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REVISITING THE IMPACT OF THE DESIGNATED HITTER ON MAJOR LEAGUE BASEBALL

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REVISITING THE IMPACTS OF THE DESIGNATED HITTER ON MAJOR LEAGUE BASEBALL

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ABSTRACT

In 1973, team owners in Major League Baseball's American League voted in favor of introducing the designated hitter into their offensive lineups. The National League owners voted against such a rule change that year and since on several different occurrences. Baseball fans, sportswriters, players, owners, economists and others have weighed in on the impact of the designated hitter rule change on Major League Baseball. Chapter One of this paper reviews recent published writings by economists on the impact of the designated hitter. Team owners gave several reasons for advocating the dramatic designated rule change in the American League. Chapter Two considers each of these reasons and compares them against actual statistical data to determine accuracy of team owner foresight. In other words, after 36 seasons of the designated hitter, did American League owners' landmark decision achieve its intended goals? Chapter Three takes the previous chapter arguments and tests several variables that resulted from the DH ruling against attendance. Chapter Four suggests several points of interest that appear to be unresolved in the existing economic DH literature. This paper considers the impact of the DH on offense, defense and attendance in Major League Baseball. In the end, attendance gains appear to strengthen the argument that American League owners were acting rationally when they instituted the DH rule change.

DEDICATION

Even the symmetrical, monochromatic Kingdome could not prevent Edgar Martinez from making the stand-up double a thing of beauty. It wasn't only the towering roof of the concrete cylinder stadium that overshadowed the game's best designated hitter. Hall of Famers passed through Seattle like spring rain clouds during late 1980's into the mid 1990's. In fact, first ballot future Hall of Famers Ken Griffey Jr., Randy Johnson and Alex Rodriguez all spent their early careers playing for the Mariners alongside Martinez. But for the true M's fan – as I was and still am – no one was more important to the team or the fans than Edgar. The city of Seattle aptly named a street after him adjacent to the newly constructed the new Safeco Field, the Mariners new home. When the votes are next cast for introduction into baseball immortality, Edgar Martinez's name should join the pantheon of other deserving inductees into the Major League Baseball Hall of Fame.

ACKNOWLEDGEMENTS

The final result of this work was a team effort. The scope and content of the paper was overseen by Dr. Robert Tollison. In addition, Dr. Robert McCormick was instrumental in pointing me toward the economics of sport many years ago. I am grateful to Dr. William Dougan for first inviting me to be part of the Clemson Economics department. The committee overseeing the quality of this work includes Dr. Raymond Sauer and Dr. Michael Maloney. Special recognition is warranted here to Dr. Maloney; his leadership provided the way for ultimate completion of this work. And to my wife and daughters, thank you.

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INTRODUCTION

When Ron Blomberg stepped into the batter's box on April 6, 1973, it began the most controversial at bat in baseball history. His plate appearance was the culmination of decades of debate that extended throughout virtually every level of organized baseball. Despite garnering an unceremonious walk, Blomberg's first appearance as a "designated pinch hitter" [1] continues to incite hearty disagreement to this day. Thirty seven years later, the institution of the designated hitter (DH) into the American League is the most fiercely debated rule change in professional sports history.

It would not have happened had the outcome of a single vote gone differently. On January 11, 1973, the twelve owners of the American League of Major League Baseball voted in favor of instituting a three year experiment of the designated pinch hitter. Following this landmark 8-4 vote, the Major League Baseball Rule Book (MLB 2008) added Rule 6.10, stating that teams in the American League[2] may designate a player to bat for the pitcher "without otherwise affecting the status of the pitcher". While there have been minor revisions to the designated hitter rule[3], the essential tenets of the experiment have remained in tact – American League pitchers do not bat. What began as

[1] The designated hitter was originally called the designated pinch hitter or DPH. The term "designated" signified that managers would have to determine (designate) which player would begin each game as the designated hitter.

[2] In the "rule of the park" decision in 1988, Baseball Commissioner Peter Ueberroth ruled that the designated hitter can be utilized when games are played at AL ballparks, but not when playing at NL parks. This would impact baseball's All-Star Game, World Series and eventually inter-league play during the regular season. In the 1973-1975 seasons, the DH was not included in these contests. The 1976-1987 seasons used the DH in alternating years for these games.

[3] After the 1973 season, the Major League Baseball Playing Rules Committee mandated that the DH had to make at least one plate appearance. This was seen as a reaction to Baltimore Orioles manager Earl Weaver who routinely created a mystery spot in the lineup by assigning a player as DH, then replacing him with a more qualified hitter when they would come to bat.

a three year trial period for the DH[4] remains the defining difference between Major League Baseball's (MLB) American and National Leagues (AL and NL respectively).

While the DH decision by the AL was remarkable, it was not the first attempt by Major League Baseball to improve its offensive output. In 1968, the Leagues decided to lower the pitching mound, reduce the size of the strike zone[5] and enforce "illegal" pitches. All three of these actions were decidedly in favor of the batter and were designed to boost slumping offenses. The 1973 decision to institute the DH is widely believed to boost offense and strengthen the1968 rule changes.

As for Blomberg, he was not the type of player owners had in mind when the DH rule change was instituted. At the time of his first plate appearance as a DH, he was 24 years old, was not considered a defensive liability, and was on the front end of what was projected to be a promising career. His batter-only status that brisk Boston afternoon in 1973 was a result of a hamstring pull during the Yankees spring training just days earlier. During the 1973 season, Blomberg routinely played on defense and was considered a second alternate DH to fellow teammate Jim Ray Hart. The 11 year veteran Hart was acquired by the Yankees from San Francisco and played 106 games at the position during the 1973 season (McKelvey 2004).

[4] AL owners agreed on a three year experiment of the DH from 1973-1975 seasons. After just one season, the AL owners made the decision permanent.
[5] The size of the strike zone had been reduced in 1950 and then expanded in 1962 before again being reduced in 1968.

CHAPTER ONE

REVIEW OF THE DESIGNATED HITTER LITERATURE

With the exception of the DH, rules in the AL and the NL remain essentially identical. Because of this near homogeneity, league to league comparison provides for a unique and fertile soil on which to conduct controlled experiments on the impact of DH.

Several economists have analyzed the impact of the DH on hit batsman in Major League Baseball. Recent material has focused on the positive statistical correlation between the DH and hit batters. Two general reasons are given for why the DH invites higher levels of hit batsmen. First, AL pitchers are more likely to engage in risky behavior (resulting in hit batsmen) than their NL counterpart because they do not have to face personal retaliation for their behavior. In this case, retaliation is in the form of a quid-pro-quo plunking of a batter from the offending pitcher's team or the offending pitcher. This theory is broadly defined as the "deterrence" hypothesis.

A second explanation for the hit batsman is the "lineup composition" hypothesis. This theory simply explains that a DH represents another quality batter in the lineup. The DH acts as a superior offensive substitute to usually poor hitting pitchers. Since it is less costly to plunk a quality batter, a DH should more often be on the receiving end of a bean ball.

Finally, a broader purpose of studying the behavior of pitchers when a DH is in the lineup is to offer evidence for the larger and very well-developed "moral hazard" theory first developed by Sam Peltzman in 1975. This theory postulates that when an actor is insulated from consequences resulting from his actions, the actor will behave differently than if he was not shielded from such consequences. In baseball, the moral

hazard theory can most closely be observed when a DH prevents direct retaliation to the offending pitcher.

The following is a sample of some of the key literature that considers the moral hazard theory along with the deterrence and lineup composition hypotheses of the DH.

Goff, Shughart, and Tollison (GST 1997)

In 1997, GST first examined data from 1901 to 1990 related to the impact of hit batsman prior to and then following the 1973 introduction of the DH. According to GST, AL batters had a 10-15% greater likelihood of getting hit by a pitch (when compared with the NL) following the DH rule change. Further extrapolating this information, GST explained that the introduction of the DH was tantamount to incentivizing hazardous behavior by removing the deterrent of pitchers to hit batters. In other words, pitchers were more likely to hit batters if they were not themselves subject to the fear physical harm as a result of direct retaliation. The work of GST would prompt a number of responses to the application of the moral hazard theory to pitcher behavior in Major League Baseball. Much of this dialogue related to GST's work follows sequentially.

Trandel, White, and Klein (TWK 1998)

The work of TWK calls into question some of the conclusions drawn by GST about why AL hitters are more likely to be hit by pitches. Instead of focusing on the moral hazard basis for hit batsmen (GST), TWK introduces the lineup composition hypothesis to explain results in the period of 1947 to 1997. This hypothesis posits that the DH constitutes an additional quality hitter in each AL lineup. More talented hitters essentially cost less (conversely, provide a larger marginal benefit) to plunk when

compared with less offensively productive players. In this case, pitchers can be assumed to be less offensively productive than their DH offensive replacement. In their analysis, TWK show that AL DH's, "have been hit at about 110% the rate of other AL batters". Conversely, poor hitting NL pitchers reach base at a far lower rate and are therefore most costly to plunk than their DH replacement.

