization objective is not always met. In turn, this suggests that future models of the firm may need take account of the fact that management skills often come bundled and lumpy.

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[24] There is a considerable literature on the distribution of costs and benefits of regulation and deregulation. For one of the best examples, see Moore (1978) who documents the gains to truck drivers from ICC regulation.

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