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Katie Stankiewicz, '09
Illinois Wesleyan University

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By: Katie Stankiewicz
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Research Supervisor: Dr. Michael Seeborg
Illinois Wesleyan University

Abstract: The goal of any professional athlete is to receive a multi-year contract that guarantees them a salary for multiple years. However, a concern that fans, coaches and owners all share is that when a player receives a multi-year contract they may have a strong incentive to shirk. Shirking is when a player purposely does not perform to the best of his ability and may occur when a player has a guaranteed salary. The goal of this paper is to determine if a Major League Baseball player with a multi-year contract will show any pattern of shirking throughout the contract. Each of the fifty players has a four year contract and the theories of moral hazard and asymmetric information suggest that a player may shirk during the contract until the last year. Descriptive statistics and OLS regression results provide evidence that Major League Baseball players with four year contracts do not have a pattern of shirking. Job security, above market wages and monitoring may be the important concepts explaining why there is no evidence for shirking.

I. Introduction

"The experience of individual clubs, and the industry as a whole, is that for whatever reason, the player's performance is not the same following the signing of a new multi-year contract." This quote from Dan O'Brien, the former vice president of negotiations for the Cleveland Indians, represents the common perception that many people, from owners to fans, have of current Major League Baseball (MLB) players (Berri and Krautmann, 2006). Multi-year contracts provide a player with a strong sense of security which people such as Dan O'Brien believe may also result in the player shirking.

Shirking is when a player purposely does not perform to the best of his ability and may occur when a player has a guaranteed salary. A longer contract gives a player more opportunity to shirk without losing his salary. A player is considered shirking when he does not put all of his effort into the training, workouts, or even his games. He can shirk during the season as well as during the off-season. A benefit of shirking for a player is that the player may extend his career because he is not putting his body through as extreme measures. Also, shirking during some part of his contract and not others may give the appearance that a player is improving or a better player than he really is. However, even though there are benefits of shirking to the player, fans and owners have an interest in making sure a player is not shirking. Since the owners and fans are spending so much money on the player they want to ensure that they are receiving the best return for their investment. In other words, owners and fans expect MLB players to perform to their potential in every game.

The focus of this paper is to see if a multi-year contract provides an incentive for a MLB player to shirk. Multi-year contracts were not common in MLB until after free agency was developed in 1977. Today these contracts are rarely used for a player who has below average skills, little experience, or is nearing his retirement age. However teams still offer these types of contracts because it helps the team avoid a high amount of player turnover. A multi-year contract is important because teams have to pay the player the amount specified in the contract even if the player does not meet performance expectations, becomes injured and cannot play, or is released from the team (Meltzer, 2005 and Dinerstein, 2007). This study uses productivity measures to determine if a player actually does shirk when he has a multi-year contract.

The negotiation status of a player affects the ability of teams and players to negotiate contracts. Contract lengths for players that have been in the majors for less than six years are not determined by free negotiations. Owners have an advantage over the players during these first six years since players are not able to freely move around the league. As a result, the data in this paper only includes players that have been in the league for more than six years and are thus classified as "free agents."

Moral hazard and asymmetric information theories, as well as human capital theories, are the underlying theories for evaluating the effect of a multi-year contract on a player's productivity. These theories may create different incentives for a player to decide if he wants to shirk or not. The hypothesis for this paper is that the concepts of moral hazard and asymmetric information cause a player to shirk during the middle years of a contract until the last year when a player's productivity begins to increase. To test this hypothesis an OLS regression is run with the productivity of a player as the

dependent variable and each contract year (as well as control variables) as the independent variables.

However, management may have discovered ways to prevent a MLB player from shirking. By using techniques, such as incentives and monitoring, owners could successfully thwart a player's attempt to shirk. If the owners are successful then this paper will not find the pattern suggested by the theory.

This paper continues by first addressing related literature (section II) and moving on to a discussion of the theory (section III). A section discussing the data in this paper (section IV) and a section addressing the empirical model (section V) follow the discussion of the theory. Finally, there is a discussion of the results (section VI) and conclusions (section VII).

II. Review of Related Empirical Studies

Using economic theories to analyze professional sports, particularly baseball, has become very popular over the last few decades. Multiple studies have been conducted that address the contracts, salaries and performance of MLB players. Some of these studies look at how previous performances affect the contract length and the salaries that the players receive (Meltzer, 2005; Dinerstein, 2007; and Tarman, 2005). These studies look at how owners evaluate players and examine contract determination from the perspective of the teams. These are solid starting places for this study.

The common focus of contract studies is the relationship between performance and the salary or contract length of a player. In these studies the dependent variable is contract length or salary, and the independent variable is the productivity of the player.

