Preliminary – Comments Welcome

Playing for Keeps:
Pay and Performance in the NBA

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Abstract

This paper examines contract-related incentive effects using a unique dataset on individual performance and individual contracts. Evidence from professional basketball players in the 1980s and 1990s supports the main predictions of a model of worker effort as individual performance improves in the year before signing a multi-year contract, but declines after the contract is signed. This is consistent with an observed salary structure that rewards both historical performance and recent improvement, which provides an incentive to increase effort and improve performance before signing a multi-year contract. The incentive effects appear important as team outcomes improve substantially when more players are competing for new contracts, but decline when more players have just signed multi-year contracts. These results highlight the double-edge nature of long-term contracts: good for employers when workers are fighting for them, but less so when workers have them.

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I. Introduction

A basic result of agency theory is that properly designed incentive contracts can align the interests of agents with those of the principal, and recent empirical work suggests that workers do indeed respond to financial incentives.[1] Explicit contract incentives, however, are not the only force motivating workers. Workers also have incentives to vary effort at different points of their contract cycle – increase effort just *before* a new contract is signed to lock-in a more lucrative deal and then reduce it *after* a multi-year contract is secured. These types of contract-related incentives create clear moral hazard problems, but have received little empirical attention.

This paper employs a unique dataset for professional basketball players in National Basketball Association (NBA) from 1988 to 2002 to examine incentive effects from this perspective. The data include contract information (year signed, length of contract, and value of contract) for every active player in 2000, and performance measures (points scored, rebounds, assists, etc.) throughout each players' career. Contract-related incentive effects are then estimated from changes in individual performance over the contract cycle: if performance systematically improves just before signing a new contract and falls afterward, some of the fluctuation is likely due to contract-related incentives. I also examine the link between pay and past performance, which must exist for these types of incentives to be relevant.

The critical advantage of this data is the detailed information on *individual* performance, *individual* contract status, and *individual* pay.[2] In contrast, previous work on individual incentives (Lazear (2000) Paarsch and Shearer (2000), Shearer (2000)) studied changes in *firm-wide* compensation plans, while the empirical literature on executive pay and performance (Murphy (1985, 1986), Jensen and Murphy (1990), Gibbons and Murphy (1992), Kaplan (1994), and Hall and Liebman (1998)) typically examined the link between individual pay and *firm* performance. The individual-level data constructed here are similar to Maxcy et al. (2002) and have the individual variation needed to allow cleaner tests of both the impact of financial incentives and the link between pay and performance.

I begin with a stylized model that yields several predictions relating individual performance to contract status. With imperfect information and multi-year contracts, workers have an incentive to exert additional effort in the year prior to signing a multi-year contract (their "contract year") in order

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[1] Prendergast (1999) surveys this literature, but emphasizes that evidence of incentive effects is not a test of agency theory, but rather one necessary input for agency theory.

[2] Ehrenberg and Bognanno (1990) cite advantages of professional sports data as a motivation for their study of tournament incentives.

to convince employers that they are high quality and raise long-term compensation. Conversely, in the early years of a guaranteed multi-year contract, workers have less incentive to exert effort because current wages are effectively independent of performance. This moral hazard problem, however, may be obscured by two offsetting factors – a "selection effect" may lead improving or high-quality workers to receive contracts and the "career concerns" discussed by Fama (1980), Holmstrom (1982), and Gibbons and Murphy (1992) may limit effort declines. These stories, however, would not generate declines in performance after the contract is signed. Secondary predictions of the model are that any decline in effort should vary with the length of the contract and the player's age.

For contract-related incentives to be an internally consistent explanation, however, improved performance must actually be rewarded with better contracts, so a first set of results follows the literature on pay and performance. Not surprisingly, better performers are rewarded with higher salaries and longer contracts. More relevant to the incentive issue, players are also strongly rewarded for improvements in performance in their contract year. A point increase in a player's scoring average, for example, is associated with an annual salary increase of over $300,000. This link provides the crucial motivation for the hypothesis that players exert additional effort in their contract year to lock-in better contracts that they expect to follow.

The data provide broad support as overall performance does in fact improve relative to a player's long-run average in the contract year, and then decline after a long-run contract is signed. Given the visibility and competitiveness of professional sports, it is unlikely that players can shirk very much during games, and these contract-related changes could reflect complementary factors that determine performance like off-season conditioning or in-season practice habits. Performance declines tend to be smallest for those who signed the very longest contracts, suggesting that the moral hazard of a multi-year contract may be offset by the selection effect of who receives contracts

A final set of results looks at the impact of these individual incentives on team performance. If players perform better in their contract year and if this effort is valuable to the team, team outcomes (measured as wins) should improve. In contrast, if players fade when multi-year contracts are in place, team performance should suffer. The data suggest that individual contract-related incentives do matter: team wins increase with the share of high-effort players in their contract year, but falls with the number of low-effort players that just signed multi-year contracts. A shift of one player from the high incentives of a contract year to the low incentives after just signing a multi-year contract, for example, leads the number of team wins to decrease by about 4.5 games. Given that the average team wins 41 games, these incentive effects seem quite large.

These results show the importance of contract-related incentive effects and the corresponding moral hazard. Even in the world of professional sports, where performance is readily observable and detailed incentive contracts are possible, workers appear to strategically alter effort over the contract cycle in order to maximize personal gains. In other situations with similar contract cycles, e.g., the professor working for tenure or the politician seeking election, these effects could be much larger due to larger informational asymmetries and reduced monitoring ability. In fact, these effects are likely to be present wherever there are multi-year contracts and some contracting friction. This highlights the double-edge nature of multi-year contracts – a valuable incentive and signal mechanism when workers are fighting for contracts, but an opportunity to shirk when workers have them.

II. Contracts and Incentives

A large theoretical literature on optimal contract theory addresses agency costs and moral hazard, and this section presents a stylized model of contract-related incentive effects to motivate the subsequent empirical work.[3] The model begins with a worker (agent) who must be compensated to provide costly effort and an employer (principal) whose success depends on that effort. The firm determines the contract structure to maximize its success. In the context of the empirical application later in the paper, the worker is a player, the employer is a team, and firm success is measured as wins.

The worker chooses effort, *E*, given ability, *A*, to maximize utility, *U*. Effort affects the worker's utility through three channels – indirectly through a performance-based contract, *W(E,A)*, and by increasing the success of the firm, *S(E,A)*, and directly through the disutility of effort – so the worker chooses *E** to:

$$(1)\quad \max U(W(E,A), S(E,A), E)$$

where $U_1>0$, $U_2>0$, $U_3<0$, $W(E)>0$, $S(E)>0$ and there are no cross-effects.[4]

The performance-based contract, *W(E,A)*, is not exogenous and determined by negotiation between the employer and the worker (or a representative like a union). For simplicity, ignore any bargaining issues between workers and the employer, and assume that the employer chooses the contract structure (the *W(E,A)* function) to induce optimal effort and maximize the success of the firm subject to a budget constraint:

$$(2)\quad \max S(E,A)\ st\ W(E,A) \leq C$$

where *A* is treated as fixed and *C* is the budget.

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[3]Hart and Holmstrom (1987) provide an overview, while Holmstrom (1979) is a classic reference.

[4]In many settings the worker may not care about the success of the firm, but in the sports case, players presumably care about winning. This effect could be dropped without changing the qualitative results.

An equilibrium incentive contract exists when both the worker and the employer are behaving optimally (Baker (1992)).[5] The employer chooses the contract structure so that the marginal benefit of induced worker effort, *E**, equals its marginal cost, while the worker is choosing optimal effort *E** to maximize utility given this contract. These two conditions jointly determine optimal effort as:

$$(3)\quad \left.\begin{array}{c} \dfrac{\partial S}{\partial E}(E^*,A)=\dfrac{\partial W}{\partial E}(E^*,A) \\ \dfrac{\partial U}{\partial W}\dfrac{\partial W}{\partial E}(E^*,A)+\dfrac{\partial U}{\partial S}\dfrac{\partial S}{\partial E}(E^*,A)=-\dfrac{\partial U}{\partial E}(E^*) \end{array}\right. \Rightarrow E^*$$

where the optimal effort level equates the worker's marginal benefit of effort (through higher wages and firm success) to the marginal cost (disutility), conditional on the contract structure.

