Application of DEA to Voting for the Baseball Hall of Fame

Thomas Miceli
University of Connecticut

Brian Volz
Assumption College

Working Paper 2010-22

August 2010
Abstract

This paper applies Data Envelopment Analysis (DEA) to voting for the Baseball Hall of Fame. The approach interprets a player's career statistics as inputs, and the percentage of votes he received for the HOF as the output. A constructed frontier based on past voting defines the maximum number of votes that a player should receive based on his statistical profile. Our results suggest that about a third of current members of the HOF (excluding Negro League players, managers, umpires, and executives) should be replaced by more deserving players. Our conclusions, however, do not account for those aspects of a player's career (both positive and negative) not captured by statistics.

Journal of Economic Literature Classification: C44, D20, L83

Keywords: Baseball hall of fame; data envelopment analysis; production theory
Debating Immortality:  
Application of DEA to Voting for the Baseball Hall of Fame

1. Introduction

Who should and who should not be in the baseball Hall of Fame (HOF)? This question has been a perennial source of debate among baseball fans, sports talk show hosts, and baseball writers. Everyone either advocates a favorite candidate who has been unjustly excluded, or points to a pretender who doesn’t belong. Often, the discussion involves a statistical comparison of the following sort: player A, who is in the HOF, had a certain number of home runs or wins, so player B, who has as many or more home runs or wins should also be in.

Of course, selection for the HOF doesn’t work that way. To be eligible, a player must simply have played in the major leagues for at least ten years and have been retired for at least five years. Then, to be selected for enshrinement, he must receive the vote of at least 75% of the baseball writers who are entitled to vote in a given year.\(^1\) Aside from that, there are no set guidelines for selection—it is based purely on the subjective opinions of the baseball writers. To be sure, certain career milestones have virtually ensured selection in the past, for example, 500 home runs, 3,000 hits, or 300 wins, but these standards have arisen informally over time, and are subject to change as styles of play evolve and people update their opinions about what is humanly “achievable.” (For example, in the era of steroids, it is no longer clear that 500 home runs will ensure selection.) For most candidates, the decision is based on an assessment of the totality of their career, centering on their achievements on the field, but also including their off-the-field activities (or antics), their personalities, and their overall “contribution” to the game.

\(^1\) To be entitled to vote, a writer must have been a member of the Baseball Writers Association of America (BBWAA) for at least ten years. A player who has been retired for at least five years remains on the ballot for fifteen years. After that, he can still be selected by the Veterans’ Committee after waiting five more years. See James (1995, pp. 35-37), or the Hall of Fame website (http://baseballhall.org) for a complete list of selection criteria.
Not surprisingly, baseball statisticians\(^2\) have developed numerous methods for identifying those players who should be in the HOF using a variety of statistical measures of performance, many of which are described in James (1995). Most of these proposals are what economists would call “normative” standards—that is, they seek to devise a consistent method for deciding who should be in the HOF based purely on objective measures. None, however, has gained wide acceptance among baseball historians or fans. This paper takes a different approach—it uses Data Envelopment Analysis (or DEA) to extract a consistent standard from the past voting patterns of baseball writers. DEA is a non-parametric technique often used in productivity analysis to estimate the efficiency of a given production unit—that is, how efficiently does that unit or decision-maker combine inputs to produce an output (Ray, 2004)?

The application of DEA in the current context is based on the idea that voting for the HOF involves an implicit production process by which writers, acting collectively, use “inputs” (a player’s career statistics) to produce an “output” (the number or percentage of affirmative votes the player receives for selection to the HOF). This approach uses data on past voting behavior to construct a “frontier,” representing the maximum attainable number of votes (or output) for players based on their statistical profiles (or inputs). The resulting “predicted vote total” can then be compared to the player’s actual vote total (for eligible players) to calculate his “efficiency score.” In this way, we can, for example, determine which players not in the HOF should be, based on past voting practices of the writers. An extension of the basic DEA technique (to be described in detail below) also allows us to address the other part of the HOF debate: that is, which players are in the HOF but should not be, again, based on past voting practices.

\(^2\) Baseball statisticians are sometimes called sabermetricians after the acronym for the Society for American Baseball Research, or SABR, which was founded in 1971. (See [http://www.sabr.org](http://www.sabr.org).)
The remainder of the paper is organized as follows. Section 2 briefly describes the DEA methodology. Section 3 then describes the sample of players and the statistical measures of performance that we will use in the analysis. Section 4 reports the results of the basic analysis, which addresses the first part of the HOF debate, namely, which players not in the HOF (or not yet eligible) should be in based on past voting patterns? Section 5 turns to the extension of the basic DEA, referred to as “super-efficiency,” which allows us to address the second part of the debate: which players in the HOF should not be, again based on past voting? Section 6 re-frames the question by using DEA to construct a HOF that is constrained in size to the number of members currently enshrined. The predicted membership of this “hypothetical” HOF is then compared to the actual membership to see which current members would be excluded and which eligible non-members would be included. The total number that should be replaced turns out to be about one-third of the current membership. The analysis also yields the implied vote threshold for inclusion, which turns out to be nearly 85% as compared to the actual threshold of 75%. Finally, Section 7 offers concluding comments and qualifications of the analysis.

