Additional On-base Worth 3x Additional Slugging?

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Notes provide additional information and were reminders during the presentation. They are not supposed to be anything close to a complete text of the presentation or thorough discussion of the subject.

If some of the tables or graphs are hard to read, you can make them larger with Acrobats viewing controls: box with size percentage or from the View menu.

Relative Marginal Values

- *Moneyball*: DePodesta 3:1 (an extra point of OBP is worth 3 of SLG)
- *Moneyball*: Conventional "wisdom" <1.5:1
- OPS = OBP + SLG implies 1:1
- Can we determine the "correct" value?
- How does the relationship vary over time and by scoring levels?

Research inspired by comments on page 128 of the book. It says DePodesta tinkered with Runs Created formula to come up with the most accurate runs estimator he knew, and it led to a 3:1 ratio.

His analysis assumes (I think) all batters are the same. In a real lineup, the relationship may well vary by lineup position and the preceding or following batters.

Alan Schwarz, author of *The Numbers Game,* told me at SABR 34 that 3:1 was economic; got three times the bang per buck trying to increase OBP vs. increasing SLG.

Note: I have not tried to get in touch with DePodesta or author Michael Lewis.

Analytical Approach

- Changing number of BB (for player, team, league) affects OBP, leaves SLG the same
- Changing distribution of 1B, 2B, 3B, HR affects SLG, leaves OBP unchanged
- Change OBP by a specified amount, find change in runs using Markov model
- How are runs changed by same SLG change?

While not likely realistic when comparing two players or teams, it is possible to vary OBP without affecting SLG by varying the number of walks and to vary SLG without affecting OBP by changing the distribution of hits while leaving the number of hits the same. That is change some singles to extra base hits (in proportion to the actual distribution of extra base hits) or vice-versa.

Will change OBP and SLG by +/- 10, 20 points and compare the change in expected runs to obtain ratios.

Note: information used is mostly from www.retrosheet.org (disclosure: I am the webmaster). Many thanks to Dave Smith for providing convenient data files based on Retrosheet site.

Markov Process Model

- Based on probabilities of going from one runners/outs situation to another
- Calculates number of runs per game
- All batters the same (team, league data) or lineup of different players
- Also useful for analysis of strategies and batting order optimization

I have used the Markov model extensively for baseball strategy analysis, batting order optimization, and have given several talks on the subject at SABR meetings. It is well suited to study the OBP vs. SLG question because one of its strengths is determining the change in expected scoring when its inputs are varied.

The model version used incorporates ML averages (84-92) for several events on the bases and some other events. None of that is going to have much of an effect on the OBP vs. SLG analysis with the possible exception of early years when errors were much more frequent.

Markov Compared to Runs Created, Linear Weights

- Markov builds innings and determines runs through play-by-play analysis
- RC, LW relate scoring directly to total stats (e.g. AB, H, 2B, HR, BB)
- RC, LW need to be re-fit for different scoring level eras
- Markov adapts better to changes in scoring levels

Others (and myself to a lesser extent) have analyzed the OBP/SLG question using Linear Weights and Runs Created to evaluate the marginal effects on scoring. Those models generally lead to smaller variations than the Markov model. The main reason, I think, is because in a sense RC, LW "hard wire" scoring to the input stats because they are developed with scoring as the "dependent variable", so they are in effect assuming the relationships hold over all scoring environments. One way around this is to re-fit those models for different scoring eras, but I have not seen that done. Regression analysis would also have the same difficulties.

Markov, in contrast, builds up the scoring a play at a time, so the effects of the types of events occurs in the context of all the model inputs. Matrix math evaluates all possible events in compact calculations.

Markov Analysis Example

- 2005 MLB (combined AL & NL data)

2005 MLB: OBP = 0.333, SLG = 0.419, Team R/G = 4.592 Markov Model "base case": Team R/G = 4.893 (+6.6%)						
SLG unchanged			OBP unchanged			
OBP	R/G	"+/-"	SLG	R/G	"+/-"	OBP/SLG
0.313	4.513	-0.380	0.399	4.677	-0.216	1.76
0.323	4.697	-0.196	0.409	4.785	-0.108	1.81
0.343	5.101	0.208	0.429	5.000	0.107	1.94
0.353	5.322	0.429	0.439	5.106	0.213	2.01
					Average:	1.88

- Inputs: AB,H,2B,3B,HR,BB,HBP,K,SB,CS

OBP does not include SF (not available for many seasons), so may be larger than published value

Model vs. actual error (+6.6%) is unusually large, the worst since 1908. Most years are within 4%. Model has been running high recently. Since model does not contain everything and assumes all batters are the same (in this analysis), differences from actual scoring are to be expected.

