DOES THE BILL JAMES FORMULA FOR LEADOFF MEN STILL WORK?

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Bill James proposed a formula for evaluating leadoff men in the 1984 Baseball Abstract,. The basis of the formula was the probability of scoring given how far the leadoff man had advanced by his own efforts. For each time a leadoff man hits a home run he scores one run. For each 10 triples hit, James posited that a leadoff man would normally score 8 runs.(end note 1) For each 100 times they hit a double he posited leadoff men to score 55 runs. For each 100 singles, walks, and hit by pitch when no stolen base was attempted, James posited an expectation for 35 runs. For each time 10 bases stolen by leadoff men, he posited that 2 extra runs are scored, as this is the difference in expectation between a single and a double. Expected runs by a leadoff man was posited to reduce by 35 runs for each 100 Caught Stealing. Collectively, these postulates about expected scoring create a formula for estimating how many runs a leadoff man will score:

Expected Leadoff RUNS = HR +0.8 x 3B + 0.55 x (2B + SB) + .35 x (singles + BB + HBP – CS-SB)

"Many players, and most modern leadoff men, will actually score about the number of runs that the formula says they should score. " (p 684 The New Bill James Historical Baseball Abstract . Free press, 2001)

In order for the formula to work, James postulates need to be good approximations for the actual scoring percentages. If one or more of the estimates are too high, then the formula will predict too many runs scored by the lead off men. If the estimates are too conservative then actual leadoff men will score more runs than predicted by the formula.

This paper will look for answers to four questions. (1) How accurate was the formula at the time that it was originally presented? (2) How accurate was the formula for the seasons around 2001. (3) Are there time periods for which the formula becomes notably inaccurate? (4) What do these results tell us about the utility of the ratings James presented in the Topsy Hartsel essay of The New Historical Baseball Abstract.

Section one. How accurate was the formula in 1982-1984

Retrosheet.org did not exist prior to 1984 so the collective data that is the basis of this study was not available to Bill James. What he had to do instead was to single out players who batted almost exclusively in the leadoff position and compare the formula results to the actual runs scored by these players. When a player scored an unusual number of runs on Sacrifice Flys the formula would come up short and if his team's #2 and #3 hitters had miserable seasons, the leadoff man's actual runs scored could plummet. By and large, the formula worked well enough at factoring out the effects of teammates that James chose to present the formula to the public via the 1984 Bill James Baseball Abstract.

The team and league split pages on Retrosheet.org allows us to see how many runs were scored by each position in the batting order. In the National league in 1983, the men batting first scored 1252 runs by virtue of 2199 hits, 332 doubles, 84 triples, 117 homeruns, 787 bases on balls, 36 Hit by Pitches, 592 Stolen Bases, and 250 Caught stealing. The formula predicts 1268.9 runs. Too high, but by only 1.4 runs per team. That sort of accuracy is what most of us would call dead on.

The formula does not do quite as well for the American League. The respective key numbers are 1440 actual runs scored versus 1497 predicted. 4.1 runs per team error. Again on the high side. For the twenty-six major league teams in 1983, the leadoff man formula predicts 2.74% too many collective runs scored: 2.8 per team. When we incorporate the numbers for the Major leagues in 1982 and 1984 the leadoff formula over-shoots by 3.39 percent; 3.4 runs per team season.

Three runs per team sounds pretty good at first hearing. If the formula worked equally well for the other eight lineup spots this would result in a collective error of about 25 runs per team(see end note 2), which sounds very much like the error from using Runs Created or Extrapolated Runs or BaseRuns. But what we have measured in the paragraph above is net League error, rather than a standard error per team. And it is standard error per team which is the test to which Runs Created and its competitors are routinely put. Thus the next step is to look at the 78 individual team seasons for 1982 to 1984.

		R	H	2B	3B	HR	BB	HBP	SB	CS	OBP	James	error
1982	STL	128	189	29	5	7	71	7	53	25	0.353	107.9	(20.1)
1983	STL	108	203	40	7	6	66	7	48	21	0.363	113.9	5.9
1984	STL	93	179	23	7	8	53	6	42	15	0.321	99.4	6.4
1982	ATL	106	181	23	4	12	65	4	43	17	0.329	104.4	(1.6)
1983	ATL	91	185	27	12	6	58	3	38	24	0.327	100	9.0
1984	ATL	90	193	29	2	14	69	2	41	20	0.353	109.4	19.4
1982	CHI N	101	171	36	8	8	67	8	45	16	0.328	105.5	4.5
1983	CHI N	99	174	29	6	11	56	3	26	15	0.311	97.15	(1.9)
1984	CHI N	112	186	29	5	4	70	3	51	19	0.350	104.9	(7.2)
1982	CIN	86	164	29	11	4	56	0	39	16	0.295	92.55	6.6
1983	CIN	120	175	29	8	22	83	5	59	19	0.356	120.9	0.9
1984	CIN	99	154	27	5	17	88	4	49	18	0.326	108.3	9.3
1982	HOU	102	161	35	11	7	59	1	39	9	0.302	98.5	(3.5)
1983	HOU	90	186	17	13	5	48	1	40	25	0.310	94	4.0
1984	HOU	104	167	23	10	5	71	4	22	15	0.321	96.2	(7.8)
1982	LA N	95	193	25	7	4	56	2	51	21	0.326	101.5	6.4
1983	LA N	98	187	21	6	5	64	1	56	33	0.340	98	0.0
1984	LA N	86	166	27	5	2	55	2	37	20	0.304	87.4	1.4
1982	SF	75	175	31	3	15	67	1	32	16	0.321	103.2	28.2
1983	SF	91	155	19	1	6	71	3	42	21	0.308	89.35	(1.6)
1984	SF	126	209	25	5	15	65	3	45	23	0.366	114.9	(11.1)
1982	SD	99	184	15	8	3	45	3	57	23	0.309	93.1	(5.9)
1983	SD	108	179	19	7	10	61	3	60	26	0.326	101.4	(6.6)
1984	SD	101	168	20	8	3	74	3	63	21	0.335	100.6	(0.4)
1982	MON	92	188	34	8	3	75	2	81	17	0.349	115.4	23.4
1983	MON	138	196	37	7	12	98	2	90	15	0.386	134.7	(3.3)
1984	MON	103	194	35	11	3	75	0	71	12	0.365	118.1	15.1
1982	NY N	99	190	28	8	5	42	3	60	17	0.317	100.8	1.8

1983	NY N	98	195	28	6	7	25	3	52	18	0.303	95	(3.0)
1984	NY N	100	177	32	4	6	73	0	46	14	0.340	103.9	3.9
1982	PIT	88	172	19	10	4	50	1	64	25	0.298	93	5.0
1983	PIT	114	187	33	5	16	77	2	44	20	0.357	114.2	0.2
1984	PIT	89	189	26	12	1	41	0	28	19	0.310	90.7	1.7
1982	PHI	82	160	20	4	5	61	3	43	16	0.305	90.45	8.5
1983	PHI	97	177	33	6	11	80	3	37	13	0.343	110.3	13.3
1984	PHI	108	204	33	19	15	34	7	67	16	0.319	118.5	10.5
1982	BAL	98	184	29	4	10	57	0	10	6	0.319	98.35	0.4
1983	BAL	103	192	29	7	11	49	0	24	6	0.318	103.2	0.1
1984	BAL	89	164	21	2	10	63	2	12	8	0.307	91.35	2.3
1982	CAL	117	181	39	3	26	86	7	2	1	0.355	122	5.0
1983	CAL	107	217	31	6	10	72	4	12	12	0.383	116.2	9.1
1984	CAL	98	164	20	6	4	75	4	48	15	0.325	98.7	0.7
1982	CHI A	110	208	33	13	6	50	0	55	20	0.338	110.7	0.7
1983	CHI A	123	185	26	8	5	59	2	81	13	0.329	109.8	(13.2)
1984	CHI A	89	166	19	9	7	59	3	36	19	0.305	92.75	3.8
1982	DET	108	187	27	8	19	69	12	12	9	0.354	114.4	6.4
1983	DET	100	219	42	5	14	68	0	21	11	0.378	120.6	20.6
1984	DET	112	188	34	2	13	83	1	9	5	0.353	111.4	(0.6)
1982	CLE	92	177	24	6	8	61	2	42	8	0.315	102.3	10.3
1983	CLE	94	182	35	6	8	79	7	14	21	0.353	104.2	10.2
1984	CLE	118	176	27	9	7	87	4	54	21	0.348	110.9	(7.1)
1982	MIL	137	202	27	8	19	71	1	41	8	0.360	122.7	(14.4)
1983	MIL	108	183	31	6	18	64	2	42	8	0.329	113.4	5.4
1984	MIL	83	166	26	7	13	55	3	12	8	0.304	94.8	11.8
1982	KC	98	221	23	17	4	32	7	38	11	0.347	109.6	11.6
1983	KC	104	183	22	11	5	41	2	67	8	0.302	102.3	(1.7)
1984	KC	100	195	31	9	6	44	4	53	8	0.329	107	7.0
1982	MIN	65	163	21	10	4	60	2	9	9	0.301	88.7	23.7
1983	MIN	100	178	21	5	11	51	3	6	5	0.309	94.25	(5.8)
1984	MIN	84	207	20	7	1	27	4	17	8	0.320	91.7	7.7
1982	NY A	107	179	24	4	5	88	4	19	11	0.362	104.7	(2.3)
1983	NY A	113	194	32	4	8	70	1	17	11	0.348	105.7	(7.3)
1984	NY A	98	188	28	3	2	88	1	13	9	0.361	104.7	6.6
1982	OAK	131	166	26	5	12	123	2	131	41	0.387	129	(2.1)