2. Methodology

The goal of our analysis is to identify players who received a different number of votes than is expected based on observed voting patterns. DEA can be used to identify such players by calculating the maximum number of votes a player could have received given his level of performance. This application differs little from the use of DEA in productivity analysis of firms as presented by Banker, Charnes, and Cooper (1984). In productivity analysis, firms take inputs and transform them into outputs. These outputs are then compared to a constructed production possibilities frontier (PPF) in order to determine how much more output a firm could have produced. The analysis presented here applies the same methodology to the production of Hall
of Fame votes, where player performance statistics are treated as inputs into the production of the output, HOF votes.

The constructed PPF is based on three assumptions about the underlying production technology. The first assumption is that inputs are freely disposable. This means that if a certain level of inputs can produce some level of output, then a level of inputs which is greater in at least one dimension can also produce that level of output. The second assumption is that output is freely disposable. This implies that if a certain level of inputs can produce some level of output, then that same level of inputs can also produce any lower level of output. The third assumption is the convexity of the production possibilities set. Convexity implies that any convex combination of two feasible input-output bundles is also feasible.

The PPF can be shown graphically for the case of a single input, single output technology. Figure 1 shows a hypothetical PPF where the input is, say, the number of homeruns a player hit during his career, and the output is the percentage of affirmative votes for inclusion in the HOF. The convexity assumption means that all points that are convex combinations of observed points are also feasible. Suppose, for example, that Player A hit 200 career homeruns and received 80% of votes cast, while and Player B hit 400 homeruns and received 100% votes cast. The convexity assumption implies that any convex combination, for example, 300 homeruns and 90% of votes cast, is also feasible. Graphically, this is shown by connecting the data points to create a convex hull. The assumption of free disposability of inputs implies that all points to the right of the convex hull are feasible, while the assumption of free disposability of output implies that all points below a feasible point are feasible. When these assumptions are combined the result is the PPF shown in Figure 1.
In order to determine whether players are receiving the maximum votes possible given their input bundle, their actual output can be compared to the maximum feasible output (as determined by the PPF) given their inputs. This measure is referred to as the output-oriented technical efficiency. Formally, this index of technical efficiency for a player is calculated by dividing the actual output by the maximum feasible output for that level of inputs. In Figure 1, for example, Player C’s technical efficiency is the distance Y divided by the sum of distances Y and Z. Given the technical efficiency of any player, his maximum feasible votes can be identified.

Obviously, no single statistic determines the number of votes a player receives for the HOF. For the case of multiple inputs, the technical efficiency can be found by solving the following maximization problem and taking the inverse of the resulting variable, $\theta$.

General DEA Model:

Maximize $\theta$

Subject to: $\sum \lambda_i V_i \geq \theta V_0$  \hspace{1cm} (1)
\[
\sum \lambda_i X_{1i} \leq X_{10} \tag{2}
\]
\[
\sum \lambda_i X_{2i} \leq X_{20} \tag{3}
\]
\[
\sum \lambda_i X_{3i} \geq X_{30} \tag{4}
\]
\[
\sum \lambda_i = 1 \tag{5}
\]
\[
\lambda_i \geq 0. \tag{6}
\]

The index \( \theta \) can be interpreted as the multiple by which output can be increased using a convex combination of observed input-output bundles. The subscript \( \theta \) identifies values for the player being analyzed. The subscript \( i \) identifies the other players in the sample. \( V \) represents the percentage of votes received. \( X_1 \) and \( X_2 \) represent positive inputs (for example, home runs, hits) while \( X_3 \) represents a negative input (for example, pitcher losses). (The specific inputs used for this analysis will be described in the next section.) Constraint (1) implies that the convex combination of other observed vote percentages must be greater than or equal to the observed vote percentage of the player being evaluated. Constraints (2) and (3) imply that the convex combination of positive inputs must be less than or equal to the inputs of the player under consideration. Constraint (4) states that the convex combination of the negative input must be at least as great as the negative input of the player being evaluated. Constraint (5) implies variable returns to scale, while constraint (6) assures that the solution satisfies the convexity assumption.

