Moral hazard in long-term guaranteed contracts: theory and evidence from the NBA

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Abstract

In sports literature and reporting the 'contract-year effect' has been treated as anything ranging from an old wives tale to a well-established fact. We note many instances of players' play falling off after landing a huge contract. In this paper we analyze the effect of being in the final year of the contract on player performance (as measured by the NBA efficiency index and using PER rating for a robustness check). Using the set of all NBA players from 1999 onwards we use a fixed effects regression model to determine that being in the last year of a contract causes a player to perform significantly better than in the year prior and that this effect is non-linear over the duration of the contract. We find that this effect is reduced for more experienced players- as players get further into their careers the change in performance level tends to flatten. We postulate a simple game theoretic model that forms the basis for and is consistent with the empirical results. This paper makes a contribution to the economics literature on career concerns and long-term contracts and should be of interest to sports agents, teams and athletes.

Introduction

The world of sports is littered with instances of athletes outperforming their past selves in the last year of guaranteed contracts. In fact this is now a widely accepted phenomenon and is referred to in sports journalism and writing as the 'contract year effect'. To the economist what makes this scenario particularly compelling is that teams routinely dole out lucrative long-term contracts to players on the basis of one or two good years and often see them flounder after signing the new contracts. This begs the question of whether teams are being repeatedly fooled and whether this can be a credible long run equilibrium.

In general the presence of moral hazard in incomplete contracts ((i.e., when contracts do not specify a menu of payments contingent on documentable levels of effort or performance) suggests that employers will prefer short-term contracts in settings where the length of the contract is part of the negotiation. Labor markets, however, are rife with examples of firms and workers agreeing to incomplete contracts that stipulate a guaranteed wage for a specified multi-year duration. For instance, consultants are frequently hired for a predetermined salary and multi-year duration. Contracts for junior academic faculty often include a guaranteed salary throughout a standard length of service. In several European countries, the only lawful alternative to non-permanent hiring is a "fixed-term" contract that specifies guaranteed payment over a negotiated duration. This type of fixed-term contract is similar to those signed by many professional team-sport athletes. Before the end of these contracts, individuals are evaluated for reappointment and a new contract is negotiated.

In this paper we investigate whether these moral hazard concerns and the contract year effect is a statistically significant determinant of performance or whether it is merely a mirage caused by an excessive focus on isolated instances. We find strong evidence that the effort of NBA players increases monotonically as their contracts near completion---a pattern that can be explained by our model of contracting. Fixed-effects estimates indicate that performance (as measured by the NBA efficiency score, which combines several performance statistics into a single index) in the final year of a multi-year deal is approximately 10% higher than in the year prior. Moreover, our point estimates indicate that effort is a non-linear function of the number of years until contract renewal, with performance in the third-to-last year of a contract falling only an additional 5%, and with no statistically significant differences in effort when a player has four or more years remaining in his contract. Estimating the model excluding player fixed effects fails to find any adverse effort incentives associated with long-term contracts, implying that unobserved heterogeneity is an important source of bias.

We view this sector as a suitable setting for this kind of analysis for several reasons. First, the extensive (and oftentimes public) information on individual and firm characteristics makes sports an ideal setting for testing many labor market phenomena (Kahn [2000]). As opposed to other professional sports, which include many incentive-based, non-guaranteed contracts, basketball has simple, fixed-wage contractual structures and rarely uses incentive clauses based on achievement. Second, basketball players of all positions are evaluated roughly uniformly across a variety of productivity categories. This is distinct from corporate employees and other professional athletes, whose job performance and productivity can be measured differently (or cannot be compared at all) depending on their position, job title, or the organization to which they belong. Finally, the bargaining between team owners and players (via their agents) is well known.

