LS88: Sports Analytics

Efficiency

Resources

A fact of life, and sports, is *limited resources*

In baseball, we only get 3 outs per inning and 27 in a 9 inning game

Sabermetrics has changed how teams think about using the limited resources
➔ No longer willingly giving up outs for baserunner advancement
➔ In important, aka high leverage situations, teams deploy their best pitchers
   The outs are more valuable given the context
➔ Starters are still valuable because roster spots are limited
   A team can't use 20 pitchers to each go 1 inning

Resources

To be a great hitter, one must balance
➔ Not wasting PA by swinging at bad pitches and thus taking a walk
➔ Hitting safely with a high BA
➔ Hitting for power to do more damage

A hitter needs to produce big upside (power), but do it efficiently by downsides (outs)

Inefficient Batting

Rougned Odor in 2017 produced power, but not efficiently

Year	Age	Tm	Lg	G	PA	AB	R	H	2B	3B	HR	RBI	SB	CS	BB	SO	BA	OBP	SLG	OPS	OPS+	TB	GDP	HBP	SH	SF	IBB	Pos	Awards
2014	20	TEX	AL	114	417	386	39	100	14	7	9	48	4	7	17	71	.259	.297	.402	.698	93	155	7	5	6	3	1	*4/D	
2015	21	TEX	AL	120	470	426	54	111	21	9	16	61	6	7	23	79	.261	.316	.465	.781	107	198	3	14	2	5	2	*4	
2016	22	TEX	AL	150	632	605	89	164	33	4	33	88	14	7	19	135	.271	.296	.502	.798	105	304	6	4	0	4	0	*4/D	
2017	23	TEX	AL	*162*	651	607	79	124	21	3	30	75	15	6	32	162	.204	.252	.397	.649	63	241	13	8	0	4	5	*4/D	
2018	24	TEX	AL	129	535	474	76	120	23	2	18	63	12	**12**	43	127	.253	.326	.424	.751	95	201	5	11	2	5	2	*4/D	
5 Yrs				**675**	**2705**	**2498**	**337**	**619**	**112**	**25**	**106**	**335**	**51**	**39**	**134**	**574**	**.248**	**.295**	**.440**	**.735**	**91**	**1099**	**34**	**42**	**10**	**21**	**10**		
162 Game A...	**.**			**162**	**649**	**600**	**81**	**149**	**27**	**6**	**25**	**80**	**12**	**9**	**32**	**138**	**.248**	**.295**	**.440**	**.735**	**91**	**264**	**8**	**10**	**2**	**5**	**2**		

Resources in Basketball

Unlike baseball, a basketball game (and most other sports) has a time limit

Hence, time is a limited resource

We can also think of possessions as a limited resource
➔ Without off. rebounds and turnovers, each team would have the same number of possessions
➔ Even if the total is variable depending on pace of play, a team doesn't get more than the other

Resources in Basketball

Efficient usage of time/possessions is a "recent" revolution

      Research lagged behind baseball

      Many teams/analysts/fans slow to adopt

It doesn't help that Kobe in his prime, and in the conversation for best player each year, was also (kind of) the model for inefficiency

      Russell Westbrook has taken the torch from Kobe

Inefficient Basketball

The quintessential Kobe game (April 13, 2016)

Lakers

STARTERS	MIN	FG	3PT	FT	OREB	DREB	REB	AST	STL	BLK	TO	PF	+/-	PTS
J. Randle PF	33	1-4	0-0	0-0	0	9	9	1	1	1	1	2	+3	2
K. Bryant SF	42	22-50	6-21	10-12	0	4	4	4	1	1	2	1	+7	60
R. Hibbert C	21	2-3	0-0	0-0	3	3	6	2	0	0	1	2	+3	4
J. Clarkson PG	34	6-10	0-1	0-0	2	5	7	1	1	0	1	1	+9	12
D. Russell PG	36	4-10	0-3	1-1	0	4	4	5	2	0	2	3	+1	9

Quantifying Efficient Basketball

So how do we quantify efficient basketball?

If time or possessions are the limited resource, then we need to compute our performance per unit in that resource

Points per Game it out.

Points per Possession is in!

      For players, we could consider Points per Minute Played

      Possession is the better choice: pace of play doesn't get manipulated

Quantifying Efficient Basketball

Points per Possession is a very useful way to measure efficiency

> 1 is good

We can also use Off. Rating: Points per 100 Possessions

Just multiply PPP by 100

Counting Possessions

Come on, possessions are easy to count in basketball

> Soccer is the hard sport!

Counting possessions is easy if you have play-by-play data

> Unfortunately, we don't have play-by-play data going back to olden times (90s)

Two choices:

➔ Restrict to the recent era with PxP data: fine if you narrow your focus
➔ Estimate the number of possessions

Estimating Possessions

From Basketball Reference

$$\text{Off. Poss.} = \text{TmFGA} +$$
$$0.4 \times \text{TmFTA} -$$
$$1.07 \times (\text{TmORB}/(\text{TmORB} + \text{OppDRB})) \times (\text{TmFGA} - \text{TmFG}) +$$
$$\text{TmTOV}$$

Similar for Def. Poss.

$$\text{Possessions} = \frac{\text{Off. Poss.} + \text{Def. Poss.}}{2}$$

Measures for Efficiency

We can quantify efficiency with Off. Rating

A problem though: it's global. Every element of offensive play affects it

Let's look at ways to isolate a key component of efficient play:

Shooting Percentage

Field Goal Percentage

The most obvious and classical to consider is Field Goal%

$$\text{FG \%} = \frac{\text{Field Goals}}{\text{Field Goals Attempts}}$$

We're going to uncover the following analogy

FG% : Basketball :: Batting Average : Baseball

3 > 2: Effective Field Goal Percentage*

Aka eFG%, it's considered an "advanced stat"

$$\text{Effective FG \%} = \frac{\text{Field Goals} + \frac{1}{2} \cdot \text{3-pt Field Goals}}{\text{Field Goals Attempts}}$$

We all know 3 > 2, so give the credit!