3. Variable and Sample Selection

The sample for our analysis includes all position players and starting pitchers who played in the major leagues from 1871-2009. Players who played a significant portion of their careers in the Negro Leagues may have received votes based on their performance in those leagues. However, because we restrict analysis to major league performance statistics which do not capture the effects of achievements in other leagues, players who spent a significant portion of
their careers in the Negro Leagues are excluded from the sample. Pitchers are included in the analysis so long as they pitched at least 100 games with at least half of those appearances as a starting pitcher.\textsuperscript{3} Position players are included in the sample so long as they had at least 1,000 at bats. This results in samples consisting of 1,340 pitchers and 3,358 position players.

Currently, there are 292 members of the baseball HOF, including players, managers, executives, and pioneers. Table 1 breaks the total down by method of selection. Excluding Negro League players, these include 142 position players and 56 starting pitchers.\textsuperscript{4} The number of these players voted in by the baseball writers, whose votes provide the data for the DEA, is 104.

\begin{table}[h]
\centering
\caption{Current Membership of the Baseball Hall of Fame by Selection Method\textsuperscript{a}}
\begin{tabular}{ll}
\hline
Number voted in by the & 109 \\
BBWAA & \\
Number selected by the & 157 \\
Veterans’ Committee & \\
Number selected by special & 26 \\
Negro League committees & \\
Total membership & 292 \\
\hline
\end{tabular}
\end{table}

\textsuperscript{a}The numbers reflect totals as of the summer of 2010.

The output of interest, VOTES, is the maximum percentage of votes for inclusion in the HOF that a player received during his fifteen years of eligibility, up to and including the 2010

\textsuperscript{3} It is only in recent decades that relief pitchers (primarily closers) have emerged as specialists in professional baseball. Since the statistical criteria for evaluating relief pitchers is still unclear, and since only a few have been inducted into the HOF, we chose to exclude them from the analysis.

\textsuperscript{4} Of the position players, 74 were elected by the BBWAA and 68 selected by the Veterans’ Committee. Of the starting pitchers, 30 were elected by the BBWAA and 26 were chosen by the Veterans’ Committee.
vote.\textsuperscript{5} Players voted into the HOF primarily as managers are treated as not receiving any votes. To ensure a solution to the maximization problem, all players who received no votes or have not yet been voted on are treated as having received .01 percent of the vote.

We ran the model for position players and pitchers separately, as the relevant statistics describing their performance are obviously different. The inputs we used for position players are as follows (all based on career totals): hits (H), homeruns (HR), batting average (AVG), on base percentage (OBP), slugging average (SLG), runs scored (R), runs batted in (RBI), and stolen bases (SB). Although this choice is somewhat arbitrary, these are the key statistics most often used to evaluate the offensive performance of major league baseball players. More complicated and comprehensive performance measures have been developed in recent years. (See, for example, James (1995).) However, it is unlikely that members of the Baseball Writers Association of American (BBWAA) had access to these more complicated statistics when they made past voting decisions.

Our analysis also focuses solely on \textit{offensive} performance for position players. It has been a standard criticism of HOF selection that it slights players who are good defensively but not strong offensively, as is often the case, for example, with shortstops. However, the only readily available defensive statistics, such as fielding percentage, cannot be meaningfully compared across positions and are often misleading (for example, the best fielders often make the most errors because they get to more balls). Thus, to the extent that voters include subjective measures of a player’s defensive prowess in their votes (or, for that matter, any other attribute not captured by statistics), our analysis will not be able to capture it.

\textsuperscript{5} Remember that players are eligible to receive votes for fifteen years. Thus, we use the maximum percentage that a player received either until he was elected (i.e., received at least 75% of votes cast), or was removed from eligibility.
The inputs for starting pitchers are as follows: wins (W), strikeouts (K), earned run average (ERA), winning percentage (WP), strikeouts per nine innings (K9), and walks plus hits per inning pitched (WHIP). These statistics have traditionally been used to evaluate the performance of major league pitchers. Again, more comprehensive and complicated statistics have been developed but are unlikely to have been available to earlier BBWAA voters. Also, since pitchers are generally not valued for their offensive ability, we do not include offensive statistics in the analysis of pitchers.

