A Descriptive Model for NBA Player Ratings

Using Expected Value Points per Possession

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May 25, 2016

Model Structure | Drivers

Basketball Game Objective

Score more points than the opponent.

Proposition

A player's value should be measured according to the number of points per possession he contributes towards his team while on the court.

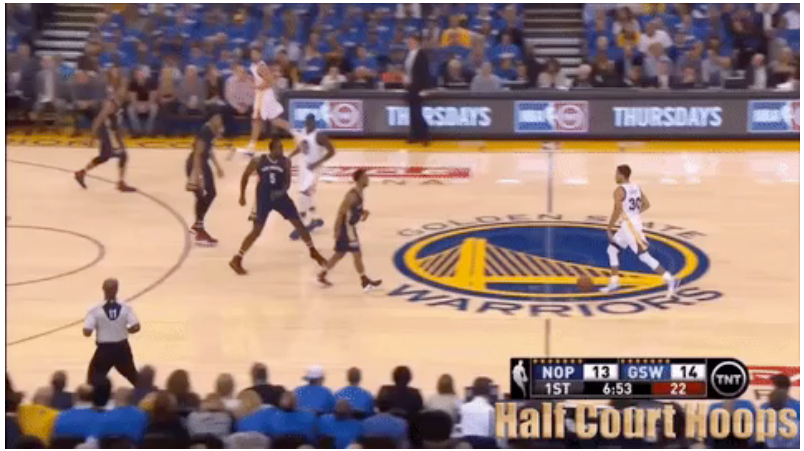
Question

How many points per possession is a given player expected to contribute while on the court?

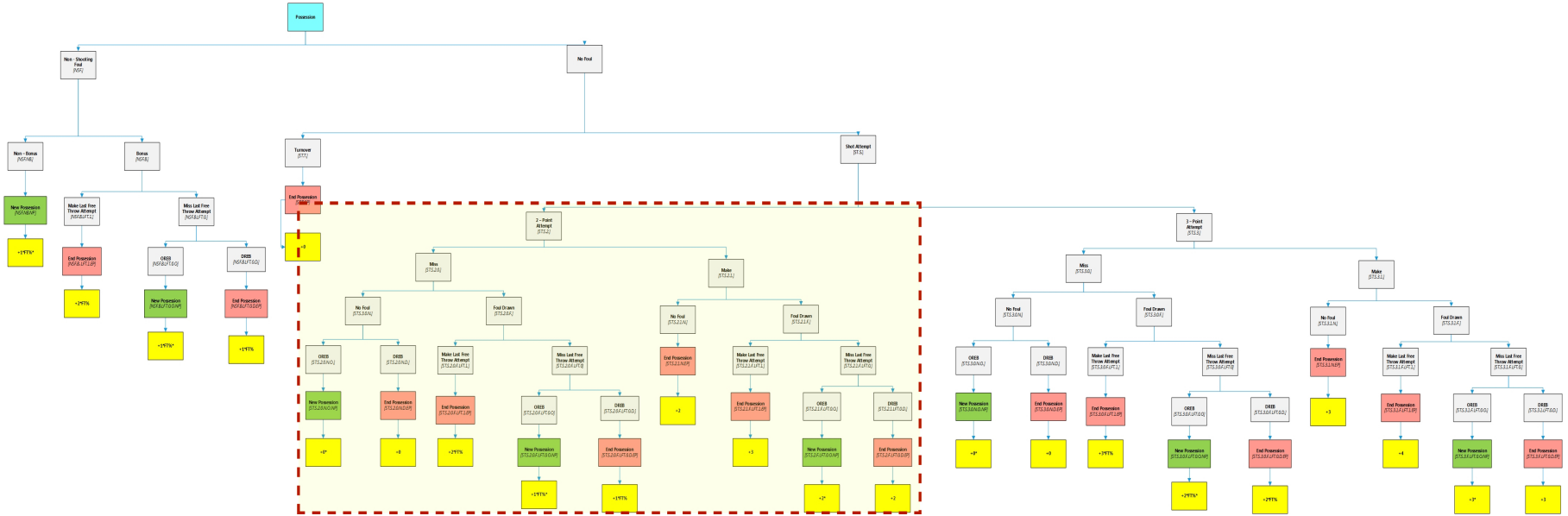
Key Feature

Accounting for the likelihood that a given event occurs during a possession while a player is on the court and the corresponding impact it has on the expected points for that possession.