The equilibrium defined by Equations (3) is a simple example of a contract that induces optimal effort by the worker. This set-up implicitly assumes that effort can be measured and verified, that effort can be distinguished from ability, that contracts are enforceable, and that a contract can be written for each point in time to induce optimal effort. These are strong assumptions, and the implications of relaxing them have been the focus of much discussion in the contracting literature.[6]

Now consider a case where effort and ability are imperfectly distinguishable, ability may be evolving, contracts are determined *ex ante* and are thus independent of contemporaneous effort, and the worker has "career concerns" and knows that a second contract may be signed after the first one ends. Employers compete for high-ability workers and must pay wages commensurate with ability, but they have trouble distinguishing effort and ability so contract wages, W_t, are determined by the employer's subjective perception of ability, X_c:

$$(4)\quad W_t = W(X_c) \quad c < t \le c+L$$

where a worker signs a multi-year contract of length *L* in year *c*+1 and X_c is the employers' subjective perception of ability as of year *c* (the contract year, just before the contract is signed).[7]

The difficulty is that the employer cannot directly observe either ability or effort, but rather observes worker performance (either a single indicator or a multi-dimensional index) that reflects both factors, $P_t = P(A_t, E_t,)$. Moreover, worker ability may be changing, e.g., skills are improving with

[5]The "participation constraint" of Baker (1992) is not made explicit here, and it is assumed that any contract provides utility that exceeds the worker's reservation level.
[6]See Sappington (1991) for a review of some of these issues in the standard principal-agent setting and Prendergast (1999) for a more recent perspective.
[7]Contract length could be endogenized if risk-adverse workers prefer longer-term guaranteed contracts, but this not central to this analysis and ignore.

experience or deteriorating with age, so the employer applies subjective weights, δ_t, to past performance in order to form the assessment of the worker's current and future ability:

$$\text{(5)}\quad X_c = A(\delta_0 \cdot P(A_0, E_0), \ldots, \delta_c \cdot P(A_c, E_c))$$

where the worker is first observed in year 0 and last observed in year c, A_s reflects factors that the player cannot control (age), and E_s reflects factors that the player can control (effort). If worker ability varies predictably with time, employers may put more weight on recent performance and $\delta_0 < \delta_{c-s} < \delta_c$.

As this point, it is worth discussing why multi-year, fixed wage contracts exist at all and the employer doesn't simply offer pure incentive contracts. One limitation to incentive contracts, emphasized by Prendergast (1999), is the additional risk they impose on workers, who must be compensated through higher average wages. In high-risk activities like professional sports pure incentive contracts may be not be practical. In fact, the majority of pay for professional basketball players is through guaranteed contracts, although explicit incentive contracts do exist. Second, the multi-dimensional nature of performance makes explicit incentive contracts difficult to design optimally. Holmstrom and Milgrom (1991), for example, argue that incentive pay may have perverse reallocation effects as workers shift their effort towards those duties that are measured and rewarded.[8] As a result, subjective performance evaluations are often used to overcome this multi-tasking problem (Pendergast (1999)). Third, there is a risk from the employers' perspective. Average salaries have been rising steadily in the NBA, and employers may be willing to accept some moral hazard in exchange for the ability to lock-in high quality players at current salary levels. Finally, the collective bargaining agreement in the NBA, discussed below, limits the value of pure incentive pay.

Given the contract structure in Equations (4) and (5), the worker's problem in contract year c is to choose effort, $E_c{*}$, to maximize the present discounted value of future utility over the course of the current contract and a subsequent contract:

$$\text{(6)}\quad U_c = \sum_{t=c}^{L} \beta_t U(W(X_c), S(E_t, A), E_t) + \rho \sum_{s=c+L+1}^{T} \beta_s U(W(X_{c+L}), S(E_s, A), E_s)$$

where β_t are the discount factors (β_c=1, β_s<β_t<1) associated with the utility, ρ is the probability of signing a second contract, T is retirement year, and X_{c+L} is defined analogously to X_c and represents the perception of ability at the end of the first contract, which determines wages of the second contract.

[8]Prendergast (1999) summarizes strong empirical evidence for this type of "dysfunctional behavior."

The worker chooses a series of optimal effort levels for the contract year, E_c^*, and the remainder of the first contract, E_t^*, as:

(7)

$$\frac{\partial U}{\partial S}\frac{\partial S}{\partial E_c}+\sum_{t=c+1}^{L}\beta_t\frac{\partial U}{\partial W_t}\frac{\partial W_t}{\partial X_c}\frac{\partial X_c}{\partial P_c}\frac{\partial P_c}{\partial E_c}+\rho\sum_{s=c+L+1}^{T}\beta_s\frac{\partial U}{\partial W_s}\frac{\partial W_s}{\partial X_{L+1}}\frac{\partial X_{L+1}}{\partial P_c}\frac{\partial P_c}{\partial E_c}=-\frac{\partial U}{\partial E_c}\Rightarrow E_c*$$

$$\beta_t\frac{\partial U}{\partial S}\frac{\partial S}{\partial E_t}+\rho\sum_{s=c+L+1}^{T}\beta_s\frac{\partial U}{\partial W_s}\frac{\partial W_s}{\partial X_{L+1}}\frac{\partial X_{L+1}}{\partial P_t}\frac{\partial P_t}{\partial E_t}=-\beta_t\frac{\partial U}{\partial E_t}\Rightarrow E_t*\ \ \forall\, c<t\leq c+L$$

The intuition behind these first order conditions is as follows. In contract year *c*, the worker has three reasons to expend effort – better firm performance, higher wages throughout the first contract if performance is strong and the employer believes the worker is high ability, and a more lucrative second contract for the same reason.[9] These gains must be traded off against the current disutility of effort. During the first contract, however, wages are fixed so the only benefits from effort are improved firm performance and higher wages in the second contract period.[10]

The main insight from this set-up is that incentive effects vary across a player's contract cycle and career. If employers discount the information in past performance relative to more recent results, recent performance will have the strongest impact on future wages during the upcoming contract and workers have the biggest incentive to exert effort in the contract year. The first testable prediction is that effort (and performance) is relatively strong in the contract year. Immediately after the contract year, effort should fall because there is no financial reward except through the second contract, so the second testable prediction is that effort declines after the contract is signed.

Rational employers anticipate this strategic variation in effort, but have difficulty distinguishing changes in effort from changes in ability. That is, the actual change in performance in

[9]Note that contract year wages are fixed and do not respond to contract year effort. This could be because an earlier contract like locked in wages or if the individual is new to the field. For example, a college player exerts effort in the hope of securing a lucrative professional contract, even if there is no immediate remuneration.

[10]This set-up is used because it parallels the empirical application, but one could easily generalize the wage structure to include contemporaneous effects. This would not eliminate the main point that effort rises in the contract year if there is asymmetric information and multi-year effects.

year c is $dP_c = \frac{\partial P}{\partial A_c} dA_c + \frac{\partial P}{\partial E_c} dE_c$ and the employer wants to sign only high ability players and not those that temporarily increase effort, so a "selection effect" confounds the prediction that performance will decline after a contract is signed. If employers effectively screen workers and can at least partially distinguish ability from effort, measured performance may steadily improve for those players actually signed to contracts. It is ultimately an empirical issue whether the negative moral hazard effect or positive selection effect dominates post-contract performance.

Post-contract declines are also mitigated by career concerns because effort will be exerted to influence employer's perception and set the stage for a lucrative contract later on. If workers have large concerns about their future (e.g., a high probability of a second contract, short contract length, small discount rate), there is more incentive to exert effort in each period and E_t* will decline less after the contract is signed. In contrast, if there are no career concerns (e.g., the worker knows he will not sign another contract, ρ=0), there are no future returns to effort and E_t* declines more.