Theoretical Discussion and Numerical Simulation

We model the interaction between player and team as a 3-period principal-agent game. The principal is risk neutral while the agent is risk averse. We view this as being a reasonable assumption given the short career spans of athletes and this will be crucial in deriving our equilibrium. In the 3-period game the player chooses effort in each period though the salary for that period is negotiated prior. The output (outcome) is realized at the end of every period and depends on the player's (unknown) inherent ability, the effort level exerted by the player and a random component. The player and the team have some prior belief on player ability and this is updated in Bayesian fashion by the team at the conclusion of every period (ultimately only the team's belief on player ability matters but we would like to abstract away from any asymmetric information considerations). Since the player is guaranteed a pre-determined wage for the period in question, the only incentive to put forth effort comes from the ability to affect future wages.

The 2 most relevant contract structures to compare in this setup are where the player and team negotiate a multi-period contract that covers the first 2 periods of the player's life versus one which covers a single period with a new contract to be negotiated for period 2. Signing a 3 period guaranteed contract up front will never make sense for the team because this will ensure that any rational player will put forth zero effort over all 3 periods since there are no future contracts to be affected. It is important to remind ourselves at this stage that even when a player puts forth zero effort a positive output can still be realized because of the player's inherent ability and the linear nature of the production function (output=unobserved ability+ effort+ random individual specific shock).

The first significant result that we derive is that if the player signs a guaranteed contract spanning 2 periods then his effort level will increase over the span of the contract i.e. effort and therefore performance will be greater in period 2 than in period 1 (ex-ante given the mean zero random component). This is simply because any effort exerted by the player in period 1 will only benefit him in period 3 when he is searching for a new contract. Given that he discounts the future he will tend to relax in period 1 and work harder in period 2 when his contract expiry is imminent.

The second noteworthy result is that the overall effort level exerted in 2 one-period contracts is less than the cumulative effort exerted in the two-period contract. Thus, all else being equal, signing single period contracts over the duration of the player's lifetime should be optimal for teams. However at this point the agent's risk aversion comes into play. The player values security and is willing to make per-period wage concession in order to gain a longer guaranteed contract. This concession is able to compensate the team for the loss of productivity that result from the lower effort levels in a multi-period guaranteed contract. Numerical simulations of our model show that for reasonable parameter values the player and team can come to an agreement where signing a 2 period deal is mutually beneficial i.e. Pareto efficient.

While we do not explicitly test for the per-period wage concession given by players to teams in exchange for security anecdotally we know it to be true in many cases. The most recent example perhaps is Richard Jefferson opting out of the last year of a contract that paid him about 14 million dollars annually to re-sign with the Spurs for an annual salary that is substantially less but has more guaranteed years tacked on (4 years 38.8 million approximately).

At this stage it might be instructive to give a brief word on the underlying logic and intuition behind the theoretical construct. Every time the team and player come to the negotiating table there is some ex-ante belief about the player's underlying ability (the player might know it perfectly). The wages are then calculated on the basis of the expected level of output that the player will generate in the periods spanning the contract. Since the output is partly affected by the level of effort the player chooses to exert these calculations are done based on the *maximum level of incentive compatible effort* that the player can be expected to put forth. The fact that incentive compatibility is satisfied means that the player will choose to put forth this level of effort rather than deviate to a lower level. The team (the market) retains the ability to punish the player in future periods by bracketing him as a lower ability player if the performance level is very far off what is expected.

The last relevant result that we derive from our simulation is that the incentive for more experienced players to vary their effort levels over the duration of their contract is lower than relative newcomers. This is because the larger the number of observations that the team has for a player the more precise idea they have of true underlying player ability. If the ability level is relatively well known then the team's ability to punish the player in future periods for poor performance is lower.

While the theory model abstracts from a number of real world-issues such as the Collective Bargaining Agreement, the presence of multiple teams, complementarities between players etc it provides very useful insight into the bargaining process between an individual player and a particular team. We also use it to generate the testable implications that form the core of this paper-the contract year effect. And lastly we are able to justify the presence of multi-period contracts in the presence of moral hazard concerns.

