

NBA Court Realty

Dan Cervone (New York University), Luke Bornn (Simon Fraser University), and Kirk Goldsberry (University of Texas)

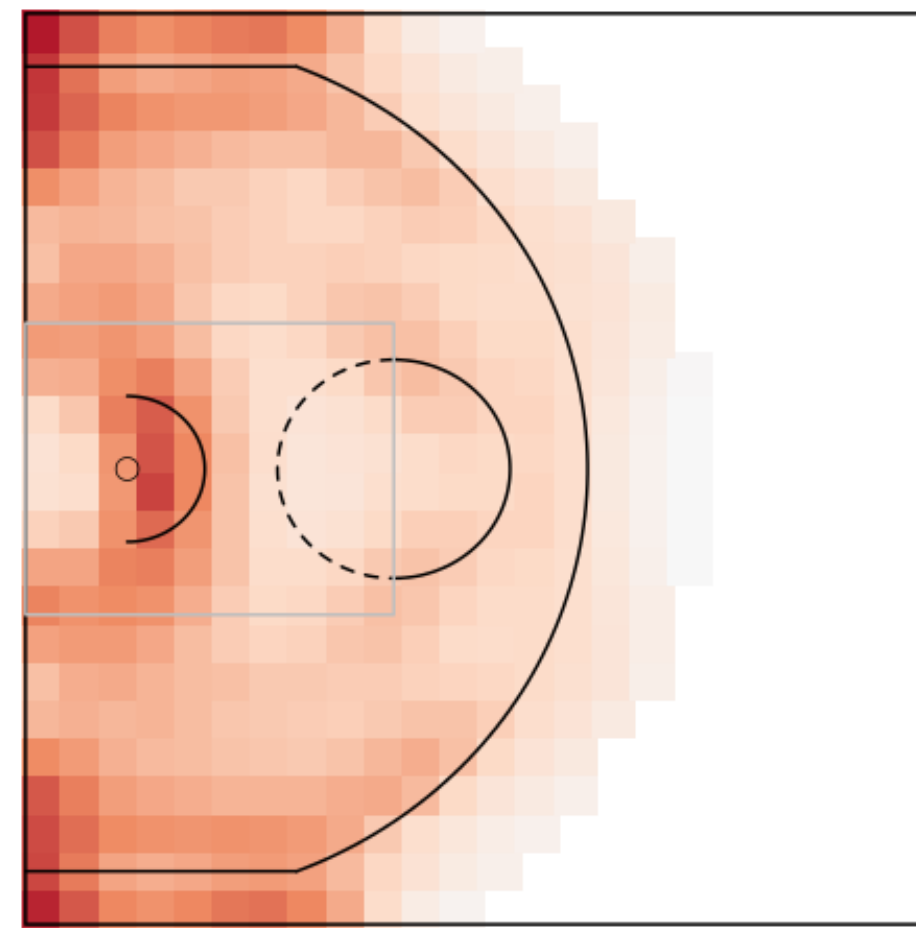
The Court is a Real Estate Market

Throughout a basketball possession, teams fight to control valuable court space. For example,