Key point: Even if model is off, the differences between the cases should be consistent and accurate (roughly same amount error that cancels), so the ratio analysis is valid. Make this point when discussing first line in box.

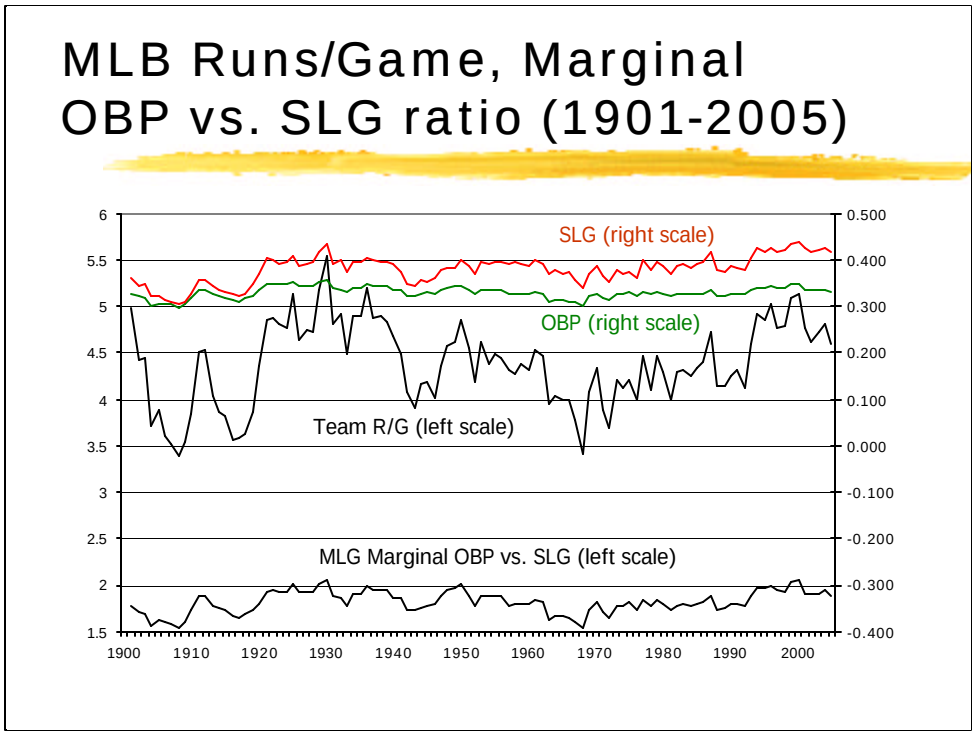
Calculations for 1901-2005

- Data not complete, so estimates made
  - Strikeouts before 1913
  - CS: 1901-1919, 1926-1950
- Markov Model Low for dead ball era
  - More than 10% under actual 1901-05
  - Likely due to higher number of errors then
- Differences in runs should be valid 1910+

K estimates based on 1913, 1916, 1917 (avoid Federal League although likely not much different) K/AB

Have CS for some teams and used average CS/SB for teams with data in 1914-16, which had a lot of teams with CS data, for the dead ball era. Used 1923-25 CS/SB as representative of 1926-50.

Differences between model and actuals are “normal” for 1909 on, so ratios should be valid except possibly for the first decade of “modern” play.