Data, Empirical Analysis and Results

The central question we are interested in addressing is whether the number of guaranteed years left in the contract significantly affects player performance. Most models involving rational agents would have players putting forth more effort when the incentive to do so for lucrative future contracts is highest and this is discussed in the theoretical section below. The focus of the empirical section of the paper is to quantify the change in effort incentives within a long-term deal, controlling for confounding factors. To do so, we focus on the agency relationship between National Basketball Association (NBA) players and team ownership. We have compiled a unique dataset containing information on 654 NBA players, their contractual terms, annual performance across several dimensions, information on team performance, and physical characteristics. The data were collected from a variety of sources. First, we compiled player characteristics and performance statistics from Sports-Reference Inc., which compiles information on professional athletes. We obtained data on NBA player characteristics including height, weight, position played, team, where the player was selected in the NBA draft, the first year in the league, college attended, and birth date. Contract information from 2000 to 2006 was primarily derived from the *USA Today* NBA contract database, which gives the annual salary, and contract start and end dates for every player in the league. Using this information together with additional publicly available sources, we assigned contract information prior to 2000 for each player for all years possible (1991 was the earliest). Our dependent variable throughout is the NBA efficiency index as found on the NBA.com website- to check the robustness of our results we undertake a similar exercise with PER created by John Hollinger.

In all, we have 2,260 player-year observations, which are derived from an unbalanced panel of 654 players. The average player in our sample is 6 feet 7 inches tall, was the 25th selection in the NBA draft, is observed for 3.5 years (max 13) throughout at least part of 2 contracts (max 5). Players enter the sample at mean age of 25 with almost 4 years of professional experience. The dominant racial category of our sample is American-born black; however, about a quarter of the sample is either American-born white (12.0%), or of "other" racial composition (10.7%), which overwhelmingly includes foreign-born players.

Our central hypothesis is that player effort and as a consequence performance will improve as the expiry date of the current contract nears. While we run a simple OLS regression of performance on years remaining as a baseline case there are some obvious concerns that would arise with such a specification. The most significant of them of course is that observed player characteristics cannot completely control for player ability. However the fact that we have multiple observations for 90% of the players in our sample enables us to run a fixed effects model that eliminates concerns of time-invariant unobserved individual heterogeneity. We also control for the duration and magnitude of the contract since better players are often the recipients of better contracts.

The main results are presented in table 1. Of particular interest are columns [2] and [3] which show non-linear regressions of performance on years remaining in the contract. In column (2) we allow for the number of years remaining in the contract to have a non-linear effect on output. Indeed, one plausible scenario is that the number of years remaining in the contract is negatively associated with performance, but that the marginal decrease in effort is a diminishing function of the number of years remaining in the contract. In this example, the linear prediction estimated in column (1) would underestimate the marginal moral hazard for initial increases in contract duration, and overestimate the marginal moral hazard effect in the early years of a long contract.

The coefficients imply just that---the largest decreases in effort are associated with initial movements away from the termination date. The first two coefficients reported in column (2) suggest that, all else equal, a player's effort in the penultimate year of his contract is 7% lower than effort in the final year of the contract. Similarly, effort in the player's third-to-last year of the contract is 5% lower than in his penultimate contract year, and effort in his fourth-to-last contract year is an additional 2% lower than in his third-to-last year. Although the coefficients in this model imply that output tends to rise for sufficiently large numbers of years remaining, the effort effects beyond year 4 are not statistically significant.

Column (3) reports the coefficients from a regression of log performance allowing for both a non-linear effect of years remaining and for an interaction between a player's experience and number of years remaining in his contract. The coefficient on the interaction between years remaining and experience is positive and statistically significant, implying that the adverse effort effect of a multi-period contract is reduced for more experienced players.