One of these studies was performed by Josh Meltzer (2005), who tested if performance is a significant predictor of a salary for a MLB player. His regression results demonstrated that performance was a significant predictor, which confirmed his hypothesis and the conclusion of other researchers. These results mean that the better player receives a longer contract and this often leads to a salary premium on top of the length of the received contract (Meltzer, 2005). Therefore, young players that are improving and performing well receive longer contracts.

Krautmann and Oppenheimer (2002) performed a similar study linking contract length to the salaries of MLB players. The authors performed an OLS regression and determined that contract length is positively related to wages. Earlier in their study, Krautmann and Oppenheimer determined, based on their work and previous studies, that superior players tend to receive higher salaries. Consequently, contract length has a positive relationship to wages, since the best players receive the longest contracts in addition to the highest salaries. These studies are very important to my research because they provide proof that a strong relationship exists between contract length and the performance of MLB players. This paper is furthering the existing research on this issue by determining whether productivity varies in a predictable way over the course of a multi-year contract.

Similar to my study, many studies in economic literature have used productivity measures as dependent variables. Some common measurements of a player's productivity are the slugging percentage, the on base percentage (OBP), and the on base percentage plus slugging (OPS) of a player (Krautmann 1990; Dinerstein, 2007; Maxcy, 2004; Krautmann and Oppenheimer, 2002; and Tarman, 2005). The OBP is the

percentage of times a player successfully reaches base without the other team making an error. The slugging percentage is the total number of bases that a player receives per at-bat (Krautmann and Oppenheimer, 2002). For example, if a player hits a home run he is credited with four bases. The OPS adds these two measures of productivity together and is often viewed as the best measure of productivity. Two possible issues associated with OPS are that the statistic does not address all offensive statistics available to a player and it weights each offensive statistic the same. Equivalent Average (EqA) is a recently developed measure that represents the total offensive value per out for a player. EqA is slightly more comprehensive than OPS and it weights certain offensive statistics differently. OPS may not be as accurate as EqA because some offensive statistics may be more valuable than others. The complex formulas for EqA and OPS are presented in Section IV.

Naturally, there are important variables to control for when evaluating a player's productivity. One of these variables that these studies address is the number of injury-free games. When a player is injured he is not able to participate in games which decreases his productivity. A similar conclusion that papers on contract length reach is that a player that has a multi-year contract tends to be on the disabled list more than a player with a short-term contract. The job security that a player receives with a multi-year contract will adversely affect the willingness of a player to play with an injury. (Berri and Krautmann, 2006; Lehn, 1984). In fact, as the number of years in the contract increase the number of days that a player spends on the disabled list increases by twenty five percent (Krautmann, 1990; Lehn, 1984). A player with a multi-year contract is more willing to reveal his injuries to his team than a player that has a one year contract and he

is also less likely to rehabilitate as quickly as a player with a one year contract (Lehn, 1984). Berri and Krautmann used games played as proxy to account for the effect of injury on a player's productivity. I choose to also use games played to account for injuries sustained by a player during the period of his contract.

Games played can also be used to account for any on-the-job training that a player receives. On-the-job training provides a worker with more experience and therefore makes the worker more productive. A worker becomes more productive because on-the-job training will increase the worker's general human capital as well as specific human capital (Strober, 1990). By playing more games a player is able to increase baseball skills as well as learn specific techniques that a team likes their players to have (i.e. base running strategies). Another aspect of training that a player will receive when he plays games is that he learns the strengths and weaknesses of his team. By knowing these strengths and weaknesses a player can adjust his play to complement them and give the team a better chance of winning. Therefore, a higher level of games played should cause a player to have a higher productivity and represents the contribution of a player to his team (Maxcy, 2002).

However, the games played variable has an element of ambiguity as well. The games played variable may also reflect any shirking that a player is doing. For example, a player may decide to shirk by playing fewer games and therefore his number of games played during that year has decreased. As a result, it is difficult to determine if the amount of games a player has participated in is due to injury or shirking.

Two other control variables in my study are dummy variables to represent if a player changed teams when he signed his multi-year contract and if incentives were built

into the contract. An incentive will likely cause a player to be more productive than he otherwise would have been if the incentive was not offered because he wants to have the extra money or security that the incentive provides. When a player is a free agent and is discussing a new contract, the team that he was previously with will have more information than other teams. Due to this lack of information the player's new team may offer him too good of a contract since the team does not necessarily know how well the player will actually perform or why the previous team has not asked the player to return (Pindyck, 2005; Berri and Krautmann, 2006). This suggests that a lemon market is present in baseball and the resulting asymmetric information causes teams to be unaware of a player's true productivity.

There were many more variables that these studies included that I have elected to not use in my study. Some of these variables include team chemistry, attitude, hustle, and intelligence (Maxcy, 2004). The productivity of a player will be affected by how well he works with his teammates and how well he knows the sport of baseball. Perhaps the most important variable not included in this study is the ability of a player to shirk during the off-season as presented by Berri and Krautmann (2006). If a player does not take care of himself or prepare himself for the season he will not be as productive as he could be. While, each of these variables could have a positive effect on how well a player will perform they are difficult to quantify. As a result, these variables are not included in my empirical model.