MODEL STRUCTURE | IMPORTANCE OF EVENT PROPENSITY

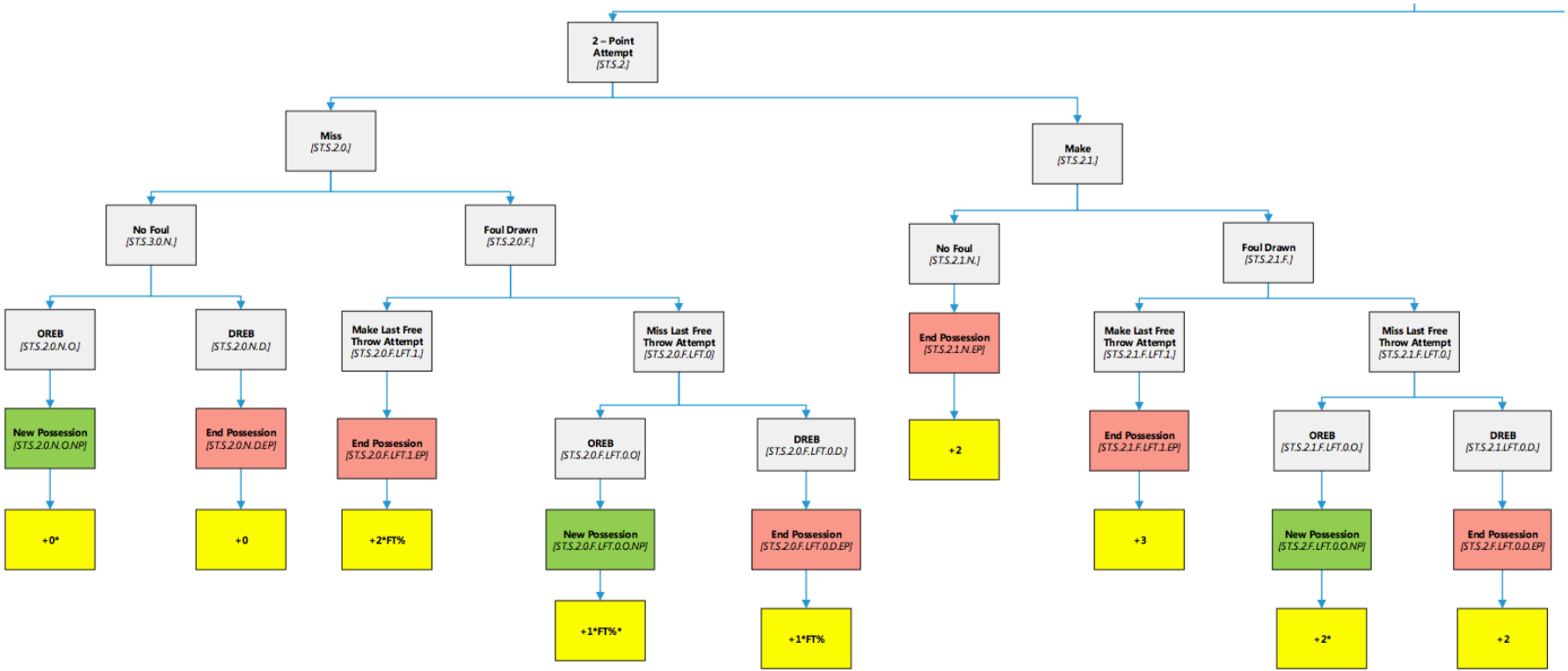


MODEL STRUCTURE | POSSESSION EVENT TREE



NBA OFFENSIVE POSSESSION

MODEL STRUCTURE | POSSESSION EVENT TREE



Model Structure | Individual Player Model

Rasch Model

Probability that a given event occurs for player i is modeled as:

$$P(y_{\gamma_i} = 1) = \frac{e^{\eta\gamma_i}}{1 + e^{\eta\gamma_i}}$$

Where

$$\eta_{\gamma_i} = \alpha_\gamma + \left(\sum_{j=1}^{5} \beta_{O_{\gamma_{ij}}} + \sum_{j=1}^{5} \delta_{D_{\gamma_{ij}}}\right) + \epsilon_{\gamma_i}$$