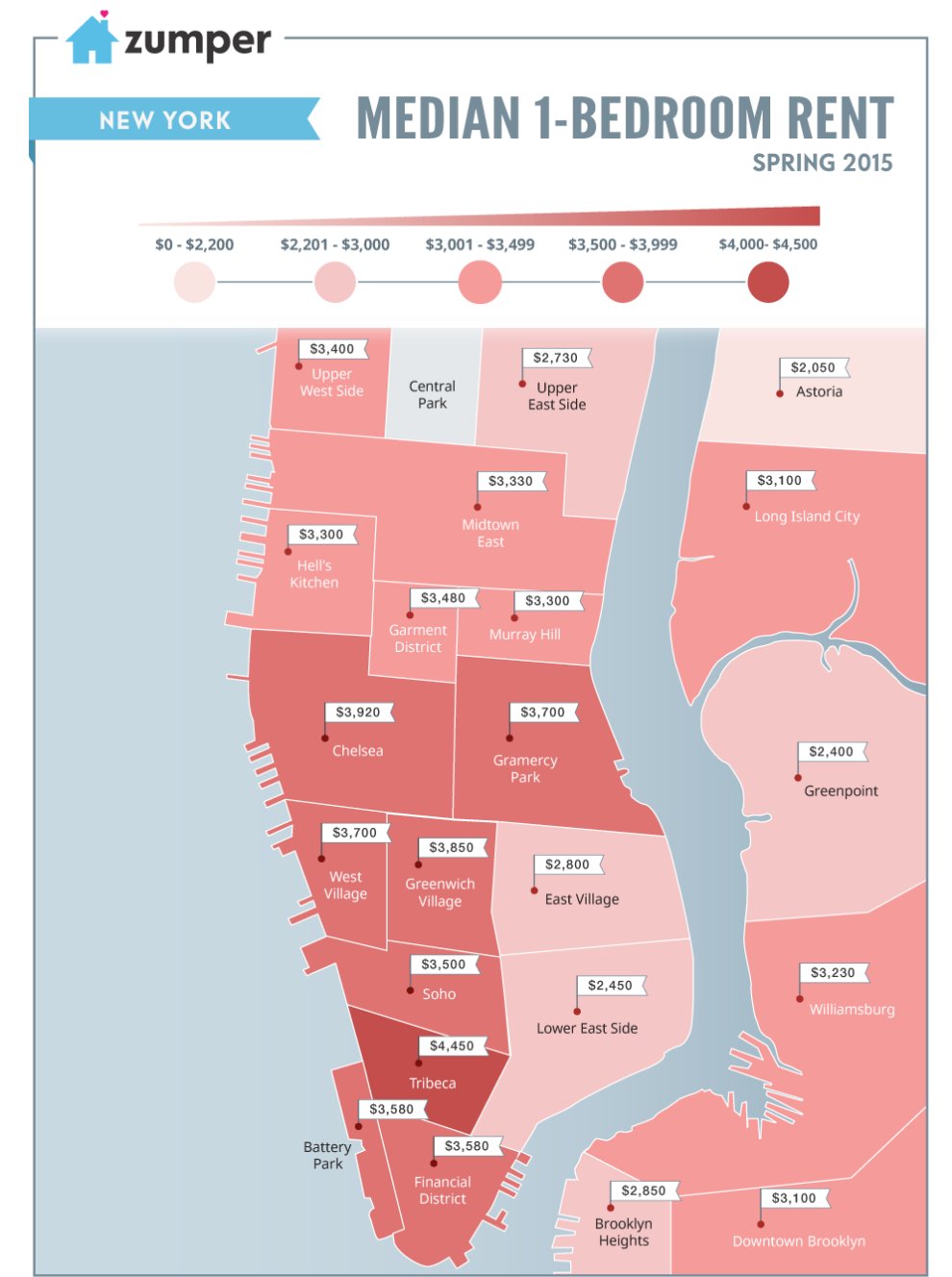
- being near the basket or in the corner 3 areas leads to high-value shots
- having the ball at the top of the arc keeps many pass options open
- being open and undefended anywhere on the court eases ball movement and minimizes turnovers.

Using only patterns of ball movement such as passes, we are able to infer which regions of the court teams value most, and quantify the effects of controlling such regions. This leads to new spatial characterizations of team/player strategy, and value quantifications of positioning and spacing. For instance, we can compare the value of the space the ballcarrier controls with the value of the space his teammates control to better understand how different lineups manage on- and off-ball resources.

