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Well, we have good news. Well, it's Chuck Tanner type good news, but I figure what the hell, it seems to be working for Chuck and Sparky. The good news is, the price freeze is over. Entering our sixth year, we are lifting the price of an Analyst subscription to $16 a year. Sorry, but the costs associated with the effort have escalated steadily--printing is 80 cents an issue, envelopes 14 cents, postage 41 cents and probably going up. . .Prior subscriptions, of course, will be honored.

Four articles this time:

Bill James

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WHAT TYPE TEAM SPELLS R-E-L-I-E-F BEST?
by Russ Eagle

As a Cardinal fan, I can remember a number of sportswriters and sportscasters in 1984 marveling at Bruce Sutter's save total of 45 with the 84-78 Redbirds. I remember one suggesting that had Sutter been with Detroit in '84 he would have saved 55-60 games. Skeptical as I was, I didn't think too much about it at the time. I did start to think about it last fall though, when I was working on PROJECT SCORESHEET'S "The Great American Baseball Stat Book." I was working on Todd Worrell's player commentary, and I recalled that I'd heard a couple of similar comments about Worrell in '86. He recorded 36 saves for a team that won only 79 games, and I read in at least two places that if the Cardinals had repeated their '85 success in '86, Worrell would have probably broken Sutter's National League save record.

How many saves would Sutter have recorded in '84 if he had pitched for a winner? Or Worrell in '86? In the commentary I wrote on Worrell, I pointed out that the eleven pitchers who have compiled save totals of 35 or more for a season during the 1980's pitched for teams with a combined winning percentage of only .522. That's less than 85 wins per season. The reasons for this, I suggested, are (1) because the teams around the .500 mark would tend to be involved in the most close games over the course of a season, and (2) because the teams just over .500 would tend to win more of these. The'86 Cardinals, I pointed out, had just as many saves as the Mets, even though they trailed New York in wins by a 108-79 margin. My suggestion then is that neither Sutter nor Worrell stood to benefit from pitching for better teams than they did. Their save totals would have increased only slightly, if at all. I'm not suggesting that a reliever could not have saved 35-40 games for the '86 Mets; I'm sure that would have been quite possible. My contention is that circumstances that could limit a pitcher's save total would be present moreso with the Mets than they would with a less successful team. My reasoning is basically this:

(1)The better the team, the bigger their lead is likely to be

(2)The bigger the lead a team has, the less likely they are to require the services of their <u>ace</u> reliever

There are other factors which come into play, of course. The better teams, for example, will have better bullpens in many cases. They may have more than one quality reliever, enabling them to split the relief chores among several pitchers. The '86 Mets are a classic example here too, with McDowell and Orosco recording save totals of 22 and 21, respectively. A division winner might also be more concerned with giving its top reliever the proper rest during the season so that his arm is strong for postseason play. (Of course there is also the possibility of being involved in a close race all season, and therefore using your stopper more often down the stretch.)

Losing teams, on the other hand, will have fewer wins and therefore fewer saves. Being losing teams also means that they are less likely to have a quality bullpen in the first place. Even if they do have a top-notch reliever, it's hard to save 40 games on a team that only wins 70. Such a team would also be more willing to give younger and/or less-proven pitchers an opportunity, particularly late in the season. The worst of the eleven teams mentioned in the Worrell piece was the '84 Oakland club, where Bill Caudill saved 36 of the team's 77 wins. It does seem that a losing team would have to struggle for more of its victories, and therefore they would have saves in a higher percentage of their victories than winning teams. But there's still no way that percentage could be high enough to make up for the difference between 70 and 95 wins.

Where, then, can we look for the man to break Dave Righetti's save record of 46 in one season? It's my guess that it'll be on a team such as Righetti's Yanks, a club with 85-90 wins that is involved in a pennant race close enough that the team sticks with its frontline players up to the last week or so of the season. CHART I below lists all players who have compiled 35 or more saves in a year during the last ten seasons (1976-1986, '81 excluded).

CHART I: 35 OR MORE SAVES IN A SEASON: 1976-1986

YEAR	PITCHER	SAVES	TEAM	TEAM RECORD
1977	Rollie Fingers	35	San Diego	69-93
1978	Rollie Fingers	37	San Diego	84-78
1979	Bruce Sutter	37	Chicago(NL)	80-82
1982	Dan Quisenberry	35	Kansas City	90-72
1982	Bruce Sutter	36	St. Louis	92-70
1983	Dan Quisenberry	45	Kansas City	79-83
1984	Dan Quisenberry	44	Kansas City	84-78
1984	Bill Caudill	36	Oakland	77-85
1984	Bruce Sutter	45	St. Louis	84-78
1985	Dan Quisenberry	37	Kansas City	91-71
1985	Jeff Reardon	41	Montreal	84-77
1986	Todd Worrell	36	St. Louis	79-82
1986	Jeff Reardon	35	Montreal	78-83
1986	Dave Righetti	46	New York(AL)	90-72
	AVERAGES	39		83-79

The figures presented in the chart seem to support the things I have suggested. First of all, there is only one player on the list, Fingers in '77, who played on a team with fewer than 77 wins, and he barely made the list with 35 saves. That's not to say his feat is not impressive; it certainly is. But it still seems unlikely that anyone will ever approach 40-45 saves on a team with fewer than 70-75 wins. Not impossible, mind you, but highly unlikely.