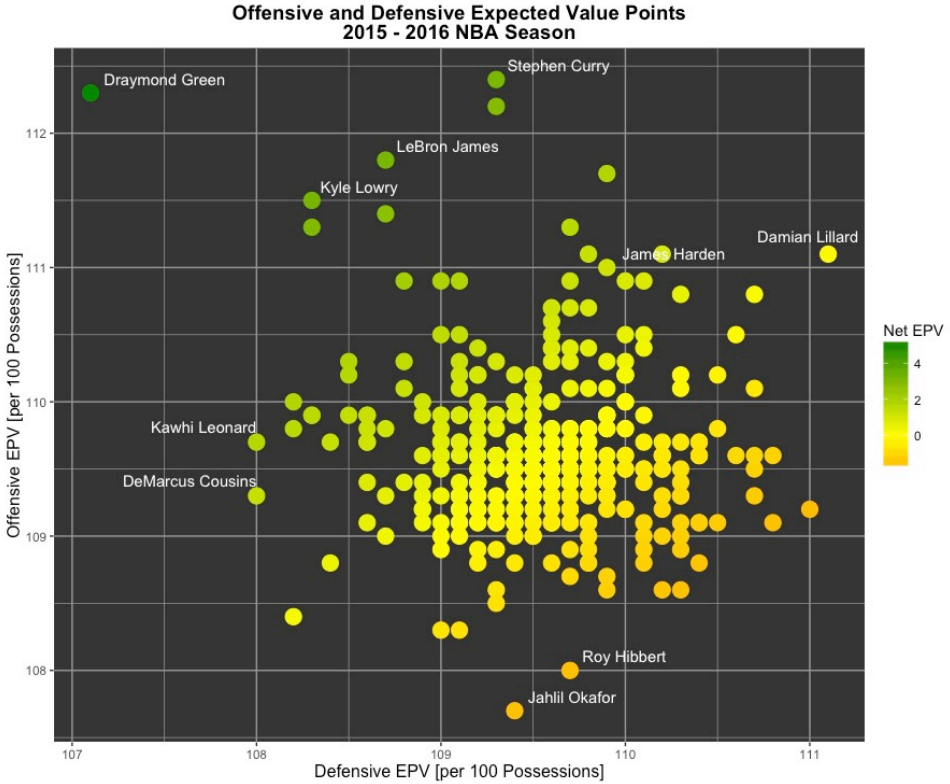
For shot specific attempts

$$\eta_{\gamma_i} = \alpha_\gamma + \theta_{\gamma_{R1}} + \theta_{\gamma_{R2}} + .. + \theta_{\gamma_{R6}} \left(\sum_{j=1}^{5} \beta_{O_{\gamma_{ij_{R1}}}} + \sum_{j=1}^{5} \delta_{D_{\gamma_{ij_{R1}}}}\right) + \left(\sum_{j=1}^{5} \beta_{O_{\gamma_{ij_{R2}}}} + \sum_{j=1}^{5} \delta_{D_{\gamma_{ij_{R2}}}}\right) + \ldots + \left(\sum_{j=1}^{5} \beta_{O_{\gamma_{ij_{R6}}}} + \sum_{j=1}^{5} \delta_{D_{\gamma_{ij_{R6}}}}\right) + \epsilon_{\gamma_i}$$

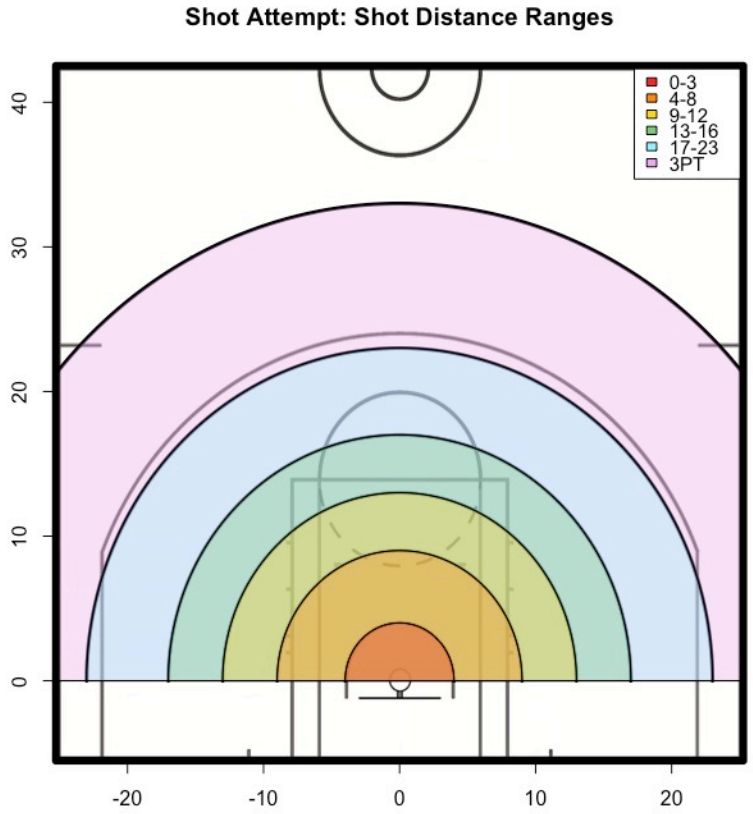
Data source

2015 – 2016 NBA Play-by-Play data [NBAStuffer]

ANALYSIS | TOTAL PLAYER VALUE



ANALYSIS | SHOT SPECIFIC EVALUATION



ASSUMPTION

EVENT IS SHOT AND DISTANCE IS KNOWN.

