NBA Impact Score: A New Metric for Player Contribution Measurement

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Overview

The National Basketball Association (NBA) All-NBA teams represent the pinnacle of individual achievement in the league, consisting of the top 15 players each season, divided into three teams with two backcourt players and three frontcourt players. Selection to these teams is often seen as a validation of a player's excellence and contribution to the game. However, both All-NBA team and MVP selections have increasingly been influenced by narratives and player name recognition rather than a focus on statistical performance and tangible impact on their team's success.

In recent years, the criteria for these prestigious honors have sparked debate. The last player to win the MVP award three consecutive times was Larry Bird, from the 1983-84 season to the 1985-86 season. The reluctance of voters to recognize repeat winners, as well as the influence of media-driven narratives, have led to contentious outcomes. A striking example is Derrick Rose receiving a first-place MVP vote in the 2020-21 season—years after his prime. Such instances highlight the subjectivity and potential biases present in the current voting system.

This project aims to address these concerns by developing a more objective measure of player impact, grounded in advanced statistics. By creating an "Impact Score," we seek to shift the conversation from narrative-driven accolades to a more evidence-based recognition of player contributions.

Objective

The primary objective of this project is to develop a comprehensive and data-driven metric called "Impact Score" that accurately quantifies an NBA player's contribution to their team's success. Unlike traditional metrics and award selections, which can be influenced by subjective narratives and voter biases, the Impact Score aims to provide an objective measure based purely on statistical performance.

This new metric will combine various advanced statistics, normalizing them to league averages and aggregating them into a single score that uniquely reflects a player's overall impact on both ends of the court.. By doing so, this project seeks to offer a more reliable tool for evaluating player performance, independent of external influences like media narratives or name value.

The ultimate goal is to establish Impact Score as the definitive measure for identifying the true Most Valuable Players each season and providing a more evidence-based framework for All-NBA team selections, thereby significantly enhancing the integrity and transparency of these honors.

Specifications

The Impact Score project relies on a robust and systematic approach to ensure accuracy and relevance. Below are the key specifications that outline the structure and methodology of the project:

- **Data Sources**:
    - The project utilizes publicly available NBA player statistics, sourced from reputable databases such as Basketball-Reference, ESPN, and RAPTOR data from FiveThirtyEight. These sources provide a wide range of traditional and advanced metrics necessary for comprehensive analysis.
- **Seasons Analyzed**:
    - The analysis covers three NBA seasons: 2021-22, 2022-23, and 2023-24. Data from these seasons were carefully compiled and adjusted to ensure consistency and accuracy across different periods.
- **Key Statistics**:
    - The Impact Score is derived from a blend of basic and advanced statistical categories, divided into three main groups:
        - **Per Game Stats**: Traditional metrics like points, rebounds, assists, and shooting percentages.
        - **Per 100 Possession Stats:** 100 possession adjusted metrics similar to traditional box score statistics.
        - **Advanced Stats**: Metrics such as PER (Player Efficiency Rating), Win Shares, VORP (Value Over Replacement Player), and various usage and shooting efficiency statistics.
        - **On/Off Stats**: Plus-minus data, BPM (Box Plus-Minus), and other on-court impact measures that reflect a player's influence on team performance during their minutes on the floor.
    - Specific statistics include: FG%, 3P%, 2P%, ORB_pergame, DRB_pergame, TRB_pergame, TOV_pergame, FTA_pergame, FT%, PTS_pergame, AST%, STL_pergame, BLK_pergame, PER, BPM, and many others.
- **Normalization and Adjustment**:
    - To account for differences in play styles and league trends across seasons, all statistics were normalized against league averages. This adjustment allows for a fair comparison of player performance across different contexts and eras.
    - Percentages were also adjusted by converting them to integers to ensure consistency in the calculation process.
- **Calculation Method**:

- The final Impact Score is calculated by summing up the adjusted values from the selected statistics, each centered around a zero baseline. This method ensures that positive and negative contributions are appropriately balanced, providing a clear picture of a player's overall impact.

These specifications provide the foundation for a rigorous and objective analysis, allowing the Impact Score to serve as a credible alternative to traditional, narrative-driven assessments of player performance. To ensure the data reflects consistent and significant contributions, only players who have played a minimum of 65 games and averaged at least 20 minutes per game are included in the analysis. The 65-game threshold aligns with the eligibility criteria for the MVP award, ensuring that only players with substantial participation are considered.