1983	**OAK**	**123**	166	28	7	12	111	4	111	21	0.377	**129.8**	**6.8**
1984	**OAK**	**124**	180	31	6	17	96	5	70	19	0.376	**125.7**	**1.6**
1982	**SEA**	**95**	165	27	5	11	64	4	45	17	0.312	**99.4**	**4.4**
1983	**SEA**	**72**	162	34	5	8	69	2	28	24	0.323	**93**	**21.0**
1984	**SEA**	**97**	195	23	4	0	63	6	31	9	0.355	**101.9**	**4.8**
1982	**TEX**	**92**	181	23	6	19	41	5	8	6	0.310	**98.6**	**6.6**
1983	**TEX**	**92**	177	27	3	8	53	5	45	14	0.315	**98.3**	**6.3**
1984	**TEX**	**98**	164	23	4	6	47	1	23	10	0.286	**85.6**	**(12.4)**
1982	**TOR**	**95**	203	32	5	6	34	8	54	17	0.330	**103.2**	**8.2**
1983	**TOR**	**114**	211	30	10	6	51	3	47	18	0.351	**110.3**	**(3.8)**
1984	**TOR**	**87**	203	37	6	4	22	9	50	15	0.307	**99.35**	**12.4**
1982	**BOS**	**96**	191	26	3	0	60	2	16	9	0.337	**95.15**	**(0.8)**
1983	**BOS**	**87**	192	24	6	1	55	1	12	3	0.332	**96.3**	**9.3**
1984	**BOS**	**115**	213	30	4	8	76	0	7	6	0.382	**113.5**	**(1.6)**
													262.7

For an individual team season, the errors range from a 28.2 run overshoot for the 1982 Giants to falling 20.1 runs short for the 1982 Cardinals. The standard error is 7.14 runs while the average for actual runs was 101.14 per team season. If we conglomerate the results by franchise this cuts down the effect of random factors (e.g. a great season by the number two hitter.) The standard error drops to 13.52 runs per three seasons or 4.51 per year. If we could predict scoring by the other members of the team with this same accuracy then this would be a total team error of something on the order of 33 runs.

If the error were this magnitude for all other seasons, then the leadoff formula belongs in the category of tools to use until something better comes along. And it is important to note that if we compensate for the fact that the formula is systematically overshooting by 3.39% then the three-season standard error falls to 11.31 runs. We may tentatively conclude from this that for any two leadoff men during this time period, if one scores higher than the other by the leadoff formula then in all probability that the higher ranked player is scoring more runs. From the fact that the three-year numbers have a significantly smaller standard error than the one year numbers, we should conclude tentatively that (if there were such thing as a player who never batted anything but leadoff) then James Leadoff formula would prove to be more accurate for his career than for single seasons

Section Two.

Was the formula working in 2001?

The answer is again a qualified yes, and those who do not want the details should skip to Section Three. Starting in 1994, the leadoff formula became a more reliable gage of how many runs leadoff hitters were scoring than when James first proposed it. For the years 1994 to 2003 Major League leadoff men and their in-game replacements scored 30760 runs while the formula predicted 31346. The difference was down to 1.91%.

Some years were better than others. In 1994 the formula is high by 1.65%. In 1995 it was off by 2.98% percent. But in 1996 the formula under-predicted runs scored by 2.1% And in 1999 it missed by a grand total of 9 runs for 30 teams. In 2000 the formula under-predicted by 1.42% and it was high in 2001 by only 2.27% Putting these seasons together yields a net overshoot of less than 0.4% over a three year period. As James was writing The New Bill James Historical Abstract, contemporary leadoff men were indeed scoring the number of runs the formula predicted.

		R	H	2B	3B	HR	BB	HBP	SB	CS	OBP	James	Error	3 yrs standard error
1999	ATL	**108**	170	35	2	15	66	7	32	18	0.318	**102.8**	(5.2)	
2000	ATL	**113**	184	31	4	9	108	5	52	21	0.396	**120.9**	7.9	
2001	ATL	**94**	172	30	4	13	61	6	21	15	0.320	**98.85**	4.8	2.5
1999	BAL	**118**	180	30	6	25	105	24	40	9	0.393	**138**	20.0	
2000	BAL	**106**	160	32	0	21	99	10	22	9	0.356	**115.5**	9.5	
2001	BAL	**85**	125	25	3	13	77	10	25	7	0.287	**91.55**	6.6	11.98
1999	ANA	**97**	173	22	6	12	54	7	16	12	0.311	**95.8**	(1.2)	
2000	ANA	**124**	248	42	6	25	66	2	29	8	0.404	**141**	17.0	
2001	ANA	**86**	186	39	1	5	55	15	19	7	0.343	**102.5**	16.5	10.7
1999	BOS	**123**	198	41	13	7	106	3	26	13	0.401	**126.7**	3.7	
2000	BOS	**99**	171	24	5	10	99	1	7	12	0.349	**105.6**	6.6	
2001	BOS	**96**	166	31	3	13	68	3	6	4	0.312	**98.75**	2.8	4.35
1999	CHI A	**111**	186	29	9	15	70	4	30	14	0.340	**111.7**	0.7	
2000	CHI A	**130**	186	35	10	19	82	7	27	14	0.353	**120.6**	(9.4)	
2001	CHI A	**109**	178	44	11	21	64	6	21	8	0.330	**115.6**	6.6	0.7
1999	CLEV	**154**	201	37	6	12	94	7	43	10	0.378	**128.7**	(25.3)	
2000	CLEV	**122**	176	30	4	15	87	4	30	10	0.337	**113.5**	(8.5)	
2001	CLEV	**126**	189	33	5	16	56	4	25	13	0.322	**106.9**	(19.2)	17.65
1999	DET	**93**	192	41	14	17	44	8	29	21	0.328	**109.4**	16.4	
2000	DET	**106**	181	33	8	17	79	4	17	9	0.342	**113.9**	7.9	
2001	DET	**110**	202	26	13	10	45	3	65	18	0.334	**111.8**	1.8	8.7
1999	CIN	**117**	194	46	11	20	69	6	43	13	0.345	**125.4**	8.3	
2000	CIN	**128**	206	37	6	17	67	5	33	3	0.359	**124**	(4.0)	
2001	CIN	**111**	185	42	2	16	66	4	20	12	0.339	**108.8**	(2.3)	0.7
1999	CHI N	**94**	165	25	10	8	69	8	19	12	0.322	**99**	5.0	
2000	CHI N	**110**	203	44	2	8	68	9	55	9	0.364	**120.8**	10.8	
2001	CHI N	**109**	184	43	5	7	53	9	32	15	0.330	**102.7**	(6.3)	3.1
1999	HOU	**129**	198	58	0	18	91	11	28	15	0.388	**128.7**	(0.3)	
2000	HOU	**128**	192	25	6	15	104	12	35	15	0.389	**127**	(1.0)	
2001	HOU	**130**	195	35	6	26	60	22	12	7	0.360	**123.5**	(6.5)	2.6
1999	KC	**105**	198	38	7	14	63	3	36	11	0.343	**115.6**	10.6	
2000	KC	**140**	221	42	10	17	65	1	47	10	0.372	**130.3**	(9.7)	