The averages on the last line of the chart also appear to support my argument: the best type of team to pitch for if you want to win the Rolaids' Award is an average-to-good team. The fourteen teams in the chart have an average record of 83 wins and 79 losses. The highest win total is that of the '82 Cardinals, who won 92 games, and again, their pitcher barely made the chart with 36 saves. In fact, of the five 40-plus save seasons, only Righetti's record '86 campaign was with a team of ninety or more wins, and the Yanks only won 90. Let's take a look at Chart II, which eliminates those players from Chart I with less than 40 saves.

CHART II: 40 OR MORE SAVES IN A SEASON: 1976-1986

YEAR	PITCHER	SAVES	TEAM	TEAM RECORD
1983	Dan Quisenberry	45	Kansas City	79-83
1984	Dan Quisenberry	44	Kansas City	84-78
1984	Bruce Sutter	45	St. Louis	84-78
1985	Jeff Reardon	41	Montreal	84-77
1986	Dave Righetti	46	New York(AL)	90-72
	AVERAGES	44		84-78

Whatever your measure of center, you're going to get 84 wins here. It's impossible to draw conclusions when something has happened only five times, but at least up to this time a team with a record of around 84-78 seems to be the best type of club to pitch for if your goal is 40-plus saves.

Thus far I've uncovered no evidence to indicate that the claims I made in the Worrell article were false. That's a far cry from proving that they're true, but at least it lends some support. To study the issue further I decided to look at each team in baseball from the past ten seasons (1976-1986, again omitting 1981). For each team I recorded the won-lost records, the number of team saves, and the number of saves by the team leader. The data is presented in CHART III below.

CHART III: MAJOR LEAGUE SAVES - 1976-1986 (Excluding 1981)

TEAM WINS	# TEAMS	AVERAGE W/L RECORD	AVERAGE # SAVES	% WINS SAVED	AVG SAVES TEAM LEADER	% SAVES BY LEADER
Below 50	0	-	-	-	-	-
50-54	3	54-108	17	31%	8	47%
55-59	5	57-104	24	42%	11	46%
60-64	15	62-99	30	48%	15	50%
*65-69	22	67-94	30	45%	16	53%
70-74	36	72-89	31	43%	16	52%
75-79	35	77-84	35	45%	20	57%
80-84	39	82-79	37	45%	22	59%
85-89	40	87-75	35	40%	20	57%
90-94	30	91-71	38	42%	22	58%
95-99	21	97-65	40	41%	22	55%
100-104	11	101-60	42	42%	23	55%
105-109	1	105-109	46	44%	22	48%

*I'll use this line of the chart as an example to explain each column. For the ten seasons mentioned, there have been 22 teams with between 65 and 69 wins, inclusive. The average record of these teams is 67-94. Their relief pitchers have recorded an average of 30 saves per season, which is 45% of the team win total. The average team leader in saves had 16, which is 53% of the average team save total.

As expected, teams with sub-.500 records do require a save in a greater percentage of their wins. The difference is not near enough, however, to make up for the difference in total saves. In other word, 48% of thirty is still less than 42% of 38. Also, the team leaders on the weaker teams had a smaller percentage of the club total. This is probably due to factors such as those mentioned earlier: (1) weaker teams usually have weaker bullpens, and (2) weaker teams would tend to give more opportunities to young, unproven talent.

Looking at the "Average # Saves" column indicates that as wins increase, saves tend to increase. Nothing earth-shattering there. Basically, for every five wins a team above .500 adds to its record, they can be expected to add around two saves to their total. The only entry in this column that's really out of context with the others is in the "80-84 Wins" row, where the average is inflated a little by the presence of three of the five "forty-plus" save totals. Again this doesn't prove anything, but at the very least it's interesting that three of the five fall within this class.

What's most interesting, though, is the "Average Saves by Leader" column. The leader on a team with 82 wins can be expected to have around 22 saves, as can the leader of a team with 97 wins. In fact, once you get up to the .500 and above teams there's virtually no difference in the average number of saves by the team leader. This appears to be the strongest support produced from the data for my original hypothesis. I still don't claim that I have proven anything, but I can at least say that I found nothing in the data to indicate that I am mistaken in my theory. The average number of saves by the team leader does not significantly increase in going from 80 to 100 wins.

So, to pull it all together. I suggested that a pitcher on a team with 80-85 wins has an "as good or better" shot at a high save total as a pitcher on a team winning 95-100 games. Historically, it's certainly true, but relief pitching as we know it has a very short history. The data in CHART III does suggest that the better a team is, the less likely they are to rely on only one reliever. As team wins and saves increase, saves by the team leader do not. And since team saves increase with team wins but leader saves don't increase along with them, it can in fact be suggested that the very good teams provide less save opportunities for their top relievers because of their ability to dominate a game. Remember, you can get a save by holding a three-run lead just as easy as you can protecting a one-run advantage. Willie Hernandez was MVP in 1984, but he only saved 32 of Detroit's 104 wins. In outscoring their opponents 829 to 643, that's all the Tigers needed from him.