Levitt (Levitt 1998)

In 1998, Stephen Levitt categorically disputes GST's contention that the moral hazard theory can be seen in hit batsmen in Major League Baseball. Levitt calls into question the (apparent) correlation between a pitcher who hits a batter and a pitcher who himself gets hit. Agreeing with and further refining the lineup composition arguments of TWK, Levitt resolves that the instances of pitchers being on the receiving end of bean balls are so few that it becomes statistically inconclusive to tie any meaningful retaliation conclusions. Using data from 1993 to 1996 MLB seasons, Levitt sees no correlation between a pitcher giving and then receiving a plunking. Ultimately, the author seeks to diminish GST's deterrence or moral hazard arguments related to pitchers engaging in riskier behaviors as a result of the DH.

Goff, Shughart, and Tollison (GST 1998)

After lineup composition arguments by TWK and Levitt that sought to neutralize the moral hazard theory proposed by GST, the authors return to update their previous work. Prior analytical framework is clarified and data beyond the original 1990 period. This expanded period (1991 through 1997 MLB seasons) constituted a prolific period for bean balls. The authors postulate that NL league expansion in 1993 followed on the heels

of strike-shortened seasons and pre-seasons of 1994 and 1995 (respectively) may have had some impact on these results. The authors reaffirm their contention that better hitting (i.e. the lineup composition hypothesis) does not explain the increased number of hit batsmen in the American League.

Trandel (Trandel 2004)

Gregory Trandel describes the similarities and differences in the previous arguments made by GST and TWK. In both points of view, there appears to be some agreement that retaliation behavior is present in Major League Baseball . In fact, retaliation is of central importance for Trandel when determining the DH/hit batsmen relationship. The author focuses his data set from several discrete decades to determine if teams' pitcher's hit batsmen is related to their being on the receiving in of getting hit. While there is not proof that retaliation is absent from MLB pitcher behavior, Trandel found little demonstrable evidence of pitcher-on-pitcher retaliation behavior. Further, the author hoped to steer future inquisitors to focus more on *detecting* retaliation rather than further discussion of retaliation methods.

Bradbury and Drinen (BD 2006, 2007)

The most recent substantive published work to address the issue of hit batsman following the DH rule change is by Bradbury and Drinen, 2007. The authors offer the most complete summary and critical commentary of previous publications on the impact of the DH on hit batters. Against these previous publications, BD offers some alternative explanations for pitcher behavior not previously discussed in the related literature.

Specifically, instead of charging further into the debated explanations of increased hit batters as a result of the DH (deterrence versus lineup composition hypotheses), BD focuses on the situational-driven decisions of pitchers as they determine the value and cost of engaging in riskier behavior.

By bringing game-level data into the hit batsmen discussion, BD sought to reduce the data aggregation necessary to draw conclusions related to the impact of the DH on hit batsmen. According to the authors, aggregation of the infrequent occurrence of direct retribution against pitchers results in a problem of data reliability. Said another way, pitchers rarely and infrequently hit batters (approximately 1% of all plate appearances result in a hit batsman) and pitchers are themselves (in retaliation) hit even less frequently. Trying to aggregate and then exact quality conclusions out of such infrequent occurrences presents a challenge to studying the impact of the DH on hit batsmen. By using a play-by-play analysis of MLB data, the authors seek to counter this aggregation problem.

Using micro-level data, the authors reach several conclusions. First, pitchers are statistically more likely to hit batters with the presence of a DH in the lineup. Second, there is also support for the GST deterrence hypothesis. For example, BD shows that pitchers are four times more likely to be plunked in the half inning following their hitting a batter. In general, when compared to non-pitchers, pitchers are 55% more likely to be hit than non-pitchers. This is a compelling argument to support the GST deterrence hypothesis. Likewise, non-pitchers who bat immediately following a teammate's homerun are 32% more likely to be hit than those who do not follow a fence-clearing

shot. Third, inferior pitcher quality (measured by a higher walk ratio and batter OPS[6]) increases the likelihood of pitchers hitting batters. Fourth, base runners and the score differential are positively correlated with hit batsmen. Fifth, off-field punishment (fines and suspensions) have served only to "increase the incidence of hit batters" according to the authors. Finally, the lineup composition hypothesis proposed by TWK and Levitt, "is not sufficient to explain the entire impact of the DH on hit batters".

Across the literature, there is a general agreement that the introduction of the DH has produced more hit batsmen. The moral hazard theory appears to be supported as a likely reason for such behavior. The lineup composition may also contribute to the number of hit batsmen, but does not fully explain the behavior of pitchers. Further areas of proposed study using similar data related to hit batsmen and the DH are suggested in a later section of this paper.

[6] OPS is calculated by adding together on base percentage and slugging percentage

CHAPTER TWO

REASONS BEHIND THE RULE CHANGE AND THE RESULTS

Lee MacPhail was the General Manager of the New York Yankees in 1972 and went on to become the President of the American League from 1974-1984. In a written response to author G. Richard McKelvey, MacPhail explained why he supported the DH,

> *"I can tell you advantages we felt it would accomplish. First, it would increase the offense of each team. Second, it would enable some clubs to retain a player, important in the club's past, who possibly was no longer able to do the job defensively. Finally, clubs would not have to remove pitcher for pinch hitters. All of these, we felt, justified the rule change."*

The above statement by MacPhail will serve as the guideline for Chapter II. The rationale given by AL owners for the DH rule change will be compared against the actual impact of the DH. There appears to be four primary reasons for the AL owners' decision to institute the DH in 1973. They included:

1. The DH will increase the offensive output of teams in the AL by adding another talented batter in the lineup
2. Marquee starting pitchers could pitch more innings and not be removed from games to insert a temporary pinch hitter
3. Aging players with quality offensive talent would be able to play longer without inflicting negative defensive costs on their teams
4. Increased attendance

Each of these four justifications will be explored in the following section to determine what impact the DH ruling may have actually had on offenses, defenses and attendance.

It should be noted that maximizing revenues via attendance is assumed here to be the most important element of this rule change and indeed any professional sports organization. As a result, each of the above variables will be measured against attendance (a proxy for team revenues) to determine their statistical relationships.

Of note, the analysis in this paper covers the 1901-2008 seasons. For comparison purposes, the available data is sourced from Baseball Reference (2009). Seasonal data has been broken into three equal periods of 36 years for purposes of analysis.

"Period 1" 1901-1936 MLB seasons
"Period 2" 1937-1972 MLB seasons
"Period 3" 1973-2008 MLB seasons

Of particular note, Period 3 encompasses the 36 years following the 1973 AL adoption of the DH rule.

Prior to the 1973 DH rule change, all rules were essentially the same in the AL and the NL. For purposes of analysis, the DH rule is considered the last significant rule change in Major League Baseball. As a result, the NL and the AL are placed side-by-side for comparative purposes. The goal is to objectively measure the impact of the DH on runs per game (R), complete games (CG), batter age (BatAge) and attendance (Attend).

Reason 1: Increased Offensive Output

In response to the DH decision in 1973, Yankees General Manager Lee MacPhail famously said, "I never got a thrill out of watching a pitcher hit." By taking pitchers out

of the batting lineup, American League teams believed they would produce a superior product by increasing the offensive output of their teams.

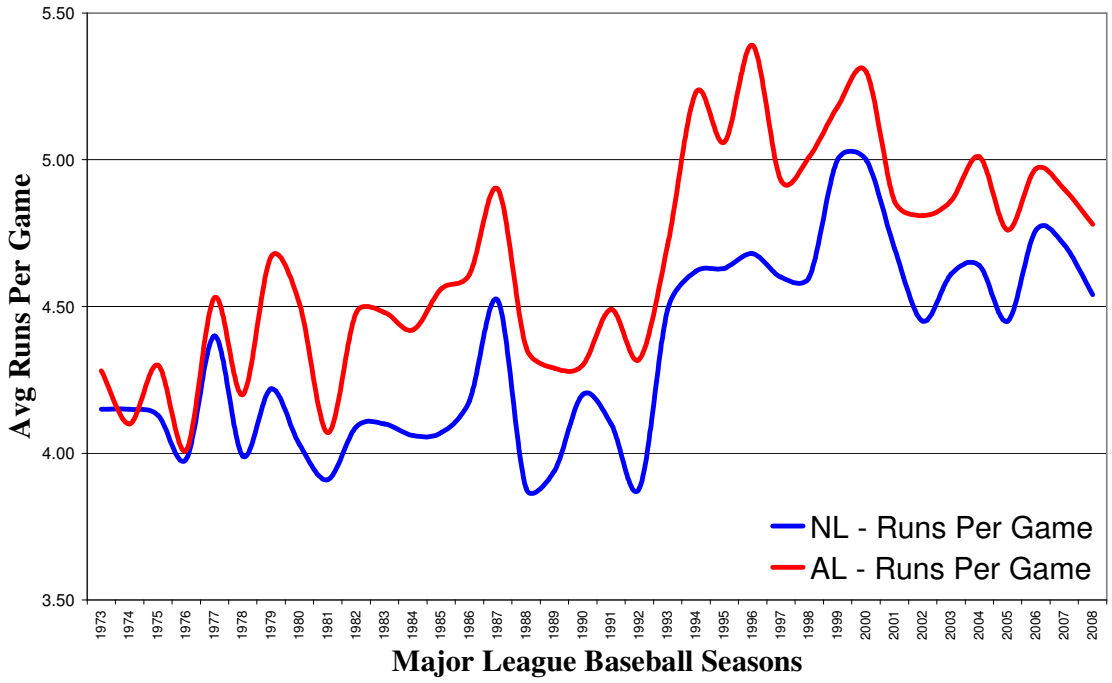
The decision to institute a DH was formally considered several times by team owners in past meetings. What caused the AL owners to take action in 1973? One reason was the NL had scored more runs than the AL in seven of eight seasons leading up to the 1973 rule change. The 1972 season proved particularly anemic for the AL offenses (see Table 2.1). Only 3 of the previous 70 seasons had been worse offensively for the AL. By comparison, the NL averaged nearly a half a run per game more than the AL in the 1972 season. As a result, the AL believed the NL was drawing more fans by producing a superior product - offensive excitement.