The negotiation status of a player affects the type of contract the player will be offered. One status of a MLB player is that they are eligible for arbitration. A player becomes eligible for arbitration after three years in the MLB (Kahn, 1993). When a

player is eligible for arbitration he can sign a new contract but he can only sign with his current team. Arbitration gives a player the chance to negotiate for a higher salary but he cannot leave the team (Tarman, 2005). Salary disputes under arbitration are settled by the decision of a neutral arbitrator. A player is eligible for free agency after six years in the MLB (Kahn, 1993). Free agency allows a player to sign with any team in the league so he does not have to remain with the team he is currently on. Andrew Tarman states that because the draft and arbitration exist, "...all players in baseball are not in a truly competitive market." (1993). In his results, Kahn discovers that free agency will raise contract duration (Kahn, 1993). This is due to the fact that free agency puts extra risk on a team and multi-year contracts will help to mitigate it (Maxcy, 2004). Therefore a player that is in the draft or arbitration stages of his career is not acting independently of the team when contracts are negotiated. As a result, only free agents who have been in the MLB for at least six years are included in my sample.

III. Theory

The goal of MLB owners is to create the best possible team. In order to accomplish this they have to find the best players and attract them to their team. If an owner signs one of the better players, or a star player, to his team he wants to make sure he stays as long as possible due to market uncertainty. Market uncertainty refers to how easy it will be for the firm to find a worker equivalent to or better than the current worker. Maxcy (2004) found that market uncertainty will increase the chance of a player receiving a multi-year contract. This would be because teams protect themselves against the risk of not being able to replace the skill level of the player. This is especially true for

a star player. A star player is very difficult to replace with a player that has similar abilities. In other words, Maxcy found that the player who receives a long term contract is least likely to be replaced (Meltzer, 2005). Maxcy (2002) states, "Maxcy (1996) finds evidence that long-term contracts are awarded judiciously and primarily to those players who have demonstrated consistent and superior performance." Market uncertainty drives the owners desire to offer multi-year contracts. These contracts protect the owners from having constant turnover and from losing their star players (Krautmann, 1990). A player will agree to these long-term contracts because they are a source of guaranteed income and give the player some job security.

However, the owner cannot relax completely once a player has signed a multi-year contract. In addition to market uncertainty an owner has to consider a concept called productive uncertainty. Productive uncertainty is when an owner is unsure of how well the player will perform on the job in the future (Maxcy, 2004). Owners cannot know the player's exact productivity each year so they form an estimate based on his previous performances (Krautmann, 1990). Production uncertainty under a long-term contract provides the opportunity for the player to shirk if he believes it is beneficial to him.

Once a player receives the multi-year contract, and therefore a guaranteed income for multiple years, the player may begin to demonstrate moral hazard (Allen and Lueck, 2001). Moral hazard occurs when an individual's behavior will change because he/she has insurance (Pindyck, 2005; Chiappori, 2002). With the insurance of a multi-year contract the individual is less likely to take necessary precautions. When it comes to baseball players, the moral hazard concept suggests that a player will not put in as much effort into preparing for the season or possibly even during the season due to the

insurance of his contract. The player has less incentive to devote his time to getting better or working hard.

In order to make sure that a player does have the motivation to work hard and put forth his maximum effort an owner can work an incentive into the player's contract (Berri and Krautmann, 2006; Strober, 1990). Examples of incentives include bonuses for becoming a most valuable player (for the entire league and playoff series), becoming an all-star, receiving a Gold Glove, or being a Silver-Slugger. These incentives will be offered to the player with the best opportunity to shirk. A star player will have the best opportunity to shirk because his potential productivity can be very high. This gives the player a lot of opportunity to shirk and still have his actual productivity be at the level the owner is looking for. In order to avoid this situation, the owner can work in incentives into the star player's contract which will encourage him not to shirk and perform closer to his potential productivity. Chiappori and Salanie (2002) found that these incentives successfully encourage a worker to maximize his/her effort so the incentives in a MLB player's contract should encourage the player to maximize his human capital.

Human capital is made up of skills or knowledge that will produce income for a worker (McConnell, 2009). Anything that a worker does to increase his/her productivity is considered an investment in human capital. For a baseball player, an example of investment in his human capital is training. Training consists of physical and labor inputs that will make him a better player by increasing skill level and thus increasing human capital. This investment in human capital therefore creates productivity potential (McConnell, 2009). When the player puts more time and effort into training and other

investments in human capital, he is increasing his chance of receiving a multi-year contract (Baker, 1988).