PROPOSITION

PLAYERS WILL PERFORM BETTER TOWARDS THEIR STRENGTHS AND THIS CAN BE OBSERVED BASED ON SHOT ATTEMPT DISTANCE.

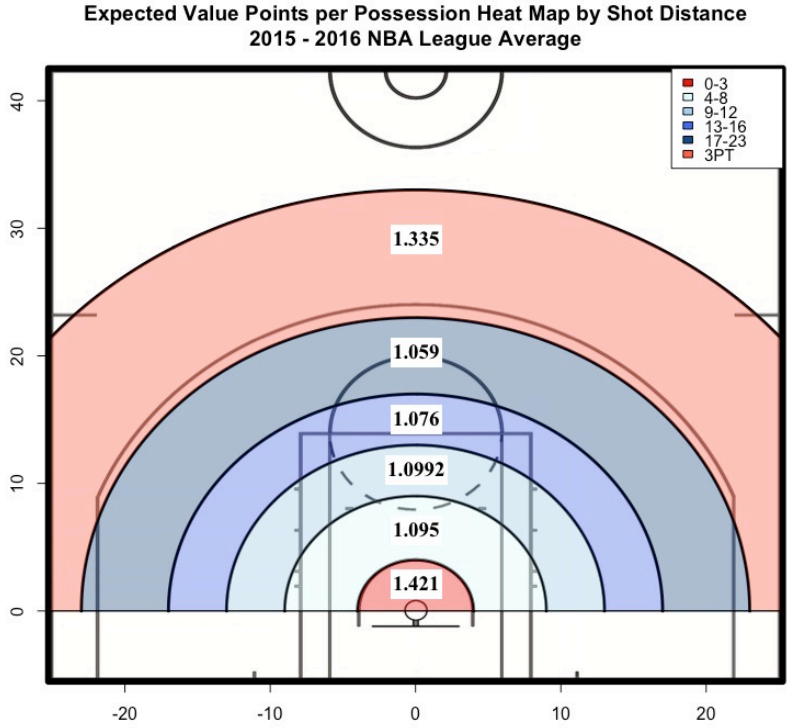
QUESTION

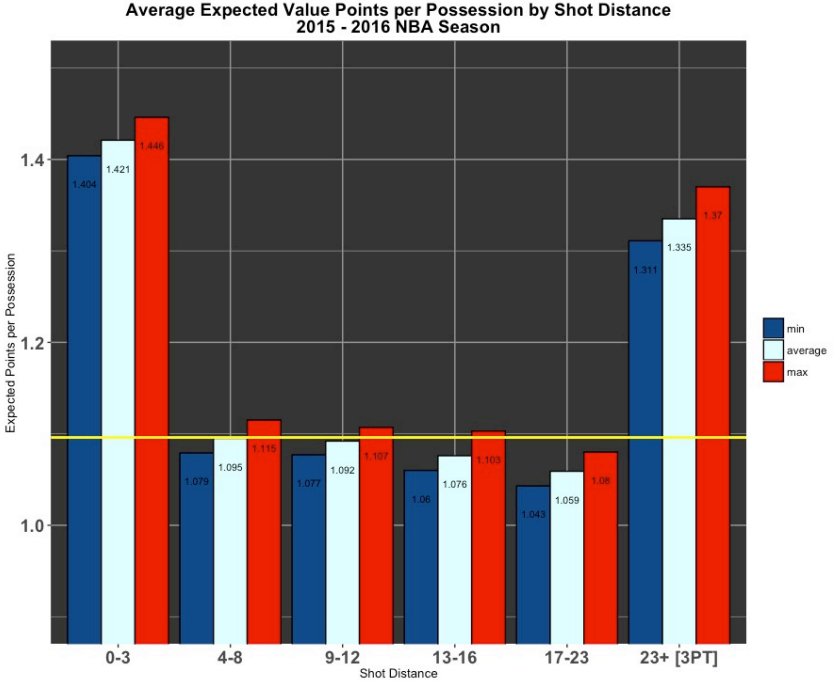
HOW DOES A PLAYER'S EXPECTED POINT CONTRIBUTION CHANGE GIVEN SPECIFIC SHOT ATTEMPT OCCURS?