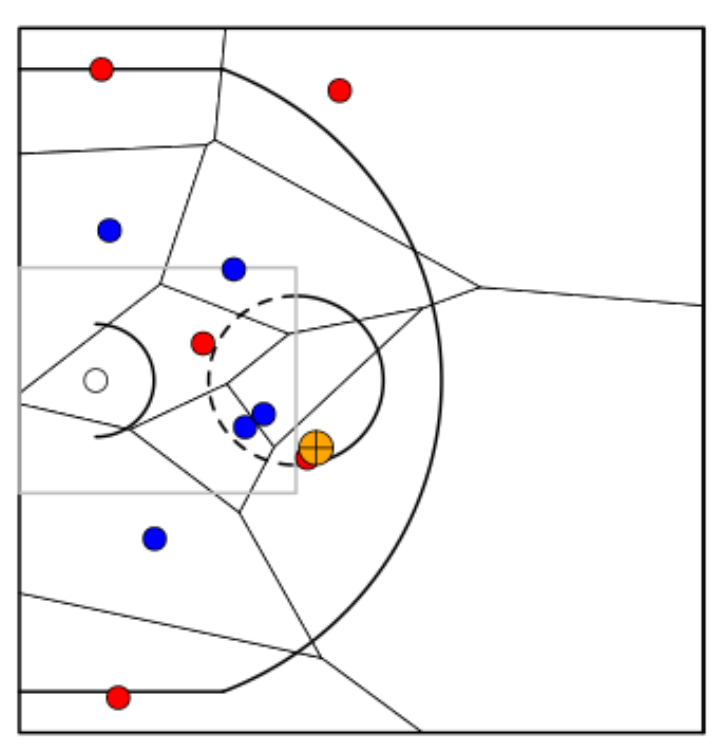
Read the full paper:



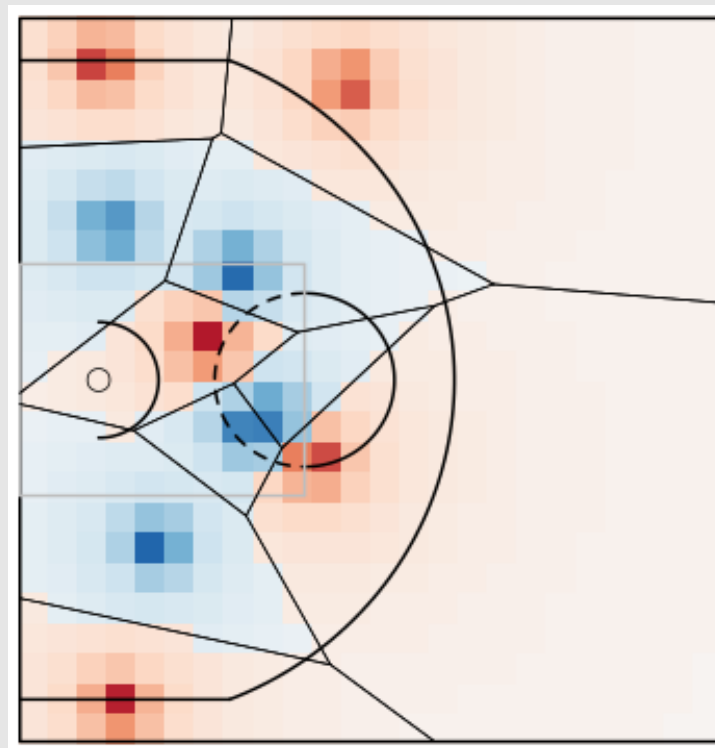
Above: Map of NBA court real estate values during 2014-15 season. Just like New York City (right), property values vary dramatically by neighborhood. The hoop is the Tribeca of the NBA. 30 feet away? That's more like Astoria.