2001	KC	88	162	21	5	12	42	6	13	9	0.282	87.2	(0.8)	0.03
1999	MIL	116	204	39	3	14	66	10	22	7	0.359	118.2	2.2	
2000	MIL	104	166	33	9	9	80	3	16	10	0.323	103.4	(0.6)	
2001	MIL	105	187	47	6	21	56	16	31	8	0.345	119.8	14.8	5.45
1999	LA N	103	186	33	4	5	75	8	56	24	0.348	108.6	5.6	
2000	LA N	100	166	20	3	15	66	4	30	13	0.308	99.15	(0.8)	
2001	LA N	113	188	27	5	26	37	4	21	9	0.306	105.8	(7.3)	0.8
1999	MON	99	185	33	10	19	48	3	18	11	0.316	105.8	6.8	
2000	MON	92	167	29	7	6	59	0	15	10	0.306	91.45	(0.6)	
2001	MON	95	165	34	7	6	55	4	18	10	0.312	92.35	(2.7)	1.2
1999	NY N	141	208	39	1	15	104	7	68	24	0.406	134.9	(6.2)	
2000	NY N	124	163	32	6	22	95	4	25	8	0.341	117.3	(6.7)	
2001	NY N	79	178	44	6	7	53	16	22	14	0.328	102	23.0	3.4
1999	NY A	129	185	39	4	19	94	22	29	12	0.387	128.9	(0.1)	
2000	NY A	127	199	38	4	10	82	12	25	9	0.381	120.3	(6.7)	
2001	NY A	87	172	28	3	15	68	14	40	11	0.334	109.8	22.8	5.3
1999	MIN	93	182	44	3	14	42	5	17	12	0.307	98.6	5.6	
2000	MIN	112	188	33	16	15	52	0	15	7	0.315	108.1	(3.9)	
2001	MIN	103	190	39	11	16	63	7	35	15	0.348	115.9	12.9	4.9
1999	OAK	120	153	33	5	18	116	7	17	7	0.350	118.1	(1.9)	
2000	OAK	128	190	35	2	20	70	5	6	2	0.340	114.2	(13.9)	
2001	OAK	115	173	36	4	10	68	7	27	13	0.320	103.2	(11.9)	9.2
1999	SD	120	174	34	3	10	84	4	44	20	0.349	108.2	(11.9)	
2000	SD	109	196	32	7	11	58	5	26	18	0.339	106.3	(2.8)	
2001	SD	117	149	31	5	11	112	6	38	9	0.349	113.5	(3.5)	6.0
1999	PHI	115	230	44	8	13	55	7	38	5	0.377	128.9	13.9	
2000	PHI	93	197	32	6	12	48	3	33	10	0.326	106.8	13.8	
2001	PHI	103	185	33	7	17	44	3	34	10	0.309	105.3	2.3	10
1999	PIT	120	186	40	7	25	64	2	30	5	0.332	119.9	(0.2)	
2000	PIT	124	195	39	4	11	66	5	19	11	0.344	109.8	(14.2)	
2001	PIT	77	156	20	6	6	60	6	12	16	0.300	85.1	8.1	2.1
1999	SF	130	201	44	7	20	80	9	35	17	0.368	127.5	(2.5)	
2000	SF	125	175	33	7	14	82	10	29	10	0.341	114.6	(10.4)	
2001	SF	113	179	33	6	18	59	6	17	12	0.315	105.6	(7.4)	6.8
1999	SEA	107	165	24	5	14	46	1	41	7	0.279	96.1	(10.9)	
2000	SEA	119	163	24	8	7	106	5	45	18	0.348	111.6	(7.4)	

2001	SEA	**135**	261	39	9	8	33	8	61	14	0.385	**130.1**	(4.9)	7.8
1999	TEX	**122**	176	27	9	6	85	1	39	13	0.339	**108.3**		
2000	TEX	**118**	185	30	8	13	71	5	11	5	0.340	**109.9**	(8.2)	
2001	TEX	**111**	210	50	4	19	63	10	20	5	0.367	**125.5**	14.5	2.5
1999	TOR	**118**	216	37	3	11	68	9	40	16	0.377	**120.9**	2.8	
2000	TOR	**129**	223	49	5	31	51	7	23	5	0.363	**133.4**	4.4	
2001	TOR	**114**	206	53	6	24	50	5	29	10	0.340	**122.6**	8.6	5.3
1999	FLA	**96**	189	34	4	1	77	0	51	18	0.354	**106.3**	10.3	
2000	FLA	**119**	211	23	4	6	88	0	65	23	0.402	**119.9**	0.9	
2001	FLA	**96**	178	23	12	5	81	2	33	19	0.346	**104.6**	8.6	6.6
1999	COL	**122**	205	26	9	13	46	1	13	7	0.326	**106.1**		
2000	COL	**126**	191	13	10	6	75	2	59	15	0.344	**111.4**		
2001	COL	**126**	230	32	9	4	43	9	43	15	0.366	**115.1**		13.8
1999	ARI	**125**	190	31	10	6	58	3	74	15	0.326	**112**		
2000	ARI	**110**	191	26	16	10	40	5	45	12	0.311	**106.3**	(3.7)	
2001	ARI	**110**	180	35	8	4	61	8	21	13	0.328	**100**		8.9
1999	T.B.	**105**	205	40	5	6	49	4	23	18	0.338	**102.8**	(2.3)	
2000	T.B.	**101**	180	28	2	21	47	5	15	16	0.309	**98.75**	(2.3)	
2001	T.B.	**97**	186	31	7	5	45	8	44	10	0.320	**101.6**	4.5	0.017
1999	STL	**112**	197	36	4	20	69	4	27	7	0.349	**119.5**	7.5	
2000	STL	**117**	205	35	7	11	54	30	16	10	0.377	**118.2**	1.1	
2001	STL	**106**	207	34	8	10	39	22	19	7	0.357	**112.1**	6.1	4.9
													(58.1)	5.32

Yet despite improved centering, the standard error increased slightly from the 7.14 runs per team of 1982-1984 to 7.75 for 1999-2001. When grouped in periods of three years, the standard error was 15.96, an average of 5.32 runs per team season. Again we see that over longer periods the formula becomes somewhat more accurate, but this time the gain in accuracy is much smaller on a percentage basis. The tentative conclusion at the end of the previous chapter is neither confirmed nor refuted by the team-by-team data from 1999-2001.

Section three.

Are there time periods for which the formula becomes notably inaccurate?

For the 189 league-seasons for which Retrosheet currently provides complete caught stealing data, the Bill James Leadoff formula predicts a collective 8011.6 runs too many, for a collective net error of 3.9 percent. Unfortunately for the formula's utility, there are periods such as 2004 to 2014 and 1963 to 1981 for which the formula overestimates by more than seven percent. For the seasons with Caught Stealing data from 1920 to 1937 the formula underestimates leadoff scoring by 4.39 percent. As we will see, this spread of well over 11 percent greatly diminishes the utility of the formula.

If we call seasons with an absolute net error of more than 5.0% a bad year and those with an absolute error of less than 3.5 percent a good year, then the last good year was 2003. Nine(9) of the last 11 seasons were bad years. From 1985 through 1993 there were six bad years to one good year. From 1963 to 1981 no year was more accurate than 4.2%; the other 18 years were too high by a minimum of 5.5%. Prior to 1963 we find a roughly even mix of good and bad years accompanied by a definite trend toward a lower net error. For the seasons 1951 to 1962 the formula predicts 5.08% too many runs. For 1942 to 1950 the overestimation is 2.96%. The formula comes within 1% for each season from 1938 to 1941.

For reasons that may be quite obvious to many readers, the season for which the formula overestimated by the highest percentage was 1968. This is partly by chance, as the net accuracy fluctuates randomly over seasons with similar scoring levels. James' formula predicted 942 runs scored by 1968 NL leadoff men; they scored only 793 times out of the #1 slot. Instead of scoring 112 runs, Lou Brock and his substitutes scored 94 Cardinal runs Felipe Alou, who had scored 118 leadoff runs for the 1966 Braves, had statistics worth 91.6 more leadoff runs in 1968. Yet Alou and his teammates combined for just 73 runs. (note 3) The White Sox leadoff men came up 24 runs short of the miserable 85.4 they projected to score.

		R	H	2B	3B	HR	BB	HBP	SB	CS	OBP	**error**
1968	**STL**	**94**	187	47	15	6	47	4	62	12	0.278	**111.6**
1968	**SF**	**96**	168	22	5	10	75	8	15	11	0.278	**100.2**
1968	**PITT**	**84**	200	16	8	0	51	0	48	23	0.278	**96.2**
1968	**PHI**	**66**	161	25	2	8	39	4	17	5	0.278	**84.15**
1968	**NY n**	**66**	156	23	4	5	40	3	12	15	0.278	**76.45**
1968	**LA**	**72**	163	32	5	12	52	4	10	10	0.278	**91.6**
1968	**HOU**	**76**	139	35	2	6	49	11	8	11	0.278	**79.2**
1968	**CIN**	**101**	236	46	6	10	59	4	4	8	0.278	**121.1**
1968	**CHI n**	**65**	158	15	7	2	36	3	9	10	0.278	**74.7**
1968	**ATL**	**73**	216	33	5	11	45	4	13	13	0.278	**106.8**
1968		R	H	2B	3B	HR	BB	HBP	SB	CS	OBP	
1968	**BALT**	**91**	162	19	4	16	78	3	27	13	0.278	**101.9**
1968	**BOS**	**90**	162	25	1	6	79	4	9	8	0.278	**94.1**
1968	**CAL**	**91**	162	19	4	16	78	3	27	13	0.278	**101.9**
1968	**CHI A**	**61**	176	26	4	5	37	3	21	14	0.278	**85.15**
1968	**CLEVE**	**81**	180	26	8	9	49	2	27	15	0.278	**95.65**
1968	**DET**	**109**	168	29	10	16	86	2	8	8	0.278	**109.1**
1968	**MIN**	**96**	177	33	7	9	38	15	37	13	0.278	**98.95**
1968	**NY A**	**70**	143	8	3	3	43	3	18	9	0.278	**71.5**
1968	**OAK**	**92**	189	26	8	4	59	4	63	22	0.278	**104.5**
1968	**WASH**	**69**	147	14	7	2	53	3	12	6	0.278	**78.6**

1930 was the 20th Century season for which the formula underestimated leadoff scoring by the greatest percentage. Five American League teams exceeded their expectation by 16 or more runs in 1930 and another team's leadoff men were underestimated by 9.2. Over all, the formula underestimated the AL's leadoff scoring by a collective 100.6 runs. In the National league, the Phillies had better hitters batting 8th than batting first. The Phillies leadoff men had a collective on-base percentage of .304 . Given their stats, they were expected by the Bill James formula to score 95.7 times; the actual count was 120 runs scored.