However, training is a perfect opportunity for a player to shirk. Each player will determine the total amount of effort that maximizes his utility and for some a guaranteed salary may cause them to have higher utility if they put in less effort (Marburger, 2003). A player has to put in effort in the weight room, during practice, and even to his diet in order to fully reach his productivity potential. If a player does not do these things, particularly during the off-season, his performance during the season will be weakened (Berri and Krautmann, 2006). The income effect may be a strong contributor to the decrease in the player's investment to his human capital. When he signs a multi-year contract, a player is getting a higher income which could cause him to choose leisure over working. As a result, the player may purposely spend less time conditioning himself for his season (Berri and Krautmann, 2006; Krautmann, 1990; Baker, 1988).

When either the owner or player does not have complete information about a situation there is asymmetric information (Pinkyck, 2005; Chiappori, 2002). By knowing the limits of his human capital the player will have an advantage over the owner. The advantage that a player has is that he knows exactly how well he can perform while the owner can only base his expectations on previous performances. This creates a prime situation for a player to shirk. Shirking is made possible by the moral hazard inherent in multi-year contracts and the asymmetric information between the owner and a player concerning the player's productive potential. As a result, the combination of asymmetric information and moral hazard suggests that the actual performance of a player with a multi-year contract could be lower than his potential productivity. Only the player will

know that he is not doing everything he can do both during the off-season and the season. When the player is nearing contract negotiations he may choose to stop shirking to give the appearance that he is a hard worker, with improving productivity, deserving of another multi-year contract. Maxcy (2002) says that, "we find that time spent on the disabled list decreases in the period immediately preceding contract negotiations." Since the owner does not know exactly how well a player can perform, this decrease in time on the disabled list and increased productivity will appear to represent an improving player. The potential impact of the player's future income encourages him to fully utilize his human capital and meet his productivity potential (Marburger, 2003). In sum, moral hazard and asymmetric information create the perfect opportunity, and excuse, for a player to shirk.

Based on the previous literature and theory on this subject, the research hypothesis for my paper is that the concepts of moral hazard and asymmetric information cause a pattern of shirking during the middle years of a contract. This pattern continues until the last year when a player's productivity begins to increase as the player competes for another multi-year contract.

However, if management is aware that moral hazard and asymmetric information can lead to a pattern of shirking, it may take actions to minimize shirking. This could be done by setting up monitoring systems such as coaches and fans. Other options include offering a player an efficiency wage or incentives to ensure that he does not want to lose his job and will not shirk. If management is successful in reducing shirking through monitoring and incentives, there may not be a pattern of shirking. The purpose of the empirical model presented in the next section is to determine whether a pattern of

shirking remains in a market where monitoring and incentives are used to discourage shirking.

IV. Data

To select the players in this data set I consulted an archived website that Meltzer (2005) used in his study.[1] The one hundred non-pitching baseball players in the sample have played at least six years in MLB and have achieved free agency. Fifty of these players had a one year contract and the other fifty had multi-year contracts. The multi-year contracts range from four to seven years and span the years of 1997-2007.

The sample of one hundred MLB players supports the idea that multi-year contracts are awarded to those players who have demonstrated the best performance. Table 1 shows that players with higher productivity tend to have a multi-year contract.

Table 1: The Productivity of Players with One-Year and Multi-Year Contracts.

	One-Year Contract		Multi-Year Contract	
Variable	**Mean**	**Standard Deviation**	**Mean**	**Standard Deviation**
EqA	0.76	0.09	0.86	.10
OPS	0.76	0.09	0.86	0.11
AGE	29.46	3.83	30.11	3.76
GAMESPLAYED	123.74	29.08	130.61	27.17
SALARY(millions)	$2.23	2.33	$34.86	24.04

Source: Baseball-reference.com

Of these one hundred players I have included thirty different players with four year contracts and their statistics in my models. Note that the unit of observation is contract year. Thus, there are five units of observation for each player, one observation for each contract year and one for the year prior to the start of the contract. The total sample size is therefore 150 (five contract years times thirty players).

[1] This website has been since removed but it can be found by using the archive website http://web.archive.org/web/web.php.

The players in this study represent each of the positions of a MLB team except for pitchers. Pitchers are not included in my sample because pitching statistics are less universal than hitting statistics and there are different types of pitchers. The two types of pitchers (starting and relief) each have different statistics and different responsibilities making it difficult to measure a pitcher's productivity (Krautmann, 1990). On the other hand, productivity of position players are all measured in the same way when they are hitting which offers a consistent measure of productivity (Meltzer, 2005). Another reason that pitchers are not included is that there are different rules for pitchers in the different leagues. Pitchers tend to play different roles in each league which would cause their statistics to not be comparable.