This suggests two additional testable predictions: effort should decline more if a worker signs a very long contract or if a worker is close to retirement age. In both cases, career concerns are less important, which reduces the incentive to exert effort once a contract is signed. The selection effect, however, works against the contract length prediction: employers may be able to identify improving players and sign them to longer-term deals. This is particularly relevant for the current empirical application where contracts values have been rising rapidly and employers try to lock in potential stars at current prices, and will make it harder to find a post-contract decline.

This is obviously a stylized model and two limitations deserve mention. First, it is not necessarily an optimal contract from the employer's perspective, although it is consistent with the literature on subjective performance evaluations and with the empirical evidence below below. Second, very little structure has been placed on the employer's process for assessing worker ability. When worker ability changes over time, it seems reasonable that employers place more weight on recent performance and the data show that recent changes in performance help predict compensation, even after conditioning on historical performance. Thus, this simple model provides a useful framework for interpreting the empirical results on the link between contract status and performance.

III. NBA Contract Background and Data

To examine these contract-related incentive effects empirically, I constructed a unique database on performance and contract status for professional basketball players in the National Basketball Association (NBA). This section first discusses the salary structure as governed by the current collective bargaining agreement (CBA) between the NBA and the player's union, the National Basketball Players' Association (NBPA), and then describes the data in detail.

a) NBA Contract Background

Labor issues in the NBA are governed by a CBA that has been in effect since January 1999 and runs through 2004. The CBA determines virtually every labor practice such as league minimum and maximum salaries, trade rules, draft issues, benefits, and team salary caps (maximum team payroll), and prevents the NBA from violating antitrust laws.[11]

The key factors for this purpose relate to the contracting framework. The CBA imposes minimum and maximum salary restrictions based primarily on player experience and the team's salary cap.[12] Minimum salaries currently range from $301,875 for a first-year player to $1,000,000 for a player with more than nine years NBA experience (CBA, Article II(6)(a)). Salary maximums depend more directly on the team salary cap and also vary with player experience. For example, a player with less than seven years experience may earn the greater of 25% of the team salary cap, 105% of the player's last annual salary, or $9 million, while a player with more than ten years experience may earn the greater of 35% of the salary cap, 105% of the player's last annual salary, or $14 million (CBA, Article II(7)(a-c)). These restrictions apply to the first year of a player's contract, and then are adjusted upward for the life of the contract.

The maximum salary applies to the player's salary and individual incentive clauses (Article II(7)(a-c)). The CBA distinguishes between "likely bonuses" and "unlikely bonuses," where likely bonuses are included in a player's salary and unlikely bonuses are not (CBA, Article VII(3)(d)(2)). These incentives can be based on pre-agreed benchmarks for individual or team performance, or on pre-agreed benchmarks for physical condition or academic achievement (CBA, Article II(3)(c)). The distinction between likely and unlikely is based on historical comparisons via negotiation or, if necessary, an independent arbitrator. It is interesting that the CBA explicitly mandates that these incentive clauses "must be structured so as to provide an incentive for positive achievement by the player and/or team (CBA, Article II(3)(c)(iv))." Finally, unlikely bonuses cannot exceed 25% of a player's regular salary (Article VII(5)(d)), and thus limit the prevalence of these incentive clauses.

Contract lengths are also restricted under the current CBA. The standard limitation is six years in length for most players, but up to seven years for certain veteran players. All players drafted

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[11]This information is based on the CBA available from the NBPA at www.nbpa.com and "NBA Salary Cap / Collective Bargaining Agreement FAQ," http://members.cox.net/lmcoon/salarycap.htm.

[12]The salary cap limits a team's maximum expenditure on player salaries and depends, with some exceptions, on a team's basketball related income (gate receipts, broadcast rights, team sponsorships, seat licenses, parking, concessions, etc.).

in the 1998-2004 college draft, however, are restricted to three-year contracts, with a fourth option year for the team (CBA, Article IX(1)). Under the previous CBA, signed in 1995, contract length was not as restricted for veterans, but certain rookies faced a three year limit. Finally, there are significant restrictions on contract extension and negotiations. For example, extensions cannot occur before the fourth year of a six or seven year contract, a contract may be renegotiated no sooner than the third year, renegotiations are limited by the team salary cap, and contracts can only be renegotiated or extended upward (CBA, Article VII(7)).

Finally, NBA contracts are typically guaranteed. The specific type of guarantee (against disability due to basketball injury, against disability unrelated to a basketball injury, or loss of skill), however, is negotiated between the player and the team. Within this highly restricted framework, players and teams negotiate contracts.

b) Data

The data used in this paper include all historical performance statistics collected by the NBA for all players from 1988 to 2002.[13] Data are from Allsports.com, a proprietary provider of sporting statistics.[14] Data on the performance of each team, e.g., wins and losses, in each year are also available. The individual data include 6,195 player/year observations, an average of 413 observations per year, for an unbalanced panel of 1,343 different players. 14 players were active in all 15 years, 320 were active for only one year, and the median number of years per player was 3. Information on each player's team and position, e.g., center, forward, or guard, are also available.

There are many performance statistics in basketball, e.g., points scored, field goal percentage, rebounds, assists, and blocked shots, but most vary in relevance across position. The empirical work examines many statistics, but concentrates on a "composite rating" that summarizes a wide range of performance statistics and provides a comprehensive measure of overall performance.[15]

Contract information was collected by the *USA Today*.[16] These data include all NBA players with active contracts for the 2000 season and contain information about when the contract was signed (signing date), contract length, last year of the contract (end year), and the total value of the contract. An annual salary is calculated as the value of the contract divided by the length. All values were put

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[13]The year refers to the first part of the season, e.g., the 2000 season runs from October 2000 to June 2001.

[14]www.allsports.com/nba/stats. These data were checked against official NBA data in Hubbard (2001) and were found to be extremely reliable; less than a dozen observations were dropped due to missing data.

[15]This rating system is described in "By the Numbers," Allen Barra, *Wall Street Journal*, April 27, 2001, W10. For those interested in the details, the composite rating is calculated as (field goals made*1.4+blocked shots*1.4+free throws made*1.0+assists*1.0+steals*1.0+offensive rebounds*0.85+defensive rebounds*0.5–turnovers*0.8–field goals missed*0.6)/minutes played *48.

[16]www.usatoday.com/sports/nba/salaries00.htm.

into 1996 dollars using the CPI deflator. This contract information was compiled by a third party from a variety of sources because the NBA does not publish comprehensive contract details. The data were checked against other private compilations where possible and 419 observations, approximated 95% of the 441 active players in 2000, contained reasonable data and were suitable for analysis.

As discussed above, NBA contracts may have explicit incentive clauses that stipulate increased pay if certain performance criteria are met, but these details were not available on a comprehensive basis. The unlikely bonuses, which are most likely to provide incentives, are capped at 25% of a players' regular salary. Moreover, contract incentives would tend to improve performance after a contract is signed, thus making it more difficult to find a decline in performance. A second data issue is that players may have signed earlier contracts in earlier years, but this should not introduce bias and simply adds variation to the early data as effort and performance may vary around those earlier dates.

c) Summary Statistics

The remainder of the paper examines 349 players that were signed to long-term contracts during the 2000 season. Players with one-year contracts are excluded because there would be competing incentive effects, and because these players are typically marginal players signed to short-term deals (as short as ten-day contracts). In addition, players that were signed to contracts, but did not play in 2000 due to injury or retirement were excluded. This left a sample of 2,646 player/year observations for 349 players from 1988 to 2002.

The first panel of Table 1 reports summary statistics for primary performance variables – points, rebounds, assists, blocks, and the composite rating – and the bottom panel shows summary contract information for the 349 players with complete long-term contract data in 2000. The average length of contract was 4.4 years, which included contracts ranging from 2 to 12 years in length, and was signed in 1998. The average value of the contract was $21 million, with a range of $0.7 million to $193 million, but the median was $10 million due to relatively few "superstar" contracts.