You may draw different conclusions from this data. Actually, I'm not drawing any conclusions. I do, however, still feel that the majority of the forty-plus save seasons will continue to come from teams with winning percentages in the .510-.560 range. The biggest reason: the better teams just don't have as many situations during the course of a season which call for their top relief pitcher. That's why I feel that St. Louis was the ideal team for Bruce Sutter to pitch for in 1984. In no other uniform could he have impressed Ted Turner any more than he did.

A NEW FRAMEWORK FOR ASSESSING INDIVIDUAL OFFENSIVE PERFORMANCE

by David Smyth

One of the lingering problems in sabermetrics is the development of mathematical models which accurately represent the real on-the-field game. This is especially so in the area of individual offensive comparison, because the whole (the team) is more than the sum of its parts (the players). A player co-exists in both a team universe and an individual universe, each with its own set of laws. Any attempt to assess value based on one, to the exclusion of the other, falls short of our goal of an accurate conceptual model.

The most important difference in the two universes is in the manner in which opportunities are presented. In the team universe opportunities are given in the form of outs, 27 per game. Logically then, performance should be evaluated on a per out basis--runs scored per out for teams; runs created per out for players. This method is handy, and leads to interesting variations, but it's based solely on a team model. Players are treated as simply miniature teams. Are cogs simply miniature wheels?

In the individual universe a player is given opportunities in the form of plate appearances, one by one. In fact, is it anything more than an implied managerial decision each time his turn comes up, whether or not he bats? So that in this universe we would naturally compare runs created on a per appearance basis. Sounds promising, except for one big problem--there is no logical connection between plate appearance totals and team run scoring. Since a player's primary goal at the plate is to help his team score runs, this is clearly the lesser of the two options we've examined.

What I have tried to do is to construct an imaginary, controlled, baseball situation which reconciles both approaches, and mirrors as closely as possible the actual situation confronting players on the field. The set-up is this: We start with an average team, scoring and allowing an equal number of runs for a theoretical .500 winning percentage. We then insert our player into the line-up, in a certain slot, batting regularly and winding up with a certain constant number of plate appearances.

An underlying assumption of this concept, on which we must agree, is that a regular's rate of appearances is primarily a function of batting order position and the number of teammates reaching base-- his own on-base percentage having little to do with it.

What this method does, in essence, is control for plate appearances, as well as league and park influences. We can now develop an analysis to determine our player's impact on the team's winning percentage, which is, after all, what we really want to know.

To determine this winning percentage we can use the Pythagorean formula:

$$\frac{V^2}{V^2 + A^2} = \text{WINNING PERCENTAGE}$$

where (V) is the team with player (twp) runs per out, and (A) is the team minus player (tmp) runs per out. (A) can be determined by figuring the average number of runs scored per team per game in the player's own context and dividing by 27. This way of controlling for league and park influences was discussed in the historical Abstract.

$$\frac{\text{actual team runs + opponent runs}}{\text{total games x 27}} = A$$

To determine (V), we need to know the player's runs created (R), outs made (O=AB-H+CS+GIDP+SH+SF), and total plate appearances, defined as (P=AB+BB+HP+SH+SF). Runs created and outs made are conveniently listed in each yearly Abstract. We must also decide on the number of appearances on which we will base our comparisons. I chose 656 because it's a common total for regulars which happens to be mathematically convenient.

Since (V) indicates twp runs per out, the first step is to formulate the number of runs our imaginary twp would score in a season. The player's contribution would simply be his runs created per 656 appearances, or

$$\frac{656(R)}{P}$$

The contribution of the rest of the team would be their average runs per out (=A) times the remaining outs (the ones not consumed by player), or

$$\left(4374 - \frac{656(O)}{P}\right) \times A$$

Adding the two contributions together generates total twp runs:

$$\left(4374 - \frac{656(O)}{P}\right) \times A + \frac{656(R)}{P}$$

Dividing this formula by 4374 outs per seasons will yield (V), twp runs per out. After some algebraic rearrangements the equation is ready to use in its final, calculator-friendly form:

$$\frac{.15\ (R-OA)}{P} + A = V$$

As you can see, both the team universe (represented by O) and the individual universe (represented by P) are included in this model.

It's useful to go one step further and convert our winning percentage into wins because it facilitates comparisons. To do so use the following formula:

(WINNING PERCENTAGE x 162) - 81 = WINS

Let's look at some examples from the 1985 season. Keep in mind that an average offensive player would have a winning percentage of .500 and a win total of zero.