	Bat	R	H	2B	3B	HR	BB	HBP	SB	CS	OBP	error
1930	STL N	**111**	200	43	10	5	62	2	4	4	0.361	**108.2**
1930	PITT	**99**	206	29	9	5	44	1	8	8	0.344	**99.75**
1930	PHI n	**120**	184	43	6	7	40	4	7	4	0.304	**95.65**
1930	NY G	**111**	193	22	13	7	29	1	8	4	0.303	**93.05**
1930	Bkn	**124**	229	48	11	15	58	3	4	8	0.398	**123.8**
1930	CIN	**94**	187	30	12	7	68	0	5	5	0.364	**104.5**
1930	CHI n	**126**	204	34	17	8	41	9	11	5	0.332	**109**
1930	BOS	**96**	187	26	13	3	33	4	11	4	0.318	**92.2**
		115										**0**
1930	STL A	**110**	148	40	6	5	96	4	16	9	0.348	**100.8**
1930	BOS	**91**	191	34	5	0	42	3	6	6	0.337	**90.75**
1930	CHI A	**93**	180	27	10	6	54	6	10	4	0.331	**98.4**
1930	CLEVE	**128**	194	31	9	12	73	1	3	4	0.368	**111.1**
1930	DET	**124**	177	44	18	3	54	3	16	13	0.327	**99.4**
1930	NY A	**158**	224	37	23	11	93	0	17	11	0.422	**135.4**
1930	PHI A	**136**	143	36	7	13	139	7	3	2	0.393	**119.9**
1930	WASH	**124**	197	27	13	6	71	1	10	10	0.365	**107.8**

The Standard error for 1968 is 10.2 runs per team, 12.4% of the average of 82.15 runs per leadoff position. The standard error for 1930 is 11.77 per team--- 10.2% of the team average of 115.31. In neither year is it true that players score about the same number of runs as the Leadoff formula predicts.

Both these two seasons are famous as outliers. In 1968 Batting averages and slugging averages were notably lower than in surrounding seasons. In 1930 both were notably high. Hence it is not surprising that a linear formula such as the Leadoff man estimator breaks down. In order for the formula to be accurate, the hitting performance by the men who follow the leadoff men must fall within certain parameters. If not, then the probabilities of scoring from first, second and third base will be different from 0.35, 0.55, and 0.80 respectively. In 1930 and again in 1968 hitters batting 2nd through 6th were well outside this range.

Before moving on, I want to point out what may prove to be an important contributing factor in the leadoff formula's failure. In 1968 it was fairly common for one of a team's best hitters to be leading off. Batting Champion Pete Rose was leading off, as were Matty and Felipe Alou. Lou Brock was arguably the Cardinals best hitter in 1968. In complete contrast to this, we find that in 1930 the number two hitters were often collectively much superior to the leadoff men.

		R	H	2B	3B	HR	BB	HBP	SB	CS	OBP	Predicted	
1930	phi	**120**	184	43	6	7	40	4	7	4	0.304	**95.65**	**(24.4)**
1930	phi	**133**	216	51	3	9	76	2	6	4	0.402		
1930	phi	**149**	235	47	8	34	63	5	3	4	0.422		
1930	phi	**124**	239	41	10	26	44	4	5	6	0.417		
1930	phi	**105**	208	45	5	14	66	2	4	5	0.402		
1930	phi	**103**	201	40	5	8	59	2	7	2	0.390		
1930	phi	**68**	175	23	3	4	32	2	2	3	0.325		
1930	phi	**84**	188	29	4	15	35	2	0	1	0.357		
1930	phi	**58**	137	26	0	9	35	0	0	1	0.277		
1968	Atl	**R**	H	2B	3B	HR	BB	HBP	SB	CS	OBP	**Predicted**	
1968	Atl	**73**	216	33	5	11	45	4	13	13	0.353	**106.8**	**33.8**
1968	Atl	**72**	174	19	4	2	29	5	11	7	0.289		
1968	Atl	**87**	183	36	4	29	67	1	28	5	0.355		
1968	Atl	**67**	167	15	4	14	58	6	3	1	0.333		
1968	Atl	**52**	157	22	2	8	58	1	5	6	0.320		
1968	Atl	**36**	140	18	4	6	49	8	5	4	0.300		
1968	Atl	**46**	139	15	4	6	43	3	9	4	0.287		
1968	Atl	**50**	140	14	2	1	44	4	7	4	0.301		
1968	Atl	**31**	83	7	2	3	21	4	1	0	0.193		

What was true for the Phillies was also very much true for the 1930 Cubs, for whom Footsie Blair, rather than Woody English, was the primary leadoff hitter(see note 4.) And lest we think that reason that Blair led off in 1930 was the absence of Rogers Hornsby at second base, the Cubs leadoff hitters for 1931 were Kiki Cuyler for 49 games, Billy Jurges for 26, Johnny Moore for 19, English for 15, Jimmy Adair for 12, Danny Taylor for 6 games and Blair for 31 games. In other words, the 1931 Cubs lead off with a regular member of their lineup only 64 times out of 156 regular season games. They paid for it too. The irregulars combined for just 48 runs from the leadoff slot during 1931.

If the 1930 Cubs and Phillies were in any way indicative of their time, then presents a problem which is not directly related to the overall level of offense. The #2 hitter is best positioned to effect scoring of runs by the leadoff hitter. The #7 and #8 hitters have no possible impact and the #6 hitters influence is limited to his rare plate appearances with two out, the bases loaded and the leadoff hitter on third base. Thus whenever we find that the typical #2 hitter of one period is nothing like the typical #2 hitter of another, then we will probably find that James leadoff formula will incorrectly predict leadoff scoring for one or both periods.

1968 and 1930 are not the only seasons with a net error of 7.5% or greater. Standard error cannot be smaller than net error, so for such seasons we know in advance that team by team testing will show a standard error of 7.5% or more. Leadoff men that manage to stay healthy for 150 games nearly always score at least 90 runs, so for these seasons James's leadoff formula will typically misrepresent the players scoring value by 8 or more runs. And that makes the Formula barely acceptable as a predictor of seasonal runs for a player.

		R	H	2B	3B	HR	BB	HBP	SB		OBP	JAMES		# tms	
1911	NL	843	1245	208	60	20	816	24	323	146	0.369	824.9	(18.2)	8	-2.2%
1914	AL	709	1244	147	74	11	647	43	250	0	0.343	796.8	87.8	8	12.4%
1914	NL	708	1288	188	62	27	558	42	221	0	0.341	788.1	80.1	8	11.3%
1915	AL	759	1238	149	92	12	698	44	240	0	0.354	820	61.0	8	8.0%
1915	NL	683	1199	180	62	17	504	49	198	0	0.316	727.8	44.8	8	6.6%
1916	AL	692	1262	197	89	16	645	19	189	0	0.341	801.8	####	8	15.9%
1916	NL	639	1240	170	84	31	444	24	211	0	0.309	732	93.0	8	14.5%
1917	AL	717	1233	160	71	16	677	32	205	0	0.345	795.1	78.1	8	10.9%
1917	NL	636	1275	194	76	18	456	33	178	0	0.318	737.7	####	8	16.0%
1918	AL	557	1012	140	56	2	519	25	119	0	0.337	622.9	65.9	8	11.8%
1918	NL	569	1092	143	55	10	386	32	126	0	0.332	613.6	44.6	8	7.8%
1919	AL	687	1169	165	71	16	624	28	142	0	0.355	741.1	54.1	8	7.9%
1919	NL	600	1195	153	53	20	419	17	199	0	0.328	678.1	78.1	8	13.0%
1920	AL	882	1459	228	81	37	633	31	77	108	0.370	826.8	(55.3)	8	-6.3%
1920	NL	715	1425	195	74	32	399	31	129	131	0.329	722.3	7.3	8	1.0%
1921	AL	901	1559	247	79	36	576	33	101	78	0.372	860.1	(41.0)	8	-4.5%
1921	NL	824	1526	216	102	47	407	29	127	127	0.345	787.3	(36.7)	8	-4.5%
1922	AL	838	1450	224	65	42	568	35	92	82	0.354	809.6	(28.4)	8	-3.4%
1922	NL	837	1499	231	79	34	539	25	113	103	0.355	812.5	(24.6)	8	-2.9%
1923	AL	836	1498	218	71	40	592	34	104	113	0.369	826.2	(9.8)	8	-1.2%
1923	NL	873	1462	230	63	46	551	35	102	103	0.353	805.4	(67.6)	8	-7.7%
1924	AL	858	1556	243	70	22	523	40	101	90	0.366	824.8	(33.3)	8	-3.9%
1924	NL	832	1458	213	74	49	464	29	114	90	0.343	781.9	(50.1)	8	-6.0%
1925	AL	935	1529	242	71	42	622	47	135	117	**0.375**	863	(72.0)	8	-7.7%
1925	NL	864	1476	243	62	40	535	35	122	92	0.354	810.8	(53.2)	8	-6.2%
1926	AL	843	1449	276	88	21	628	36	118	81	0.368	843.3	0.3	8	0.0%
1926	NL	778	1394	226	69	24	527	39	110	0	0.347	799.9	21.9	8	2.8%
1927	AL	872	1484	254	81	19	594	41	121	76	0.366	838.9	(33.2)	8	-3.8%
1927	NL	817	1511	230	69	20	438	23	109	87	0.344	771.6	(45.4)	8	-5.6%
1928	AL	851	1462	263	79	31	580	28	101	91	0.360	821.2	(29.8)	8	-3.5%
1928	NL	805	1511	229	62	35	479	35	87	0	0.352	822.6	17.6	8	2.2%
1929	AL	870	1448	268	85	39	725	25	84	80	0.381	875.3	5.3	8	0.6%
1929	NL	943	1593	310	68	56	474	34	111	0	0.362	886.6	(56.5)	8	-6.0%
1930	AL	964	1454	276	91	56	622	25	81	59	0.362	863.5	####	8	#####
1930	NL	881	1590	275	91	57	375	24	58	42	0.340	826.1	(55.0)	8	-6.2%