At this point, it is useful to be very clear about the structure of the data. For each player signed to a multi-year contract in 2000, performance statistics are observed in every year from 1988 to 2002 that the player is active, while contract data is observe only once in 2000. The contract itself, however, may have been signed in any earlier year. Figure 1 shows this schematically. Player A was active from 1988 to 1993, but was not active in 2000 so has no contract information. Player B was active from 1991 to 2002 and a new contract began in 1996; 1995 is his contract year. Player C was active from 1995 to 2001 and a new contract began in 2000; 1999 is his contract. Player D entered in 2001 and has no contract information. The differences in signing date and the corresponding changes in relative performance provide the variation to identify the incentive effects of contract status. Table 1 shows that some contracts were signed as early as 1993 and the typical contract was signed in 1998.

IV. Empirical Result

This section begins with an analysis of the factors that determine the features of a player's contract features like salary and length. Because contract-related incentive effects are the underlying motivation for the predicted changes in performance, it is critical to first establish a link between pay and performance to identify those performance measures that seem most rewarded. If performance, in fact, was not rewarded with better contracts then contract-related incentive effects would be less plausible. The second subsection tests the main empirical predictions related to contract status and performance – effort increases in the contract year, effort falls after a multi-year contract is signed, and the decline increases with contract length and with age. The final subsection examines the ultimate impact of contract-related incentives on the performance of the team. If players really do expend different amounts of effort depending on their contract status, this could affect the team's overall performance.

a) Individual Performance and Wages

The earlier model posits that salary depends on the employer's perception of worker ability. Ability and effort are not easily distinguished, so there should be a link between individual wages and observable performance statistics. In particular, I am interested in whether changes in performance in the contract year are associated with more lucrative subsequent contracts, which would provide the key incentive for players to increase effort in their contract year.

This link can be seen in Equations (4) and (5), which imply:

$$(8)\quad W_{i,t} = W(\mathbf{P}_{i,c-N} \ldots \mathbf{P}_{i,c}) \quad c < t \le c + L$$

where $W_{i,t}$ is the wage in each year over the contract, $\mathbf{P}_{i,s}$, are vectors of past performance for each earlier year, N is the number of years of available data for each player, and each player signs their contract in a different year $c+1$.

The critical advantage of this analysis is the detailed data on individual compensation and individual performance. In contrast, the empirical literature on executive pay and performance ((Murphy (1985, 1986), Jensen and Murphy (1990), Gibbons and Murphy (1992), Kaplan (1994), and Hall and Liebman (1998)), typically examined the link between individual pay and firm performance.

Obviously corporate executives have considerable impact on firm outcomes, but individual data allow a cleaner and more straightforward test of an operational incentive channel.[17]

For this analysis, I am particularly interested in whether above-average performance in the contract year is rewarded with more lucrative, multi-year contracts. I have few priors on the process that employers use to form perceptions of worker ability or to value specific outcomes, however, so I use a very straightforward regression:

$$(9)\quad Z_{i,t} = \beta_1 \overline{\mathbf{P}}_{i,t-N,t-2} + \beta_2 \Delta\mathbf{P}_{i,t-1} + \beta_3 NAGE_{i,t} + \alpha_p + \alpha_j + \alpha_t + \varepsilon_{i,t}$$

where $Z_{i,t}$ are contract features like total pay, length of the contract, and average annual pay that are determined in year t, $\overline{\mathbf{P}}_{i,t-N,t-2}$ is "historical performance" before the contract year (averaged for years t-N to t-2), $\Delta\mathbf{P}_{i,t-1}$ is the "contract year change" in performance ($\Delta\mathbf{P}_{i,t-1} = P_{i,t-1} - \overline{\mathbf{P}}_{i,t-N,t-2}$), and $NAGE_{i,t}$ is the player's age (normalized by subtracting out the average age) to controls for predictable age-related variation in contracts due to seniority or tenure effects.[18] Finally, dummy variables for position (α_p), team (α_j), and year (α_t) control for other factors that affect contract features such as different salaries across positions, the ability of certain teams to maintain higher payrolls than others, or the general trend toward higher valued contracts.

Equation (9) is estimated for each contract feature using a cross-section of 264 players with contract information and a historical performance record.[19] Estimation is via weighted least squares (WLS), with weights equal to the average number of games played before the contract is signed.[20] All standard errors are corrected for heteroskedasticity. Three different dependent variables and two sets of independent variables are used. The dependent variables, $Z_{i,t}$, are contract features – the total value of the contract signed in year t (measured in the log of millions of 1996 dollars), the length of the contract (measured in years), and the annual value of the contract (measured in the log of millions of 1996 dollars). The independent variables are the lagged performance measures $\boldsymbol{P}_{i,s}$ $s<t$, which is either the composite rating (a linear combination of many statistics) or a vector of the most important specific statistics (points scored, rebounds, assists, and blocked shots).

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[17]Fernie and Metcalf (1999) also pursue this strategy when examining the link between performance and pay for British jockeys and find a strong correlation.

[18]To be clear about the timing, the contract is determined in year t. Year $c=t-1$ is the contract year, and years t-N to t-2 are all years prior to the contract year.

[19]This is less than the 349 players with contract information in 2000 because some of these players are new to the league and do not have previous performance records.

[20]Weights are used because some players with limited opportunities can have very noisy statistics. Results are qualitatively similar without weights.

Table 2 shows a strong correlation between historical performance and contract features as players with better performance receive more lucrative and longer term contracts. Moreover, the effect seems to be economically large. A one point increase in a player's historical composite rating is associated with a 13% increase in average annual pay; with a mean salary at about $4 million per year, this amount to over $500,000 in annual salary.[21]

With the vector of individual statistics as independent variables, all are positive and most are significant. In the last column with annual salary as the dependent variables, for example, three are individually significant at the 99% level, and jointly significant at the 99% level. Recall that this controls for the effects of team differences, signing year, and position due to the dummy variables, so this amount of explanatory power is substantial. Again, the magnitudes seem large: a one point increase in historical scoring is associated with an increase in annual salary of the next contract of almost 5%, which is $184,000 at the mean contract.

Age is clearly an important factor: the negative and highly significant coefficient in all regressions shows that older players receive worse contracts, conditional on performance. This goes against the literature on deferred compensation (Lazear and Moore (1986) and Kotlikoff and Gokhale (1992)), where employers use back-loaded contracts as a selection and incentive mechanisms, and likely reflects the relatively ease of mobility of players between teams and the predictable deterioration of skills as players age.[22]

More important for the analysis of contract incentives, the data also clearly show that contract year changes, conditional on historical performances, are associated with more lucrative and longer-term contracts. The change in composite rating is significant at the 99% level in all three regressions. For the individual statistics, they are jointly significant at the 99% level in all three regressions, almost all are positive, and changes in points are clearly the most important factor. Here, a one point increase in average points scored in the contract year raises the annual salary of the next contract by about 7%, or about $280,000. This suggests that employers do put substantial weight on recent performance.

These results show a strong and economically important link between player performance and subsequent pay. This is not particularly surprising, of course, but the fact that both historical performance and recent changes predict contract features suggests a complex process determining employer's perceptions of worker ability where all past information is incorporated and potential moral hazard issues are recognized. A naïve employer, on the other hand, might not understand the

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[21]It is likely that this understates the true effect on income because outside compensation like endorsement contracts and appearance fees are likely to depend on performance.

players' incentives to increase effort in the contract year and might just look at the most recent performance. This does not seem to be the case, although I have no means to test if these prices are right in the sense that future compensation corresponds to expected returns for the employer.[23] In either case, the strong link between contract features and contract year performance provides an operational channel for contract-related incentive effects.

b) Individual Performance and Contract Status

The previous results show that players with improved performance in their contract year are rewarded with more lucrative and longer term contracts, which provides a clear financial incentive for players to increase effort in their contract year and motivates the contract-related incentive hypothesis. A selection and signaling story, however, offers an alternative interpretation. If recent improvement provides a signal to employers about a player's long-term prospects, then this type of correlation might exist without any contract-related incentive effects as players with large upside-potential are rewarded with better contracts.

