NBA Futre Analytics Stars

NBA EXPANSION DRAFT

Lauren Manis | May, 2024

PROJECT OVERVIEW

Determining the optimal number of players each existing NBA franchise should be permitted to protect in an expansion draft scenario that introduces two new teams, with the ultimate goal of developing a framework that maximizes competitive balance across the league.

PROJECT OVERVIEW

Competitive Balance refers to a scenario in which

- The largest number of teams achieve or surpass the average number of wins
- There are an equal or greater number of teams with winning records as losing records
- The win gap between the strongest and weakest teams is minimized
- Talent distribution is equitable across all teams
- Expansion teams have a viable chance of achieving the mean number of wins

EXPANSION DRAFT
RULES & ASSUMPTIONS

Selections

- A coin flip will determine which expansion team selects first
- Expansion teams must select at least 14 players, but no more than 29 players
- Each expansion team may only select 1 unprotected player from each existing NBA team
- Expansion teams may select players and acquire contracts without regard to the Salary Cap
- Any player selected by an expansion team is automatically placed on their roster
- Expansion teams will not select more than 4 players of the same position

EXPANSION DRAFT
RULES & ASSUMPTIONS

Protections

- Each existing team can protect up to a designated number of players (“N”), and each team will protect that number of players
- UFAs cannot be protected, nor selected
- RFAs can be protected and selected, but will become UFAs if drafted by an expansion team
- Existing teams must designate at least 1 roster player to be eligible for selection in the case that they have fewer than N players on contract for the upcoming season
- Two-Way players can be protected and selected
- Teams will protect their All-Stars, and their starters, followed by their best remaining players, while under the protection limit

EXPANSION DRAFT
RULES & ASSUMPTIONS

Stopping Rules

The expansion draft will conclude once:

- Both expansion teams have selected the minimum number of players required (14) AND
- Both expansion teams have selected the maximum number of players (29) OR
- One player has been selected from every existing franchise OR
- There are no remaining players to be selected

PROTECTED PLAYERS

In order to maximize competitive balance across the league in an expansion scenario, each existing NBA team should be permitted to protect a **maximum of 7 players**.

★★★★★★★

MODELING & ANALYSIS

PROCESS & MODELS

1

Data Collection

Sources: Basketball Reference, HoopR Package, HoopsHype

2

Player Clustering

K-Means Clustering for all active players in 2022-23 season

3

Player Protection

Existing teams protect N players

4

Draft Selections

Expansion teams rotate selecting players

5

Team Win Projections

Project regular-season wins for all 32 teams

6

Analysis & N Selection

Distribution of wins, Distribution of talent, etc.

Simulation

1,000 Simulations
for each N from 6 through 11

2

PLAYER CLUSTERING

K-Means Clustering Model

Grouping NBA players into 8 clusters, or tiers, based on per-game and advanced performance metrics from the 2022-23 NBA season

2

PLAYER CLUSTERING

Select Metrics by Clsuter

Cluster	Minutes	Points	Assists	Rebounds	VORP	Win Shares	PER
1	34.8	26.5	6.0	9.1	4.3	8.6	24.4
2	32.1	19.4	4.6	4.7	1.1	3.3	16.5
3	25.2	11.6	1.6	7.9	1.3	5.4	18.5
4	27.1	11.0	3.0	4.1	0.7	3.4	13.2
5	16.9	6.5	1.3	2.3	0.0	1.2	11.4
6	11.8	4.7	0.6	3.1	0.1	1.1	15.8
7	10.2	3.1	1.0	1.6	-0.1	0.0	8.1
8	4.09	0.9	0.3	0.7	-0.1	-0.1	2.2

2 PLAYER CLUSTERING

1
All-Stars
Joel Embiid, Steph Curry, Luka Dončić, etc.

2
High-Performance Starters
Paolo Banchero, Bradley Beal, Mikal Bridges, etc.

3
Effective Starters
Aaron Gordon, Rudy Gobert, Deandre Ayton, etc.

4
6th Men & Key Rotation Players
Cole Anthony, Nic Batum, Patrick Beverly

5
Bench Contributors
Nickeil Alexander-Walker, Christian Braun, Ochai Agbaji

6
Solid Rotation Players
Mo Bamba, Precious Achiuwa, Darius Bazley

7
Limited Minutes Role Players
Ryan Arcidiacono, Dalano Banton, T. Antetokounmpo

8
Minimal Contributors/Non-Rotation Players
Joe Wieskamp, Ryan Rollins, Trevor Keels

3

PLAYER PROTECTION

Simulation

Simulating the protection of N roster players, where N ranges from 6 to 11 (inclusive), for each of the existing 30 NBA teams 1,000 times