The reported coefficients allow for comparative statics of the output effect of a longer-term contract for a player at two points in his career. For example, the coefficients suggest that the performance of a player with two years of experience and in the penultimate year of the contract will be 15% less than the same player in the final year of his current contract. This output differential is approximately twice as large as would be the case for the same player with 6 years of experience, whose output if playing the penultimate contractual year would be 8% less than if playing in the ultimate year. In addition, the coefficients imply that the within contract effort fluctuations approach zero for players with just over 10 years of experience. This finding conforms to our theoretical results. Because the market has a history of outcomes on which to base its estimate of ability, the precision of this estimate will be relatively high. The outcome of any singular period will have a relatively small impact on the beliefs about ability. Second, the performance of older players affects a shorter stream of future wages and therefore the present discounted benefit of effort exertion is relatively low. For these reasons, the maximum incentive compatible level of effort is reduced.

TABLE 1

Regression results of ln (Efficiency) on player characteristics and years remaining in current contract

	Fixed Effects			OLS
Independent Variable	(1)	(2)	(3)	(4)
Years remaining	-0.0219*	-0.0870**	-0.2165**	0.0246
	[-2.2]	[-3.5]	[-6.6]	[0.7]
Years remaining squared	--	0.0106**	0.0161**	-0.0059
		[3.5]	[5.1]	[-1.8]
Experience	-0.0683*	-0.1026*	-0.1640**	-0.0011
	[-5.1]	[-6.2]	[-8.0]	[0.1]
Team-specific experience	--	0.0655**	0.0571**	0.0844**
		[6.1]	[5.3]	[7.8]
Years remaining × experience	--	--	0.0167**	0.0050*
			[6.6]	[1.9]
Salary	0.0055**	0.0033**	0.0032**	0.0109**
	[4.3]	[2.6]	[2.5]	[8.6]
Total duration of current contract	0.0355*	0.0310*	0.0304*	0.0217
	[2.3]	[2.1]	[2.1]	[1.1]
Superstar	--	--	--	0.2124**
				[3.5]
R-squared	0.1168	0.1459	0.1692	0.3817
N	2,260	2,260	2,260	2,260
ρ	0.7863	0.8248	0.8579	--

NOTE*t*-statistics derived from robust standard errors reported in brackets; All regressions include team dummies and*T-1* year-specific dummies. The OLS results additionally include individual dummies for a variety of player characteristics; 1 Efficiency score is a measure of player output as discussed in the text;* and ** denote statistical significance at $p < 0.05$ and $p < 0.01$, respectively

In Table 2, we present the results of the performance effect of being in the first or last contract year-which in some sense is where the action really is. All reported coefficients are derived from fixed-effects (within-group) estimation, which includes all covariates reported in column (3) of Table 1. We exclude in this estimation, however, the experience x years remaining interaction terms. In particular, the results reported in Panel A are derived from a version of estimation equation (estimate), substituting dummy variables denoting a player in the first year or last year in a contract, for the continuous measure of years remaining in the contract. We find that players score 10 percent fewer efficiency points per game in the first year of their current contract, and 7 percent more efficiency points in the last year of their contract relative to all other years. These effects are statistically significant, and are similar to the results found in Table 2 and Figure 3, above. The results are larger in magnitude than findings in previous studies such as Berri and Krautman [2006] who use a smaller sample size of NBA players to find only a 1 percent decrease in output associated with being in the first year of a contract.

In Panel B, we select the sub sample of players in the last year of their contract, for whom we also have data on the first year of the subsequent contract (714 player-year observations). Using only these two observations, we estimate a fixed-effects model with a dummy variable that takes the value of 1 if the player is in the first year of a new contract. We find that relative to the year prior (i.e., the final year of the previous contract), player productivity falls by 17%, lending further support to the hypothesis of decreased effort subsequent to signing a new contract. We recognize the potential selection bias in panel B of Table 2. Namely, if the only players who are able to continue in the league are players who had large positive random output shocks in the final year of their contract, we would expect such a large shock to be unlikely to occur in the subsequent year. Nevertheless, we view this estimation as a useful illustration and robustness check.