What happened to offensive production in the AL after the DH ruling? Since 1973, both the AL and NL have experienced a sustained positive growth rate[7] in runs per game. When compared to Period 2 (1937-1972), AL R in Period 3 (1973-2008) grew by an average of 1/3 of a run per game. Raw comparisons between the NL and AL show that the AL has scored more R than the NL in 35 of the 36 years since the DH rule change[8].

[7] "Growth Rate" here is synonymous with compound average growth rate (CAGR). This is a smoothed measurement often used to calculate gain or loss over a specified time horizon. The exact calculation is achieved by taking the nth root of the total percentage growth rate where n is the number of years being calculated.

[8] The 1974 season was the only season in Period 3 where the NL averaged more R than the AL

Table 2.1: NL vs. AL Runs 1973-2008



The superior offensive output of the AL meaningfully demonstrates that the decision to include the DH in AL lineups improved offensive production in the league[9]. The impact on attendance of this DH-fueled offensive improvement will be discussed later.

Reason 2: Marquee Starting Pitchers Yield Longer Starts

Starting pitchers are assumed to be the most talented on any team's pitching staff. As a result, AL owners reasoned that it would be a positive outcome if these pitchers lasted longer in games – fans would stick around in later innings. The statistic of "Complete Games" (CG) is used here as a relevant measurement of pitcher in-game

[9] Average runs per game were used due to the variability in number of games played due to teams being added to the league, teams changing leagues and strike shortened seasons

longevity[10]. It is hypothesized that AL pitchers should compile more CG than their NL counterparts following the DH rule change for two reasons. First, NL managers are forced to make decisions to insert pinch hitters who replace starting pitchers as a stronger bat in the lineup. Rules in the NL state that inserting a pinch hitter in place of a pitcher must be followed by the replacement of that pitcher.

Second, pitchers in the AL would spend no practice time or in-game energy on offensive participation. In other words, pitchers in the AL would not take practice batting or exert any energy during game when batting and running the bases. This specialization was expected to yield better results and longevity from starting pitchers.

American League starting pitchers should have an advantage in CG when compared to their NL counterparts. However, there were developments in the game that served to limit this superiority. First, the increased role of specialized relief pitchers in both leagues has continued to erode the number of times starting pitchers last for a full nine innings (see Table 2.3). Second, Major League Baseball clubs have moved from 4 to 5 man pitching rotations in the last several decades. As duration between starts increases, the number of actual starts decreases for pitchers over a season. As total number of starts falls, the opportunities for pitchers to pitch a complete game decreases.[11]

Results show that there have been sustained negative rates of CG over the 72 years prior to 1973 in both the AL & NL. However, post 1973, (the DH era) appears to coincide with a significant decline in CG across both leagues.

[10] Modern baseball tracks a statistic called "quality starts" that may be a better measure of starting pitcher in-game longevity. A quality start is defined as a starting pitcher lasting six or more innings and allows three or fewer runs. However, this data is not available in earlier years.

[11] Certainly there could be an argument made for pitchers who throw less can last longer when they do start. However, this does not appear to be an argument used by any noted publication.

Table 2.2: Compound Average Growth Rates in Complete Games (CG)

	AL	NL
Period 1	-1.68%	-1.83%
Period 2	-1.45%	-1.01%
Period 3	-6.54%	-7.17%

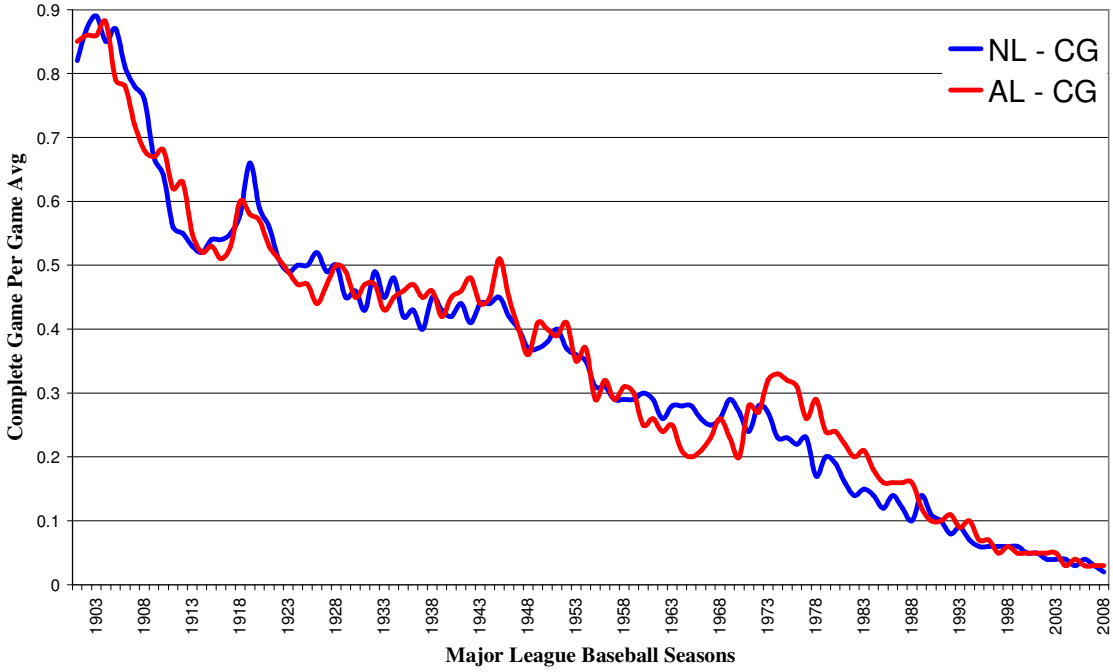
In other words, the observable trend in MLB appears to be that starting pitchers lasting nine innings (CG) is decreasingly likely. This is shown in Table 2.2 as a negative compound average growth rate. Of particular note is the large difference in (negative) growth rates from Period 2 to Period 3. Both the AL and the NL have seen steep declines in CG since 1973. The AL's decline has been only slightly slower in Period 3 than the NL's decline (-6.54% vs. – 7.17%).[12]

Despite facing a more potent offensive lineup that includes a DH (TWK 1998), it appears that AL starting pitchers have been able to pitch CG slightly more often than the NL since 1973.[13] The importance of the CG in relation to attendance will be discussed later.

[12] Over the 1901-2008 period, NL CG CAGR was -3.53%, AL CG CAGR was -3.13%

[13] Average number of complete games per game were used due to 1) the variability in number of games played over the time periods, 2) number of teams being added to the league, 3) teams changing leagues and 4) strike shortened seasons

Table 2.3: NL vs. AL Complete Games (CG)



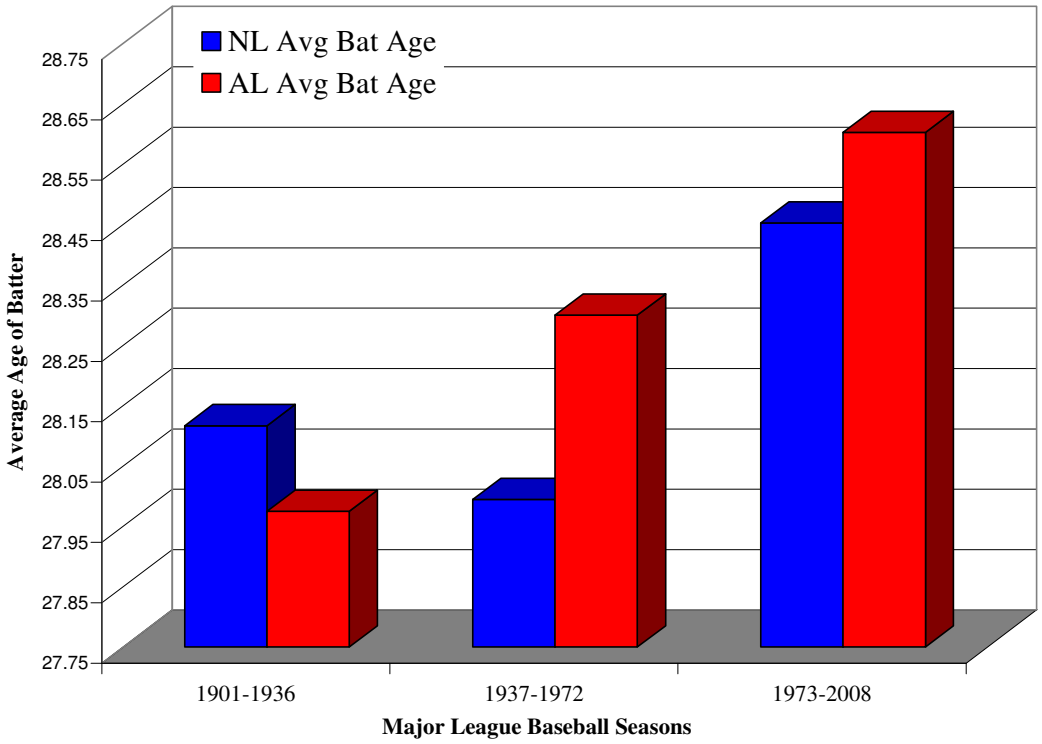
Reason 3: Increased Longevity for Productive Offensive Players

The AL owners believed that they could employ popular, established batters for more seasons by adding a DH position to the offensive lineup. By adding a hitting-only option for talent, the 1973 rule change was expected to allow popular players struggling with defensive responsibilities to continue playing. Owners surely had in mind to extend the careers of great players like Frank Robinson, Orlando Cepeda, Al Kaline and Hank Aaron. In other words, employment in baseball would be easier in the AL for these aging legends with suffering defensive skills.