4. Results of the Basic Analysis

Using the results of the standard DEA, we calculate the maximum possible votes each player could have received given their performance statistics. Based on this efficient vote percentage (EVOTE%), we identify those players who could have received enough votes to be inducted into the HOF (75% of votes cast). We also identify those players who are not yet eligible for the HOF but who would receive enough votes to be inducted. A summary of these results is presented in Table 2.\(^6\)

<table>
<thead>
<tr>
<th></th>
<th>Eligible for HOF</th>
<th>Not yet eligible for HOF</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Position Players</td>
<td>135</td>
<td>55</td>
<td>190</td>
</tr>
<tr>
<td>Starting Pitchers</td>
<td>48</td>
<td>12</td>
<td>60</td>
</tr>
<tr>
<td>Total</td>
<td>183</td>
<td>67</td>
<td>250</td>
</tr>
</tbody>
</table>

\(^6\) Tables including the detailed results of the analysis in this and subsequent sections are available from the authors on request.
Among those players eligible for inclusion in the HOF (i.e., those who played at least 10 years and have been retired for at least 5 years), there are 183 players (including 135 position players and 48 starting pitchers) whose maximum possible vote percentages put them above the 75% threshold for election to the HOF. As noted, excluding Negro League players and relief pitchers, there are currently (as of 2010) 142 position players and 56 starting pitchers in the HOF, or a total of 198 players (including those elected by the BBWAA or selected by the Veterans’ Committee). Our results therefore suggest that if the writers had voted in a consistent manner throughout history, based purely on statistical measures of performance as described above, then the population of the HOF would be almost double its current size, with 135 additional position players and 48 additional starting pitchers being included. Table 1 also shows that among players not yet eligible for the HOF (i.e., active players and those who have been retired for less than five years as of 2010), 67 would make the HOF based on past voting, including 55 position players and 12 starting pitchers.

The fact that our analysis suggests that the HOF is underinclusive does not necessarily reflect “errors” or lax standards in the past (though there may be some of that). More likely, it reflects a learning process among voters concerning what constitutes “greatness.” As time goes by and the overall quality of play improves, milestones once thought to be attainable only by the best players have become more commonplace, and voting standards have adjusted accordingly. Thus, players whose records would have met the standards for selection to the HOF in earlier eras are now excluded because their achievements are no longer seen as meriting enshrinement. For example, pitchers who reached 200 career wins were once almost assured of induction, but they no longer are.

---

7 On evolving standards of play, see Gould (2003, pp. 151-172).
As a consequence of this upward ratchet in voting standards, the basic DEA method as described to this point can only identify those players who are not in the HOF, or are not yet eligible, who should be included based on past voting patterns. This is true because DEA can only increase a player’s vote total compared to the number that he actually received. Thus, if he actually received >75% and hence was elected to the HOF, DEA would never be able to “downgrade” him. As a consequence, the analysis to this point cannot address the other half of the HOF debate, namely, which players currently in the HOF should not have been selected (either by vote or by the Veterans’ Committee). Fortunately, it turns out that there is a DEA technique, referred to as “super-efficiency,” that allows us to address this question.

5. Super-Efficiency

The fact that \( V_0 \) is a feasible level of output assures that the maximum value of \( \theta \) will be greater than or equal to 1. Therefore, the technical efficiency measure will always lie in the closed interval from 0 to 1. Furthermore, all players who lie on the PPF will, by definition, have a technical efficiency equal to 1. This implies that their maximum feasible output is equal to their observed output. For these players, their maximum feasible output is based on their own input-output bundle, not on the other observations in the sample. In order to eliminate this problem the same model can be run with the added constraint that the lambda of the player under consideration be set equal to zero. This results in the frontier being based on all observations other than the player under consideration. This measure, which is referred to as super-efficiency, was first proposed by Anderson and Petersen (1993).

The resulting super-efficiency model is shown graphically in Figure 2 for the single-input, single-output case. In this example Player A is located on the efficiency frontier and therefore, by definition, has a technical efficiency equal to one. In order to calculate the super-
efficiency measure for Player A, we compare that player to a frontier created using all players excluding Player A. This frontier is shown in Figure 2 by the solid line connecting players B and D. Player A’s efficiency relative to this frontier is calculated as the sum of distances S and T divided by T. This value will be greater than one for all players who lie on the original frontier. For players who are “inefficient” (i.e., lie inside the frontier) the value of this measure will be the same as that of the output-oriented technical efficiency presented previously.

**Figure 2: Super-Efficiency Model**

The advantage of a super-efficiency measure is that those players who are “efficient” (i.e., on the original frontier) will now have a measure of the maximum votes they could have received based on the other observations in the sample rather than their own. In this manner it is possible to identify players who actually should have received fewer votes based on the observed voting behavior. In particular, we can identify those players who are in the HOF but should not have received the necessary threshold of 75 percent of the vote based on this analysis. This
group includes players on the PPF who, based on their super-efficiency measure, should have received fewer votes. It also includes players who were inducted into the HOF via means other than the BBWAA vote (specifically, by the Veterans’ Committee). A summary of these individuals is presented in Table 3.