Also not represented in this study is any measure of the defensive ability of a player. The statistics that are available to measure defense represent the mistakes that a player makes rather than the ability of a player to make exceptional plays (Meltzer, 2005). For example, the fielding percentage of a player remains at one (which means 100%) and it only decreases as a player makes an error. However, it will not increase if a player makes an extraordinary play. Without the ability to measure exceptional plays on defense there is not an accurate way to measure the productivity of a player's defensive ability. In addition to this, a player is acting independently of his teammates when he is hitting. The completion of a defensive play often depends on a player's teammates (Dinerstein, 2007). In other words, defensive statistics are not included in this study because of their ambiguity.

All of the individual offensive statistics that make up the productivity statistics are available from the website baseballreference.com. The formula for OPS is

((hits+walks+hit by pitch)/(at bats+walks+hit by pitch+sacrifice fly))+(total bases/at bats). OPS is already calculated by the website. Baseballreference.com does not explicitly state the equivalent average for MLB players but it does provide each of the statistics that are needed to calculate equivalent average (EqA). EqA is calculated by (hits+total bases+1.5*(walks+hit by pitch)+stolen bases)/(total number of at bats+walks+hit by pitch+number of times caught stealing+(stolen bases/3)) (http://www.baseballprospectus.com/article.php?articleid=2596). EqA is a more comprehensive measure of a player's productivity because it includes more measures of offensive production such as statistics dealing with a player's ability to steal a base.

As a result, I have chosen to predict two productivity measures: OPS and the EqA. None of the studies I have read have used the recently developed productivity measure of Equivalent Average so this paper furthers the existing research by using a new productivity measure.

V. Empirical Model

By combining the variables mentioned in the previous sections an empirical model is created that tests the hypothesis that there is pattern associated with a player's productivity during a multi-year contract. There are also dummy variables to represent each year of the contract. This is done to detect any shirking that may be occurring during the period of the contract (Berri and Krautmann, 2006). Also included in the model are two dummy variables to specify if the player's position is the shortstop or catcher position and a dummy variable to represent if the player changed teams when he signed the new contract. Dummy variables are included for catchers and shortstops

because these positions emphasize the defensive prowess of the players. The defensive abilities for catchers and shortstops are more difficult and so time has a higher value when it is spent training defensively instead of offensively. However, the opportunity cost of the time spent training for the defensive responsibilities is time that could be spent on offensive training. As a result, the offensive productivity of these players may be lower. Therefore, the final model is:

$$\text{Productivity of Player} = \alpha + \beta_1(\text{YEAR1}) + \beta_2(\text{YEAR2}) + \beta_3(\text{YEAR3}) + \beta_4(\text{YEAR4}) + \beta_5(\text{GAMESPLAYED}) + \beta_6(\text{INCENTIVES}) + \beta_7(\text{CHANGETEAMS}) + \beta_8(\text{CATCHER}) + \beta_9(\text{SHORTSTOP})$$

The coefficients in front of each year of the contract are relative to Year 0, the year before the multi-year contract begins. I expect all the coefficients in front of the contract years to have a negative sign except for β_4 which will have a positive sign. This is because the theory developed earlier suggests that imperfect information and moral hazard propose that players with four year contracts may shirk the first three years and then increase their effort in the fourth year. The other coefficients that I expect to have a negative sign are β_7 due to the psychological costs of moving to a new team and /or town and β_8 and β_9 due to the large physical demands of the catcher and shortstop positions. I expect the rest of the coefficients to be positive. The variables are summarized in Table 2.

The last year of a multi-year contract may have a positive effect on the productivity of a player because the contract is almost over. A player will need to sign a new contract either with the current team or another team if he wishes to keep working

with the MLB. In order to be offered a new contract a player will need to demonstrate that he is a productive player. Therefore, his productivity should rise in the fourth and final year of his contract.

Table 2: Variable Definitions and Hypothesized Relationships to Dependent Variables

Variable	Definition
Dependent	
EqA	Total offensive value per out
OPS	On-base percentage + slugging percentage
Independent	
YEAR1 (-)	Dummy; 1=Year 1 of contract, 0=not
YEAR2 (-)	Dummy; 1=Year 2 of contract, 0=not
YEAR3 (-)	Dummy; 1=Year 3 of contract, 0=not
YEAR4 (+)	Dummy; 1=Year 4 of contract, 0=not
GAMESPLAYED (+)	The number of games played by the player
INCENTIVES (+)	Dummy; 1=incentives built into contract, 0= no incentives
CHANGEDTEAMS (-)	Dummy; 1=changed teams with new contract, 0=no change
CATCHER (-)	Dummy; 1=catcher position, 0=other
SHORTSTOP (-)	Dummy; 1=shortstop position, 0=other

Noticeably missing from the model is a variable to represent the age of a player. Age can be a very strong determinant of the productivity of a player because as the player ages his human capital begins to become obsolete. The player is not as quick or as sharp as he used to be which means his productivity will generally decrease as he gets older. However, my model is set up so that each productivity observation represents a year in the contract. Meaning, the four observations connected with each player represent each year of the contract. The age of the player will be highly correlated with the contract year variables since the movement to the next contract year is also an increase in his age by one year. Thus, age is not included in the model.