After the DH introduction, did the AL begin to employ older players more frequently than in the NL? To determine the impact of the DH decision on batters age,

the average age of batters in the AL and NL was used. Comparisons between the AL and NL were employed to determine the significance of the rule change on AL batters.

Table 2.4: NL vs. AL Average Batter Age



Results from Table 2.4 indicate that the raw average age of an AL batter has increased from Period 2 (pre-DH) to Period 3 (post-DH). However, NL batters' age has grown at a faster rate during this time. Using average age in the 36 years pre and post DH (Periods 2 and 3), AL batters are 110 days and NL batters are 167 days older in Period 3 than they were in Period 2. This would indicate that the AL did not disproportionately employ older batters following the DH rule change.

Reason 4: Increased Attendance

In the three seasons leading up to the DH decision, the NL drew 36% more fans to their ballparks than their AL counterparts. Of the twelve AL teams, 8 were said to have lost money in 1972 (McKelvey 2004). Because professional baseball is presumably a for-profit enterprise, increased team revenue is considered an important reason for the AL adoption of the DH.

Did the DH experiment boost AL attendance? The answer appears nuanced with several areas to consider. First, the number of teams in the AL and the NL are not always equal. From 1901-1960 each league had eight teams. In Period 2, the NL and AL grew their number of teams at the same rate[14]. Unlike the previous two periods, Period 3 (the DH era), the AL and NL had the same number of teams in just 9 out of 36 seasons. Raw totals show that the league with the most number of teams had the highest attendance in each of these unbalanced 27 years. In years where there was parity in the number of teams, the NL outdrew the AL in 8 of the 9 years in Period 3[15].

Table 2.5: Number of Teams in Major League Baseball

Years	NL	AL
1901-1960	8	8
1961	8	10
1962-1968	10	10
1969-1976	12	12
1977-1992	12	14
1993-1997	14	14
1998-Current	14	16

[14] 1961 was the only year where the teams had an imbalance

[15] In 1995, when both leagues had 14 teams, the AL outdrew the NL in attendance by .5%, – a negligible difference.

Second, it is difficult to speculate on what the attendance growth rate in the AL would have been without the DH rule change. Table 2.6 indicates little variation in attendance growth rates in the AL across each of the three periods. The most significant changes in attendance growth rates occurred in the NL. The positive changes in growth rates from Period 1 to Period 2 (2.1% to 3.8%) were greatly offset by growth rates falling (3.8 to 2.8%) from Period 2 to Period 3.

Table 2.6: Compound Average Growth Rates of Attendance

	AL	NL
Period 1	2.6%	2.1%
Period 2	2.6%	3.8%
Period 3	2.7%	2.8%

Third, stadium information[16] was not included in this analysis. This is relevant to consider as the NL invested in nine new stadiums from 1960 to 1970 (see Table 2.7). The AL, by contrast, invested very little in their stadiums during the decade leading up to the DH ruling. Only the Oakland Athletics and California Angels moved into newly constructed stadiums during this period.

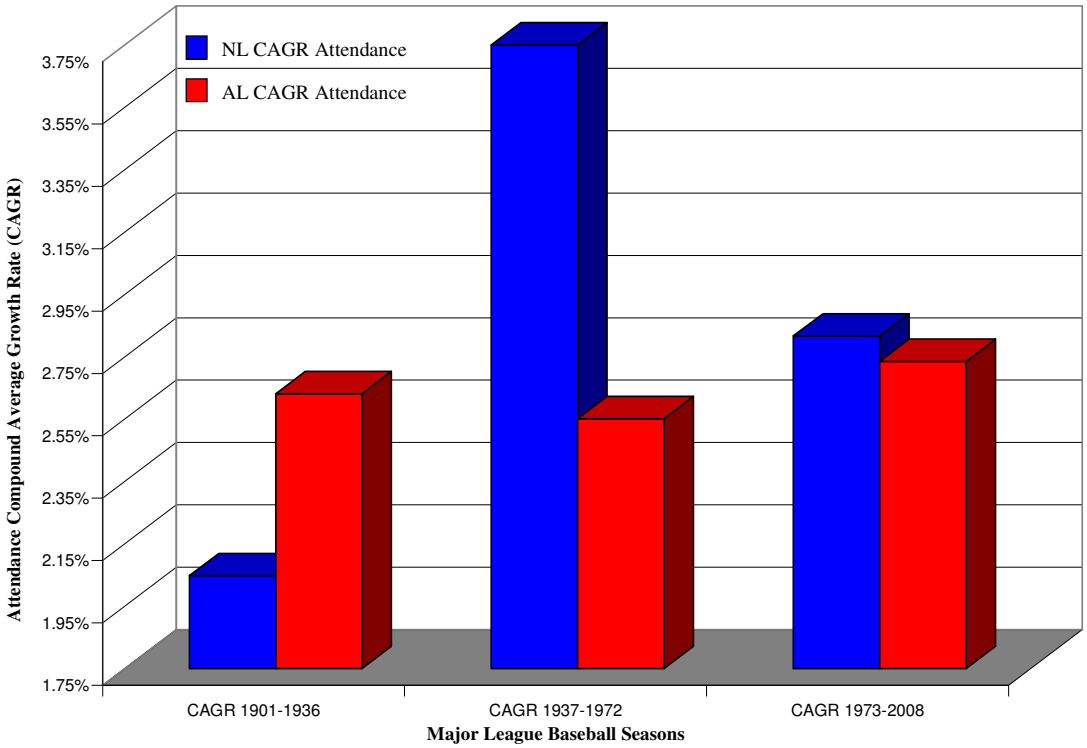
Table 2.7: National League Stadiums Build From 1960-1970

Year	Stadium	City, State
1960	Candlestick Park	San Francisco, CA
1962	Dodger Stadium	Los Angeles, CA
1964	Shea Stadium	New York, NY
1965	Astrodome	Houston, TX
1966	Busch Stadium	St. Louis, MO
1966	Fulton County Stadium	Atlanta, GA
1968	Padres Stadium	San Diego, CA
1970	Riverfront Stadium	Cincinnati, OH
1970	Three Rivers Stadium	Pittsburg, PA

[16] Other variables such as populations of cities, neighborhood demographics around stadiums, economic growth, population growth, park dimensions, etc. were also not included here

As a substitute to constructing attendance boosting new ballparks, the AL may have simply instituted the DH rule change in order to increase attendance.

Table 2.8: Attendance Compound Average Growth Rates Periods 1-3



It should also noted that when calculating raw attendance numbers, baseball experienced several meaningful strike-shorted seasons that likely contributed to lower gross attendance numbers. Notable strike years included 1972, 1981, 1994, and 1995. These strike events impacted both AL and NL teams.

CHAPTER THREE

TESTING THE DH/ATTENDANCE HYPOTHESIS

As mentioned previously, AL owners may have believed that the DH rule change would improve attendance and team revenues. In addition, the DH was expected to increase offensive output, encourage starting pitchers to last longer in games, and allow aging but productive offense players to lengthen their playing careers.

Is attendance data closely aligned with any of these variables? Considering both the AL & NL, analysis was performed to determine whether attendance (the dependant variable) is meaningfully correlated with any one of the three remaining (independent) variables. Offensive output is computed by runs scored per game (R), duration of starting pitching uses complete games (CG), and average batter age (BatAge) is used to calculate age differences of offensive players across periods.

Table 3.1: Attendance Correlation Analysis

	R	**CG**	**BatAge**
Period 1	NL	NL/AL	NL
Period 2	x	NL/AL	NL
Period 3	NL/AL	NL/AL	NL/AL

Where

- 'NL' or 'AL' alone indicates a positive correlation in the National League or American League only in a given period
- 'NL/AL' signifies positive correlation with attendance in both leagues in a given period

- 'x' signifies lack of significant correlation between attendance and the other variables in either the NL or the AL during a given period

As shown in Table 3.1, attendance in the NL was correlated with R, CG and BatAge across most periods (Period 2 R being the lone exception). By contrast, the AL experienced no correlation in R and BatAge prior to Period 3. The correlation results of R, CG and BatAge in Period 3 in the AL resemble much of what was happening in the NL in Period 1 and Period 2.

Could the AL have been trying to replicate NL attendance gains? The AL owners may have believed the NL was more optimally managing R, CG and BatAge due to the NL attendance growth superiority in Periods 1 and 2. As a result of the introduction of the DH (and possibly other changes), AL began to reflect NL-type correlation between attendance, R, CG and BatAge.