<table>
<thead>
<tr>
<th>Position Players</th>
<th>Voted in by BBWAA</th>
<th>Selected by Veterans’ Committee</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Position Players</td>
<td>8</td>
<td>29</td>
<td>37</td>
</tr>
<tr>
<td>Starting Pitchers</td>
<td>2</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td>10</td>
<td>32</td>
<td>42</td>
</tr>
</tbody>
</table>

The results show that only 10 players voted in by the BBWAA would not have received the necessary votes to be selected for the HOF, while 32 players selected by the Veterans’ Committee would not have received the necessary votes. This reflects the conventional wisdom that the Veterans’ Committee is a kind of “back door” into the HOF which has perhaps diluted the standards for admission. In some sense, this must be the case since the Veterans’ Committee is only considering players whom the BBWAA did not select during their fifteen years of eligibility. And since this committee is comprised of former players, there is certainly the possibility of bias and cronyism in its selection process. On the other hand, many would argue that the Committee serves an essential purpose by correcting errors or oversights by the writers, as in the case of players who were not popular with writers during their careers, or whose accomplishments or importance to the game were not fully appreciated in their time.

6. Constructing an “Efficient” Hall of Fame
Finally, in order to compare the current HOF to one in which all players received an efficient number of votes, we construct a “hypothetical” HOF based on the efficient vote percentages from this analysis. Again, excluding Negro League players, relief pitchers, and non-players from the analysis, there are currently 142 position players and 56 starting pitchers in the HOF. A hypothetical HOF constrained to have the same number of starting pitchers and position players results in some players currently in the HOF being excluded and other eligible players who were not selected being added. The results of this analysis are presented in Table 4.

<table>
<thead>
<tr>
<th>Table 4: Efficient Hall of Fame</th>
</tr>
</thead>
<tbody>
<tr>
<td>Position Players</td>
</tr>
<tr>
<td>Current HOF(^a)</td>
</tr>
<tr>
<td>Number of these replaced in the efficient HOF</td>
</tr>
<tr>
<td>Threshold % of votes needed for inclusion</td>
</tr>
</tbody>
</table>

\(^a\)Excluding Negro league players, relief pitchers, and non-players.

Our proposed “Efficient” HOF results in 67 current HOF members (33.8%), consisting of 54 position players (38%) and 13 starting pitchers (23.2%), being replaced by other players. The specific players along with their replacements are listed in the Appendix. As an illustration, consider two players who have historically been the center of much debate. According to our analysis, Gil Hodges, who is not currently in the HOF, should be included. In particular, he should have received 91.55% of the vote based on his career record, which is enough to merit inclusion in our efficient HOF.
In contrast, Phil Rizzuto, who was selected by the Veterans' committee in 1994, should not be included. According to our results, Rizzuto should only have received 58.70% of the vote based on his career record, which is not enough to make the cut in our efficient HOF. Of course, Rizzuto did not receive enough actual votes to make the HOF either (suggesting that the baseball writers got it right), but his many advocates have argued that his defensive ability, the fact that he missed several years during his prime to WWII, and his intangible value to several championship teams, were not captured by his career statistics, and thus it was appropriate for the Veterans’ Committee to rectify the error.

A similar argument obviously applies to Jackie Robinson, who fails to make the cut for our efficient HOF based purely on his career statistics (his efficient vote is 77.50%). However, in consideration of his overall contribution to game (and the fact that he was also deprived of several productive years for a different reason), he clearly deserves enshrinement. On the other hand, Pete Rose easily makes the cut for our HOF based on his career statistics (which yield an efficient vote of 93.34%), but his admitted gambling on baseball has resulted in a lifetime ban from the HOF. The impact of admitted (or suspected) steroid use among current and recently retired players casts a similar shadow on their HOF prospects, regardless of their career statistics.

Finally, Table 4 shows the minimum percentage of votes a player has to receive for inclusion in our efficient HOF. For position players it is about 85% and for starting pitchers it is about 83%, both significantly higher than the current threshold of 75%. As discussed above, this reflects the consistent application of the higher standard for selection that has emerged over time as the quality of play has improved.

7. Conclusion
This paper used DEA to examine the outcome of voting for the Baseball Hall of Fame. This approach interprets a player’s career statistics as the inputs into a production process that yields percentage of affirmative votes for inclusion in the HOF as the output. A constructed frontier based on past voting defines a player’s “efficient vote,” or the maximum number of votes that he should receive given his statistical profile. Using this frontier, we compared the actual membership of the HOF to the membership that would have emerged if the standards implicit in past voting behavior had been efficiently applied; that is, if players had received the maximum number of votes that their career records warranted. Our results indicated that approximately one-third of current members of the HOF should be replaced by other, more deserving players, holding total membership fixed.