PURPOSE

IDENTIFY PLAYERS THAT PERFORM WELL IN KNOWN SITUATIONS – I.E. WHAT PLAYERS MATCH UP BEST AGAINST "SMALL BALL" OR THREE-POINT ORIENTATED LINEUPS.

ANALYSIS | SHOT SPECIFIC VALUE – LEAGUE TRENDS





ANALYSIS | 3PT DEFENSIVE IMPACT PLAYERS

POINT GUARD

	Player	EPV/POSS	Delta
1	Deron Williams	1.317	-0.018
2	Elfrid Payton	1.320	-0.014
3	Goran Dragic	1.324	-0.011
4	Steph Curry	1.325	-0.011
5	Tony Parker	1.326	-0.001

SHOOTING GUARD

	Player	EPV/POSS	Delta
1	Arron Afflalo	1.318	-0.017
2	Kyle Korver	1.321	-0.015
3	Wesley Matthews	1.321	-0.014
4	Danny Green	1.322	-0.013
5	Klay Thompson	1.323	-0.012

SMALL FORWARD

	Player	EPV/POSS	Delta
1	Kawhi Leonard	1.322	-0.013
2	Paul George	1.324	-0.011
3	**Rudy Gay**	**1.324**	**-0.011**
4	Joe Johnson	1.325	-0.010
5	Nicolas Batum	1.325	-0.010

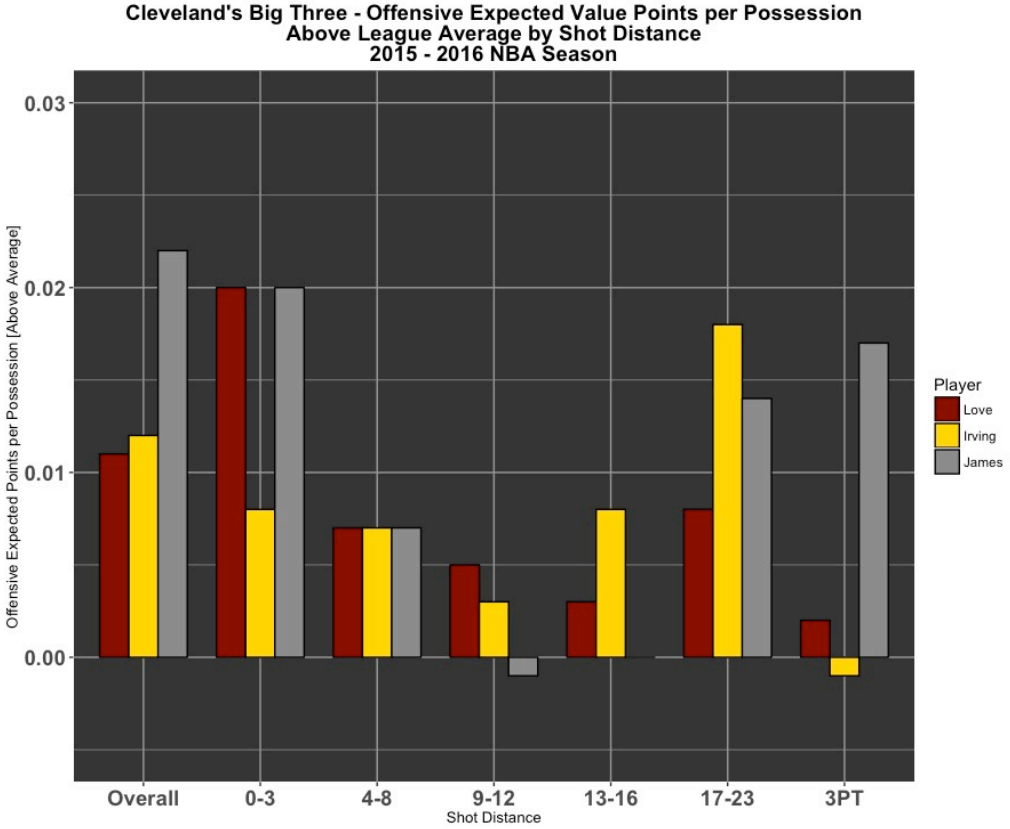
POWER FORWARD

	Player	EPV/POSS	Delta
1	Draymond Green	1.319	-0.016
2	Kevin Love	1.320	-0.015
3	Luol Deng	1.322	-0.013
4	Thaddeus Young	1.322	-0.013
5	Derrick Favors	1.327	-0.008