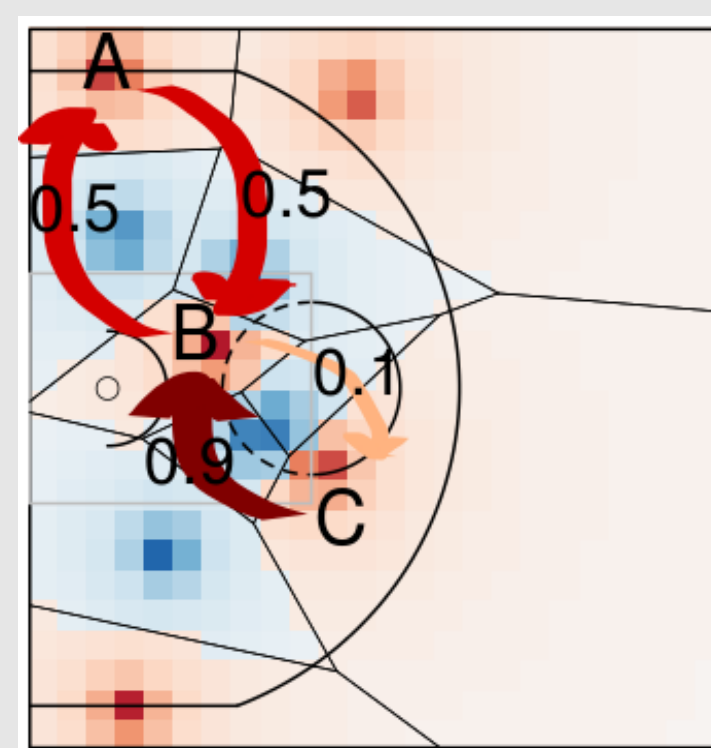
The Value of a Player's Court Real Estate Investment Portfolio



1. Voronoi cells: First, create Voronoi diagrams for all 10 players' positions over time. Each player owns investments everywhere within his Voronoi cell, and nowhere else.



2. Investment: Each player's investment in an area of court space with his Voronoi cell is inversely proportional to distance. Any instant, His portfolio consists of all such investments

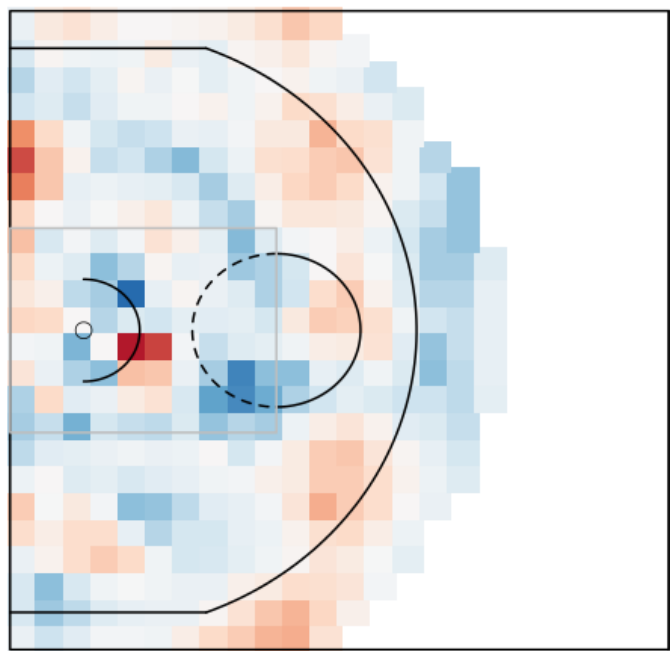


3. Valuing property investments based on exchanges: When players pass the ball on offense, the team exchanges property investments. The patterns of these transactions allow us to infer the value of each player's real estate investment portfolio. For instance, in the figure on the left, if a pass between players A and B is equally likely to go $A \rightarrow B$ as $B \rightarrow A$, we'd think A's and B's investment portfolio values are equal. But when a pass between B and C is much more likely to go $C \rightarrow B$ (0.9) than $B \rightarrow C$ (0.1), then C's portfolio value is less than B's (and A's). Formalizing this idea, we use a penalized Plackett-Luce model to estimate NBA court property values that comprise investment portfolios.