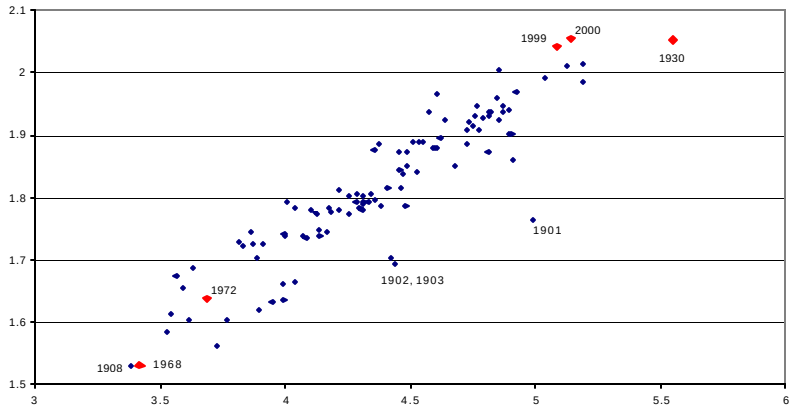
Graph shows the marginal ratios for each year in the bottom line (left scale). Due to scale, variation may not look that large, but low of about 1.5 to high over 2 is about a 33% change.

Top three lines provide batting, scoring context. Red line is slugging average (right scale), green line is OBP (right scale), and black line is the average runs per game per team.

R/G varies from about 3.5 to 5.5. High scoring eras around the 1930 peak and recently. OBP does not fluctuate that much. SLG was quite low in dead ball era (not a surprise) and is now consistently over 0.400. Was also high in the 1920s and 1930s, with a peak in 1930.

Will look at ratio sorted by R/G next to see the relationship.

Marginal OBP vs. SLG ratio (left scale) by Runs/Game



Some seasons have been highlighted and/or labeled. In the lower left, 1968 is the red diamond. It was the "year of the pitcher" and the mound was lowered after it. It was similar to 1908. The next red point is 1972, the last year before the DH was introduced (boo!) in the AL. At the upper right, 1930 stands out, the highest scoring season by far. 1999 and 2000 are also highlighted as two recent high scoring seasons.

Clear that the OBP/SLG ratio goes up as scoring does. This makes intuitive sense. When runs are hard to get, being able to drive in runners (SLG) gains in relative importance. When scoring is high, it is easier to bring in runners on the bases, so there is a larger gain from getting on (OBP).

1901-1903 are "outliers", likely due to higher frequency of errors then. Even with those points, correlation coefficient for the 105 years is 0.92, which is quite high and indicates a strong positive relationship between scoring levels and OBP/SLG.

1901-2005 MLB OBP/SLG

- Ranges from low of 1.53 (1908, 1968) to high of 2.05 (1930, 2000)
- Average over last 10 seasons: 1.95
- Look at very low, high scoring teams to see if range is wider

Nothing close to 3:1 on the MLB level. What about for highest and lowest scoring teams. Will start with lowest scoring. Only title shown when next slide appears. Ask audience to name lowest scoring non-dead ball team. I expect that they will fairly quickly.

Very Low Scoring Teams

- 1968 CHA: 2.86 R/G, OBP=0.284, SLG=0.311
- 1963 HOU: 2.86 R/G, OBP=0.283, SLG=0.301

- Marginal OBP/SLG ratios:
  - 1968 CHA: 1.39
  - 1963 HOU: 1.40

First line will display on first click or down arrow. White Sox scored 463 in 162 games. ’63 Colt 45’s scored one more, which rounds the same to two places.

Consistent with the MLB results, these teams have even lower marginal OBP/SLG ratios.

Now go to the highest scoring teams. Same steps: only title shows and ask audience to name some.

Very High Scoring Teams

- 1930 NYA: 6.90 R/G, OBP=0.384, SLG=0.488
- 1931 NYA: 6.88 R/G, OBP=0.383, SLG=0.457
- (1936 NYA: 6.87 R/G, OBP=0.381, SLG=0.483)
- 1950 BOS: 6.67 R/G, OBP=0.385, SLG=0.464
- Marginal OBP/SLG ratios:
  - 1930 NYA: 2.59
  - 1931 NYA: 2.49
  - 1950 BOS: 2.46

Before for first key press, ask for highest scoring season.

(Tom Ruane, according to Dave Smith, pointed out that the real answer is opponents of the 1930 Phillies: 1199 runs allowed in 156 games.)

1930 Yankees are highest R/G (1062/154). Next two Yankee teams scored more (1067 in 1931, 1065 in 1936), but played one more game. 1936 in () since won't show ratio for them.