These two explanations are not mutually exclusive, and one can identify the contract-related incentive effects by examining the changes in performance across the full contract cycle. Under the contract-related incentive interpretation, performance should rise before the contract is signed and decline once the multi-year contract is signed. Under the selection interpretation, performance should continue to improve after the contract is signed. This section presents empirical evidence on the performance profile around the contract year in order to distinguish these explanations and test additional predictions. Maxcy et al. (2002) perform similar tests and reject the notion of strategic performance around the contract cycle for professional baseball players, while Woolway (1997) finds strong evidence of contract-related incentive effects.

Recall that the model is defined in terms of ability, $A_{i,t}$, and effort, $E_{i,t}$, although these are not directly observable. Rather, actual performance is observed where:

$$(10) \qquad \mathbf{P}_{i,t} = P(A_{i,t}, E_{i,t}, \varepsilon_{i,t})\,.$$

and $\varepsilon_{i,t}$ represents all other factors that affect performance, e.g., teammate ability and random error.

The idea of contract-related incentive effects implies that contract status affects effort:

$$(11) \qquad \mathbf{P}_{i,t} = P(A_{i,t}, E_{i,t}(Contract\ Status), \varepsilon_{i,t})$$

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[22] In other regressions not shown, there were no significant interaction effects between performance and age as a determinant of contract parameters.
[23] A similar difficulty is discussed by Prendergast (1999) in the context of the pay and performance literature.

Equation (11) can be readily turned into a regression where performance is compared to indicators of contract status, e.g., one dummy variable for the contract year and another one for the year immediately following the contract year. It is more difficult to control for individual ability, however, which may also vary over time. Estimation with individual fixed effects (FE) can help account for the unobserved component, and a series of dummy variables and age ($A_{i,t} = f(A_i, AGE_{i,t}, YEAR, TEAM)$) are included as explanatory variables to account for predictable variation in performance over a player's career. This suggests the following specifications for estimating Equation (11):

$$(12) \qquad P_{i,t} = \beta_{PRE} PRE_{i,t} + \beta_{POST} POST_{i,t} + \beta_{AGE} NAGE_{i,t} + \alpha_i + \alpha_p + \alpha_t + \alpha_j + \varepsilon_{i,t}$$

where $PRE_{i,t}$ is a dummy variable set equal to 1 in the contract year and zero otherwise, $POST_{i,t}$ is a dummy variable set equal to 1 in the year after the contract year and zero otherwise, and α_i is an individual dummy that is a natural proxy for the permanent component of $A_{i,t}$,. All other variables are defined above.

β_{PRE} and β_{POST} are the coefficients of interest and measure the conditional impact of contract status on a player's performance. The main predictions of the contract-incentive model are $\beta_{PRE}>0$ and $\beta_{POST}<0$ as effort rises in the contract year and falls once the contract is signed. As discussed above, however, a selection effect works in the opposite direction for β_{POST}; if only improving players receive contracts, performance might improve as changes in ability swamp changes in effort.

Table 3 presents results using eight measures of performance as dependent variables – composite rating, points scored, total rebounds, assists, blocked shots, shots attempted, free throws attempted, and minutes played. The composite rating is the preferred measure because it encompasses a wide range of performance attributes into a single, meaningful index. Points, rebounds, assists, and blocks are important individual measures of performance and the evidence in Table 2 points to financial gains, and therefore incentive effects, from improvement in these areas. Shots and free throws attempted are included because they may be a better proxy for player effort, i.e., a player has more control over how many shots he takes than how many he makes. Finally, minutes played are included because they are determined by the coach who will presumably reward overall performance with more playing time, so this variable includes the impact of intangible contributions that might be missed by standard statistics.

Each regression is estimated via WLS with games played as the weights. The regressions include up to 2,646 observations from 1988 to 2002 for the 349 players with multi-year contracts in 2000. Note that $PRE_{i,t}$ and $POST_{i,t}$ can equal one in any year prior to 2001 depending on when the contract was signed, but each equals one in only a single year for each player. All regressions include year, team, and position dummy variables and standard errors are corrected for heteroskedasticity.

The first column in Table 3 uses the summary composite rating as the dependent variable and show a significant increase in performance in the contract year (β_{PRE}>0) and a significant decline in the following year (β_{POST}<0). This is as the theory predicts. Recall that these regressions control for separate team, year, player age, and position effects, and remove individual effects, so the fact that β_{PRE} and β_{POST} are jointly and individually significant is strong evidence of contract-related incentive effects.

The next four columns use the individual performance measures as the dependent variable. Here, the evidence strongly shows improvement in the contract year, but there is no evidence of a post-contract decline. Because these regressions include individual fixed effects, this means that post-contract year performance equals the same as the player's long-run average. Both shots attempted and free throws attempted increase show similar patterns. Finally, minutes played increases in the contract year, suggesting that overall performance does indeed rise as players are rewarded with additional playing time.

Age is negatively related to performance (significant in more than half of the regressions) as performance declines steadily with age due to eroding skills and deteriorating ability. This is similar to Kotlikoff and Gokhale (1992), who report that productivity declines with age for a single Fortune 1000 firm.

These results provide support for contract-related incentive effects. All measures show an improvement in performance in the contract year, but the results are mixed regarding the post-contract decline. With the preferred measure of overall performance, there is a significant decline after the long-term contract is signed, while the individual performance measures are essentially flat. This pattern is more consistent with the hypotheses about contract-related incentive effects than with the alternative selection story. If it were only the case that improving players were receiving contracts, one would expect performance to steadily improve after the contract is signed. In fact, performance after the contract is signed falls or returns back to a player's long-run average, which suggests a change in effort over the contract cycle.

Table 4 provides robustness tests of these results using the preferred composite rating as the measure of individual performance. Column 1 repeats the base regression from Table 3. The next column drops the age variable and all dummy variables, while column 3 just drops the dummy variables. Here, the negative post-contract effect becomes larger and more significant, while the pre-contract effect disappears. This is not surprising: overall performance measures like the composite rating and points scored have been trending steadily downward over this period, so it is difficult for the data to show an increase until the league-wide trend is removed via the year dummy variables. When the dummy variables are include but estimation is via OLS (column 4), β_{POST} remains large and significant, while β_{PRE} becomes much larger, but not quite statistically significant (p-value=0.14). When age is included as a quadratic (column 5) or an indicator of whether the player is on an new team is included (column 6), the results do not change much.

In all regression in Table 4, the data clearly show that information about an individual's contract status is useful in predicting overall performance. The estimates coefficient on the contract status variables are almost always the correct sign and typically statistically significant. Moreover, β_{PRE} and β_{POST} are jointly significant in all cases and the data always reject the null hypothesis that they are equal. This provides substantial and robust evidence of predictable changes in performance over the contract cycle.

The third prediction is that the decline in performance after a contract is signed depends on the length of the contract. *Ceteris paribus*, longer contracts mean that any career concern occurs farther in the future and are thus discounted more strongly, which reduces the incentive to exert effort today. The final prediction is that the post-contract year decline increases with a player's age because older players have relatively small future career concerns. The selection effect, however, works against these predictions as better players are likely to be signed to longer-term contracts or at later ages.

To examine these issues, Equation (12) can be extended with an interaction between the post-contract year dummy variable and the length of the contract, or with interactions between the post-contract year dummy variable and player age. I allow the interactions to enter as both a linear and squared interaction as:

$$P_{i,t} = \beta_{PRE} PRE_{i,t} + \beta_{POST} POST_{i,t} + \gamma_1 POST_{i,t} \cdot L_i + \gamma_2 POST_{i,t} \cdot L_i^2 + \beta_{AGE} NAGE_{i,t} + \alpha_i + \alpha_t + \alpha_j + \varepsilon_{i,t} \tag{13}$$

$$P_{i,t} = \beta_{PRE} PRE_{i,t} + \beta_{POST} POST_{i,t} + \gamma_1 NAGE_i + \gamma_2 NAGE_i^2 + \gamma_3 POST_{i,t} \cdot NAGE_i + \gamma_4 POST_{i,t} \cdot NAGE_i^2 + \alpha_i + \alpha_t + \alpha_j + \varepsilon_{i,t} \tag{14}$$

where L_i is the relative length of the contract (contract length less average contract length).[24 25]

Table 5 reports estimates of the regressions in Equations (13) and (14) for the composite rating. β_{PRE} remains positive and significant in all cases, while β_{POST} is negative in all cases and significant in two cases. The data strongly reject the hypothesis that performance in the contract year and the following year are the same, which supports the earlier results.