In order to approximate the independent variable most closely associated with attendance, a fitted regression and regression coefficient analysis was performed. To improve sample size, the period-by-period delineation of data was dropped. Three 36 year periods were combined into a single 108 season data set.

Table 3.2: Attendance R-Squared Analysis

	R	CG	BatAge
AL	.0693	.7326	.1559
NL	.0468	.7296	.1821

When comparing the independent variables of R, CG and BatAge (Table 3.2), the CG data is outstanding. Specifically, the regression analysis signals that approximately

73% of the variation in attendance is explained by CG. By contrast, R explains only 5-7% of attendance. Batter Age appears to explain 16-18%. Stated differently, it appears that CG is most closely associated with attendance.

Only starting pitchers are eligible for CG status. Therefore, the growth in participation by relief pitchers - acting as substitutes for starting pitchers - may indeed have had an impact on attendance. In specific contrast, CG has steadily declined since 1901 while attendance has been on the rise (Tables 2.2 and 2.1 respectively). This certainly bears further consideration as the number of CG has fallen more rapidly in most recent years. It should also be noted that the number of CG fell in the NL and the AL at a similar rate. Whether the introduction of the DH has had any effect on CG is the subject of further study.[17]

Finally, several other empirical tests were run for this work but excluded from the final results. The first was a test to determine which important offensive statistic (runs, doubles, home runs, slugging percentage, and strikeouts) was most closely aligned with hit batsmen. The second test was to determine if pitchers' age (PitchAge) and BatAge were correlated in the AL, NL or blended leagues. Further, cross-league analysis of AL versus NL PitchAge and AL versus NL BatAge was conducted. The results of this analysis proved inconclusive and did not fall within the scope of this work to explore.

[17] First difference calculations were not included here. It is likely that the CG/Attendance relationship will be proved less remarkable when performing this level of analysis.

CHAPTER FOUR

OTHER IDEAS TO BE CONSIDERED

Approximately one percent (1%) of all plate appearances in Major League Baseball results in a hit batsman (BD 2006, 2007). As a result of this scarcity, there have been legitimate questions about the accuracy of explanation related to the DH and hit batsman. Some questions have been answered through the deterrence and lineup composition theories. Additionally, organization of micro-level play-by-play information has further resulted in many reasons behind pitchers hitting batters.

Moving forward, there appear to be a number of additional issues related to the DH and hit batsmen that have not yet been publicly addressed and properly analyzed. The following are a number of suggestions for future related research on this topic.

Who Gets Hit

A first area of consideration is simply a consideration of which batters get hit? Does data show that as batter quality increases, they are more likely to be plunked? A logical conclusion would be that the higher the OPS (on base percentage plus slugging percentage), the lower the cost of hitting a batter. Assuming pitchers are logical in their choices of plunking, they should choose higher OPS batters to hit, decreasing the cost of their behavior. Is this the case? Additionally, it may be interesting to compare the NL and AL offenses and hit batsmen. Specifically, as the two leagues have converged in offensive output (runs) in recent years, does the proportion of hit batsmen follow?

Batting Helmets

There were three meaningful rule changes in MLB from 1969-1973. The pitchers mound was lowered in 1969, batting helmets became mandatory in 1971 and the DH was introduced in the AL in 1973. An area for further study would be the impact of batting helmets on hit batsman in MLB. Using Peltzman's *The Effects of Automobile Safety Regulation*[18] as a basis for analysis, one could determine if additional protection offered to batters contributed to riskier behavior. Using Peltzman's conclusions as a predictor of behavior, one would assume that batters and pitchers would both engage in riskier behavior post-batting helmets. More specifically, pitchers should be observed hitting more batters given the added protection that ostensibly would protect batters from serious injury.[19]

Designated Hitter Return on Investment

The cost of employing a designated hitter may be more expensive than employing additional relief pitchers or substituting pinch hitters. As the DH position has developed over the years, it has become one of the most highly compensated on team payrolls. Further study into this topic would consider team profitability prior to and after the 1973 DH ruling. In other words, has the hiring of a player to fill the DH position offered a positive return on investment for AL owners?

[18] Peltzman, Sam "The Effects of Automobile Safety Regulation", Journal of Political Economy, 1975, vol. 83, no 4, pp 677-724

[19] "Warnings to pitchers about hitting batter stir up controversy" (Warm Up Tosses), Baseball Digest, November 1, 2002 offers a brief history of notable injuries from batters who were struck in the head by pitched balls and the results of player's productivity post-beaning

Umpire Effect

Studies related to the impact of the DH on hit batsman have included (BD 2006, 2007) but not narrowly focused on the impact of the umpire on the game. Specifically, the 1994 double-warning rule appears to have impacted the behavior of pitchers. The double-warning rule was intended to increase the cost of hitting a batter. It appears to have had the opposite effect as "NL pitchers now bear a lower cost for hitting batters and therefore ought to be expected to behave more like their counterparts in the AL" (BD 2006). Data post 1994 appears to support this moral hazard conclusion.

One possible area to consider is the impact on offense after umpire invoking of the double-warning rule. After this action by officials, do pitchers behave differently? Does offensive production improve as a result of ejection-avoidance behavior by pitchers who are less willing to pitch inside to batters? Further study of this concept would likely include the rates of pitcher ejection in both leagues prior to and following the institution of the DH rule change and/or the double-warning rule in 1994. All things being equal, the double-warning rule should be closely correlated with higher in-game OPS rates following the warning. Due to the relative infrequency of such ejections, data would have to be gathered over a longer period of time and may be subject to heavy levels of aggregating. This post-ejection data may provide a further opportunity to utilize BD's micro-level data.

Pitcher Durability

With the exception of the DH, rules in the AL and NL are virtually identical. The DH and pitcher in the AL are assumed to exert less energy than their NL pitching and

fielding counterparts who must perform both offensive and defensive tasks. What impact does this have on the performance of the NL pitchers? One would suspect that AL starting pitchers should last longer in games than NL pitchers. The degree of difference in performance may factor into the true cost of a pitcher hitting. A relevant statistic would be to study quality starts by NL and AL pitchers prior to and following the DH rule change in 1973. Additional statistics such as earned run average (ERA), CG and opposing hitter OPS may provide a more complete picture to previous discussions of the impact of the DH on baseball.

Also, NL pitcher fatigue may result in pitchers batting. Evidence of decreased NL pitching performance may be found in pitchers not holding runners close to bases resulting in more stolen bases allowed. (For example, Bradbury and Drinen mention the correlation of hit batsmen and base runners in their work.)

Also, do NL catchers pick up the defensive slack from fatigued pitchers? Do catcher games caught or catcher OPS suffer as a result of their increased defensive responsibilities? If there shows no statistical difference in these areas across leagues, then one justification for the DH – marquee starting pitchers lasting longer on the mound – could be called into question.

The Impact of Player Size on Hit Batsmen

When it comes to hit batsmen, does size matter? In 1972, Cleveland Indians General Manager Gabe Paul wrote, "The stadiums and the pitchers are getting bigger" (New York Times 1972). While Bradbury and Drinen do not discuss pitcher size, they do point out that lower-skilled pitchers (as judged by batter OPS) are wilder and thus more likely to hit batters. Trandel, White and Klein (1998) posit that, "threatening the

opponents with injury to a top hitter should provide a…deterrent" and "plunking a big slugger is in fact standard retaliatory strategy". What about pitcher size? Large hurlers such as Roger Clemens, Randy Johnson or Nolan Ryan were known as "intimidation pitchers" that frequently pitched inside strikes. Is it possible that physically larger pitchers engage in riskier behavior because their physical stature discourages one type of retribution – batters charging the mound? Do large hitters pose a similar threat of deterrence against pitchers?

The quality and quantity of MLB data along with legions of devoted baseball fans should continue to provide a solid foundation for scholarly work in the impact of the DH in the years ahead. The above represent several directions for future study of the moral hazard argument in Major League Baseball.

CONCLUSION

The DH began as a peculiar experiment at an equally peculiar place – Fenway Park. Nearly four decades after the decision, the DH now seems less an experiment and more of an institution. The DH debate remains as heated as the Red Sox versus Yankees rivalry.

The Major League Baseball winter meetings of 1973 were some of the most memorable on record. In 18 of the 20 seasons leading up to the 1973 vote, the NL drew more fans and was growing faster than the AL[20]. When called to a vote, the NL team owners voted against instituting a DH[21]. The AL owners voted in favor of the rule change. The owners in the AL believed that the DH would positively impact the fan experience, giving a boost to attendance totals.

More specifically, AL owners predicted attendance would follow DH-driven improvements in their games including the following: increased offense, in-game longevity for marquee starting pitchers and longer careers for aging players who could still be offensively productive.