Player	R	O	P	A	WIN%-656	WINS-656
Brett	146	388	665	.152	.561	9.8
Mattingly MVP	136	475	727	.172	.531	5.1
Guererro	121	353	581	.144	.559	9.6
McGee MVP	123	421	652	.151	.543	7.0
Coleman	79	500	692	.151	.502	0.4
Guillen	50	375	513	.165	.489	-1.7

It should be emphasized that this does not mean that George Brett actually created 9.8 wins for the Royals in '85. It means that Brett, batting 656 times and performing as he did in '85, would theoretically create 9.8 wins for an otherwise average team.

The negative win total for Guillen should not be taken to imply that he has negative value to his team. If that were so, he would obviously be replaced. It's just a mathematical way of indicating that he is below average; that the team would score more runs with an average player instead.

How do our results compare with those of other methods? The truth is that the best methods will rank most players in the same order, most of the time. Let's take an example where this isn't the case, that of Wade Boggs vs. Greg Walker during the 1984 season. Since league and park influences are not relevant to the point I wish to make, let's eliminate them by supposing that Boggs and Walker played for the same team, in a neutral environment of 4.32 runs per game, approximately the major league average. The OPS formula (on-base + slugging)--a valuable method because of its combination of accuracy and simplicity-- puts Walker ahead by a fairly wide margin (878 to 823). On the other hand, James' individual winning percentage method (again, in our neutral context) would give the nod to Boggs, (.701 to .692). Let's see what my method has to say about it:

Player	R	O	P	A	WIN%-656	WINS-656
Boggs	110	449	726	.160	.524	3.9
Walker	79	329	482	.160	.525	4.0

It's a virtual tie, with Walker ahead by a hair. Boggs' greater runs created per out and Walker's greater runs created per appearance effectively cancelled each other out, in this case.

It would be interesting to see someone with all the data do a comparison of Ruth and Williams using this method.

A good way to check the method for mathematical and conceptual accuracy is to see how it fares with team data. For example, the 1985 Cardinals scored 4.61 runs per game in a context of 4.07 runs per game. Plugging these values into the Pythagorean formula yields an expected winning percentage of .562. Remember, this theoretical winning percentage is computed against an imaginary team, and thus will not coincide with the team's actual won-lost record. Does my method show the same result? Yes!

Team	R	O	P	A	V	WIN%
'85 Cardinals	747	4374*	6182**	.151	.171	.562

*the Cardinals actually used only 4319 outs, according to our definition, but since the original 4.61 runs per game is based on games, not outs, we should use 4374 for our outs made. Either way would work as long as we were consistent.

**to reflect the fact that the Cards had 6182 plate appearances, not 656, the constant in the formula for (V) must be changed from .15 to 1.41 .

Now that we've established that the method works, that it does and means what it's supposed to do and mean, we must consider the question of its merit. There are several criteria by which each method should be judged; they include accuracy, conceptual clarity, simplicity, and adaptability. I have an opinion on each of these, but since I have not yet received any criticism from others, I'll leave it to you, the readers, to give my method a fair evaluation.

THE FURTHER ADVENTURES OF CLUTCH HITTING

Dick O'Brien

Hi, there, boys and girls in Radioland! If you remember our last episode, you'll recall that Clutch Hitting was in a terrible quandary! There were those who said he was just a figment of somebody's imagination, while others maintained he really did exist. Well, today you're just in time to tune in on the next thrilling chapter!!

Clutch hitting has been defined in any number of ways, ad nauseum. Half the definitions seem spurious, while the better part of the remainder require a Ph D in casuistry or necromancy just to understand what the hell they're talking about. Some equate it only with pressure situations based on escalating priorities pegged to the score and proximity to the last out. Frankly, these methods totally turn me off. To my feeble mind, clutch hitting is simply defined as getting on base or driving in a run when to do so will either give your team the lead, tie or win a game. It's that simple.

Judging clutch hitting for those other than RBI producers is difficult to do working with the currently available stats. LOI is a starting point, but we don't have the context in regard to the score. What we need is info showing rally-starters by either base hits or walks when the team is tied or behind by one or two runs. We don't have this yet.

So we are left to evaluate only those who drive in clutch runs. Even this is imperfect because RDI/RSP is similarly lacking in showing clutch situations. But it does show one's ability to bring home the bacon regardless of the score. This is considerably better than nothing. And when a team is ahead or behind by 5 runs, it still shows a player's ability to tally a score when the occasion arises. This to me qualifies as clutch hitting.

My biggest problem with Victory Important RBIs is that this is a determination made after the game is over. If Pudley Smelsh gets two ribbies to give his team an 8-1 lead in the 4th inning, the game may well end that way, but if it ends up 10-8 in his team's favor, his two ribbies were critical. Seemingly irrelevant ribbies at the time of their occurrence may later prove vital, if not decisive. But no one knows at that time. That's why all ribbies are important, even those for the losing team.

Using the ELIAS 1985-87 stat books as the reference we find the following batting situations occuring in the percentages shown for total at-bats:

Situation	AB %
Bases empty	.57
Runners on	.43
LOI	.14
LIP	.15
Runners in scoring position	.25

Now, in all honesty, would you really want to judge a player's clutch hitting ability on just 15% of his at-bats? (The American League percentage stays fairly constant at 14% while the National League varies up to 17.5%) Those who maintain that LIPs is the only reliable measure of clutch hitting would have us do so.