Column 1 includes only the linear interaction with contract length and shows longer contracts are associated with a *smaller* post-contract decline. This goes against the moral hazard prediction, and likely reflects a selection effect with better, improving players receiving longer contracts. When the quadratic term is included in column 2, however, post-contract decline increases, which shows the moral hazard of very long-term contracts. There is no evidence that the post-contract decline varies with age. In both the regression with the linear interaction (column 3) and quadratic interaction (column 4), the effect is positive: older players show a smaller decline after a contract is signed.

These results provide support for the model's main predictions that performance improves in a player's contract year and falls afterward. This specific up-and-down pattern around the year the contract is signed is consistent with powerful contract-related incentives, and inconsistent with the alternative selection hypothesis. The secondary predictions of the model – that the incentive effects should fluctuate with contract length and player age – are not well supported. This could reflect either an offsetting selection effect or the lack of power in the data to identify these second-order effects.

c) Individual Performance and Team Performance

The final set of results examines whether these contract-related changes in individual performance affect team outcome. If these performance measures are valuable to the team, one would expect team outcomes to follow the player's performance, rising when many players are in their contract year and falling when many sign long-run contracts. Leonard (1990) and Abowd (1990), for example, found that firms where executives' pay was linked to long-run performance showed above-average firm performance.

Several factors complicate this issue, however, and may drive a wedge between individual and firm performance. Holmstrom and Milgrom (1991) argue that if only some valuable tasks are measurable, incentive effects can lead workers to misallocate resources toward the measurable tasks and away from other, equally valuable ones. Alternatively, quality could suffer under some contract

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[24]Defining contract length relative to the average helps with the interpretation of the results, i.e., β_{POST} is the effect at mean contract length.

structures, e.g., if workers are paid a piece rate (Lazear (1986), Holmstrom and Milgrom (1991), Baker (1992)). Finally, Holmstron (1982) discusses the free-rider problem associated with joint output production by a team when agents who cheat cannot be identified. All of these are potential concerns as players might misallocate their effort toward activities with high individual returns and away from those that might be more beneficial to the team. Whether these perverse incentives are strong enough to actually affect team performance is the empirical question addressed next.

To examine whether changes in contract status and the induced change in individual performance actually affects the team performance, I estimated variants of the following cross-sectional regression:

$$(15) \qquad WIN_j = \alpha + \beta_C SHC_j + \beta_M SHM_j + \varepsilon_j$$

where WIN_j is the number of wins in 2000, $SHC_{,j}$ is the share of players in their contract year in 2000 and SHM_j is the share of players that signed multi-year contracts in 2000, all for team j in year 2000.[26]

If individual performance improves in the contract year and if this positively affects team performance, $\beta_C>0$. Conversely, if individual performance falls immediately after a long-run contract is signed and this negatively effects team performance, $\beta_M<0$. Because SHC_j and SHM_j are shares, the coefficients can be interpreted as follows: α is predicted number of wins for a team with no players in their contract year and no players that just signed multi-year contracts, $\alpha+\beta_C$ is the predicted number of wins if all players are in their contract year, and $\alpha+\beta_M$ is the predicted number of wins if all players just signed multi-year contracts. It is straightforward to estimate this type of cross-section regression, but several caveats deserve mention before discussing the empirical results.

Most important, the contract data is only available for 2000 and I can only estimate Equation (15) for a single cross-section of 29 teams, so omitted variables cloud the interpretation. Certain teams, for example, may have better management skills that determine the player roster, the number of wins, and their contracting strategies.[27] To try to control for this problem, I include other characteristics of the players and of the team. Player characteristics include average length of the remaining contracts of the team and the average age of the team (linear and quadratic) because earlier results show they help predict individual performance, while team characteristics include total team

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[25]Note that Equation (14) includes $NAGE_{i,t}$ directly, while Equation (13) does not include contract length directly. This is because contract length is only observed for those players with a new contract and thus cannot be identified independently of the interaction.

[26]These two shares do not sum to 1 because some players signed multi-year contracts in earlier years that extend beyond 2000.

payroll in 2000 and average wins in the previous five years. This will help, but one would prefer to have information about exogenous changes in these shares and changes in team performance. In addition, this is a test of the joint hypothesis that player performance depends on contract status and that these performance variables help predict team wins.

Table 6 presents results of several versions of Equation (15). The first column shows the simplest regression with only the two contract-related shares as independent variables. As predicted, the data show a positive (though not statistically significant, p-value=0.14) link between team wins and the percentage of players in their contract year and a significant, negative link with the share of players that just signed multi-year contracts. The two variables are jointly significant (p-value=0.013) and suggest that the contract-related incentive effects documented above have a meaningful impact on firm performance. Just these two variables explain about one-quarter of the variation in team wins.

When the player characteristics are included in column two, the estimated impact of the share of players in their contract year increases substantially, while the share of players that just signed multi-year contracts declines only slightly. Both are individually significant and jointly significant. Neither average remaining contract length nor average age is significant. Column 3 includes the total team payroll, while column also adds lagged wins; in both cases, the magnitude and significance of the share in contract year variable falls, although the two contract variables remains jointly significant. As a reference column 5, only includes the team characteristics.[28]

To provide some perspective on the magnitude of these coefficients, consider the following hypothetical experiment. The average team had 15 players on its roster during the 2000 season, 28% of them were in the contract year, 31% just signed multi-year contracts, and the remaining 41% were in other stages of their contract cycle. The estimates in column one suggest that moving one player to contract year status from having just signed a multi-year contract would lead to 4.5 additional wins (4.5=0.067*26.7–0.067*(-42.0)). Given that the average team wins 41 games per season, this is a substantial improvement.

These results open the possibility that employers are naïve in some sense because post-contract moral hazard appears to be hurting the team. That conclusion, however, rests on the

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[27]As a concrete example, Brooks et al. (2001) find that firm performance improves after incentive contracts are adopted, which they attribute this primarily to a signal of private information rather than the gains from better aligned incentives for managers.

[28]As an aside, if one includes only average salary and average wins as explanatory variables, the data show a modest positive relationship between team performance and total payroll. This link, however, is not very robust and vanishes when average age of the players is included. Note also that including lagged wins rather than average wins eliminates the significance of the contracting variables. If one wants to control for omitted management characteristics, average performance is probably a better measure than lagged performance.

assumption that owners are maximizing the number of wins. In reality, owners are surely concerned with team profitability as well and the rational owner may anticipate these changes in effort and price them accordingly. Without data on team revenue and costs, it is hard to draw implications about employer strategies, but one can get some idea by using wins per dollar of total payroll as the dependent variable. The final two columns report estimates. Here, team outcomes also decline with the share of players that just signed multi-year contracts, but there is no impact from the share of players in their contract year.

These results on team performance are tentative due to their cross-sectional nature and lack of information on team profits, but they do suggest that contract-related incentive effects are large enough to affect the outcome of the entire firm. More work on the impact of individual incentives affect firm outcomes is needed.

V. Conclusions

This paper presents a simple theoretical model for interpreting the observed differences in individual performance over a contract cycle. A critical advantage of the empirical analysis is the use of a unique database with individual-level measures of performance, contract status, and compensation. The results show that performance improves in the year before a new contract is signed as workers increase effort to convince employers of their high ability and earn more lucrative long-run contracts. Once the contract is signed, however, overall performance declines, which provides strong evidence that these changes are indeed contract-related incentive effects. Finally, these individual incentive effects affect the performance of the team as the number of wins is positively correlated with the share of players in their contract year, but negatively correlated with the share that just signed multi-year contracts.