Another analogy:

eFG% : Basketball :: Slugging Pct : Baseball

*Good Janet says, "not a percentage"

Charity Stripe: True Shooting Percentage*

We care about *using* possessions to score, so why are ignore Free Throws?

$$\text{True Shooting \%} = \frac{\text{Total Points}}{2(\text{Field Goals Attempts} + .44 \cdot \text{Free Throw Attempts})}$$

Divide by 2 to make it close to the others
    Without the 2, it measures Points per Possession Used to Shoot

Another analogy
    TS% : Basketball :: wOBA :: Baseball

*Good Janet says, "also not a percentage"

Shooting Percentage Summary

"Totals" over "opportunities"

FG%: Makes per Attempts from the Floor

eFG%: Points per Field Goal Attempt
  Efficiency from the floor (ignores FTs!)

TS%: Total points per possessions used to shoot
➔ Turnovers can count as a possession used. That's ignored for now
➔ Where does the .44 value in front of FTA come from?
  FTs typically come in pairs so .5 x FTs is approximately the number of possessions used that ended in 2 FT shots. .44 accounts for flagrants, technicals, And-1s, 3pt fouls, etc

Top 20 Performance

Field Goal Pct

1. Clint Capela · HOU		.656
2. DeAndre Jordan · LAC		.653
3. Steven Adams · OKC		.634
4. Enes Kanter · NYK		.607
5. John Collins · ATL		.591
6. John Henson · MIL		.589
7. Taj Gibson · MIN		.574
8. Jonas Valanciunas · TOR		.569
9. Hassan Whiteside · MIA		.554
10. Andre Drummond · DET		.552
11. Julius Randle · LAL		.551
12. Derrick Favors · UTA		.550
13. Dwight Howard · CHO		.547
14. Giannis Antetokounmpo · MIL		.544
15. LeBron James · CLE		.542
Karl-Anthony Towns · MIN		.542
17. Anthony Davis · NOP		.542
18. Domantas Sabonis · IND		.538
19. Marcin Gortat · WAS		.537
20. Ben Simmons · PHI		.526

Effective Field Goal Pct

1. Clint Capela · HOU		.656
2. DeAndre Jordan · LAC		.653
3. Steven Adams · OKC		.634
4. Joe Ingles · UTA		.615
5. Stephen Curry · GSW		.615
6. Enes Kanter · NYK		.607
7. E'Twaun Moore · NOP		.604
8. John Collins · ATL		.599
9. Karl-Anthony Towns · MIN		.595
10. Klay Thompson · GSW		.593
11. Joe Harris · BRK		.592
12. John Henson · MIL		.589
13. Jonas Valanciunas · TOR		.589
14. LeBron James · CLE		.588
15. Trey Lyles · DEN		.587
16. Kevin Durant · GSW		.585
17. Taj Gibson · MIN		.581
18. Al Horford · BOS		.578
19. Gary Harris · DEN		.578
20. Kelly Olynyk · MIA		.573

True Shooting Pct

1. Stephen Curry · GSW		.673
2. Clint Capela · HOU		.661
3. DeAndre Jordan · LAC		.656
4. Mike Scott · WAS		.645
5. Enes Kanter · NYK		.641
6. Steven Adams · OKC		.640
7. Darius Miller · NOP		.639
Karl-Anthony Towns · MIN		.639
9. Kyle Korver · CLE		.637
10. Jonas Valanciunas · TOR		.635
11. Kevin Durant · GSW		.634
12. John Collins · ATL		.632
13. Marvin Williams · CHO		.624
14. Joe Ingles · UTA		.623
15. LeBron James · CLE		.621
16. Montrezl Harrell · LAC		.621
17. Anthony Davis · NOP		.620
18. James Harden · HOU		.619
19. Nikola Mirotic · TOT		.614
20. Giannis Antetokounmpo · MIL		.613
Kevin Love · CLE		.613

Top 20 Performance

TS% can change our view of a player's performance a lot

➔ FG% loves big men: short shots
DeAndre Jordan 2016-17: #2 all time in FG% and eFG%, #18 all time in TS%

➔ eFG% boosts up 3pt shooters

➔ James Harden finally in the top 20 for TS%

➔ Makes sense: an attacking player getting a lot of FTs

◆ Inherently shoots tough shots so FG% is going to be low

◆ But if the player earns fouls and scores from the line, that needs to count
That's a good use of a possession! (this is like counting a walk)

Our Analogies

Recall our analogies

      FG% : Basketball :: Batting Average : Baseball

      eFG% : Basketball :: Slugging Pct : Baseball

      TS% : Basketball :: (sort of) wOBA :: Baseball

Weighting differently and accounting for an important component of scoring directly translate from baseball

The analogies also indicate performance as a metric

Shooting Percentage Demo