A fairer and more realistic evaluation would be to judge him on at least 25%

of his at-bats which RDI RSP shows. If one feels the need to separate the super-duper stars from the super stars then go to LIPs. Otherwise, forget it.

Only 171 players have three year totals for RDI/RSP and LIPS. The benchmarks for separating the men from the boys is 29% for RDI/RSP and a BA of .255 or better for LIPS. Of the 171 players only 12 get above average marks in both categories in all three years:

Bochte	Hernandez	Mattingly
Boggs	Hrbek	Moreland
Brooks	Iorg, G	Schmidt
Carter,G	Law, R	Whitaker

According to my way of thinking, these are truly clutch hitters par excellence. No less formidable are those 46 batters who have a better than 28% RDI/RSP mark in all three years: - the twelve above plus -

Baines	Fletcher	O'Brien	Moseby
Barfield	Franco	Oglivie	
Bell, G	Gladden	Parker	
Brett	Garcia	Ray	
Buckner	Johnson, C	Rice	
Cruz, J	Knight	Strawberry	
Davis, Chili	Lopes	Tabler	
Dawson	McRae	Thornton	
De Cinces	McReynolds	Walling	
Downing	Mulliniks	Whitaker	
Fitzgerald	Murray	Winfield	

Not a surprise among them. Unless you'd consider Fitzgerald and Garcia. They're all certifiable clutch hitters.

There's another two groups worthy of mention. The first is that who show a yearly improvement in RDI/RSP each year other than those shown above:

Bernarzard	Kennedy, T.	Smith, O
Harrah	Randolph	Walker, G
Hayes	Sax, S	Ward
Fernandez	Schofield	Wilson, M
Jacoby	Slaught	

And then, sadly, there are those who have never reached the 29% level:

Anderson	Kearney	Oester	Tolleson
Boone	Lemon	Owen	Wilkerson
Brenly	Leonard	Rayford	Wynne
Brock	Manning	Samuel	Youngblood
Brunansky	Mazzilli	Schroeder	
Cerone	Milner	Smalley	
Herndon	Murphy, Dw	Smith, L	

A final group consists of those unfortunates who have retrogressed in each of the past three seasons:

Ashby	Jones, Rup
Backman	Kingman
Baker, Dusty	Lacy
Butler	Lansford
Collins	Martinez, C
Durham	Mathews
Esasky	Motley
Evans, Dar	Pena
Foley	Porter
Gantner	Ramirez
Garner	Sheridan
Garvey	Washington, C
Griffey	Wilson, W
Henderson, R	

Is it coincidental that at least four of these players have spent a considerable amount of time as leadoff batters? One can't help but wonder.

THE EFFECT OF RELIEF PITCHERS

ON AGGREGATE BATTING AVERAGES

1901-1984

by: Robert E. Shipley, Phd

One of the most discussed topics in the "hot stove" leagues over the last thirty years has been the Herculean batting averages of the 1920s and 1930s. As most serious baseball fans are aware, Major League batting averages during those two decades averaged 20 to 40 points higher than in any period before of after in the 20th century (Table I). In fact, the composite batting average of 1920-1939 is 26 points higher than the composite average for all other years combined (.282 vs. .256).

TABLE I

MAJOR LEAGUE BATTING AVERAGES
(5 Year Averages)

1901-1904	.262	1945-1949	.261
1905-1909	.244	1950-1954	.261
1910-1914	.259	1955-1959	.258
1915-1919	.252	1960-1964	.254
1920-1924	.285	1965-1969	.244
1925-1929	.285	1970-1974	.252
1930-1934	.280	1975-1979	.260
1935-1939	.278	1980-1984	.261
1940-1944	.259		

SOURCE: Figures derived from data in The Sports Encyclopedia: Baseball, by Neft and Cohen and checked against team batting averages in The Baseball Encyclopedia, ed. by Reichler. Note: 1901-1904 is a four year average rather than a five year average.

The specific question that we "hot stove leaguers" ask, of course, is "Why?" The lower batting averages prior to the 1920s are explained to the satisfaction of most by the absence of a "lively ball", the use of the spitball and other now-illegal pitches, and the practice of leaving dirty and/or deformed balls in play. The remaining controversy rages over the period subsequent to 1940. Either you believe, as many old timers do, that hitters were simply better during the twenties and thirties, or you believe that other factors than mere batting ability have acted against higher batting averages in the later decades. Some of the larger factors most frequently noted are the advent of night baseball, larger ballparks, better fielders, better gloves, new pitches such as the slider, and improved relief pitching.

Since it is generally accepted that athletes in all sports have improved over time (as is seen in track and field records, the level of tennis play, the abilities of basketball players, etc.), let us assume that the argument that "old-timers were just better hitters" is much too simplistic. Moreover, it begs the issue of whether or not pitchers were much worse during the 1920s/1930s rather than hitters much better. Therefore we are left with the pursuit of other factors such as the above which may have made it more difficult for hitters after the twenties and thirties.