Throughout the analysis we noted several qualifications of our approach. Most importantly, it ignores those aspects of a player’s career that are not well reflected in his offensive or pitching statistics but which are legitimate factors in deciding on his admissibility. This deficiency is best epitomized, on one hand, by Jackie Robinson, whose record did not meet the minimum standard based on our analysis, but who clearly merits inclusion in the HOF based on the totality of his contribution to the game; and, on the other, by Pete Rose, who easily made the cut based on statistics alone, but whom many feel is justly banned from inclusion because of his admitted gambling on baseball. Factors such as these suggest that purely statistical measures will never fully reflect a player’s fitness for inclusion (or exclusion) from the HOF.
Works Cited


## Appendix

### Changes to Hall of Fame Based on Efficient Votes

<table>
<thead>
<tr>
<th>Position Player</th>
<th>Seasons</th>
<th>EVOTE%</th>
<th>Position Player</th>
<th>Seasons</th>
<th>EVOTE%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fred McGriff</td>
<td>1986-2004</td>
<td>97.11</td>
<td>Rick Ferrell</td>
<td>1929-1947</td>
<td>34.03</td>
</tr>
<tr>
<td>Andres Galarraga</td>
<td>1985-2004</td>
<td>96.67</td>
<td>Ernie Lombardi</td>
<td>1931-1947</td>
<td>37.23</td>
</tr>
<tr>
<td>Dwight Evans</td>
<td>1972-1991</td>
<td>96.33</td>
<td>Lloyd Waner</td>
<td>1927-1945</td>
<td>42.60</td>
</tr>
<tr>
<td>Chili Davis</td>
<td>1981-1999</td>
<td>96.20</td>
<td>Ray Schalk</td>
<td>1912-1929</td>
<td>44.84</td>
</tr>
<tr>
<td>Roberto Alomar</td>
<td>1988-2004</td>
<td>95.90</td>
<td>Frank Chance</td>
<td>1898-1914</td>
<td>50.41</td>
</tr>
<tr>
<td>Dale Murphy</td>
<td>1976-1993</td>
<td>94.69</td>
<td>Roger Bresnahan</td>
<td>1897-1915</td>
<td>53.63</td>
</tr>
<tr>
<td>Tim Raines</td>
<td>1979-2002</td>
<td>94.14</td>
<td>Johnny Evers</td>
<td>1902-1929</td>
<td>54.03</td>
</tr>
<tr>
<td>Ellis Burks</td>
<td>1987-2004</td>
<td>93.94</td>
<td>Hughie Jennings</td>
<td>1891-1918</td>
<td>56.10</td>
</tr>
<tr>
<td>Harold Baines</td>
<td>1980-2001</td>
<td>93.58</td>
<td>Phil Rizzuto</td>
<td>1941-1956</td>
<td>58.70</td>
</tr>
<tr>
<td>Jimmy Ryan</td>
<td>1885-1903</td>
<td>93.47</td>
<td>Dave Bancroft</td>
<td>1915-1930</td>
<td>59.12</td>
</tr>
<tr>
<td>Pete Rose</td>
<td>1963-1986</td>
<td>93.34</td>
<td>Billy Herman</td>
<td>1931-1947</td>
<td>60.92</td>
</tr>
<tr>
<td>George Van Haltren</td>
<td>1887-1903</td>
<td>92.92</td>
<td>Joe Tinker</td>
<td>1902-1916</td>
<td>61.08</td>
</tr>
<tr>
<td>Bill Dahlen</td>
<td>1891-1911</td>
<td>92.78</td>
<td>Ross Youngs</td>
<td>1917-1926</td>
<td>62.41</td>
</tr>
<tr>
<td>Will Clark</td>
<td>1986-2000</td>
<td>92.44</td>
<td>Richie Ashburn</td>
<td>1948-1962</td>
<td>62.56</td>
</tr>
<tr>
<td>Edgar Martinez</td>
<td>1987-2004</td>
<td>92.15</td>
<td>Tommy McCarthy</td>
<td>1884-1896</td>
<td>63.76</td>
</tr>
<tr>
<td>Barry Larkin</td>
<td>1986-2004</td>
<td>92.13</td>
<td>Joe Sewell</td>
<td>1920-1933</td>
<td>63.98</td>
</tr>
<tr>
<td>Bob Johnson</td>
<td>1933-1945</td>
<td>91.92</td>
<td>Earle Combs</td>
<td>1924-1935</td>
<td>64.59</td>
</tr>
<tr>
<td>Vada Pinson</td>
<td>1958-1975</td>
<td>91.74</td>
<td>Chick Hafey</td>
<td>1924-1937</td>
<td>69.67</td>
</tr>
<tr>
<td>Gil Hodges</td>