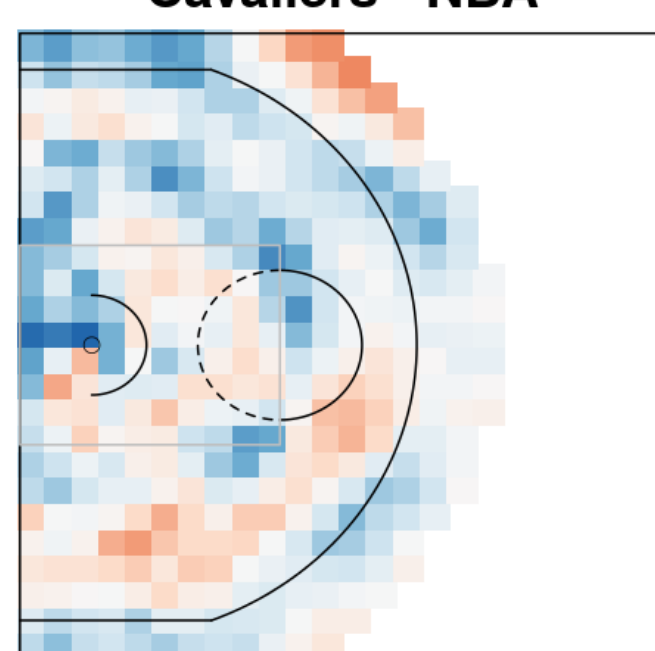
Player and team effects

Adding player- and team-specific effects to our real estate pricing model reveals variation on court property value among different teams on offense. Moreover, within each team, player-specific property values highlight different roles/skills.

Warriors - NBA

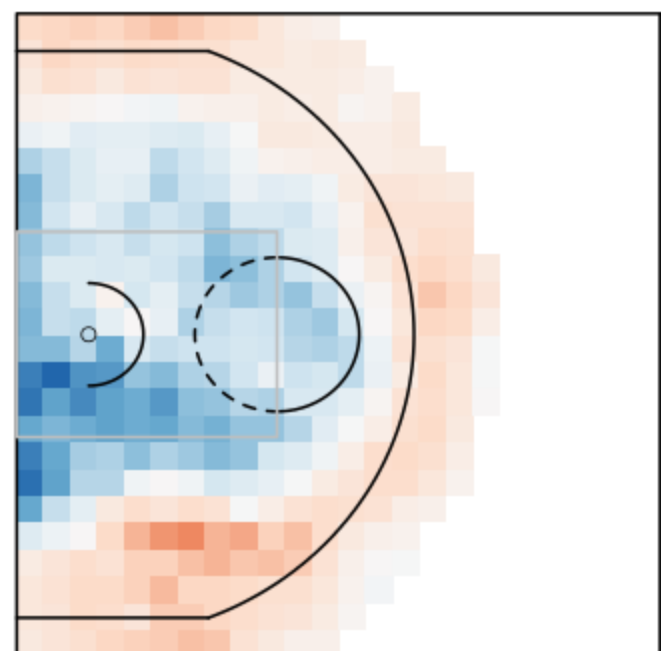


Cavaliers - NBA

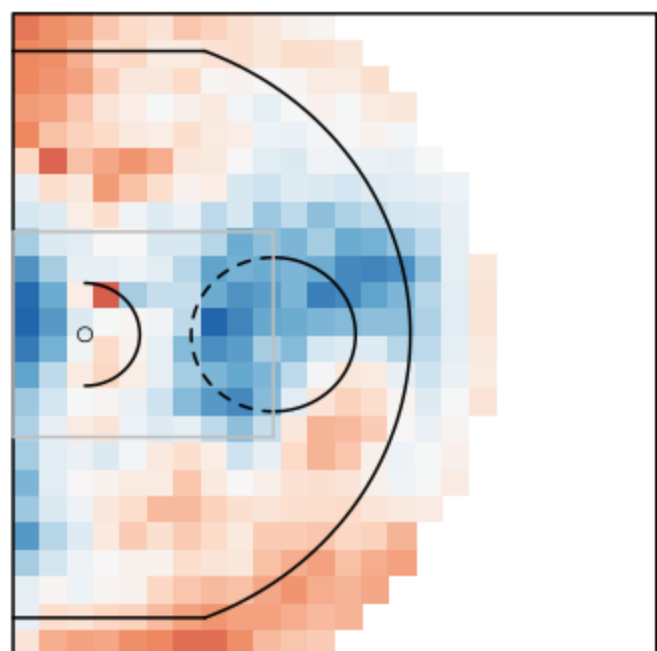


For example, we clearly see that for Steph Curry and Klay Thompson, space beyond the three point line is more valuable than for the Warriors as a whole. Interestingly enough, the Cavs value Love more (relative to the rest of the team) in the midrange and paint than beyond the arc.