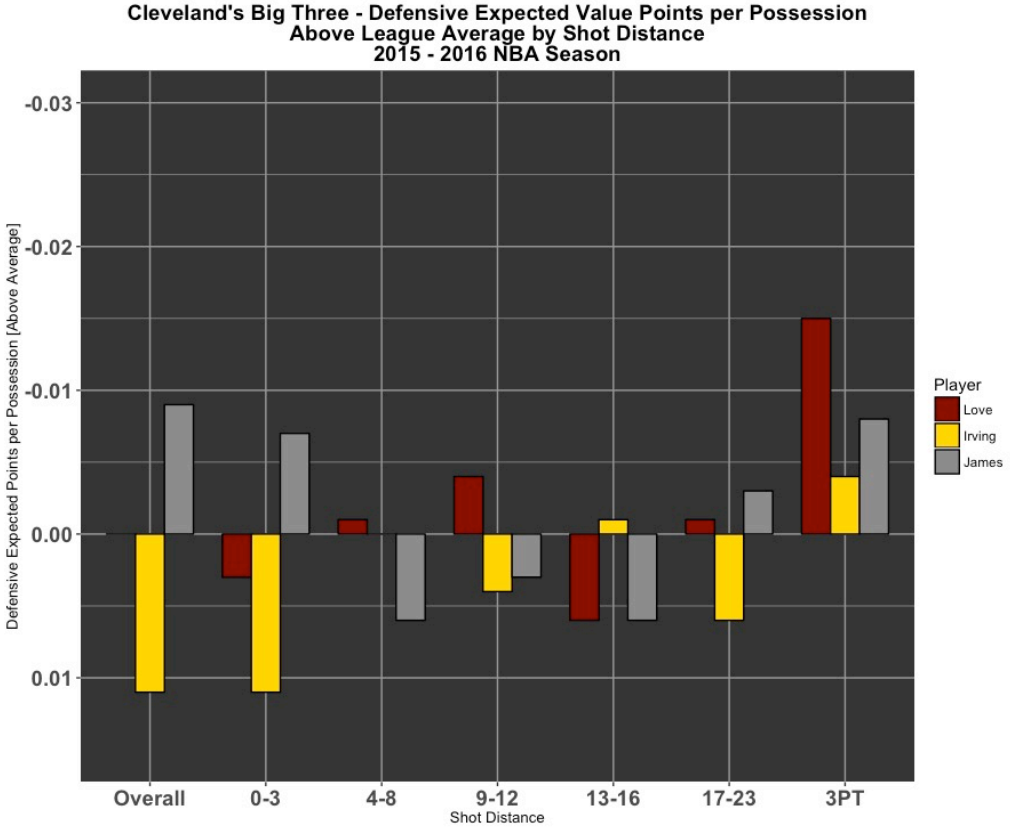
CENTER

	Player	EPV/POSS	Delta
1	Andre Drummond	1.318	-0.017
2	DeMarcus Cousins	1.319	-0.016
3	**Ian Mahinmi**	**1.323**	**-0.012**
4	Andrew Bogut	1.324	-0.011
5	Tim Duncan	1.324	-0.010