Contract-related incentive effects and the ultimate impact on firm success are issues that have received considerable theoretical attention, but data limitations have made empirical tests quite difficult. The finding of considerable contract-related incentive effects in an industry where performance is easy to measure and contract for attests to the practical importance of this issue. These types of moral hazard problems are likely to be even worse where individual performance is harder to measure, where employers have less ability to monitor employee effort, and where individual contracts are more difficult to write. This suggests considerable scope for employees to optimally vary effort to maximize personal gains, even at the expense of firm gains, and the evidence presented here suggest that this is exactly what employees do

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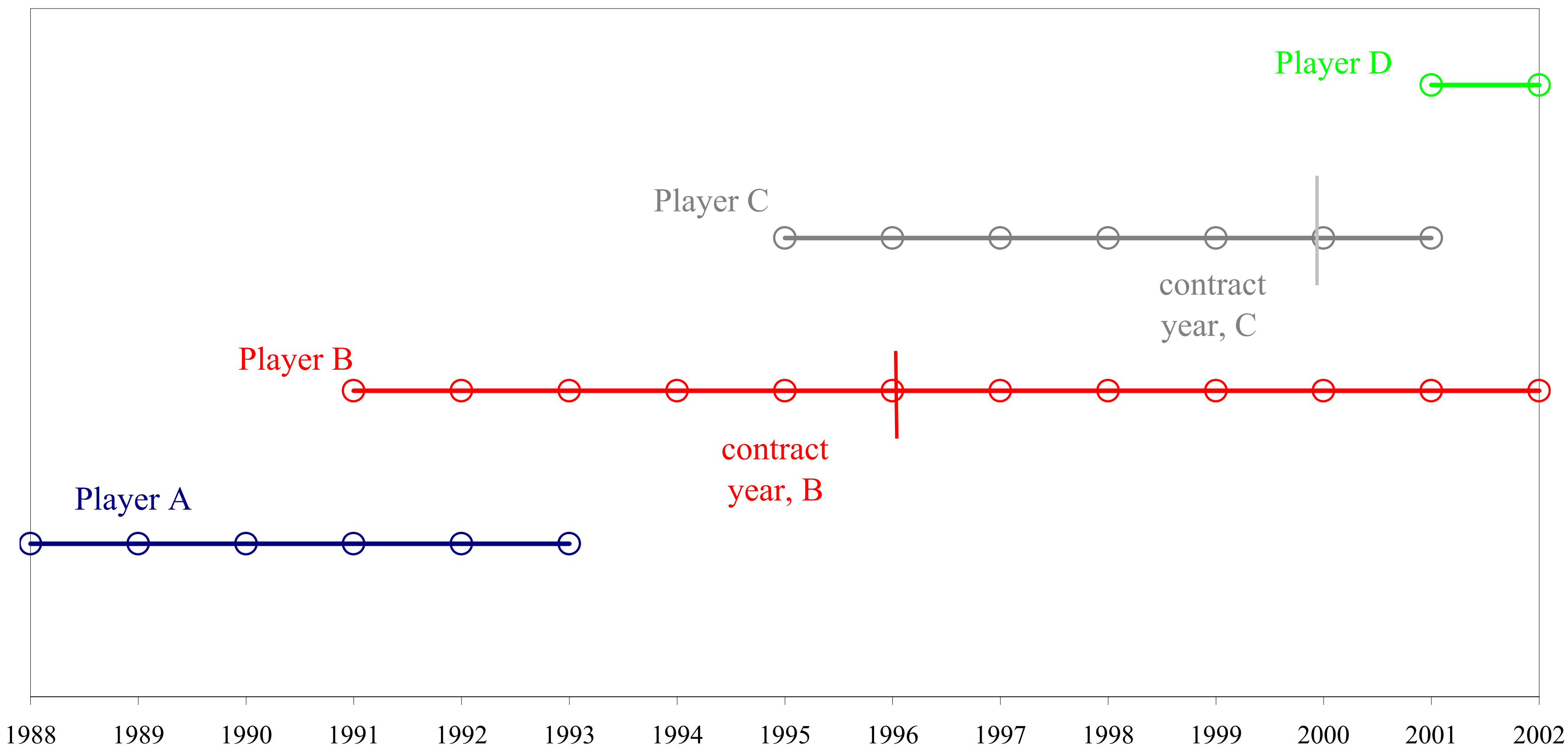
Figure 1: Data Structure



Notes: Schematic representation of data structure. Horizontal lines indicate years that a player was active. Vertical lines represent the year a player began a new contract. The "contract year" is the year prior to beginning a new contract.

Table 1: Summary Statistics

	No. Obs.	Mean	Standard Deviation	Minimum	Maximum
		Performance Variables			
Points	2,646	10.3	6.2	0.0	32.1
Rebounds	2,646	4.5	2.8	0.0	16.3
Assists	2,646	2.4	2.1	0.0	14.5
Blocks	2,646	0.6	0.7	0.0	4.6
Composite Rating	2,646	18.8	5.1	-2.3	43.5
Season	2,646	1997.4	3.6	1988.0	2002.0
		Contract Information			
Signing Date	349	1998.6	1.5	1993.0	2001.0
Length	349	4.4	1.8	2.0	12.0
End Year	349	2003.0	1.6	2001.0	2007.0
Contract Value	349	21.2	25.4	0.7	193.4
Annual Salary	349	4.0	3.7	0.2	20.3

Summary statistics for performance variables include all player/year observations for 15 seasons from 1988 to 2002 for 349 players that have signed multi-year contracts. *Points*, *Rebounds*, *Assists*, and *Blocks* are average per game values for a season. *Composite Rating* is for the season. *Season* is the observation year. Summary statistics for contract information include one observation per individual and is reported for all individuals that signed a multi-year contract. Data include the year the contract was signed (*Signing Date*), the length of the contract (*Length*), the last year under contract (*End Year*), total value of contract (*Contract Value*), and value per year (*Annual Salary*). *Contract Value* and *Annual Salary* are in millions of 1996 dollars.

Table 2: Contract Features and Individual Performance

	Contract Value		Contract Length		Annual Salary	
Historical Performance						
Composite Rating	0.169 ***		0.117 ***		0.132 ***	
	(0.018)		(0.026)		(0.012)	
Points		0.047 **		0.006		0.046 ***
		(0.020)		(0.032)		(0.012)
Rebounds		0.158 ***		0.158 *		0.107 ***
		(0.055)		(0.089)		(0.033)
Assists		0.210 ***		0.139		0.167 ***
		(0.057)		(0.093)		(0.034)
Blocks		0.186		0.270		0.118
		(0.169)		(0.276)		(0.101)
Contract Year Change						
Composite Rating	0.120 ***		0.106 ***		0.081 ***	
	(0.024)		(0.035)		(0.016)	
Points		0.107 ***		0.123 ***		0.073 ***
		(0.027)		(0.044)		(0.016)
Rebounds		0.035		-0.054		0.024
		(0.066)		(0.107)		(0.039)
Assists		0.084		0.065		0.065
		(0.070)		(0.115)		(0.042)
Blocks		0.359		0.312		0.249 *
		(0.226)		(0.368)		(0.135)
Age	-0.095 ***	-0.104 ***	-0.214 ***	-0.213 ***	-0.040 ***	-0.049 ***
	(0.018)	(0.017)	(0.027)	(0.028)	(0.012)	(0.010)
Jt. Sig. Historical Performance		0.000		0.000		0.000
Jt. Sig. Contract Year Jump		0.000		0.001		0.000
Adjusted R^2	0.52	0.62	0.56	0.58	0.48	0.65
No. Obs.	264	264	264	264	264	264

Notes: Dependent variables are *Contract Value* (in logs), *Contract Length* (in years), and *Annual Salary* (in logs). Results are from weighted least squares regressions with year, team, and position dummy variables. Weights are equal to the average number of games played prior to contract year. Robust standard errors in parentheses. *Contract Value* and *Annual Salary* are in logs. *Historical Performance* variables are averages for all years prior to the contract year. *Contract Year Change* variables are differences between contract year performance and historical performance. *Jt. Sig. Historical Performance* reports the p-value associated with an F-test of the joint significance of the *Historical Performance* variables. *Jt. Sig. Contract Year Change* reports the p-value associated with an F-test of the joint significance of the *Contract Year Change* variables.