Good chance 1950 Red Sox will be mentioned. They had 1027 for a 154 game season, which is the next best after the three Yankee teams.

Ratios are higher as expected, but still well below 3:1.

3:1 OBP/SLG possible?

- Almost certainly not for league or team using Markov model
  - *Moneyball* said DePodesta had more accurate version of RC that yielded 3:1
  - Analysis using RC, LW not close to 3:1
- What about for a team's lineup?
  - Different ratios by batting order position?
  - Markov model can be applied
  - Look at 1927 Yankees

I am skeptical that a more accurate version of RC could yield a 3:1 ratio since versions I have seen are very good and nowhere close to 3:1 for any team or league I have seen analyzed.

1927 Yankees scored 975 runs in 155 games, which was by far and away a new team record. More interestingly, they are the only team to have two hitters with SLG over 0.750.

Only other team I have looked at is 2001 Oakland (because of *Moneyball*). I had planned to look at more teams and present them in a poster session, but the scheduling did not permit that. Maybe next year.

Markov Model: 1927 NYA

				added runs/154 games		
Player	AVG	OBP	SLG	OBP +.020	SLG +.020	OBP/SLG
Combs	0.356	0.414	0.511	10.15	4.51	2.25
Koenig	0.285	0.320	0.382	13.17	3.45	3.82
Ruth	0.356	0.486	0.772	9.09	2.81	3.23
Gehrig	0.373	0.474	0.765	7.83	3.88	2.02
Meusel	0.337	0.393	0.510	9.05	4.75	1.90
Lazzeri	0.309	0.383	0.482	7.92	4.40	1.80
Dugan	0.269	0.321	0.362	9.16	4.23	2.16
Collins	0.275	0.407	0.418	7.12	3.07	2.32
Pitchers	0.215	0.288	0.260	8.35	3.33	2.51

Lineup shown is most common for the team that year.

Only change used in analysis is increase of 20 points. That is due to the complexity of handling individual players. Also, decreases might not be possible if a player does not have enough BB, and would be more complex to figure if he does not have enough (or any!) triples or HR. Based on team data and 2005 MLB example shown earlier, these ratios may be a little higher than "true" values.

First box shows added R/154 G for Combs when is OBP is increased by 20 points (and his SLG other players unchanged) and when SLG is up by 20. Ratio of the two is 2.25. Second box highlights all the ratios. Green box highlights the two (well above 3). Ruth may be a bit surprising, but he is followed by a great hitter and two very good ones. Lowest ratio for Lazzeri since he his followed by the weakest hitters.

Note how well their pitchers hit although they were pretty poor in comparison with the rest of the team.

I did not try to improve the batting order. It looks like switching Lazerri and Koenig would help. I think Collins's OBP is inflated by IBB (no data) in front of pitchers.

1927 Yankees Lineup

- OBP is most valuable for batters in front of power hitters (Koenig, Ruth)
- OBP/SLG well over 3 in front of Ruth, Gehrig; below 2 before weakest hitters
- 0.020 additional OBP at top of strong lineup can add a win per season per better hitter

Given high scoring team, it probably would take more than 10 runs in a season to add a win. Combs improving by 20 OBP points might not do it, but it looks like Koenig would.

Conclusions

- Marginal OBP/SLG varies by scoring level
  - Range of about 1.5 to 2.1 for MLB totals
  - Wider for teams: 1.4 to 2.6
- Recent values for MLB close to 2
- Marginal ratio can vary much more for individual batters
- 3:1 or higher is possible for some batters in some lineups

We see that the marginal values vary quite a bit on the level of scoring (Markov estimates) for a particular season or a particular team. In a lineup, the values can vary quite a bit due to the strengths of the preceding and following hitters. Insight rather than huge surprises here.

There is a strong relationship (0.92 correlation) between ratio and team runs/game at the MLB level.

Reached 3:1 for one hitter on 2001 A's (only other team analyzed so far).

I will post this talk on my web site (next slide) and hope to write an article based on it for a SABR publication (but no firm promises).

Web sites, e-mail

www.pankin.com/baseball.htm

has details about Markov model and other baseball studies

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