Step-by-Step Process

Data Collection:

- The process began with the collection of a wide range of player statistics from multiple NBA seasons. These stats were divided into four main categories:
  - **Per Game Stats:** The following per-game statistics were collected for each player:
    - Field Goal Percentage (FG%)
    - Three-Point Percentage (3P%)
    - Two-Point Percentage (2P%)
    - Offensive Rebounds per Game (ORB_pergame)
    - Defensive Rebounds per Game (DRB_pergame)
    - Total Rebounds per Game (TRB_pergame)
    - Turnovers per Game (TOV_pergame)
    - Free Throw Attempts per Game (FTA_pergame)
    - Free Throw Percentage (FT%)
    - Points per Game (PTS_pergame)
    - Assists Percentage (AST%)
    - Steals per Game (STL_pergame)
    - Blocks per Game (BLK_pergame)
  - **Per 100 Possession Stats:** Additionally, the following statistics per 100 possessions were used:
    - Points per 100 possessions (PTS_100)
    - Offensive Rebounds per 100 possessions (ORB_100)
    - Defensive Rebounds per 100 possessions (DRB_100)
    - Total Rebounds per 100 possessions (TRB_100)
    - Turnovers per 100 possessions (TOV_100)
    - Free Throw Attempts per 100 possessions (FTA_100)
    - Steals per 100 possessions (STL_100)

        - Blocks per 100 possessions (BLK_100)
    - **Advanced Stats:** the following advanced metrics were included:
        - Usage Percentage (USG%)
        - Offensive Rebound Percentage (ORB%)
        - Defensive Rebound Percentage (DRB%)
        - Total Rebound Percentage (TRB%)
        - Turnover Percentage (TOV%)
        - Player Efficiency Rating (PER)
        - Value Over Replacement Player (VORP)
        - Win Shares (WS), including Offensive Win Shares (OWS) and Defensive Win Shares (DWS)
        - True Shooting Percentage (TS%)
        - Effective Field Goal Percentage (eFG%)
        - LEBRON WAR
        - RAPTOR WAR
    - **On/Off Court Stats:** These statistics evaluate the impact of a player when on the court versus when off the court:
        - Box Plus/Minus (BPM)
        - Offensive Box Plus/Minus (OBPM)
        - Defensive Box Plus/Minus (DBPM)
        - Net Rating (NetRtg)
        - Offensive Rating (ORtg)
        - Defensive Rating (DRtg)
        - LEBRON (Overall, Offensive, and Defensive)
        - RAPTOR (Overall, Offensive, and Defensive)

League Average Adjustment:

- To standardize the data and allow for a meaningful comparison across players, each player's traditional per-game statistics and per-100 possession statistics were adjusted by subtracting the league average for each respective stat. This step was critical in ensuring that the resulting impact score accurately reflects a player’s contribution relative to the league as a whole.
- The league average for each stat was calculated separately for each season and then subtracted from the corresponding player’s stat. This adjustment was applied to all the per game and per 100 possession stats listed above.

Percentage Adjustment:

- Specific stats that are expressed as percentages (e.g., FG%, 3P%, USG%, etc.) were adjusted to convert their percentage values into integers, making them easier to work with

in subsequent calculations. This adjustment was applied to stats such as FG%, 3P%, 2P%, USG%, ORB%, DRB%, TRB%, TOV%, FT%, TS%, eFG%, and AST%.

Eligibility Filtering:

- After adjusting the stats, the data was filtered to include only players who met the eligibility criteria of playing a minimum of 65 games and averaging 20 minutes per game during the season. This step ensured that only players with significant playing time were considered in the final impact score calculation.

Summation of Impact:

- The final impact score for each player was calculated by summing the adjusted values of all the stats mentioned above. Since each stat was adjusted to be centered around zero, the summation of these values provides a comprehensive measure of a player's overall impact on their team's success. Centering around zero makes digesting the resulting statistic easier since it shows how much a player makes their respective team better or worse, similar to offensive and defensive ratings.

Statistical Result

After gathering, filtering, and conditioning the data, each season yielded roughly 140 to 150 players eligible for this analysis. The final Impact Score calculation is presented below in mathematical notation. Each step of the process is outlined individually, with the final formula summarizing the entire calculation:

Variables:

- $X_{i,j}$: Value of the j-th stat for player i.
- $\bar{X}_j$: League average for the j-th stat.
- $X'_{i,j}$: Normalized value of the j-th stat for player i.
- $X''_{i,j}$: Adjusted value (converted to integer) for percentage stats.
- ImpactScore_i: Impact score for player i.

$$\text{X'}_{i,j} = X_{i,j} - \bar{X}_j$$

$$\text{X''}_{i,j} = \text{round}(100 \times (X'_{i,j}))$$

$$\text{ImpactScore}_i = \sum_{j \in \text{PerGameStats}} X''_{i,j} + \sum_{k \in \text{Per100Stats}} X'_{i,k} + \sum_{l \in \text{AdvancedStats}} X_{i,l} + \sum_{m \in \text{OnOffStats}} X_{i,m}$$

$$\text{ImpactScore}_i = \left(\sum_{j \in \text{PerGameStats}} \text{round}(100 \times (X_{i,j} - \bar{X}_j))\right) + \left(\sum_{k \in \text{Per100Stats}} (X_{i,k} - \bar{X}_k)\right) + \left(\sum_{l \in \text{AdvancedStats}} X_{i,l}\right) + \left(\sum_{m \in \text{OnOffStats}} X_{i,m}\right)$$