TABLE 2

Fixed effects egression results of ln(Efficiency) conditional on a player being in the first or last year of the current contract.

	Coefficient	Std. Error
A. Full sample (N=2,260)		
First year of a contract	-0.0694**	0.0256
Last year of a contract	0.0645*	0.0286
B. Sample with two consecutive contracts (N=714)		
First year of subsequent contract relative to last year of prior contract	-0.1598**	0.0470

NOTE–The models control for all variables in Table 1; Robust standard errors reported,1
* and ** denotes statistical significance at *p*<0.05 and p<0.01, respectively

Summary and Conclusion

It is a commonly observed labor market phenomenon that individuals tend to exert more effort as the fiscal year comes to a close, as case deadlines approach, and as year-end performance reviews take place. Anecdotally, workers are less industrious the more distant the deadline (case in point is this version of the paper being finished at 3.30 pm EST for a 5 PM deadline). Our results lend theoretical support to this notion, even in the presence of career concerns. The empirical results provide some of the first quantitative estimates and a characterization of the expected magnitude of effort variation as these deadlines approach. Although this paper analyzes effort fluctuation in a particular type of employment contract, we expect that our results carry out quantitatively to any industry or employment contract in which the workers are aware of the timing of important dates.

To the extent that multi-period contracts give reduced effort incentives, one might wonder if there is any economic justification as to why NBA contracts, and those in other labor markets, are written in this fixed-wage manner. Indeed, an optimal contract should include all (free) contingencies that provide information regarding the agent's (hidden) actions. The use of incentive-laden contracts, for instance, which offer performance bonuses contingent on output each year, could serve the dual purpose of allowing for a more precise proxy of the agent's underlying ability, and to offset the effect of shirking in the early years of the contract. The use of these incentive contracts in the NBA, however, is minimal. Holmstrom and Milgrom [1987, 1991] suggest that one reason why real world incentive schemes are relatively rare may be that when an agent's "output" is multidimensional, there may exist efficiency reasons for paying fixed-wages because any attempt to specifically engineer incentives to motivate hard work in every period may conflict with other team or league-wide profitability goals. Thus, including an array of bonuses is not free since their presence may give rise to new sources of inefficiencies. Including additional year-by-year player bonuses in the NBA for surpassing a pre-specified points-scored threshold, for instance, may motivate the player to shoot at every opportunity which, in-turn, conflicts with sound teamwork that is valued by fans and is critical for overall franchise success. In the Holmstrom-Milgrom model of multitasking, the ability to separate job tasks among workers is essential for such incentives to be efficient.

Given the portfolio of within-contract effort that we find theoretically and empirically, another puzzle is why the principal in our model weights performance in every period equally. It seems that the principal could induce constant (high) effort by announcing that when the time comes for re-contracting, she will use a weighting formula that puts more emphasis on performance in early periods of the contract. There are two potential problems with this strategy. First, there is no commitment by firms to future contracts. In addition, announcements of this kind are not renegotiation proof---there is nothing to prevent the principal, for instance, from announcing a change to her weighting scheme that puts more emphasis on period 2 output, once period 1 has transpired, and so on. Any alternate weighting scheme has the additional effect of reducing the insurance gains to the agent. Thus, such an alternative may lead to fewer observed long-term contracts, since agents will be less willing to make the necessary wage concessions.

We conclude by answering the question that was put forth at the start of this paper- are teams being fooled repeatedly and is this an equilibrium of this market? The answer to that question is quite simply, no. Teams perfectly anticipate the level of effort the athlete will exert over the duration of the contract. While we do not expect a completely literal interpretation of our results they do point to the teams anticipating the level of effort and performance improving over the life of the contract. This is especially true when signing younger players since more established players tend to exert a steadier level of effort. As a rational agent in our model the player chooses a level of effort such that the contemporaneously incurred cost of his exertion is equal to the benefit that he derives from a more lucrative contract further down the road.

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