In this article I attempt to move towards a measurable assessment of one of these other proposed factors: the effect of relief pitchers on aggregate batting trends. It is generally acknowledged that relief pitchers, and specifically relief specialists, have become a steadily increasing part of the game since the early years of the Major Leagues. Thus, it is not illogical to consider that steady improvement in the quality of relief pitching and relief pitchers may have contributed to the lower batting trends. Ideally, of course, the effect of relief pitching over time could be measured by precisely determining batting averages achieved during all relief appearances by all pitchers since 1901. This task would require a prohibitively long period of tedious research through endless box scores and might still result in information gaps. Fortunately, there is another method which can be used to approach this question.

This method consists of first measuring the hits per innings pitched (H/IP) surrendered by pitchers who were used primarily as starters and comparing these to similar statistics for pitchers used primarily as relievers. The differential between these two computations for a given period can then be used to reconstruct batting averages that would have occurred if relief pitchers had pitched at the same level of competence as starting pitchers--that is, giving up the same number of hits per inning. This counterfactual exercise will demonstrate how much relief pitchers contributed to higher or lower batting averages during any period.

Two clarifications about this method and about what is actually being measured should be noted. One, I am not measuring precisely the hits per inning given up by pitchers in a starting role versus pitchers in a relief role. Unfortunately, it is not possible to measure this precisely without the same extensive research of boxscores previously noted. Rather, I am using certain criteria to separate pitchers into starters and relievers for given periods and then measuring their hits per inning for all innings pitched, whether as a starter or in relief. Thus what I will measure is a somewhat different, but equally important phenomena--the ability of pitchers who were viewed by their teams as being relief pitchers and therefore used mostly in this manner.

The second clarification deals with the criteria used to separate starting pitchers from relief pitchers. Using the Sports Encyclopedia Baseball by Neft and Cohen, I selected relief pitchers based on whether or not 50% or more of their total appearances were in a relief role (i.e., games started is no more than 50% of total appearances). Thus, it is possible, although not likely, that a few pitchers selected in one category based on appearances may have actually appeared in more innings in the other category. Moreover, one might argue that the definition of what constitutes a relief pitcher is somewhat arbitrary. This definition was selected for two reasons: One, it seems logical that a manager who used a pitcher in relief at least half of the time would view him in his own mind as primarily a reliever/spot starter at best. Two, on any given team there are usually no more than four or five starting pitchers on a staff of 9-11. Therefore somewhere between 50-60% of all pitchers should be primarily relievers. A pre-test sample of the data using the 50% or better relief appearances criterion consistently resulted in a 50-60% reliever make-up of a pitching staff. The results of the sample were verified during the calculation of the total data base.

Using this criterion, I determined that an average of 54.7% of all pitchers from 1901-1984 can be designated as relief pitchers. On the average, they pitched about 27.9% of the innings. As Table II below demonstrates, these pitchers started from a low of 17.2% of all pitchers during the period 1901-1904 and rose to a level of over 55% during the peiod 1920-1924. They remained at this percentage level or higher for most of the rest of the period under study. Their percentage of innings pitched has risen almost steadily from a low of 1.9% in 1901-1904 to a consistent level of 30% or higher after 1945-1949. This figures conform nicely with the figures for complete games which averaged between 55 - 90 % during the pre-1920 "dead ball" era (when starting pitchers where expected to finish) and which had steadily declined to a level of under 30% today.

TABLE II

RELIEF PITCHERS DEFINED

1901-1984

	PERCENT OF TOTAL PITCHERS	PERCENT OF TOTAL INNINGS PITCHED
1901-1904	17.2	1.9
1905-1909	27.2	6.5
1910-1914	47.0	17.1
1915-1919	43.8	20.3
1920-1924	55.7	26.0
1925-1929	56.2	26.9
1930-1934	55.5	28.7
1935-1939	55.6	30.8
1940-1944	53.3	27.2
1945-1949	57.4	31.6
1950-1954	58.2	33.5
1955-1959	63.8	36.4
1960-1964	62.1	34.6
1965-1969	60.6	33.7
1970-1974	61.2	31.4
1975-1979	57.8	32.4
1980-1984	56.9	34.9

SOURCE: Computed From Data Appearing In The Sports Encyclopedia Baseball by Neft and Cohen.

What effect did these relievers have on batting averages? Let's begin by looking at statistics for H/IP for all pitchers between 1901-1984. Table III below shows these figures as well as projections over nine innings pitched and the difference from the previous period. As the table demonstrates, the average H/IP fluctuated prior to 1920, rose substantially in the 20s/30s, and declined to under 1 H/IP after 1940. More specifically, these H/IP ratios translate to about 1.6 hits per game greater in the 20s/30s than in the period directly preceeding (1915-1919) and a little under a hit per game (.864) in the period directly after (1940-1944). (See Column C) By 1965-1969 the average hits per game were down again to about 1.6 hits per game less than in the 20s and 30s. By 1980-1984 the difference was about 1 hit per game. Thus, the bottom line is that the difference between the "Golden Age of Hitting" and the "Dark Ages" before and after is about 1 to 1.6 hits per game per team.