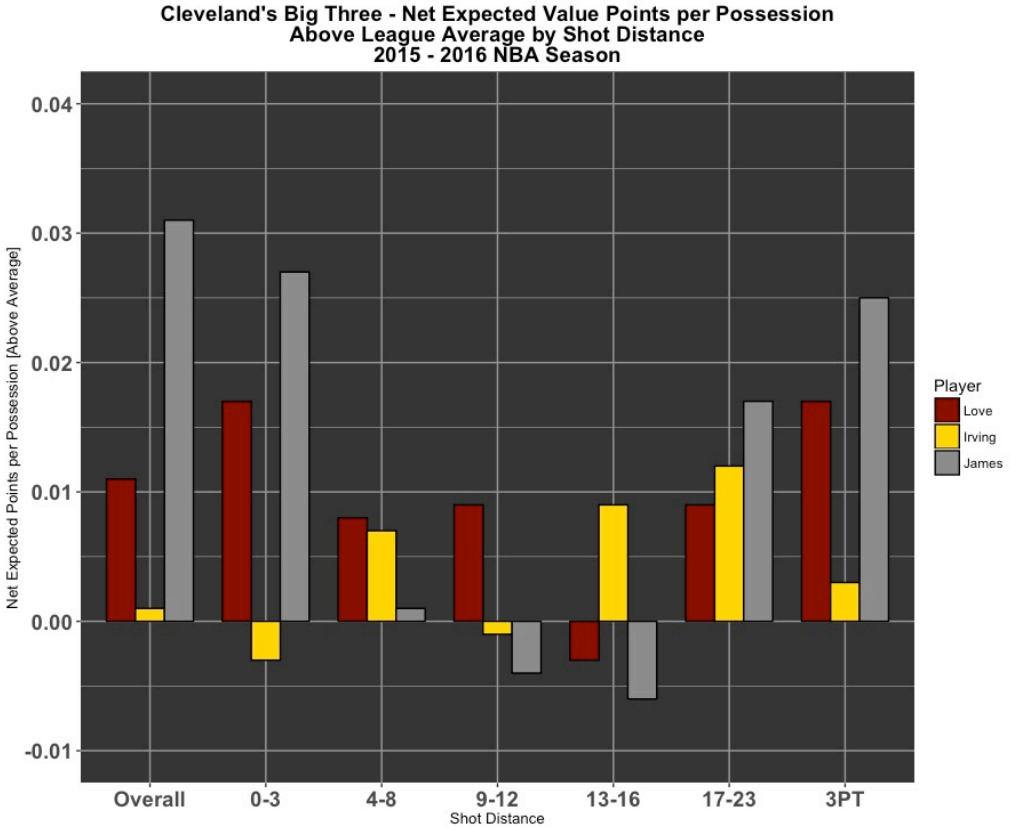
ANALYSIS | CLEVELAND'S "BIG THREE" - OFFENSE



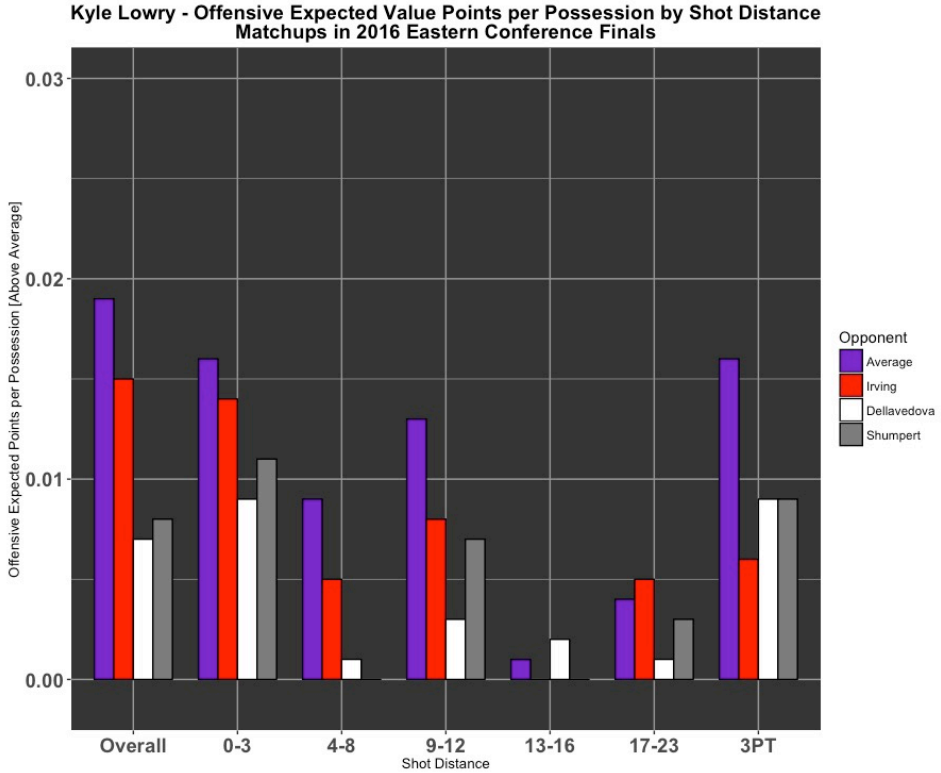
ANALYSIS | CLEVELAND'S "BIG THREE" - DEFENSE



ANALYSIS | CLEVELAND'S "BIG THREE" – NET EXPECTANCY



ANALYSIS | CLEVELAND'S LOWRY PROBLEM



ANALYSIS | WINS ABOVE REPLACEMENT

1) CALCULATE POINTS SCORED AND ALLOWED WHILE PLAYER$_i$ AND REPLACEMENT PLAYER ON COURT.