When comparing the results from the NL to the AL in these areas, several conclusions can be drawn. First, the AL has realized offensive superiority to the NL since 1973. [22] Second, batters ages are not significantly different across leagues thus rejecting the idea that the AL is the exclusive home for the aged slugger. Third, starting pitchers across both leagues have continued to earn fewer complete games over the three periods

[20] In 1961, one of the two years the AL had a higher growth rate than the NL, they also had two more teams
[21] The NL voted in favor of instituting the DH back in 1928, but both leagues were required to approve such a measure and the AL was against the rule change.
[22] The most recent decade (1998-2008) has witnessed the NL offenses coming in line with the AL. Further study is warranted to determine reasons for such a convergence

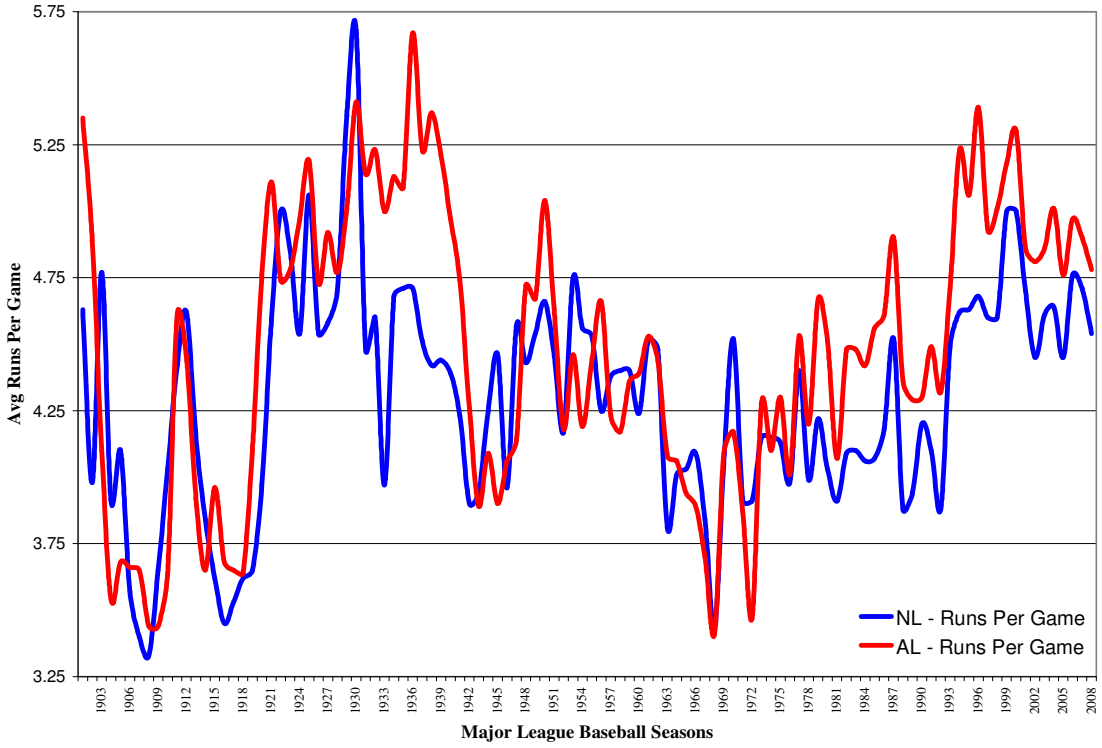
in this study. From 1973-2008 (Period 3) the number of complete games saw much steeper declines than in previous periods across both leagues.

The DH rule change was designed to improve attendance in the AL. When performing a regression analysis on 108 years of data, it appears that complete games pitched is more closely aligned with attendance than are batters ages or runs scored.

Finally, there appear to be several areas left to consider about the designated hitter and hit batsmen. Some of the possible options could cover batter ability, batter physical protection, umpire behaviors and player size. Fortunately, data is readily available to consider these and other reasons for pitchers hitting batters.

APPENDICES

Appendix 2.1a: NL vs. AL Runs



Appendix 2.1b: Runs Per Game NL vs. AL

Runs Per Game

Years	NLAverage	ALAverage	Delta
1901-1936	4.29	4.46	0.18
1937-1972	4.26	4.32	0.06
1973-2008	4.35	4.66	0.31

Appendix 2.2a: CAGR: A, R, BatAge, CG

CAGR Analysis

CAGR	ALAttend	ALR	ALBatAge	ALCG
1901-1936	2.63%	0.17%	0.05%	-1.68%
1937-1972	2.55%	-1.17%	-0.07%	-1.45%
1973-2008	2.73%	0.32%	0.10%	-6.54%

CAGR	NLAttend	NLR	NLBatAge	NLCG
1901-1936	2.05%	0.05%	0.01%	-2.20%
1937-1972	3.80%	-0.41%	-0.10%	-1.45%
1973-2008	2.82%	0.26%	0.14%	-6.74%

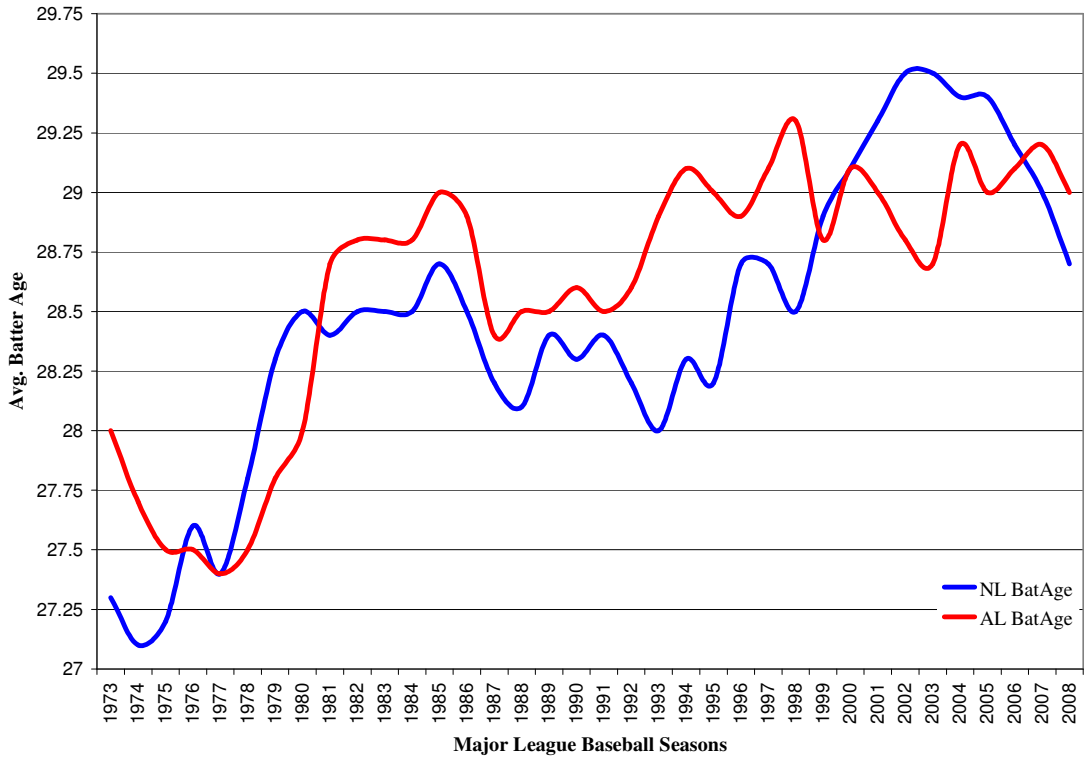
CAGR	ALAttend	NLAttend
1901-1936	2.63%	2.05%
1937-1972	2.55%	3.80%
1973-2008	2.73%	2.82%

CAGR	ALR	NLR
1901-1936	0.17%	0.05%
1937-1972	-1.17%	-0.41%
1973-2008	0.32%	0.26%

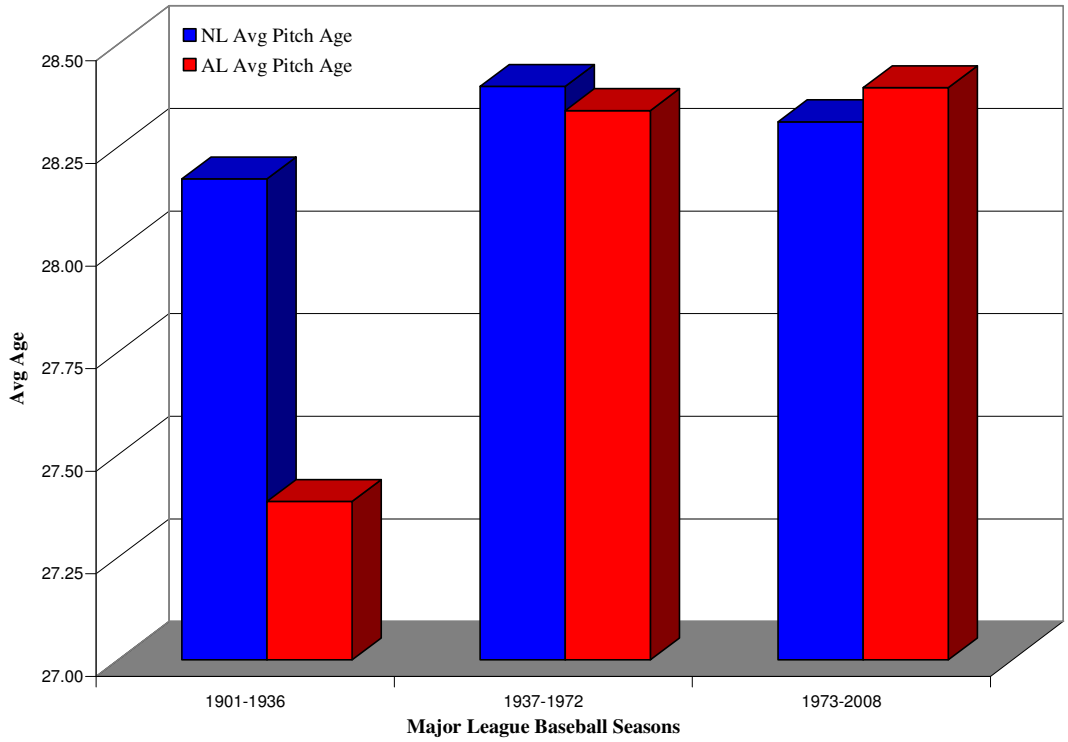
CAGR	ALBatAge	NLBatAge
1901-1936	0.05%	0.01%
1937-1972	-0.07%	-0.10%
1973-2008	0.10%	0.14%