TABLE III

HITS/INNINGS PITCHED RATIO
(ALL PITCHERS)
1901-1984

	A HITS PER INNING	B PROJECTED OVER NINE INNINGS	C DIFFERENCE FROM PREVIOUS PERIOD
1901-1904	1.007	9.063	N/A
1905-1909	.895	8.055	-1.008
1910-1914	.953	8.577	.522
1915-1919	.921	8.289	-.288
1920-1924	1.096	9.864	1.575
1925-1929	1.102	9.918	.054
1930-1934	1.101	9.909	-.009
1935-1939	1.092	9.828	-.081
1940-1944	.996	8.964	-.864
1945-1949	.998	8.982	.018
1950-1954	.999	8.991	.009
1955-1959	.980	8.820	-.171
1960-1964	.962	8.658	-.162
1965-1969	.917	8.253	-.405
1970-1974	.951	8.559	.306
1975-1979	.987	8.883	.324
1980-1984	.991	8.919	.036

SOURCE: Computed From Data Appearing In The Sports Encyclopedia Baseball by Neft and Cohen

When H/IP for starters is compared to H/IP for relievers, we get a good initial indication of the role that relief pitchers played in yielding these extra hits in the 20s/30s, and reversing the trend later. Table IV (Columns A + B, D + F) below shows that the H/IP ratio for starters has always been lower than for relievers until the period 1975-79 when relievers achieved parity. In 1980-84 relievers finally realized superiority, due in some part to a decline in performance by starters. (Actually, during two earlier years - 1976 and 1977 - relievers' H/IP ratio was lower than starters. Only during 1980 and after, however, did relievers consistently achieve lower figures every year, and thus affect the 5-year average.) Therefore, it is obvious that until 1975-79, relievers were giving up more hits and yielding higher batting averages than starters.

Looking at specific trends, it is apparent that H/IP ratios for both starters and relievers prior to 1920 were, with some fluctuations, declining (Columns A + B, D + F). Moreover, the difference between starters and relievers was steadily decreasing during this period, a fact created by the increasing use of better pitchers in a relief role (Columns C and H). Both starters and relievers suffered from the advent of the lively ball. Starters' H/IP rose by 1.521 hits per game during 1920-24 (Column E), and relievers by 1.602 (Column G). As with the overall trend, neither fully "recovered" these increases until the 1965-69. Although relievers did not achieve parity until 1975-1979, they continuously lowered the difference from 1935-39 through 1970-74 (Columns C + H). Nonetheless, it is important to note that a very large gap existed during the 20s/30s when relievers were giving up almost 1 hit per game more than starters (Column H).

Were these starter/reliever differentials enough to account for the large fluctuations in batting average trends? To determine this more precisely, we turn to the second part of our analysis. The question we will ask is, "What would aggregate batting averages have been if relief pitchers had registered the same H/IP ratio as starters?"

The methodology used in this counterfactual process is relatively simple. First, we take the difference in H/IP between the starters and relievers for a given 5 year period. Then this figure is multiplied by the number of innings pitched by relievers for that period. This yields the number of hits that relievers would not have given up if they had pitched as well as starters (or extra hits they would have given up for the period 1980-84 when they had a better H/IP ratio.) This hypothetical number of hits is then subtracted from (or added to) the total hits yielded during the period. This figure is divided by total at bats during the period to yield the readjusted batting averages. (Note: Hit totals and total at bats are not depicted in any of the tables shown here.)

Results of this analysis appear in Table V. True to the H/IP statistics, aggregate batting averages would have been lower until 1975-79. During the periods 1901-04 and 1905-09, relievers had almost no effect on batting averages because of the small percentage of innings pitched. Starting in 1910-1914 through 1955-1959, relievers' inferiority contributed at least .004 (or 4 additional points) to aggregate batting averages. Between 1960-64 and 1975-79 their affect on averages was gradually lessened once again, this time because of improved H/IP ratios. During the period 1980-84, when relievers were pitching better than starters, the aggregate batting average would even have improved by .002 (or 2 additional points).

TABLE V
READJUSTED BATTING AVERAGES
1901-1984

	A ACTUAL BATTING AVERAGES	B READJUSTED BATTING AVERAGES	C DIFFERENCE
1901-1904	.262	.261	-.001
1905-1909	.244	.243	-.001
1910-1914	.259	.254	-.005
1915-1919	.252	.248	-.004
1920-1924	.285	.280	-.005
1925-1929	.285	.279	-.006
1930-1934	.280	.272	-.008
1935-1939	.278	.271	-.007
1940-1944	.259	.255	-.004
1945-1949	.261	.256	-.005
1950-1954	.261	.256	-.005
1955-1959	.258	.253	-.005
1960-1964	.254	.251	-.003
1965-1969	.244	.242	-.002
1970-1974	.252	.251	-.001
1975-1979	.260	.260	0
1980-1984	.261	.263	+.002

SOURCE: Computed Using Methodology Described Above With Data Appearing In The Sports Encyclopedia Baseball by Neft and Cohen.