1931	AL	946	1489	284	84	40	662	22	103	63	0.369	879.7	(66.3)	8	-7.0%
1931	NL	753	1469	255	64	38	386	27	83	72	0.328	754.6	1.6	8	0.2%
1932	AL	939	1451	295	73	57	649	12	72	61	0.359	861.2	(77.9)	8	-8.3%
1932	NL	802	1539	265	55	44	389	22	65	55	0.337	782.6	(19.4)	8	-2.4%
1933	AL	820	1374	244	78	50	607	10	63	70	0.346	801.4	(18.7)	8	-2.3%
1933	NL	707	1442	226	54	25	395	23	85	58	0.330	733.5	26.5	8	3.7%
1934	AL	920	1449	246	58	46	634	22	95	53	0.359	842.4	(77.6)	8	-8.4%
1934	NL	849	1526	279	64	47	380	42	84	37	0.341	800.8	(48.2)	8	-5.7%
1935	AL	870	1447	260	72	50	581	22	99	56	0.351	834.6	(35.4)	8	-4.1%
1935	NL	838	1539	274	58	64	399	24	94	33	0.341	816.5	(21.6)	8	-2.6%
1936	AL	989	1580	312	62	54	647	31	128	74	**0.377**	915.4	(73.6)	8	-7.4%
1936	NL	830	1519	273	57	44	399	28	86	25	0.332	798.4	(31.6)	8	-3.8%
1937	AL	934	1478	301	53	65	579	27	108	60	0.352	856.3	(77.7)	8	-8.3%
1937	NL	798	1467	255	59	69	465	16	92	64	0.339	800.2	2.2	8	0.3%
1938	AL	845	1475	260	51	40	583	28	113	64	0.356	831.3	(13.8)	8	-1.6%
1938	NL	792	1450	237	70	65	522	18	51	32	0.349	816.7	24.7	8	3.1%
1939	AL	855	1451	241	61	46	544	24	107	58	0.345	813.3	(41.7)	8	-4.9%
1939	NL	767	1487	244	54	49	479	26	67	36	0.347	803	36.0	8	4.7%
1940	AL	820	1371	266	61	82	548	29	91	58	0.333	813.7	(6.4)	8	-0.8%
1940	NL	777	1440	226	58	48	462	26	95	45	0.334	780.6	3.5	8	0.5%
1941	AL	818	1385	264	56	50	549	23	105	61	0.332	795.1	(22.9)	8	-2.8%
1941	NL	726	1377	215	46	33	524	15	79	21	0.330	764.2	38.2	8	5.3%
1942	AL	776	1378	234	50	56	484	23	129	82	0.331	762.6	(13.5)	8	-1.7%
1942	NL	655	1264	201	38	32	565	27	57	25	0.328	730.4	75.3	8	11.5%
1943	AL	704	1363	223	47	24	486	20	167	88	0.325	738.1	34.1	8	4.8%
1943	NL	696	1379	230	58	29	560	19	68	26	0.339	780.8	84.7	8	12.2%
1944	AL	761	1427	227	78	39	469	16	177	85	0.332	780.7	19.7	8	2.6%
1944	NL	740	1406	208	47	39	442	15	66	41	0.322	739	(1.0)	8	-0.1%
1945	AL	692	1351	224	71	37	531	15	125	87	0.336	759.3	67.3	8	9.7%
1945	NL	787	1383	212	41	31	598	22	87	49	0.346	782.3	(4.7)	8	-0.6%
1946	AL	739	1350	225	45	36	562	26	123	78	0.337	764.3	25.3	8	3.4%
1946	NL	696	1273	188	41	31	633	22	88	54	0.337	749.7	53.7	8	7.7%
1947	AL	737	1323	192	65	47	603	17	80	68	0.338	770.5	33.5	8	4.5%
1947	NL	748	1370	214	50	56	517	20	51	51	0.330	761.5	13.5	8	1.8%
1948	AL	825	1403	223	48	40	710	19	83	63	0.365	833	7.9	8	1.0%
1948	NL	762	1475	233	35	53	515	15	107	83	0.348	790.9	28.9	8	3.8%

1949	AL	787	1403	201	74	61	709	17	83	59	0.364	854.3	67.3	8	8.5%
1949	NL	794	1372	218	52	50	631	18	91	51	0.349	807.2	13.2	8	1.7%
1950	AL	868	1439	227	63	72	775	29	51	48	0.381	899	31.0	8	3.6%
1950	NL	830	1347	222	55	87	646	35	99	56	0.351	835.7	5.7	8	0.7%
1951	AL	829	1448	218	51	85	640	33	85	68	0.365	857.4	28.3	8	3.4%
1951	NL	719	1333	206	38	70	582	28	69	66	0.334	774.6	55.6	8	7.7%
1952	AL	740	1360	207	54	67	654	32	60	65	0.353	814.6	74.6	8	10.1%
1952	NL	681	1257	209	38	76	525	53	78	65	0.321	743.4	62.4	8	9.2%
1953	AL	798	1432	249	44	73	576	27	52	60	0.352	818.7	20.7	8	2.6%
1953	NL	785	1386	222	81	67	567	32	89	56	0.344	817.4	32.3	8	4.1%
1954	AL	793	1358	223	29	72	675	37	53	57	0.359	819.6	26.6	8	3.4%
1954	NL	757	1362	204	62	71	550	21	83	59	0.334	787.4	30.4	8	4.0%
1955	AL	830	1424	226	45	93	596	38	48	50	0.354	838.3	8.3	8	1.0%
1955	NL	767	1346	200	50	74	539	30	95	80	0.336	771.9	4.8	8	0.6%
1956	AL	814	1355	205	54	101	676	31	77	57	0.354	848.1	34.1	8	4.2%
1956	NL	701	1374	178	61	47	542	20	75	50	0.341	768.7	67.7	8	9.7%
1957	AL	702	1329	234	44	102	500	27	81	60	0.324	777.7	75.7	8	10.8%
1957	NL	720	1376	206	53	60	517	23	105	63	0.331	773.6	53.6	8	7.4%
1958	AL	707	1307	214	47	93	520	28	63	63	0.326	764.2	57.2	8	8.1%
1958	NL	723	1382	210	58	56	597	21	122	62	0.350	807.2	84.2	8	11.6%
1959	AL	774	1309	200	33	101	590	45	102	44	0.340	805.9	31.9	8	4.1%
1959	NL	776	1383	201	49	54	560	19	117	67	0.341	784	8.0	8	1.0%
1960	AL	731	1325	210	38	91	532	39	98	56	0.330	781.9	50.8	8	7.0%
1960	NL	780	1365	206	62	63	542	24	145	67	0.337	791.5	11.4	8	1.5%
1961	AL	974	1772	276	55	82	692	30	187	86	0.330	1013	39.5	10	4.1%
1961	NL	724	1314	175	50	60	507	26	110	65	0.322	742.2	18.2	8	2.5%
1962	AL	1009	1757	277	55	120	719	37	179	81	0.333	1045	36.1	10	3.6%
1962	NL	1000	1831	259	58	94	674	46	217	87	0.338	1045	44.8	10	4.5%
1963	AL	892	1762	266	59	114	583	37	165	64	0.319	998.2	106.2	10	11.9%
1963	NL	911	1763	262	76	78	529	49	177	106	0.317	955	43.9	10	4.8%
1964	AL	905	1694	275	51	108	594	38	110	66	0.311	961.2	56.1	10	6.2%
1964	NL	880	1792	244	65	82	467	49	182	120	0.312	933.6	53.6	10	6.1%
1965	AL	948	1706	275	79	117	610	44	197	100	0.318	997	49.0	10	5.2%
1965	NL	793	1784	294	59	70	493	45	198	118	0.314	941.9	148.9	10	18.8%
1966	AL	904	1714	263	68	121	560	44	204	92	0.317	981.8	77.8	10	8.6%
1966	NL	940	1896	266	68	112	491	63	239	132	0.330	1016	75.7	10	8.1%