CAGR	ALCG	NLCG
1901-1936	-1.68%	-2.20%
1937-1972	-1.45%	-1.45%
1973-2008	-6.54%	-6.74%

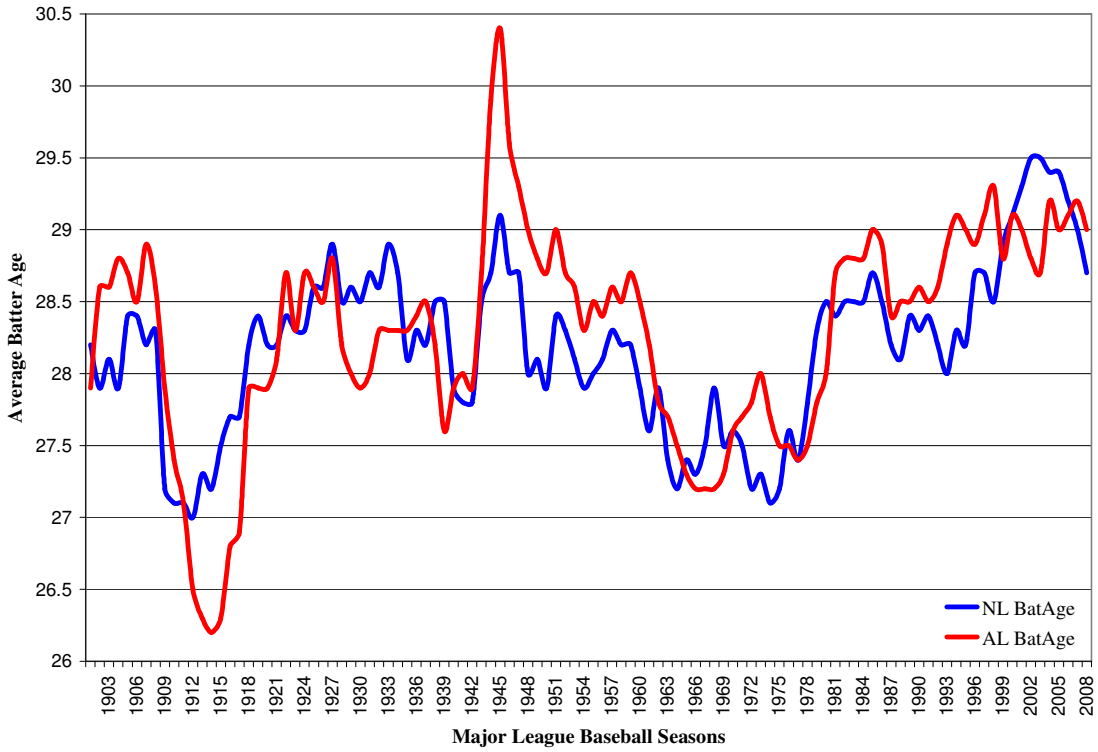
Appendix 2.3a: Average MLB Batter Age 1973-2008



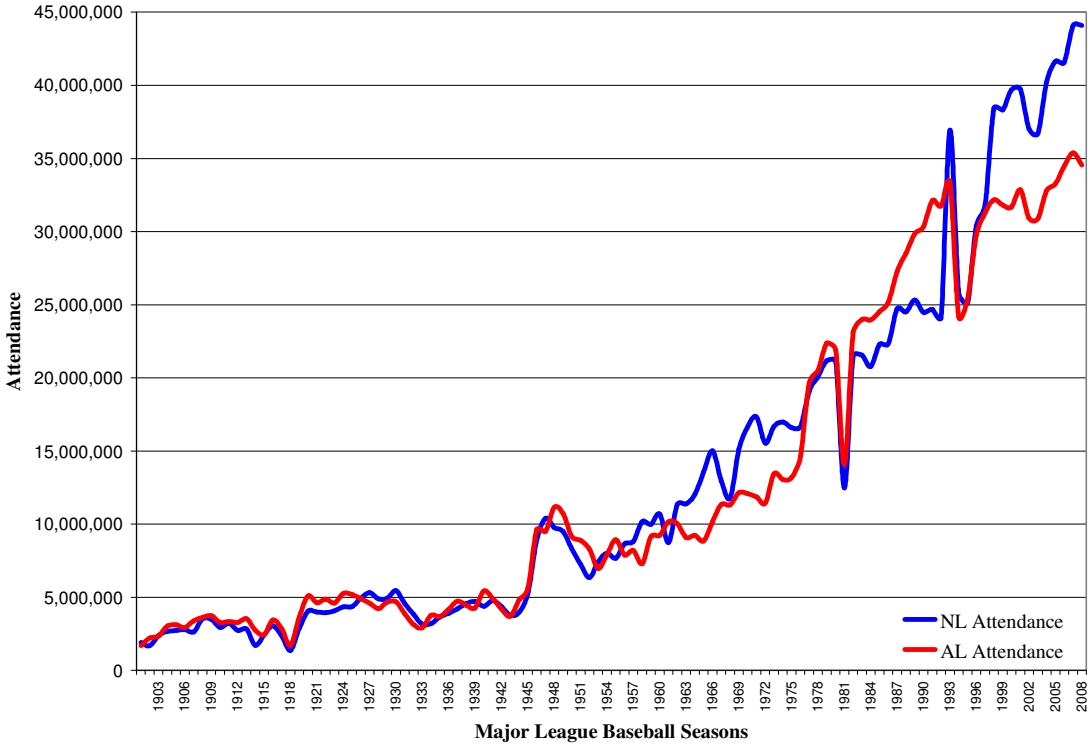
Appendix 2.3b: NL vs. AL Pitcher Age



Appendix 2.3c: NL vs. AL Average Batter Age



Appendix 2.5a: NL vs. AL Attendance



Appendix 3.1a: NL vs. AL Seasons – A, R, BatAge, CG

Attendance, Runs, BatAge, CG

Year	AL Attend	AL R	AL BatAge	AL CG	NL Attend	NL R	NL BatAge	NL CG
2008	34,540,540	4.78	29.0	0.03	44,083,775	4.54	28.7	0.02
2007	35,389,158	4.90	29.2	0.03	44,095,560	4.71	29.0	0.02
2006	34,465,295	4.97	29.1	0.03	41,578,607	4.76	29.2	0.03
2005	33,270,923	4.76	29.0	0.04	41,644,345	4.45	29.4	0.04
2004	32,798,075	5.01	29.2	0.03	40,224,897	4.64	29.4	0.03
2003	30,906,711	4.86	28.7	0.05	36,723,341	4.61	29.5	0.04
2002	30,918,426	4.81	28.8	0.05	37,025,963	4.45	29.5	0.04
2001	32,853,727	4.86	29.0	0.05	39,727,374	4.70	29.3	0.04
2000	31,675,798	5.30	29.1	0.05	39,683,109	5.00	29.1	0.05
1999	31,816,532	5.18	28.8	0.05	38,322,848	5.00	28.9	0.05
1998	32,174,363	5.01	29.3	0.06	38,426,784	4.60	28.5	0.06
1997	31,283,321	4.93	29.1	0.05	31,885,368	4.60	28.7	0.06
1996	29,718,093	5.39	28.9	0.07	30,379,288	4.68	28.7	0.06
1995	25,358,988	5.06	29.0	0.07	25,110,248	4.63	28.2	0.06
1994	24,202,197	5.23	29.1	0.10	25,807,819	4.62	28.3	0.06
1993	33,333,365	4.71	28.9	0.09	36,924,573	4.49	28.0	0.07