I run this model using OLS regression to determine the significance of each of the coefficients to the independent variables. Once the regression is run, it is be possible to see if there is a pattern of productivity during a multi-year contract.

VI. Results

Before running the regressions I did a closer inspection of the raw data. By creating a panel data set it is possible to see each player's productivity across their contracts as well as the average productivity for all thirty players for each year of the contract. Year 0 represents the year before the contract is signed regardless of what year the contract starts, Year 1 represents the year that the contract begins, Year 2 represents the second year of the contract and so on. The first year that a contract begins is 1997 for some players in the sample and the last is 2003 for other players. Therefore the unit of observation in the following table is the player. Table 3 summarizes these results.

Table 3: The Average Productivity (EqA and OPS) for Each Year of a 4-Year Contract

Productivity Measure	Year 0	Year 1	Year 2	Year 3	Year 4
EqA	0.87302	0.84835	0.84216	0.85089	0.82241
OPS	0.85667	0.84877	0.83520	0.84337	0.81010

Based on these averages there is no concrete evidence that the MLB players in this sample demonstrate shirking. This result is consistent across both measures of productivity. The averages in Table 3 do not support the hypothesis of this paper because there is no increase in productivity during the later years of the contract. In fact, throughout the four years of the contract productivity tends to decrease. This is consistent with the results in Marburger (2003). For both productivity measures Year 3 has a small increase in productivity but there is a substantial drop in productivity in Year 4.

One of the interesting results that is evident in Table 3 is the decrease in productivity between Year 0 and Year 1. This pattern is demonstrated by nineteen of the

thirty players when looking at EqA and by seventeen of the thirty players when looking at OPS. For some reason, the players in this data set tend to have a decrease in productivity the first year of their contract. However, this change in average productivity between Year 0 and Year 1 is not statistically significant.

It is important to discover if the difference between each of these means of productivity (i.e. between Year 0 and Year 1, between Year 1 and Year 2, etc.) is statistically significant by running a t-test. If the results are statistically significant then there could be a pattern of shirking. In the following table $\overline{x_0}$ represents the mean productivity level of the year before the contract, $\overline{x_1}$ represents the mean productivity level of the first year of the contract, and so on. The results of the t-tests are summarized in Table 4.

Table 4: T-Test Determining if the Difference Between Means is Statistically Significant*

	Hypotheses	T-Test (EqA/OPS)	Statistically Significant
Ha_1	$\overline{x_0} > \overline{x_1}$	t = 1.003/ t = .281	no/no
Ha_2	$\overline{x_1} > \overline{x_2}$	t = .222/ t = .457	no/no
Ha_3	$\overline{x_2} > \overline{x_3}$	t = -.311/ t = -.267	no/no
Ha_4	$\overline{x_3} < \overline{x_4}$	t = 1.173/ t = 1.267	no/no

*The critical value of t at the .1 level of significance for a one tailed test is 1.297, the critical value of t at the .05 level is 1.673, and the critical value of t at the .01 level is 2.396.

The results of the t-test show that there is no significant difference between the means. The results were insignificant at the 10% level and for both measures of productivity. This means that the observed difference in means that were found in Table 3 could have arisen randomly.

To further test if each year of the four year contract has any statistical significance I ran some OLS regressions. The results of the OLS regression with EqA as the dependent variable are summarized in the following table:

Table 5: EqA Regression Results

Variables	Model A	Model B
YEAR1	-.013 (-.636)	-.025 (-1.164)
YEAR2	-.015 (-.730)	-.032 (-1.446)
YEAR3	-.006 (-.306)	-.023 (-1.048)
YEAR4	-.020 (-.926)	-.051 ** (-2.347)
GAMESPLAYED	.001 *** (4.582)	----
CHANGETEAMS	-.023 (-1.351)	-.043 ** (-2.398)
INCENTIVES	.061 *** (3.636)	.058 *** (3.227)
CATCHER	-.134 *** (-3.579)	-.165 *** (-4.195)
SHORTSTOP	-.083 *** (-4.472)	-.093 *** (-4.683)
Adjusted R^2	.370	.281
N=150		
Values in parenthesis represent T-statistics		
*significant at .1 level **significant at .05 level ***significant at .01 level		

The first regression includes each of the variables in the empirical model and is represented by Model A in the table above. Model A has an adjusted R^2 of .37 and four of the variables prove to be statistically significant. These variables are the games played, incentives, catcher, and shortstop variables. All of these variables are highly significant with a significance value of less than .001. However, Model A does not offer support for the hypothesis that a player will demonstrate a pattern of productivity

demonstrating shirking during a four year contract when everything else is held constant. The sign in front of the YEAR4 does not match the predicted signs. In Model A's results, the YEAR4 variable has a negative sign which implies that a player will be less productive during the fourth year of his contract. However, the coefficient for this variable is not statistically significant. This means that in year 4 of a contract the equivalent average (and therefore productivity) fails to show the expected increase. This result goes against the hypothesis that the last year of a contract will cause a player to be more productive.