1967	AL	826	1630	267	60	83	545	37	189	101	0.301	911	85.0	10	10.3%
1967	NL	880	1792	244	65	82	467	49	182	120	0.312	933.6	53.6	10	6.1%
1968	AL	835	1667	231	58	76	582	41	242	125	0.314	927.9	92.9	10	11.1%
1968	NL	793	1784	294	59	70	493	45	198	118	0.314	941.9	148.9	10	18.8%
1969	AL	1110	2123	309	61	112	797	42	329	122	0.329	1222	111.9	12	10.1%
1969	NL	1171	2201	342	79	123	739	46	269	132	0.333	1237	65.6	12	5.6%
1970	AL	1171	2111	316	50	178	829	47	259	119	0.331	1257	86.0	12	7.3%
1970	NL	1269	2260	342	90	129	795	39	287	135	0.339	1286	16.8	12	1.3%
1971	AL	1099	2095	315	70	128	707	40	254	116	0.321	1183	83.6	12	7.6%
1971	NL	1071	2128	273	67	78	725	91	253	117	0.330	1176	104.5	12	9.8%
1972	AL	918	1809	272	39	63	733	60	295	117	0.311	1042	123.7	12	13.5%
1972	NL	1019	1974	282	71	86	699	54	252	103	0.319	1113	94.1	12	9.2%
1973	AL	1138	2219	309	90	133	741	46	323	154	0.333	1252	113.6	12	10.0%
1973	NL	1193	2204	313	62	152	810	54	284	153	0.339	1266	73.3	12	6.1%
1974	AL	1106	2132	288	68	92	754	51	344	177	0.329	1183	76.8	12	6.9%
1974	NL	1125	2234	316	82	82	814	57	381	162	0.343	1260	134.7	12	12.0%
1975	AL	1125	2105	323	63	146	873	55	281	176	0.339	1244	119.0	12	10.6%
1975	NL	1199	2254	366	91	80	797	47	314	116	0.342	1273	73.6	12	6.1%
1976	AL	1091	2159	284	77	68	679	33	420	192	0.321	1157	66.3	12	6.1%
1976	NL	1147	2128	307	85	92	834	35	323	154	0.335	1219	72.1	12	6.3%
1977	AL	1359	2682	430	91	130	815	44	312	209	0.338	1440	81.1	14	6.0%
1977	NL	1200	2285	371	101	84	762	41	436	178	0.340	1280	80.0	12	6.7%
1978	AL	1300	2379	377	72	114	837	53	410	207	0.314	1336	35.6	14	2.7%
1978	NL	1121	2225	362	85	90	707	34	385	164	0.334	1227	105.9	12	9.4%
1979	AL	1416	2683	391	111	121	849	48	461	185	0.344	1487	71.2	14	5.0%
1979	NL	1213	2266	319	106	121	752	42	442	178	0.340	1287	74.3	12	6.1%
1980	AL	1434	2734	427	107	92	939	53	540	187	0.354	1540	106.0	14	7.4%
1980	NL	1168	2192	323	93	83	844	32	647	223	0.341	1286	117.6	12	10.1%
1981	AL	869	1644	220	60	51	607	26	312	151	0.330	910.7	41.7	14	4.8%
1981	NL	769	1383	200	66	49	553	31	392	143	0.331	818.4	49.3	12	6.4%
1982	AL	1441	2608	381	97	149	896	56	482	173	0.338	1499	57.6	14	4.0%
1982	NL	1153	2128	324	87	77	714	35	607	218	0.320	1206	53.1	12	4.6%
1983	AL	1440	2641	412	89	125	892	36	527	175	0.339	1497	57.0	14	4.0%
1983	NL	1252	2199	332	84	117	787	36	592	250	0.336	1269	16.9	12	1.3%
1984	AL	1392	2569	370	78	98	885	47	435	160	0.333	1429	37.2	14	2.7%
1984	NL	1211	2186	329	93	93	768	34	562	212	0.334	1252	41.1	12	3.4%

1985	**AL**	**1423**	2606	385	118	151	905	42	496	172	0.339	**1511**	**87.8**	14	**6.2%**
1985	**NL**	**1198**	2125	336	102	118	773	40	562	186	0.328	**1265**	**67.4**	12	**5.6%**
1986	**AL**	**1486**	2524	432	87	206	960	57	476	186	0.336	**1529**	**42.9**	14	**2.9%**
1986	**NL**	**1173**	2131	374	70	136	793	39	587	208	0.329	**1276**	**103.4**	12	**8.8%**
1987	**AL**	**###**	2592	445	95	219	1037	51	521	187	0.348	**1601**	**61.8**	14	**4.0%**
1987	**NL**	**1358**	2265	391	98	186	860	54	552	187	0.351	**1401**	**42.8**	12	**3.2%**
1988	**AL**	**1414**	2608	443	83	139	873	52	491	156	0.338	**1496**	**82.5**	14	**5.8%**
1988	**NL**	**1164**	2174	350	85	131	747	51	522	194	0.334	**1270**	**106.1**	12	**9.1%**
1989	**AL**	**1346**	2510	394	84	99	993	53	483	185	0.341	**1457**	**111.4**	14	**8.3%**
1989	**NL**	**1183**	2048	352	72	116	797	44	416	184	0.323	**1208**	**25.1**	12	**2.1%**
1990	**AL**	**1365**	2486	413	98	140	955	62	438	166	0.334	**1473**	**108.3**	14	**7.9%**
1990	**NL**	**1281**	2300	406	77	122	856	49	538	188	0.357	**1359**	**77.7**	12	**6.1%**
1991	**AL**	**1488**	2574	443	94	176	1076	70	423	176	0.350	**1570**	**82.3**	14	**5.5%**
1991	**NL**	**1244**	2086	311	79	104	849	40	484	210	0.334	**1230**	**(14.1)**	12	**-1.1%**
1992	**AL**	**1407**	2513	412	83	127	1043	75	509	196	0.345	**1506**	**99.4**	14	**7.1%**
1992	**NL**	**1145**	2175	335	81	92	797	46	470	202	0.338	**1243**	**97.8**	12	**8.5%**
1993	**AL**	**1493**	2612	443	91	133	1099	76	445	182	0.356	**1567**	**73.8**	14	**4.9%**
1993	**NL**	**1455**	2589	430	99	140	964	72	516	225	0.343	**1515**	**59.8**	14	**4.1%**
1994	**AL**	**1148**	1821	363	62	118	760	48	367	102	0.347	**1135**	**(12.9)**	14	**-1.1%**
1994	**NL**	**1063**	1867	316	70	115	720	58	331	140	0.351	**1112**	**49.4**	14	**4.6%**
1995	**AL**	**1401**	2371	411	99	164	915	61	440	167	0.350	**1434**	**33.3**	14	**2.4%**
1995	**NL**	**1349**	2328	398	94	138	891	99	489	209	0.349	**1398**	**48.6**	14	**3.6%**
1996	**AL**	**1733**	2739	508	81	211	1113	91	404	145	0.362	**1685**	**(47.7)**	14	**-2.8%**
1996	**NL**	**1534**	2598	421	102	148	900	103	506	187	0.338	**1522**	**(11.6)**	14	**-0.8%**
1997	**AL**	**1555**	2634	479	100	163	1010	95	450	192	0.349	**1578**	**23.2**	14	**1.5%**
1997	**NL**	**1433**	2564	452	98	132	972	118	506	186	0.345	**1535**	**102.3**	14	**7.1%**
1998	**AL**	**1556**	2602	447	82	197	1063	102	522	173	0.353	**1617**	**60.6**	14	**3.9%**
1998	**NL**	**1663**	2949	527	87	184	1050	143	412	150	0.342	**1744**	**80.8**	16	**4.9%**
1999	**AL**	**1595**	2610	482	95	190	1036	105	426	175	0.348	**1599**	**4.5**	14	**0.3%**
1999	**NL**	**1847**	3082	597	93	222	1121	90	598	218	0.349	**1851**	**4.4**	16	**0.2%**
2000	**AL**	**1661**	2671	475	88	241	1056	68	319	134	0.351	**1636**	**(24.6)**	14	**-1.5%**
2000	**NL**	**1822**	3008	484	104	182	1158	102	553	198	0.348	**1797**	**(25.0)**	16	**-1.4%**
2001	**AL**	**1462**	2606	495	85	187	797	106	430	144	0.331	**1523**	**60.6**	14	**4.1%**
2001	**NL**	**1684**	2918	543	102	197	940	143	394	191	0.332	**1695**	**10.8**	16	**0.6%**
2002	**AL**	**1518**	2514	488	81	227	880	148	304	136	0.335	**1535**	**16.5**	14	**1.1%**
2002	**NL**	**1566**	2936	534	118	174	928	109	427	183	0.329	**1685**	**118.9**	16	**7.6%**