1992	31,759,331	4.32	28.6	0.11	24,111,135	3.88	28.2	0.09
1991	32,117,588	4.49	28.5	0.10	24,696,172	4.10	28.4	0.08
1990	30,332,260	4.30	28.6	0.10	24,491,508	4.20	28.3	0.10
1989	29,849,262	4.29	28.5	0.12	25,323,834	3.94	28.4	0.11
1988	28,499,636	4.36	28.5	0.16	24,499,268	3.88	28.1	0.14
1987	27,277,351	4.90	28.4	0.16	24,734,155	4.52	28.2	0.10
1986	25,172,732	4.61	28.9	0.16	22,333,471	4.18	28.5	0.12
1985	24,532,225	4.56	29.0	0.16	22,292,154	4.07	28.7	0.14
1984	23,961,427	4.42	28.8	0.18	20,781,436	4.06	28.5	0.12
1983	23,991,053	4.48	28.8	0.21	21,549,285	4.10	28.5	0.14
1982	23,080,449	4.48	28.8	0.20	21,507,425	4.09	28.5	0.15
1981	14,065,986	4.07	28.7	0.22	12,478,390	3.91	28.4	0.14
1980	21,890,052	4.51	28.0	0.24	21,124,084	4.03	28.5	0.16
1979	22,371,979	4.67	27.8	0.24	21,178,419	4.22	28.3	0.19
1978	20,529,965	4.20	27.5	0.29	20,106,921	3.99	27.8	0.20
1977	19,639,551	4.53	27.4	0.26	19,070,228	4.40	27.4	0.17
1976	14,657,802	4.01	27.5	0.31	16,660,529	3.98	27.6	0.23
1975	13,189,423	4.30	27.5	0.32	16,600,490	4.13	27.2	0.22
1974	13,047,294	4.10	27.7	0.33	16,978,314	4.15	27.1	0.23
1973	13,433,604	4.28	28.0	0.32	16,675,322	4.15	27.3	0.23
1972	11,438,538	3.47	27.8	0.27	15,529,730	3.91	27.2	0.27
1971	11,868,560	3.87	27.7	0.28	17,324,857	3.91	27.5	0.28
1970	12,085,135	4.17	27.6	0.20	16,662,198	4.52	27.6	0.24
1969	12,134,720	4.09	27.3	0.23	15,094,946	4.05	27.5	0.27
1968	11,317,387	3.41	27.2	0.26	11,785,358	3.43	27.9	0.29
1967	11,336,923	3.70	27.2	0.23	12,971,430	3.84	27.5	0.26
1966	10,166,738	3.89	27.2	0.21	15,015,471	4.09	27.3	0.25
1965	8,860,764	3.94	27.3	0.20	13,581,136	4.03	27.4	0.26
1964	9,235,151	4.06	27.5	0.21	12,045,190	4.01	27.2	0.28
1963	9,094,847	4.08	27.7	0.25	11,382,227	3.81	27.4	0.28
1962	10,015,056	4.44	27.8	0.24	11,360,159	4.48	27.9	0.28
1961	10,163,016	4.53	28.2	0.26	8,731,502	4.52	27.6	0.26
1960	9,226,526	4.39	28.5	0.25	10,684,963	4.24	27.9	0.29
1959	9,149,454	4.36	28.7	0.30	9,994,525	4.40	28.2	0.30
1958	7,296,034	4.17	28.5	0.31	10,164,596	4.40	28.2	0.29
1957	8,196,218	4.23	28.6	0.29	8,819,601	4.38	28.3	0.29
1956	7,893,683	4.66	28.4	0.32	8,649,567	4.25	28.1	0.29
1955	8,942,971	4.44	28.5	0.29	7,674,412	4.53	28.0	0.31
1954	7,922,364	4.19	28.3	0.37	8,013,519	4.56	27.9	0.31
1953	6,964,076	4.46	28.6	0.35	7,419,721	4.75	28.1	0.35
1952	8,293,896	4.18	28.7	0.41	6,339,148	4.17	28.3	0.36
1951	8,882,674	4.63	29.0	0.39	7,244,002	4.46	28.4	0.37
1950	9,142,361	5.04	28.7	0.40	8,320,616	4.66	27.9	0.40
1949	10,730,647	4.67	28.8	0.41	9,484,718	4.54	28.1	0.38
1948	11,150,099	4.72	29.0	0.36	9,770,743	4.43	28.0	0.37
1947	9,486,069	4.14	29.3	0.40	10,388,470	4.57	28.7	0.37
1946	9,621,182	4.06	29.6	0.45	8,902,107	3.96	28.7	0.40
1945	5,580,420	3.90	30.4	0.51	5,260,703	4.46	29.1	0.42
1944	4,798,158	4.09	29.9	0.45	3,974,588	4.25	28.7	0.45
1943	3,696,569	3.89	28.7	0.44	3,769,342	3.94	28.5	0.44

1942	4,200,216	4.26	27.9	0.48	4,353,353	3.90	27.8	0.44
1941	4,911,956	4.74	28.0	0.46	4,777,647	4.23	27.8	0.41
1940	5,433,791	4.97	27.9	0.45	4,389,693	4.39	27.9	0.44
1939	4,270,602	5.21	27.6	0.42	4,707,177	4.44	28.5	0.42
1938	4,445,684	5.37	28.2	0.46	4,560,827	4.42	28.5	0.43
1937	4,735,835	5.23	28.5	0.45	4,204,228	4.51	28.2	0.45
1936	4,178,922	5.67	28.4	0.47	3,903,691	4.71	28.3	0.40
1935	3,688,007	5.09	28.3	0.46	3,657,309	4.71	28.1	0.43
1934	3,763,606	5.13	28.3	0.45	3,200,105	4.68	28.7	0.42
1933	2,926,210	5.00	28.3	0.43	3,162,821	3.97	28.9	0.48
1932	3,133,232	5.23	28.3	0.47	3,841,334	4.60	28.6	0.45
1931	3,883,292	5.14	28.0	0.47	4,583,815	4.48	28.7	0.49
1930	4,685,730	5.41	27.9	0.45	5,446,532	5.68	28.5	0.43
1929	4,662,470	5.01	28.0	0.49	4,925,713	5.36	28.6	0.46
1928	4,221,188	4.77	28.2	0.50	4,881,097	4.70	28.5	0.45
1927	4,612,951	4.92	28.8	0.47	5,309,917	4.58	28.9	0.50
1926	4,912,583	4.73	28.5	0.44	4,920,399	4.54	28.6	0.49
1925	5,186,851	5.19	28.6	0.47	4,353,704	5.06	28.6	0.52
1924	5,255,439	4.97	28.7	0.47	4,340,644	4.54	28.3	0.50
1923	4,602,589	4.78	28.3	0.49	4,069,817	4.85	28.3	0.50
1922	4,874,355	4.74	28.7	0.51	3,941,820	5.00	28.4	0.49
1921	4,620,328	5.11	28.1	0.53	3,986,984	4.59	28.2	0.51
1920	5,084,300	4.76	27.9	0.57	4,036,575	3.97	28.2	0.56
1919	3,654,236	4.10	27.9	0.58	2,878,203	3.65	28.4	0.59
1918	1,707,999	3.64	27.9	0.60	1,372,127	3.62	28.2	0.66
1917	2,858,858	3.65	26.9	0.53	2,361,136	3.53	27.7	0.58
1916	3,451,885	3.68	26.8	0.51	3,051,634	3.45	27.7	0.55
1915	2,434,684	3.96	26.3	0.53	2,430,142	3.62	27.5	0.54
1914	2,747,591	3.65	26.2	0.52	1,707,397	3.84	27.2	0.54
1913	3,526,805	3.92	26.3	0.55	2,831,531	4.15	27.3	0.52
1912	3,263,631	4.45	26.5	0.63	2,735,759	4.62	27.0	0.53
1911	3,339,514	4.61	27.1	0.62	3,231,768	4.42	27.1	0.55
1910	3,270,689	3.64	27.4	0.68	2,935,758	4.03	27.1	0.56
1909	3,739,870	3.44	27.9	0.67	3,496,420	3.65	27.2	0.64
1908	3,611,366	3.44	28.6	0.68	3,512,108	3.33	28.3	0.67
1907	3,398,764	3.65	28.9	0.72	2,640,220	3.40	28.2	0.76
1906	2,938,076	3.66	28.5	0.78	2,781,213	3.57	28.4	0.78
1905	3,120,752	3.68	28.7	0.79	2,734,310	4.10	28.4	0.81
1904	3,024,028	3.54	28.8	0.88	2,664,271	3.91	27.9	0.87
1903	2,344,888	4.10	28.6	0.86	2,390,362	4.77	28.1	0.85
1902	2,206,454	4.89	28.6	0.86	1,683,012	3.98	27.9	0.89
1901	1,683,584	5.35	27.9	0.85	1,920,031	4.63	28.2	0.87

Appendix 3.1b: Statistical Summary

Statistical Analysis Summary

R-Squared

AL	Attend/R	Attend/BatAge	Attend/CG
1901-1936	0.190	0.087	0.359
1937-1972	0.206	0.101	**0.537**
1973-2008	0.399	**0.545**	**0.869**

T-Stat Intercept

AL	Attend/R	Attend/BatAge	Attend/CG
1901-1936	0.932	-1.163	10.561
1937-1972	5.293	2.507	13.688
1973-2008	-2.442	-5.725	48.778

P-Value Intercept

AL	Attend/R	Attend/BatAge	Attend/CG
1901-1936	0.358	0.253	0.000
1937-1972	0.000	0.017	0.000
1973-2008	0.020	0.000	0.000

R-Squared

NL	Attend/R	Attend/BatAge	Attend/CG
1901-1936	0.389	0.268	0.404
1937-1972	0.111	0.454	**0.726**
1973-2008	**0.605**	**0.572**	**0.758**

T-Stat Intercept

NL	Attend/R	Attend/BatAge	Attend/CG
1901-1936	-1.342	-3.107	10.484
1937-1972	3.088	5.632	14.683
1973-2008	-5.143	-6.141	27.713

P-Value Intercept

NL	Attend/R	Attend/BatAge	Attend/CG
1901-1936	0.188	0.004	0.000
1937-1972	0.004	0.000	0.000
1973-2008	0.000	0.000	0.000

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