3

PLAYER PROTECTION

Simulation

Simulating the protection of N roster players, where **N ranges from 6 to 11**

- In the 2004 Bobcats expansion draft, teams were permitted to protect up to 8 players
- In the G League, teams have historically been permitted to protect up to 10 players in the case of expansion drafts
- WNBA Teams have protected up to 6 players in expansion drafts

3

PLAYER PROTECTION

Simulation

Function to iterate through the roster of each NBA team and protect players up to the specified limit.

First Pass: Protect All-Stars (Cluster 1)

Second Pass: Protect Starters (Highest-ranked player from each position on the team)

Third Pass: Protect player(s) at random, from the highest available cluster until the limit is reached

4

DRAFT SELECTIONS

Simulation

Function to alternate between the two expansion teams, allowing each to select one unprotected player from the existing franchises during each round of the draft, until one of the stopping conditions are met.

4

DRAFT SELECTIONS

Simulation

Function to alternate between the two expansion teams, allowing each to select one unprotected player from the existing franchises during each round of the draft, until one of the stopping conditions are met.

Expansion teams randomly select one of the best available players (ie from the highest available cluster), regardless of position, but with some consideration for overall team balance.

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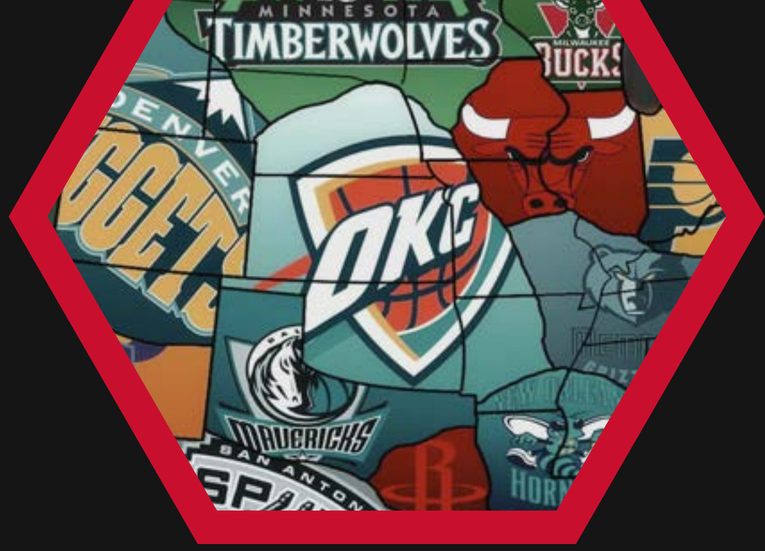
TEAM WIN PROJECTIONS

After each simulation of player protection and selection, aggregate the statistics, project team wins, and store the results, before initiating the next simulation



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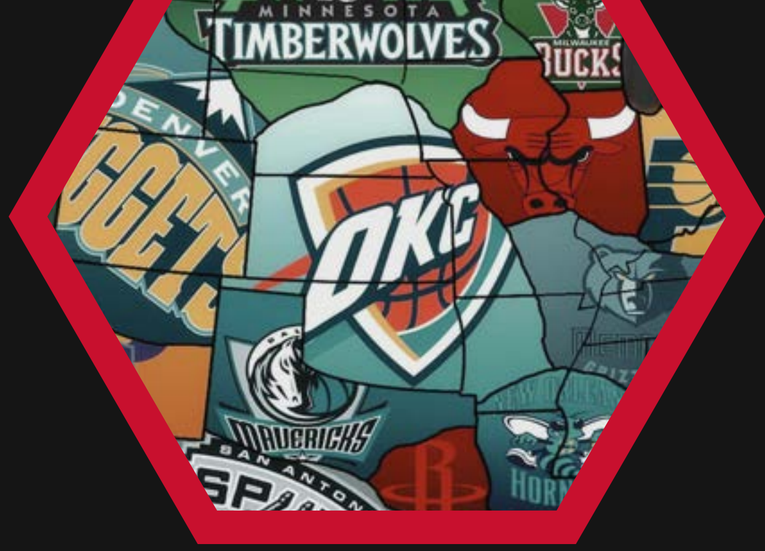
TEAM WIN PROJECTIONS