2003	**AL**	**1475**	2684	500	83	219	734	103	364	118	0.331	**1544**	**68.6**	14	**4.6%**
2003	**NL**	**1695**	2969	555	102	180	948	134	409	151	0.334	**1721**	**25.7**	16	**1.5%**
2004	**AL**	**1515**	2846	496	84	215	843	82	310	134	0.353	**1612**	**96.7**	14	**6.4%**
2004	**NL**	**1652**	3017	549	107	230	929	125	407	146	0.335	**1763**	**110.6**	16	**6.7%**
2005	**AL**	**1511**	2711	474	98	202	840	101	331	132	0.345	**1568**	**57.4**	14	**3.8%**
2005	**NL**	**1584**	3020	541	114	184	931	128	436	189	0.339	**1728**	**143.8**	16	**9.1%**
2006	**AL**	**1527**	2723	525	86	210	905	102	357	116	0.350	**1617**	**89.5**	14	**5.9%**
2006	**NL**	**1747**	3026	582	130	238	954	141	552	184	0.338	**1818**	**71.0**	16	**4.1%**
2007	**AL**	**1525**	2629	463	95	171	998	91	400	102	0.349	**1592**	**67.1**	14	**4.4%**
2007	**NL**	**1792**	3067	589	118	277	984	115	525	157	0.341	**1859**	**67.1**	16	**3.7%**
2008	**AL**	**1464**	2633	481	92	185	966	99	396	102	0.347	**1596**	**131.7**	14	**9.0%**
2008	**NL**	**1701**	2994	582	105	281	1081	85	491	146	0.342	**1849**	**148.4**	16	**8.7%**
2009	**AL**	**1502**	2693	474	80	215	1003	70	437	137	0.355	**1628**	**126.1**	14	**8.4%**
2009	**NL**	**1635**	2976	571	130	193	1057	83	402	163	0.340	**1762**	**127.1**	16	**7.8%**
2010	**AL**	**1381**	2559	446	66	115	829	87	457	130	0.330	**1456**	**74.8**	14	**5.4%**
2010	**NL**	**1625**	2841	522	114	245	996	104	423	152	0.328	**1726**	**100.7**	16	**6.2%**
2011	**AL**	**1366**	2526	472	84	202	793	92	421	144	0.326	**1491**	**125.2**	14	**9.2%**
2011	**NL**	**1617**	2945	543	108	228	944	97	532	168	0.331	**1748**	**131.1**	16	**8.1%**
2012	**AL**	**1433**	2521	493	77	217	845	80	372	111	0.329	**1516**	**82.9**	14	**5.8%**
2012	**NL**	**1528**	2789	558	122	186	911	100	443	168	0.319	**1647**	**119.2**	16	**7.8%**
2013	**AL**	**1433**	2521	493	77	217	845	80	372	111	0.329	**1516**	**82.9**	14	**5.8%**
2013	**NL**	**1393**	2701	517	97	172	907	124	350	153	0.333	**1582**	**188.5**	16	**13.5%**
2014	**AL**	**1438**	2754	521	93	187	831	82	339	112	0.326	**1580**	**141.7**	15	**9.9%**
2014	**NL**	**1444**	2739	502	102	167	794	98	474	169	0.326	**1561**	**117.4**	15	**8.1%**
		####										**2E+05**	**8012**		**3.9%**

When working without caught stealing data, the Bill James formula overestimates lead off scoring in the 1914-1919 seasons by a collective 11.3 percent. If we assume that only 58% of attempts by lead off men were successful, then net error calculates as a little over 4%. This improvement indicates that lack of caught stealing data is responsible for the bulk of the net error. Therefore we use can use the formula on players whom caught stealing data is available with a moderate level of confidence.

To summarize the implications of Table FIVE

a) For specific periods such as 1938-1941 and 1991-2001 the Bill James leadoff formula would probably work quite well if applied to specific teams and players.
b) It is possibly the best available tool for many others seasons, and so may be applied to the years 1942-1950, 1982-84, and 1994-2003 with a reasonable level of confidence.

c) The same is true for 1920-1937, but there are individual seasons for which the formula is likely to fail nearly as badly as it does in 1930.
d) The confidence in results from 1951 to 1962, and 1985 to 1993 is undermined by the fact the formula estimates too many runs, with a net error of 5% or more during these periods.
e) The formula will probably give a misleading result if applied to teams and player during 1963 to 1981 or to 2008 to present.
f) The situation is even worse for the years prior to 1920 unless caught stealing data is available.

Section Four:

What do these results tell us about the validity of the ratings James presented in the Topsy Hartsel essay?

James wrote: "One can turn <the formula> into a rating of the greatest Leadoff men by (1) Converting the expected runs scored into expected runs scored per 27 outs. (2) contrasting that figure with the league average for runs scored per out during the players careers.

Obviously imperfect, for many reasons, but still…sometimes it is helpful to take a fresh look at these kinds of issues with new methods, even if these methods are imperfect."

All of the greatest leadoff men ever, by this method, would be guys who aren't leadoff men, starting with Ted Williams.---- This is logical on its own term: if you had two Ted Williams, and could afford to use one of them as a Leadoff man, he would be the greatest leadoff man who ever lived.

What we want ..are the greatest leadoff men who were actually leadoff men, That list is:

1. Rickey Henderson 1.67
2. Tim Raines 1.64
3. Topsy Hartsel 1.61
4. Lenny Dykstra 1.59
5. Wade Boggs 1.57

The 1.67 for Henderson means that the runs Henderson could be expected to score as a leadoff man (which is almost the same as the number of runs he ***has*** scored) is 67% higher, per 27 outs, than the league runs scored per game for his era. " (pp 684-685 The New Bill James Historical Baseball Abstract.)"

In other words, **1.67** equals 27 * (Henderson's career Expected Runs/Henderson's outs made) divided by Runs per game for Henderson's career so far, (which was 1979-2000 as James was writing)

The essay does not mention how outs consumed are determined. James' usual formula is outs= AB-H +SF+ SH+ CS+GIDP. For Topsy Hartsel's career, the number that balances the equation is approximately 1.61. For Bobby Bonds it is 1.57; for Pete Rose it is 1.54; for Stan Hack it is 1.53; for Billy Hamilton it is 1.51; for Richie Ashburn it is 1.47, for Lou Brock it is 1.44. Earl Combs rates at 1.37 by this method, Lloyd Waner is at 1.21.

To contrast with Hartsel's actual performance. I have chosen nine players whose careers were at least 10 seasons long and who are either in the Hall of Fame or have been strong candidates. Combs played in a period in which the formula underestimates leadoff scoring. Bonds and Rose and Brock played in a time when the formula badly overestimated leadoff runs. Henderson and Ashburn played in periods in which the systematic overestimation was smaller than for Brock and Rose. Stan Hack played in some seasons for which the formula was pretty much accurate for leagues as a whole. And over the course of Lloyd Waner's career the net error transitioned from underestimation to overestimation. Hamilton and Hartsel come from time periods for which the scoring levels are known, but the performance of the Leadoff formula is unknown.

	R	H	single	2B	3B	HR	BB	HBP	SB	CS	OUTS	James	Rating
Hamilton	**1697**	2164	1787	242	95	40	1189	89	914	??	4166	**1504.6**	1.51
Henderson	**129**	2818	2005	473	59	281	2026	88	1337	315	7717	**2187.1**	1.67
combs	**1186**	1866	1345	309	154	58	670	17	98	71	4047	**1057.1**	1.37
Bonds	**1258**	1886	1186	302	66	332	914	53	461	169	5513	**1337.5**	1.57
Hartsel	826	1336	1031	182	92	31	837	12	247	??	3608	**912.1**	1.61
Hack	**1239**	2193	1692	363	81	57	1092	21	165	74	5352	**1310.3**	1.53
ROSE	**2165**	4256	3215	746	135	160	1566	107	198	149	####	**2376.5**	1.54
Brock	**1610**	3023	2247	486	141	149	761	49	938	307	7823	**1679.2**	1.44
ashburn	**1322**	2574	2119	317	109	29	1198	43	234	117	6121	**1472.4**	1.47
Waner	**1201**	2459	2033	281	118	27	420	26	67	22	5506	**1149.3**	1.21

When we look at the actual number of runs scored, we see that the formula estimate for Waner and Combs is low, (much more so for Combs than for Waner.) Bobby Bonds count of runs is 1% under where you would expect it to be (see note 5). Given the time in which he played, Lou Brock's ratio of Runs Scored to Runs Estimated is more than 4% better than expected. Henderson's is 1% better. Stan Hack's actual runs scored are 3% too low to be entirely accounted for by formula's bias for those seasons.

Pete Rose scored a LOT of runs, yet other men would probably have scored 1.5% more if they had been in the same positions on the base paths. Ashburn was either a very cautious base runner or his teammates were particularly inept at driving him in. Whatever the cause, Ashburn scored five(5) percent or so less runs than the formula expects him to score.

Which brings us to Billy Hamilton and Topsy Hartsel, the best of the 1890s and the 1900s respectively. Hamilton's actual runs far exceed his estimates, which is what we would expect from a high scoring period. As we might expect from an extremely low offense period, Hartsel scored significantly less runs than predicted. What we do not know without other data is whether other leadoff men of their respective era were showing similar differentials.