All-“Impact” Teams

The resulting All-“Impact” Teams are listed below, akin to the NBA’s annual all-NBA teams awarded each year. In this listing, the players were grouped simply by front and backcourt rather than positionally as in other instances where guards, forwards, and centers are separated. This was done in order to allow for the top players of each binary class of player to receive recognition, as opposed to limiting players positionally which can exclude centers from being recognized in some instances. Here are the teams for the three seasons studied, listed in reverse chronological order:

2023-2024 First Team

Backcourt: Shai Gilgeous-Alexander
Backcourt: Luka Doncic
Frontcourt: Domantas Sabonis
Frontcourt: Giannis Antetokounmpo
Frontcourt: Nikola Jokic

2023-2024 Second Team

Backcourt: Jalen Brunson
Backcourt: Tyrese Haliburton

Frontcourt: LeBron James
Frontcourt: Jayson Tatum
Frontcourt: Anthony Davis

2023-2024 Third Team
Backcourt: Devin Booker
Backcourt: Stephen Curry
Frontcourt: Kawhi Leonard
Frontcourt: Kevin Durant
Frontcourt: Victor Wenbenyama

2022-2023 First Team
Backcourt: Shai Gilgeous-Alexander
Backcourt: Luka Doncic
Frontcourt: Domantas Sabonis
Frontcourt: Joel Embiid
Frontcourt: Nikola Jokic

2022-2023 Second Team
Backcourt: Donovan Mitchell
Backcourt: Jrue Holiday
Frontcourt: Jayson Tatum
Frontcourt: Lauri Markannen
Frontcourt: Julius Randle

2022-2023 Third Team
Backcourt: Jalen Brunson
Backcourt: Trae Young
Frontcourt: Jarrett Allen
Frontcourt: Rudy Gobert
Frontcourt: Nic Claxton

2021-2022 First Team
Backcourt: Luka Doncic
Backcourt: Trae Young

Frontcourt: Giannis Antetokounmpo
Frontcourt: Joel Embiid
Frontcourt: Nikola Jokic

2021-2022 Second Team

Backcourt: James Harden
Backcourt: Dejounte Murray
Frontcourt: Jayson Tatum
Frontcourt: Karl-Anthony Towns
Frontcourt: Rudy Gobert

2021-2022 Third Team

Backcourt: Chris Paul
Backcourt: Devin Booker
Frontcourt: Demar DeRozan
Frontcourt: Pascal Siakam
Frontcourt: Jakob Poeltl

As many readers will notice, some very notable names are missing from these teams each season. As outlined in the 'Specifications' and 'Step-by-Step' sections, players must have played a minimum of 65 games and averaged at least 20 minutes per game to be eligible for this accolade. The games played criterion align with the NBA's MVP eligibility rules. Some notable players who did not meet these requirements include, but are not limited to:

2023-2024	2022-2023	2021-2022
Joel Embiid	LeBron James	Ja Morant
Ja Morant	Stephen Curry	LeBron James
Zach Lavine	Damian Lillard	Kevin Durant
Bradley Beal	Giannis Antetokounmpo	Stephen Curry
Kyrie Irving	Jimmy Butler	Jimmy Butler
Darius Garland	James Harden	Anthony Davis
Donovan Mitchell	Paul George	Paul George
Jimmy Butler	Anthony Davis	
OG Anunoby	Kevin Durant	
Kristaps Porzingis		

*All above listed players missed eligibility due to lack of games played

Conclusion and Future Use

The development of the Impact Score represents a significant advancement in the objective evaluation of NBA player performance. By shifting the focus from narrative-driven accolades to a data-centric approach, this metric provides a more accurate and equitable reflection of a player's contribution to their team's success. The Impact Score's reliance on advanced statistics and normalization to league averages ensures that every aspect of a player's performance is measured on an equal footing, minimizing biases, and subjectivity.

This study underscores the growing importance of data in modern sports analysis and sets a new standard for transparent and fair evaluations in the NBA. Beyond its immediate application in recognizing the league's most impactful players, the Impact Score holds significant potential for team management and decision-making. Teams can leverage this metric to evaluate players not only as MVP candidates but also as prospects, trade targets, or free-agent signings. By providing a comprehensive view of a player's overall impact, the Impact Score can guide teams in making more informed decisions that align with their strategic goals.

Looking ahead, the framework established by this study can be expanded to incorporate more nuanced data, such as player tracking and lineup combinations, to further refine the metric. Additionally, adapting the Impact Score to different leagues or sports could offer similar benefits, creating a universal tool for evaluating player impact across various competitive environments.

Ultimately, the Impact Score aims to reshape how the NBA and its stakeholders approach player evaluation, leading to more equitable recognition of the true Most Valuable Players and empowering teams with a powerful tool for talent assessment and acquisition.

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