***, **, * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Table 3: Relative Performance and Contract Status
Major Indicators of Performance

	Composite Ranking	Points Scored	Total Rebounds	Assists	Blocked Shots	Shots Attempted	Free Throws Attempted	Minutes Played
Pre	0.381 **	0.847 ***	0.295 ***	0.161 **	0.054 ***	0.587 ***	0.273 ***	102.924 **
	(0.172)	(0.244)	(0.095)	(0.075)	(0.020)	(0.184)	(0.078)	(41.468)
Post	-0.325 **	0.164	0.165 *	0.042	0.026	0.170	0.083	59.341
	(0.146)	(0.215)	(0.091)	(0.059)	(0.018)	(0.169)	(0.067)	(36.636)
Age	-0.374 ***	-0.168 ***	-0.019	-0.017	-0.014 ***	-0.093 *	-0.081 ***	-6.612
	(0.038)	(0.064)	(0.024)	(0.023)	(0.005)	(0.048)	(0.019)	(9.552)
Jt. Sig. of Pre and Post	0.001	0.002	0.005	0.097	0.019	0.006	0.002	0.029
Test of Pre=Post	0.013	0.013	0.248	0.150	0.195	0.050	0.029	0.352
Adjusted R^2	0.776	0.699	0.761	0.818	0.851	0.698	0.731	0.537
No. Obs.	2,646	2,646	2,646	2,646	2,646	2,646	2,646	2,646

Notes: All results are from weighted fixed effects (player) regressions with year, team, and position dummy variables. Weights are equal to the number of games played by each player in the year. Robust standard errors are in parentheses. *Pre* is a dummy variable set equal to 1 in the contract year; equal to 0 otherwise. *Post* is a dummy variable set equal to 1 in the year the contract is signed; equal to 0 otherwise. *Jt. Sig. of Pre and Post* reports the p-value associated with an F-test of the null hypthesis that $\beta_{PRE}=\beta_{POST}=0$. *Test of Pre=Post* reports the p-value associated with a test of the null hypothesis that $\beta_{PRE}=\beta_{POST}$.

***, **, * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Table 4: Robustness Tests of Link between Composite Rating and Contract Status
Dependent Variable: Composite Rating

	Base Regression					
Pre	0.381 **	-0.012	0.065	0.303	0.359 **	0.406 **
	(0.172)	(0.178)	(0.161)	(0.204)	(0.163)	0.171
Post	-0.325 **	-0.800 ***	-0.596 ***	-0.370 **	-0.179	-0.262 *
	(0.146)	(0.139)	(0.131)	(0.176)	(0.135)	0.149
Age	-0.374 ***		-0.411 ***	-0.385 ***	-0.267 ***	-0.360 ***
	(0.038)		(0.019)	(0.041)	(0.036)	0.038
Age^2					-0.048 ***	
					(0.003)	
Traded						-0.437 ***
						0.117
Year Dummy Variables	Y	N	N	Y	Y	Y
Team Dummy Variables	Y	N	N	Y	Y	Y
Position Dummy Variables	Y	N	N	Y	Y	Y
Weights	Y	Y	Y	N	Y	Y
Jt. Sig. of Pre and Post	0.001	0.000	0.000	0.016	0.014	0.001
Test of Pre=Post	0.000	0.000	0.001	0.005	0.003	0.000
Adjusted R^2	0.776	0.698	0.768	0.702	0.805	0.777
No. Obs.	2,646	2,646	2,646	2,646	2,646	2,646

Notes: All results are from weighted fixed effects (player) regressions. Weights are equal to the number of games played by each player in the year. Robust standard errors are in parentheses. *Pre* is a dummy variable set equal to 1 in the contract year; equal to 0 otherwise. *Post* is a dummy variable set equal to 1 in the year the contract is signed; equal to 0 otherwise. *Jt. Sig. of Contract Variables* reports p-value associated with an F-test of the joint significance of *Pre* and *Post*. *Test of Pre=Post* reports the p-value associated with a test of the null hypothesis that $\beta_{PRE}=\beta_{POST}$.

***, **, * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Table 5: Tests for Interaction Effects between Contract Status, Contract Length, and Age
Dependent Variable: Composite Rating

	Contract Length Interaction Effects		Age Interaction Effects	
Pre	0.370 **	0.381 **	0.381 **	0.357 **
	(0.173)	(0.173)	(0.173)	(0.163)
Post	-0.356 **	-0.214	-0.312 **	-0.279
	(0.144)	(0.165)	(0.145)	(0.173)
Age	-0.373 ***	-0.372 ***	-0.381 ***	-0.271 ***
	(0.038)	(0.038)	(0.038)	(0.036)
Age^2				-0.049 ***
				(0.003)
Post*Length	0.142 *	0.195 ***		
	(0.073)	(0.074)		
Post*Length^2		-0.040		
		(0.022)		
Post*Age			0.071 **	0.043
			(0.029)	(0.030)
Post*Age^2				0.006
				(0.006)
Jt. Sig. of Contract Variables	0.000	0.000	0.000	0.009
Test of Pre=Post	0.000	0.004	0.000	0.003
Adjusted R^2	0.776	0.776	0.776	0.805
No. Obs.	2,646	2,646	2,646	2,646

Notes: All results are from weighted fixed effects (player) regressions with year, team, and position dummy variables. Weights are equal to the number of games played by each player in the year. Robust standard errors are in parentheses. *Pre* is a dummy variable set equal to 1 in the contract year; equal to 0 otherwise. *Post* is a dummy variable set equal to 1 in the year the contract is signed; equal to 0 otherwise. *Length* is the number of years in the contract, measured in years and normalized by the average contract length. *Age* is player's age, measured in years and normalized by the average age. *Jt. Sig. of Contract Variables* reports p-value associated with an F-test of the joint significance of *Pre*, *Post*, and the *Post* interactions. *Test of Pre=Post* reports the p-value associated with a test of the null hypothesis that $\beta_{PRE}=\beta_{POST}$.

***, **, * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Table 6: Team Performance and Player Contract Status

	Dependent Variable: Team Wins					Dependent Variable: Wins per Dollar of Payroll	
Share in Contract Year	26.701	60.254 **	14.843	9.784		-0.026	0.213
	(17.647)	(29.137)	(16.212)	(16.962)		(0.388)	(0.352)
Share with Multi-Year Contract	-42.037 ***	-31.542 *	-39.676 **	-42.752 **		-0.760 *	-0.867 **
	(17.755)	(17.452)	(18.715)	(17.676)		(0.443)	(0.387)
Average Remaining Contract Length		-8.805					
		(35.882)					
Average Remaining Contract Length^2		4.232					
		(6.127)					
Average Age		-14.089					
		(22.436)					
Average Age^2		0.308					
		(0.406)					
Log Total Payroll			15.558 **	12.026 *	17.863 *		-0.461 ***
			(6.545)	(7.014)	(10.470)		(0.166)
Average Wins, 1995-1999				0.346 *	0.318		0.005
				(0.202)	(0.222)		(0.005)
Jt. Sig. of Contract Shares	0.013	0.046	0.049	0.049		0.207	0.064
Adjusted R^2	0.221	0.365	0.275	0.327	0.168	0.076	0.200
No. Obs.	29	29	29	29	29	29	29

Notes: Results from oridnary least squares regressions. Robust standard errors in parentheses. Constant not shown. *Share in Contract Year* is the percent of individuals on a team with a contract that expires in 2000. *Share with Multi-Year Contracts* is the percent of players on a team with a multi-year contract that began in 2000. *Average Remaining Contract Length* is the average number of years on remaining on the contract of all players on the team in 2000. *Average Age* is the average age of players on the team in 2000. *Log Total Payroll* is the mean annual salary of individuals on a team in 2000. *Average Wins* is the average number of team wins from 1995 to 1999. J*t. Sig. of Contract Shares* reports p-value associated with an F-test of joint significance of *Share in Contract Year* and *Share with Multi-Year Contracts* .

***, **, * indicate statistical significance at the 1%, 5%, and 10% level, respectively.