The fact that all of the contract year variables have a negative sign is very interesting. This also seems to be consistent with the results demonstrated by the descriptive statistics. Since the coefficients in front of these variables represent the productivity of a player relative to year 0 the negative signs do fit with the descriptive statistics reported in Table 3.

Model B is an attempt to improve the first regression. By removing selected variables from the regression it is possible to see if the contract year variables become significant. Model B removes only the GAMESPLAYED variable. This variable was removed due the ambiguous nature of the GAMESPLAYED variable. The number of games that a player participates in may be correlated with his shirking activity and therefore the year variables may not be completely accurate in Model A. Once GAMESPLAYED was removed, the adjusted R^2 becomes .28 compared to .37 for the complete model. The contract year variables all become more significant with YEAR4 becoming significant at the 5% level. This is a large jump from the first regression where it is highly insignificant. However, the variable still has the opposite sign than predicted.

While significant the YEAR4 variable predicts that the productivity of a player will decrease by -.051. The other variable that became significant in this model is the CHANGETEAMS variable. Therefore, if a player changed teams it has a significant, negative effect on his productivity. This result is consistent with the belief that a player's previous team knows something that his new team does not. The INCENTIVES, CATCHER, and SHORTSTOP variables all remained highly significant.

The exact same models were run again with OPS as the dependent variable rather than EqA. The results are summarized in Table 6.

Table 6: OPS Regression Results

Variables	Model C	Model D
YEAR1	.005 (.230)	-.008 (-.330)
YEAR2	-.004 (-.173)	-.021 (-.896)
YEAR3	.004 (.189)	-.013 (-.555)
YEAR4	-.013 (-.555)	-.047 * (-1.944)
GAMESPLAYED	.001 *** (4.437)	----
CHANGETEAMS	-.031 (-1.616)	-.052 *** (-2.630)
INCENTIVES	.069 *** (3.720)	.065 *** (3.324)
CATCHER	-.163 *** (-3.976)	-.196 *** (-4.566)
SHORTSTOP	-.094 *** (-4.598)	-.104 *** (-4.806)
Adjusted R^2	.379	.297
N=150		
Values in parenthesis represent T-statistics		
*significant at .1 level **significant at .05 level ***significant at .01 level		

The results from the OPS regressions are very consistent with the results from the EqA regressions and demonstrate a slightly higher adjusted R^2s. YEAR1, YEAR2, and YEAR3 remain statistically insignificant, although signs did change on some of the coefficients.

Running both of these regressions confirm that the both dependent variables, EqA and OPS, perform equally well as proxies of productivity. In other words, the pattern of the regression coefficients was the same regardless of which model was used. The results of this study suggest that MLB players do not demonstrate a pattern of productivity that implies they have shirked during a four year contract.

VII. Conclusion

The main finding of this study is that there is no evidence of systematic shirking over a four year contract in MLB. These results are supported by descriptive statistics and multiple regression analysis. Table 3 shows average productivity did not change much over the course of the contract or demonstrate any pattern and therefore did not offer any evidence of systematic shirking. Multiple regression analysis shows that the year of contract variables were generally insignificant and where they were significant they often did not demonstrate the expected sign. Furthermore the same lack of pattern is seen when using OPS or EqA. All of these results do not support the hypothesis that MLB players demonstrate a pattern of systematic shirking.

The hypothesis of this paper is that a player will demonstrate a pattern of shirking during the middle years of his contract. The thought behind this hypothesis was that a player with a multi-year contract would take advantage of the guaranteed salary, exhibit

moral hazard, and shirk during a few of the years covered by the contract. However, this study offers proof that this is not the case. INCENTIVES remained highly significant throughout each of the models the variable was included in. Therefore, the use of incentives will cause a player to be more productive than he might otherwise have been and may be the reason a player will not shirk during a multi-year contract.

Therefore, owners need to be cautious when determining the contract for a player because a player that has an increase in productivity during the contract year may be having an unusual season instead of being a shirker (Dinerstein, 2007). A player may have the best season of his career, be offered a multi-year contract by a team, and then return to his natural level of talent the next year. However, the results suggest that on average, players productivity are remarkably stable over the course of a four year contract.

By looking through various magazines, websites, or listening to sports talk shows, it is very common to hear a story about players who are shirking. Reporters, owners, and fans all believe that players in MLB will shirk when they have the opportunity. They may be correct about some individual players but based on this study they may not be completely correct about professional baseball players as a whole. There are a few reasons why baseball players are not showing evidence of systematic shirking.