<td>1943-1963</td>
<td>91.55</td>
<td>Buck Ewing</td>
<td>1880-1897</td>
<td>70.23</td>
</tr>
<tr>
<td>Don Baylor</td>
<td>1970-1988</td>
<td>91.43</td>
<td>Red Schoendienst</td>
<td>1945-1963</td>
<td>70.84</td>
</tr>
<tr>
<td>Paul O'Neill</td>
<td>1985-2001</td>
<td>90.94</td>
<td>Travis Jackson</td>
<td>1922-1936</td>
<td>72.24</td>
</tr>
<tr>
<td>Al Oliver</td>
<td>1968-1985</td>
<td>90.62</td>
<td>Bobby Wallace</td>
<td>1894-1918</td>
<td>72.44</td>
</tr>
<tr>
<td>Steve Garvey</td>
<td>1969-1987</td>
<td>90.40</td>
<td>George Kelly</td>
<td>1915-1932</td>
<td>72.69</td>
</tr>
<tr>
<td>Mickey Vernon</td>
<td>1939-1960</td>
<td>89.59</td>
<td>Freddie Lindstrom</td>
<td>1924-1936</td>
<td>73.04</td>
</tr>
<tr>
<td>Reggie Smith</td>
<td>1966-1982</td>
<td>89.56</td>
<td>Elmer Flick</td>
<td>1898-1910</td>
<td>73.05</td>
</tr>
<tr>
<td>Alan Trammell</td>
<td>1977-1996</td>
<td>89.56</td>
<td>Hack Wilson</td>
<td>1923-1934</td>
<td>73.69</td>
</tr>
<tr>
<td>Ken Boyer</td>
<td>1955-1969</td>
<td>89.50</td>
<td>Joe Gordon</td>
<td>1938-1950</td>
<td>74.54</td>
</tr>
<tr>
<td>Jose Canseco</td>
<td>1985-2001</td>
<td>89.50</td>
<td>Larry Doby</td>
<td>1947-1959</td>
<td>74.70</td>
</tr>
<tr>
<td>Lou Whitaker</td>
<td>1977-1995</td>
<td>89.08</td>
<td>Ralph Kiner</td>
<td>1946-1955</td>
<td>75.21</td>
</tr>
<tr>
<td>Dick Allen</td>
<td>1963-1977</td>
<td>88.89</td>
<td>George Kell</td>
<td>1943-1957</td>
<td>75.54</td>
</tr>
<tr>
<td>Mark Grace</td>
<td>1988-2003</td>
<td>88.69</td>
<td>Lou Boudreau</td>
<td>1938-1952</td>
<td>77.33</td>
</tr>
<tr>
<td>Fred Lynn</td>
<td>1974-1990</td>
<td>88.17</td>
<td>Gabby Hartnett</td>
<td>1922-1941</td>
<td>77.38</td>
</tr>
<tr>
<td>Ron Santo</td>
<td>1960-1974</td>
<td>87.93</td>
<td>Frank Baker</td>
<td>1908-1922</td>
<td>77.46</td>
</tr>
<tr>
<td>Cesar Cedeno</td>
<td>1970-1986</td>
<td>87.90</td>
<td>King Kelly</td>
<td>1878-1893</td>
<td>77.46</td>
</tr>
<tr>
<td>Minnie Minoso</td>
<td>1949-1980</td>
<td>87.69</td>
<td>Jimmy Collins</td>
<td>1895-1908</td>
<td>77.48</td>
</tr>
<tr>
<td>Sherry Magee</td>
<td>1904-1919</td>
<td>87.32</td>
<td>Jackie Robinson</td>
<td>1947-1956</td>
<td>77.50</td>
</tr>
<tr>
<td>Starting Pitcher</td>
<td>Seasons</td>
<td>EVOTE%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------------------</td>
<td>---------</td>
<td>--------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jim Kaat</td>
<td>1959-1983</td>
<td>91.92</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tommy John</td>
<td>1963-1989</td>
<td>91.568</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tony Mullane</td>
<td>1881-1894</td>
<td>89.603</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jim McCormick</td>
<td>1878-1887</td>
<td>89.175</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Charlie Buffinton</td>
<td>1882-1892</td>
<td>87.277</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dennis Martinez</td>
<td>1976-1998</td>
<td>86.92</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Luis Tiant</td>
<td>1964-1982</td>
<td>86.586</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bobby Mathews</td>
<td>1871-1887</td>
<td>86.554</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jack Morris</td>
<td>1977-1994</td>
<td>85.345</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bob Welch</td>
<td>1978-1994</td>