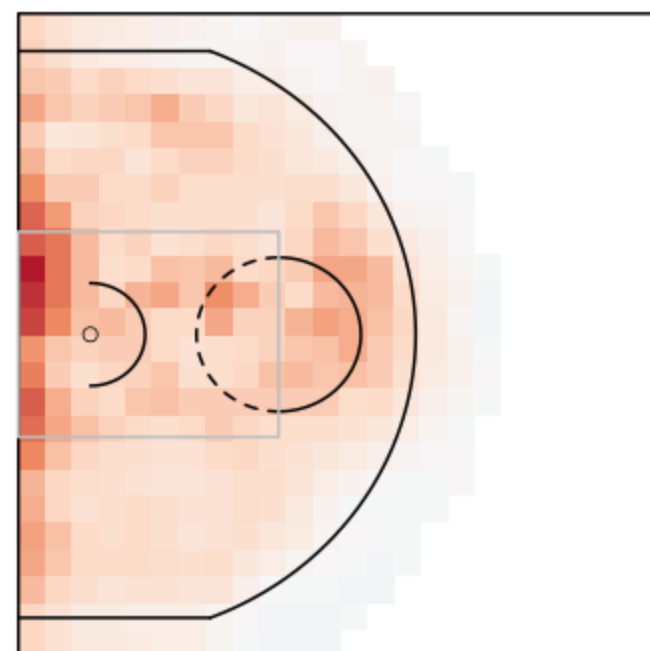
Kyrie Irving



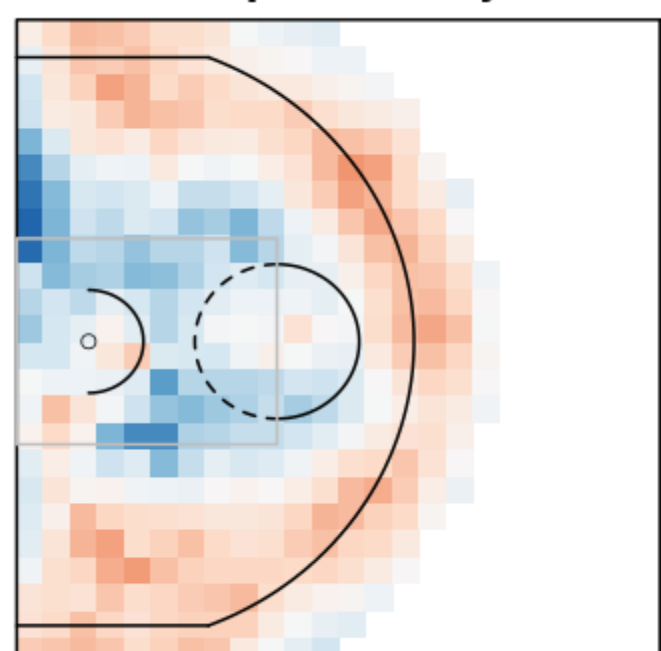
LeBron James



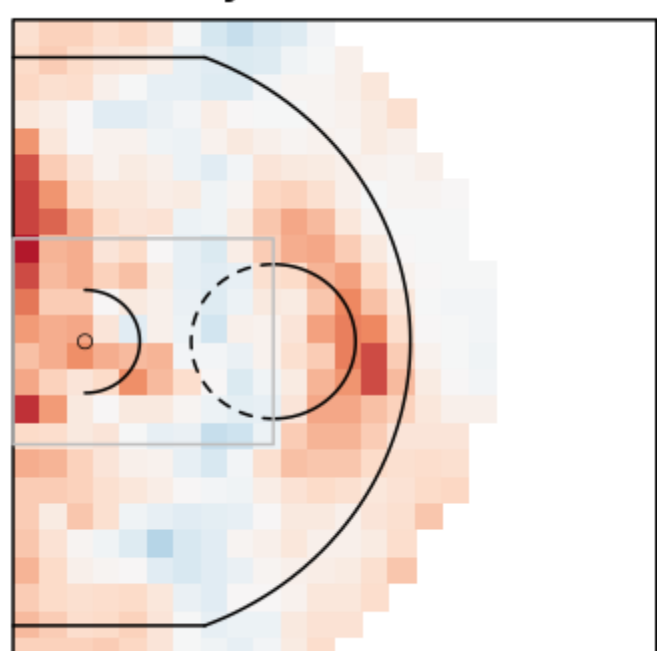
Kevin Love



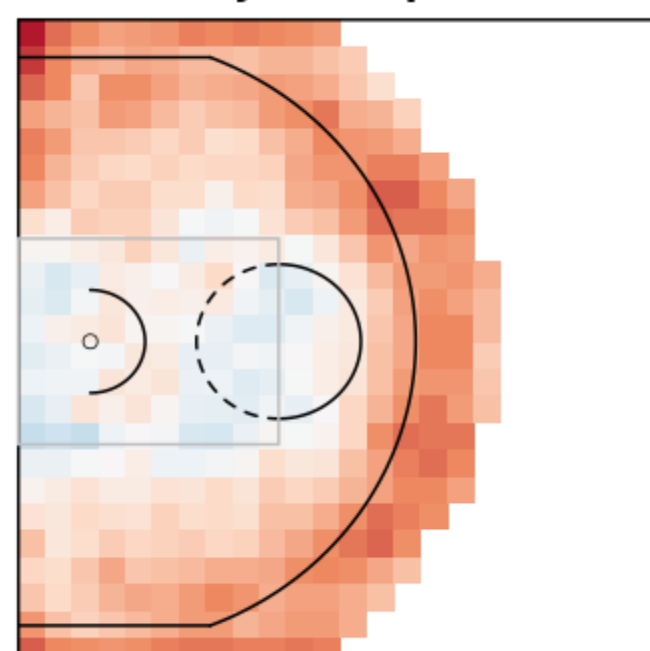
Stephen Curry



Draymond Green



Klay Thompson



Player	Player's Avg. Portfolio Value While Ballcarrier	Player's Avg. Portfolio Value While not Ballcarrier	Teammates' Avg. Portfolio Value While Player is Ballcarrier
Marreese Speights	2.46	2.29	8.51
David Lee	2.07	1.97	8.42
Andrew Bogut	1.91	1.95	8.56
Draymond Green	1.89	1.89	8.55
Harrison Barnes	1.87	2.46	8.34
Klay Thompson	1.81	2.36	8.50
Leandro Barbosa	1.52	2.24	8.38
Shaun Livingston	1.47	1.91	8.51
Andrew Iguodala	1.41	2.30	8.50
Stephen Curry	1.03	1.78	8.54

GOLDEN STATE WARRIORS

Metrics After calculating the value of each player's real estate portfolio during every instant throughout the season, we can create metrics to compare these values in different situations, such as when that player (or a teammate) possesses the ball. This reveals that point guards tend to have the lowest average portfolio values as ballcarriers, since they're often in control well beyond the arc. Big men usually have higher portfolio values when possessing the ball, since these opportunities usually occur close to the basket.

Player	Player's Avg. Portfolio Value While Ballcarrier	Player's Avg. Portfolio Value While not Ballcarrier	Teammates' Avg. Portfolio Value While Player is Ballcarrier
Kevin Love	2.46	2.34	8.65
Timofey Mozgov	2.33	2.22	8.71
Shawn Marion	2.06	2.39	8.72
Tristan Thompson	2.03	2.05	8.76
J. R. Smith	1.89	2.42	8.66
Dion Waiters	1.85	2.50	8.65
LeBron James	1.80	1.99	8.73
Iman Shumpert	1.69	2.46	8.65
Kyrie Irving	1.38	2.01	8.84
M. Dellavedova	1.25	2.06	8.59

CLEVELAND CAVALIERS