We can say is this: based on actual runs scored compared to the runs per game of his time. Hamilton rates even higher then Henderson. And Combs surpasses Bonds, Hack, and Rose by a significant margin. These facts may well be the result of the outstanding hitting by their Hall of Fame teammates. But these discrepancies could also turn out to be two of the many examples that demonstrate the formula's inadequacy for the player's respective eras.

What is completely clear is that the rank ordering of the Hartsel essay is very sensitive to whether any correction is made for James's formula not being centered on actual runs by leadoff men. After the leaders—Henderson, Raines and

Hartsel, the next fourteen men are packed tightly between 1.47 and 1.59. Another dozen are packed between 1.39 and 1.44.

Table Six shows what happens if we make a period correction to James' rating based on the yearly net errors . Rose (formerly at 1.53) is passed by Combs(previously 1.37). Meanwhile Bonds slips from 1.57 to 1.50, which puts him in virtual dead heat with Stan Hack(formerly 1.53). If the net error correction for the 1890s turns out to more than 6.23% then Hamilton, and not Henderson should be regarded as the king of leadoff efficiency.

	Scoring efficiency per 27 outs	James Rated Est R/27 outs	ratio actual to estimated	net accuracy for period	adjusted Efficiency
Hamilton	1.70	1.51	1.13	??	??
henderson	1.63	1.67	0.97	96.05%	1.60
combs	1.54	1.37	**1.12**	105.14%	1.44
Bonds	1.48	1.57	0.94	95.44%	1.50
Hartsel	1.46	1.61	0.91	??	??
Hack	1.45	1.53	**0.95**	98.19%	1.50
ROSE	1.40	1.54	0.91	92.77%	1.43
Brock	1.38	1.44	**0.96**	91.93%	1.32
ashburn	1.32	1.47	**0.90**	95.54%	1.40
Waner	1.26	1.21	1.04	105.14%	1.27

We don't KNOW whether Hamilton would indeed pass Henderson, but Sliding Billy was in all probability more efficient relative to his time than Hartsel. Hamilton played ten full seasons. In those years he led the Major leagues multiple times in several categories including walks, stolen bases and Batting Average. In his nine full seasons Hartsel led in Walks four times, Stolen bases once, and in On base percentage once. Topsy Hartsel did hit triples more frequently than Hamilton—especially when the time and place is taken into account. Even so, when we use runs created per out and compare to the scoring background for the two players it is Hamilton who has the superior Offensive winning percentage. Hamilton's career OPS+ is similarly larger and he was stealing bases just as often if not more often than Hartsel. (see note 6) .

So why does the leadoff formula rate Hartsel as a better leadoff man? The answer must be that either Hamilton is being underrated or Hartsel is being overrated, or some combination of both. Their respective ratios of runs to expected runs suggest that this is true, but do not prove it. Better evidence that the formula went haywire is that Hamilton played when batting and on base percentages exceeded even the 1920s and Total Bases per game were just as high as the early 1930s. Errors were also higher. Thus if f ever there was a time period in which a linear formula would predict too few runs it was the 1890s. By similar reasoning, we can see why a linear formula created in the 1980s would probably predict too many runs for seasons at the nadir of the "deadball era"(see note 7.)

Until further evidence comes in, the most reasonable conclusion is that the gap in efficiency found by James' leadoff formula is the result of failures of the formula rather than the abilities of Topsy Hartsel and Billy Hamilton.

Conclusions:

A) Even though the formula might be quite useful in comparing players from the same season, it fails entirely as a tool for comparisons of players with very different scoring environments. Much of the reason for this should be attributed to changes in the performance of #2 hitters over the decades.

B) Players from high scoring time periods will likely be systematically underrated by the Leadoff formula.

C) Players from Low Scoring periods will likely systematically overrated by the combination of the formula and the comparison to total actual runs per out for that period. The problem is that expected runs by the Bill James leadoff formula fall more slowly in a low scoring environment than actual runs do.

D) Topsy Hartsel was not better than Billy Hamilton. Hamilton and John McGraw are badly underrated by Bill James' methodology.

WRAPUP

The utility of the leadoff formula is that it factors out the difference in ability of the teammates that might follow the leadoff man. It also factors out certain things that might be attributable to luck such as the number and timing of defensive miscues. If I wanted to know which of two players would be likely to score more real runs in the following year, the man with more estimated runs and less real runs would be a better choice than someone with more real runs and less estimated runs. In this respect, the Formula has similar utility to Defense Independent ERA.

And this utility is not lost in the face of the trend from under-predicting to over-predicting. The formula picks up accuracy when seasons are grouped, so if we want to compare the career numbers for two contemporaries, we may use the formula with a high degree of confidence of a reliable verdict.

The insurmountable problem with a purely linear estimator is this. There are seasons when the background environment is sufficiently different from the posited norm that the formula systematically falls short and other seasons in which the formula systematically estimates too high. Even if the absolute net error in each case is just 3.0 % the difference between the two environments is a full 6%, a gap which undermines the utility of the cross-year comparison.

Table FIVE shows that there are dozens upon dozens of pairs of seasons for which the difference in net error far exceeds ten percent, and this totally invalidates the conceptual framework for the rating system employed in the Topsy Hartsel essay.

END NOTES

1. To posit is to set out a proposition as basis for discussion, another meaning is to lay down a postulate. James' posits about scoring probabilities are treated as postulates by the formula and for the leadoff man evaluations found in the Topsy Hartsel essay of The New Bill James Historical Baseball Abstract. James made no reference to any study supporting those particular numbers, but calling them "guesstimates" sounds unnecessarily hostile given that for specific time frames they are very much accurate. So "posit" is the proper term here.
2. Leadoff men always receive more than one ninth of their team's plate appearances. Each player below the leadoff man gets a smaller percentage than the man before them. With this drop would come a smaller and smaller average error for lineup slot. The error per plate appearance is assumed to remain constant but on average each slot gets only 95 percent of the plate appearances of the previous slot. An error of 3.4 runs for the #1 slot (which gets 13.52% of the PA) extrapolates down to 2.26 runs for the 9th spot(which gets 8.97% of the PA. The sum for #1 through #9 comes to 25.14. The figure of 33 runs in a later paragraph was obtained by this same calculation method.

3. The numbers are from the split page. Alou scored 122 runs overall in 1966 but only 118 as the leadoff hitter. He was used almost exclusively as a leadoff man in 1968 and performed well enough to project to 91.6 runs in his 143 games leading off. His seasonal totals would project to 101 runs.
4. James lists Woody English among the most efficient leadoff men of all time. In 1930 English put up terrific numbers for a leadoff batter, and was in the #1 slot on opening day. Hence it is widely assumed that English led off most of the time for the 1929 through 1931 Cubs. Retrosheet data reveals that after hitting second as rookie in 1927, English became the primary leadoff man in 1928. In subsequent years the Cubs phased him out of the leadoff spot, reversing their decision only after Billy Herman emerged as a dangerous hitter.

   In 1929 English split leadoff duties with third basemen Norm McMillan, who was the leadoff man in all five games of the 1929 World Series. In 1930 English hit 1st 38 times when Footsie Blair was not in the lineup. In 1931 and 1932 English batted leadoff 15 games each season. English and Billy Herman split the #2 duties in 1932 on a roughly even basis with Herman batting leadoff in 82 regular season games and 4 more in the World Series. In 1933 Cubs decided that Herman would bat second, which moved English to leadoff for 54 more games. In 1934 they reconsidered; Herman batted more 1st than 2nd ; and English batted more often as a #2 hitter than at leadoff-(70 games to 27 games). After that, English was moved to the bottom of the batting order. For his career Woody English batted leadoff in 313 games, 2nd in 599, 8th in 154, 7th in 72 games 3rd in 49 games, and 4th 5th or 6th in 55 games for which retrosheet.org has the data.
5. Table Six shows that Brock's estimated runs exceed his actual runs, but not by as much as was common to the period. Henderson scored fewer runs than his period-adjusted estimate while Waner and Combs exceeded their period-adjusted estimate. Given that Babe Ruth and Lou Gherig were two of the five hitters who followed Combs, his large discrepancy even after a period adjustment is exactly what we would expect to find. Earl Combs's very high adjusted estimate indicates that he would have scored gobs of runs for other teams in this era, just not as many as he actually scored.
6. Hamilton has more stolen bases per time reaching base than Hartsel. But all of Hartsel's Stolen Bases would count as stolen bases under today's rules, and an unknown percentage of Hamilton's Stolen Bases would not.
7. The problem is not the linear nature of the equation but rather that the background assumptions for the coefiicents 0.8, 0.55, 0.35, and negative 0.35 depend on how many singles and doubles and so forth are being hit. In the dead ball era, it was nearly impossible to score directly from 1st base. So the value placed by the formula on singles and walks and hit by pitches exceeds the actual percentage of runners who scored after such events.

In the lively ball era, batting averages were higher than today, making scoring from second or third base much easier than it is now or in any other era other than the 1890s. Thus the formula puts too little run value on doubles and triples and hence underestimates leadoff scoring.

Non- linear formula such as Runs Created can handle changes in background because there is a multiplier effect built in—more hits means extra total bases as well as extra times on base---reduced slugging lowers the scoring value of the hits and walks, ultimately raising the percentage of runners who fail to score..