$$Ps_i = \frac{MPG_i}{48\ min} * 100Poss * EPV_{OFF_i} + \left[1 - \frac{MPG_i}{48\ min}\right] * 100Poss * EPV_{OFF_{AVG}}$$

$$Pa_i = \frac{MPG_i}{48\ min} * 100Poss * EPV_{DEF_i} + \left[1 - \frac{MPG_i}{48\ min}\right] * 100Poss * EPV_{DEF_{AVG}}$$

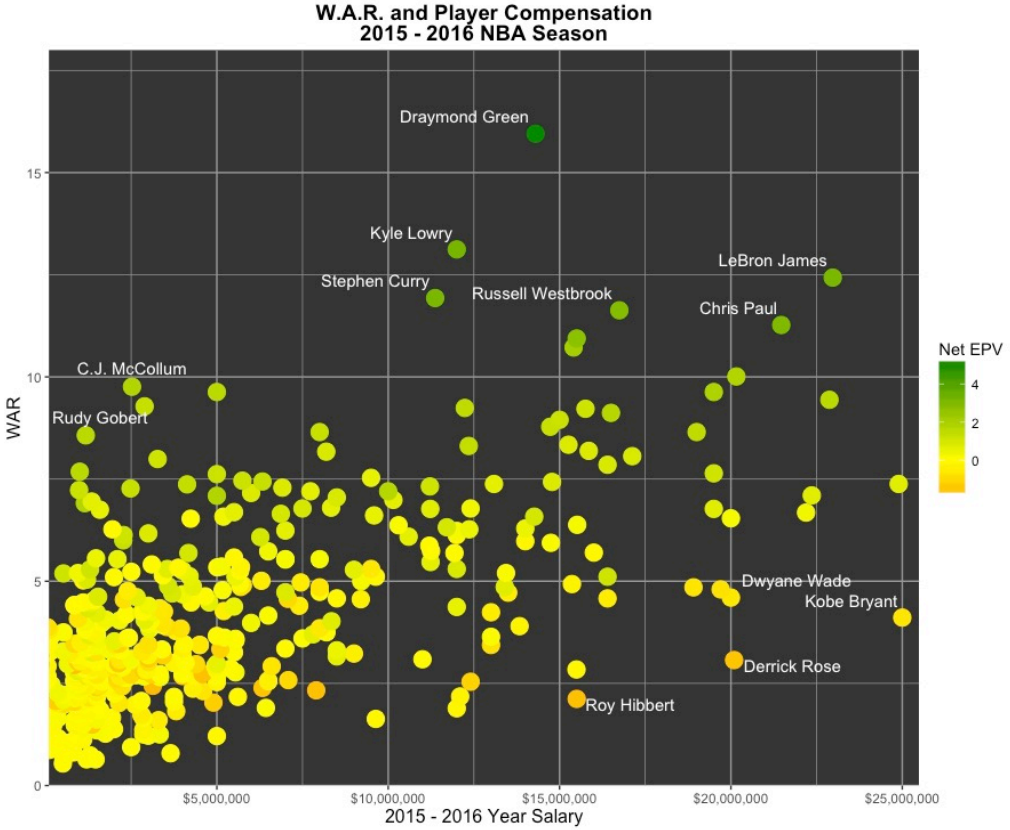
2) CALCULATE WIN PERCENTAGE FOR PLAYER$_i$ AND REPLACEMENT PLAYER.

$$win\% = \frac{{Ps_i}^{13.91}}{{Ps_i}^{13.91} + {Pa_i}^{13.91}}$$

3) CALCULATE WIN DIFFERENTIAL FOR PLAYER$_i$ OVER REPLACEMENT PLAYER OVER AN 82 GAME SEASON.

$$WAR_i = \left[win\%_i - win\%_{Replacement}\right] * 82$$

ANALYSIS | WAR AND PLAYER MARKET VALUE



MODEL | TAKE ALWAYS

MODEL VALUES DYNAMIC PLAYERS INVOLVED IN HIGH YIELD POINT EVENTS.

- DRAYMOND GREEN

MODEL IS BUILT TO ENCOURAGE INQUIRY ABOUT WHY RESULTS ARE THE CASE.

- KYLE LOWRY'S SUCCESS AGAINST CLEVELAND

MODEL PROVIDES OPPORTUNITY FOR INSIGHT THAT IS UNTOUCHED IN RESULTS.

- LINEUP SPECIFIC EVENTS

THANK YOU!

QUESTIONS?