TABLE IV

HITS PER INNING PITCHED
STARTERS VS. RELIEVERS
1901-1984

	H/IP STATISTICS			PROJECTED OVER NINE INNINGS				
	A	B	C	D	E	F	G	H
	STARTERS	RELIEVERS	DIFFERENCE	STARTERS	CHANGE FROM PREVIOUS PERIOD	RELIEVERS	CHANGE FROM PREVIOUS PERIOD	DIFFERENCE STARTERS & RELIEVERS
1901-1904	1.003	1.190	0.187	9.027	N/A	10.710	N/A	1.683
1905-1909	0.892	0.997	0.105	8.028	-0.999	8.973	-1.737	0.945
1910-1914	0.937	1.033	0.096	8.433	0.405	9.297	0.324	0.864
1915-1919	0.907	0.977	0.070	8.163	-0.270	8.793	-0.504	0.630
1920-1924	1.076	1.155	0.079	9.684	1.521	10.395	1.602	0.711
1925-1929	1.079	1.162	0.083	9.711	0.027	10.458	0.063	0.747
1930-1934	1.072	1.173	0.101	9.648	-0.063	10.557	0.099	0.909
1935-1939	1.066	1.151	0.085	9.594	-0.054	10.359	-0.198	0.765
1940-1944	0.979	1.042	0.063	8.811	-0.783	9.378	-0.981	0.56
1945-1949	0.978	1.039	0.061	8.802	-0.009	9.351	-0.027	0.549
1950-1954	0.979	1.037	0.058	8.811	0.009	9.333	-0.018	0.52
1955-1959	0.963	1.009	0.046	8.667	-0.144	9.081	-0.252	0.41
1960-1964	0.952	0.981	0.029	8.568	-0.099	8.829	-0.252	0.26
1965-1969	0.908	0.934	0.026	8.172	-0.396	8.406	-0.423	0.23
1970-1974	0.945	0.966	0.021	8.505	0.333	8.694	0.288	0.18
1975-1979	0.987	0.987	0	8.883	0.378	8.883	0.189	[illegible]
1980-1984	0.999	0.978	-0.021	8.991	0.108	8.802	-0.081	-0.18

SOURCE: Computed From Data Appearing in The Sports Encylcopedia Baseball by Neft and Cohen.

Looking at the 1920s and 1930s, we see that the elevated averages of these decades would have been lowered by anywhere from .005 to .008 (or 5-8 additional points) if relievers had thrown as well as starters. When compared to the other readjusted batting averages in the table, however, a composite of the readjusted batting averages during the 20s/30s would still be .023 (or 23 additonal points) higher than a composite figure for the other periods (i.e., .276 vs. .253). It would be only .022 (or 22 additional points) higher than a composite for all periods after 1939 (i.e., .276 vs. .254). This suggests that relief pitchers only accounted for about .003-.004 (3-4 points) difference in batting averages between the "Golden Age" and the other periods (i.e., .026 actual difference vs. .023 or .022 readjusted difference). Obviously, relief pitching cannot fully explain the vast difference among batting averages over time.

In conclusion, we can note several aspects of relief pitching suggested by this study:

1. Relief pitchers have played an increasing role in the Major Leagues since 1901, growing in absolute and relative numbers, and throwing an increasing amount of innings.

2. By the standard of H/IP, the rise of truly superior, widespread relief pitching is of comparatively recent origin; becoming statistically apparent only within the last 15-20 years. (This is not to say that the same statement is true in regard to runs allowed or ERA. These await their own analysis.)

3. Starting pitchers surrendered less H/IP than relievers from 1901-04 through 1970-74. The difference was especially noticeable during the 1920s and 1930s.

4. This difference between starters and relievers was never great enough to explain more than a small proportion of the large fluctuations in aggregate batting averages over time. Relief pitchers, in fact, can be blamed for only about 5-8 additional aggregate batting average points for any given period during the "batting boom" years of the 20s and 30s when H/IP and batting averages soared. From another point of view, the changing effectiveness of relief pitchers over time would account for only about 3-4 points of the difference between the composite batting average of the 20s/30s compared to the composite of all other eras.

The full accounting for the decline of aggregate batting averages after 1939 must be sought elsewhere. From the data presented here, the best explanation might well be that pitching in general, not just relief pitching, had trouble adjusting to the lively ball and rule changes introduced after WWI. It took about 20 years for pitchers to adjust to them. This would fit historically with other instances of changes in baseball which were introduced to increase hitting (e.g., moving the mound from 50′ to 60′6" in 1893, lowering the mound and reducing the strike zone in 1969, etc.). After such events it always took pitchers a while to adjust and regain their former position of predominancy. Factors contributing to improved pitching must await analysis on some other day. The quest continues.