<td>83.966</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jack Quinn</td>
<td>1909-1933</td>
<td>83.844</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eddie Cicotte</td>
<td>1905-1920</td>
<td>82.722</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Starting Pitcher</th>
<th>Seasons</th>
<th>EVOTE%</th>
</tr>
</thead>
<tbody>
<tr>
<td>John Ward</td>
<td>1878-1894</td>
<td>78.31</td>
</tr>
<tr>
<td>Luke Appling</td>
<td>1930-1950</td>
<td>78.80</td>
</tr>
<tr>
<td>Mickey Cochrane</td>
<td>1925-1937</td>
<td>79.50</td>
</tr>
<tr>
<td>Bill Dickey</td>
<td>1928-1946</td>
<td>80.16</td>
</tr>
<tr>
<td>Willie Stargell</td>
<td>1962-1982</td>
<td>82.24</td>
</tr>
<tr>
<td>Pee Wee Reese</td>
<td>1940-1958</td>
<td>82.81</td>
</tr>
<tr>
<td>Harmon Killebrew</td>
<td>1954-1975</td>
<td>82.92</td>
</tr>
<tr>
<td>Rabbit Maranville</td>
<td>1912-1935</td>
<td>82.94</td>
</tr>
<tr>
<td>Gary Carter</td>
<td>1974-1992</td>
<td>83.06</td>
</tr>
<tr>
<td>Johnny Mize</td>
<td>1936-1953</td>
<td>83.41</td>
</tr>
<tr>
<td>Arky Vaughan</td>
<td>1932-1948</td>
<td>83.51</td>
</tr>
<tr>
<td>Billy Hamilton</td>
<td>1888-1901</td>
<td>83.87</td>
</tr>
<tr>
<td>Tony Lazzeri</td>
<td>1926-1939</td>
<td>84.10</td>
</tr>
<tr>
<td>Luis Aparicio</td>
<td>1956-1973</td>
<td>84.41</td>
</tr>
<tr>
<td>Hank Greenberg</td>
<td>1930-1947</td>
<td>84.97</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Starting Pitcher</th>
<th>Seasons</th>
<th>EVOTE%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jim Kaat</td>
<td>1959-1983</td>
<td>91.92</td>
</tr>
<tr>
<td>Tommy John</td>
<td>1963-1989</td>
<td>91.568</td>
</tr>
<tr>
<td>Tony Mullane</td>
<td>1881-1894</td>
<td>89.603</td>
</tr>
<tr>
<td>Jim McCormick</td>
<td>1878-1887</td>
<td>89.175</td>
</tr>
<tr>
<td>Charlie Buffinton</td>
<td>1882-1892</td>
<td>87.277</td>
</tr>
<tr>
<td>Dennis Martinez</td>
<td>1976-1998</td>
<td>86.92</td>
</tr>
<tr>
<td>Luis Tiant</td>
<td>1964-1982</td>
<td>86.586</td>
</tr>
<tr>
<td>Bobby Mathews</td>
<td>1871-1887</td>
<td>86.554</td>
</tr>
<tr>
<td>Jack Morris</td>
<td>1977-1994</td>
<td>85.345</td>
</tr>
<tr>
<td>Bob Welch</td>
<td>1978-1994</td>
<td>83.966</td>
</tr>
<tr>
<td>Jack Quinn</td>
<td>1909-1933</td>
<td>83.844</td>
</tr>
<tr>
<td>Eddie Cicotte</td>
<td>1905-1920</td>
<td>82.722</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Starting Pitcher</th>
<th>Seasons</th>
<th>EVOTE%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Addie Joss</td>
<td>1902-1910</td>
<td>65.844</td>
</tr>
<tr>
<td>Jesse Haines</td>
<td>1918-1937</td>
<td>73.973</td>
</tr>
<tr>
<td>Lefty Gomez</td>
<td>1930-1943</td>
<td>74.516</td>
</tr>
<tr>
<td>Rube Marquard</td>
<td>1908-1925</td>
<td>75.316</td>
</tr>
<tr>
<td>Stan Coveleski</td>
<td>1912-1928</td>
<td>75.614</td>
</tr>
<tr>
<td>Bob Lemon</td>
<td>1946-1958</td>
<td>78.61</td>
</tr>
<tr>
<td>Dizzy Dean</td>
<td>1930-1947</td>
<td>79.17</td>
</tr>
<tr>
<td>Rube Waddell</td>
<td>1897-1910</td>
<td>80.38</td>
</tr>
<tr>
<td>Don Drysdale</td>
<td>1956-1969</td>
<td>80.902</td>
</tr>
<tr>
<td>Hal Newhouser</td>
<td>1939-1955</td>
<td>81.04</td>
</tr>
<tr>
<td>Jack Chesbro</td>
<td>1899-1909</td>
<td>81.445</td>
</tr>
<tr>
<td>Eppa Rixey</td>
<td>1912-1933</td>
<td>82.036</td>
</tr>
<tr>
<td>Dazzy Vance</td>
<td>1915-1935</td>
<td>82.358</td>
</tr>
</tbody>
</table>