One key reason for players not being able to shirk in the major leagues is all the monitoring that is available to the owners. The players have many different people they have to answer to when their performance is not meeting expectations. In the dugout and the clubhouse the players have multiple coaches that are watching them. Teams generally have a coach for every aspect of the game. For example, there is a hitting

coach, a pitching coach, a bullpen coach, and of course there is the clubhouse manager. All of these coaches make sure the players are doing everything they can to be the best hitter, pitcher, catcher, etc.

In addition to these coaches, there is a general manager (GM) that is responsible for the make up of the team. He is constantly watching to see if there is some aspect of the team that needs improvement. Therefore, the players know the GM is watching and that if they shirk the GM may decide to invest in different players. Perhaps the most important source of monitoring, however, is done by the fans themselves. Fans come to the parks to see the team and they want to see a win. It is very easy for fans to express their approval or disapproval by not attending the games or buying the players' merchandise. Both attendance and merchandise sales make up a large part of a player's salary so in order to ensure that these actions continue and his salary remains high he needs to perform the best that he can. Otherwise, fans may no longer support him if they believe that he is a shirker.

Another reason that players may not be shirking is because owners may have discovered how to effectively utilize incentives. The players that may need the incentive the most are the star players that have a higher potential productivity than the average player. As a result, they can get away with shirking easier because their productivity even with shirking will most likely still be higher than the average productivity. Owners may have discovered this "trick." By offering incentives to the star players the owner is providing a reason for the players to play at their potential productivity. These incentives could discourage the players from systematic shirking by rewarding exceptional productivity.

A third possible reason that players may not be shirking combines the ideas of the efficiency wage and job security. The career of MLB players seems to be somewhat secure due to the smaller supply of people available with the necessary skills. However, there is less job security in this profession than is commonly accepted. Teams are finding new "stars" every year from the draft and other teams. These new stars could easily replace any player that is currently on the team. The fear of being replaced by another player can be enough to cause players to perform to the best of their abilities in order to not be replaced. In other words, it encourages the players to not shirk. The incentive to receive the benefits or recontracting will dominate the incentive for players to shirk during the contract year (Marburger, 2003). Another reason there is some lack of job security for MLB players is the risk of injury or being released from the team. MLB players have a very specific skill set that cannot be applied to jobs outside of baseball. The threat of a career ending injury or being released can cause players to work as hard as they can during their career to earn as much income as possible in order to be protected in case one of these situations occur. Once again, the players are encouraged to not systematically shirk.

Adding to the idea of job security is the idea of an efficiency wage. It is common knowledge that the wages that are paid to professional athletes are generally very high. This may be because the owners are offering the players an efficiency wage. The basic idea is that the "above market" wage will cause highly skilled players to work harder and become more productive. The market clearing wage may not be a strong enough incentive for the players to be productive. However, the higher wages create a strong incentive to be more productive since along with the higher wages comes a bigger threat

of unemployment. The efficiency wage that players may receive will cause an excess in supply of baseball players and therefore a higher threat of unemployment (McConnell, 2009). The efficiency wage becomes a strong incentive for players to not shirk.

Also dominating MLB players' desire to shirk may be the knowledge that they are getting older. The older players get, the harder it will be for the players to start over with a new team. As they age, the players will begin to lose some of the skills that they had while they were younger. This knowledge that they will have to start over with a new team may push players to stay with the team they are on and work hard (Strober, 1990).

A final reason, and perhaps the reason that everyone would like to be true, could be that MLB players have a strong desire to win. Players in MLB tend to have a very competitive attitude and they are not happy when their team does not perform well (Singell, 1993). A team does not perform well when there are players who are not producing as much as they should and are purposely shirking. The desire to win a game pushes players to perform as well as they can in order to achieve the satisfaction of a victory. Not only does it encourage players to perform as well as they can, but it also is an incentive to encourage their teammates to not shirk. The strong desire to win may be the best reason that players have to not shirk.

One way to further this research is to find a larger sample of players to use. By increasing the sample size the results will be more representative of the league as a whole and it provides the opportunity to compare players who have incentives built into their contracts to those who do not. One might expect the players without incentives to possibly demonstrate a pattern of shirking. This will help determine which players in particular are more likely to shirk during their contract.

The results of this study suggest that MLB players do not demonstrate a pattern of systematic shirking. This could be for any of the reasons above or it could be that players are beginning to find ways to hide their shirking from fans, owners, and even from showing up in the statistics. Further studies could attempt to capture the effect of shirking during the off-season which may have a strong impact on how well a player performs during the season. With further work done on the issue, it may be found that multi-year contracts are not maximizing the productivity of the players but based on this study owners may be benefiting from offering multi-year contracts. Hopefully MLB players will continue to show this trend due to their desire to be the best and represent their fans.

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