01. Data Aggregation

For each of the now 32 teams:

1. **Project Player Minutes:** estimate each player's minutes per game, ensuring the total does not exceed 240 minutes per team.
2. **Normalize Box Score Metrics:** Convert all box score statistics to per-minute figures
3. **Adjust to Per 48 Minutes:** Scale all per-minute statistics to a per 48-minute basis
4. **Calculate Per-Game Stats**: Define each player’s per-game statistics by multiplying their per 48-minute stats by the percentage of 48 minutes they are expected to play.
5. **Aggregate to Team Level:** Sum up individual player stats to derive team totals and compute percentage-based statistics for the team as a whole.
6. **Rank Teams In Relevant Areas**: Rank each team across the league based on their projected performance in relevant statistical areas.

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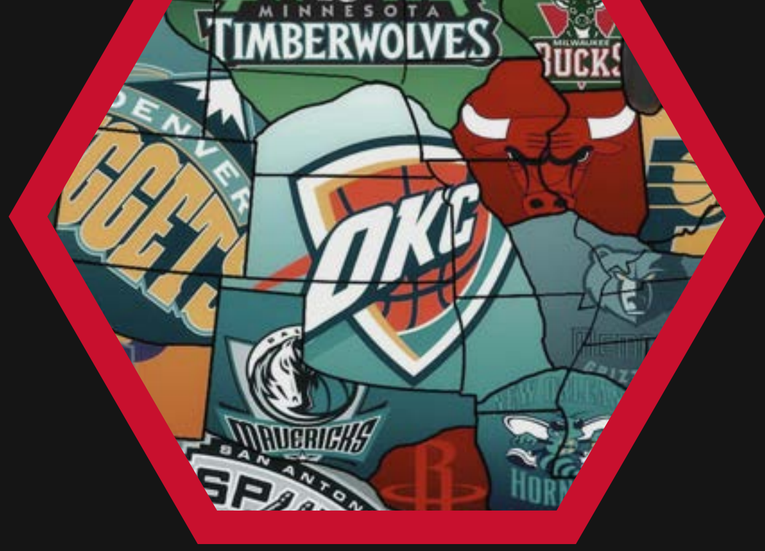
TEAM WIN PROJECTIONS



02. Win Projection Model

Utilizing Stepwise Linear Regression to predict the percentage of total available wins attributed to each team.

Using regular season team statistics from the past 10 complete seasons

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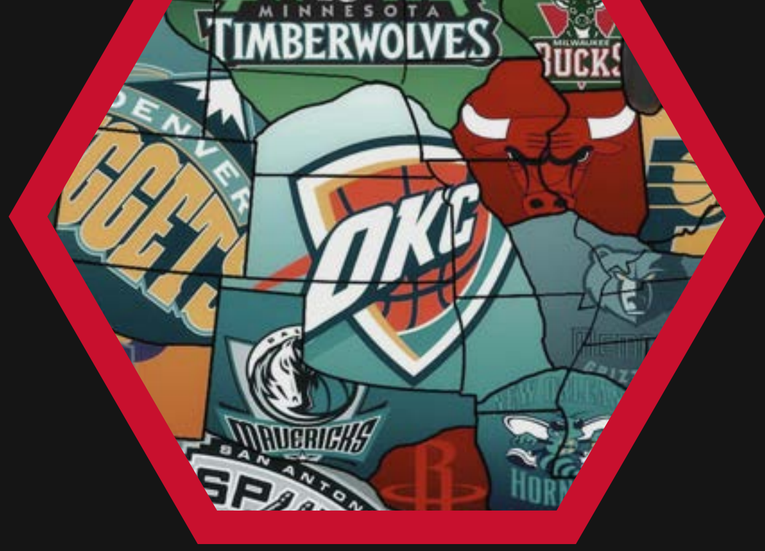
TEAM WIN PROJECTIONS



02. Win Projection Model

Features: Plus-Minus Rank, FG Pct Rank, TOV Rank, DREB Rank, BLK Attempt Rank, STL Rank

- Using team ranks, rather than per-game statistics, is advantageous for this analysis which excludes free agents — often highly productive players. Excluding these players tends to lower team stats on a per-game basis. Consequently, a model trained on data including free agents would likely underpredict values for teams without these players.

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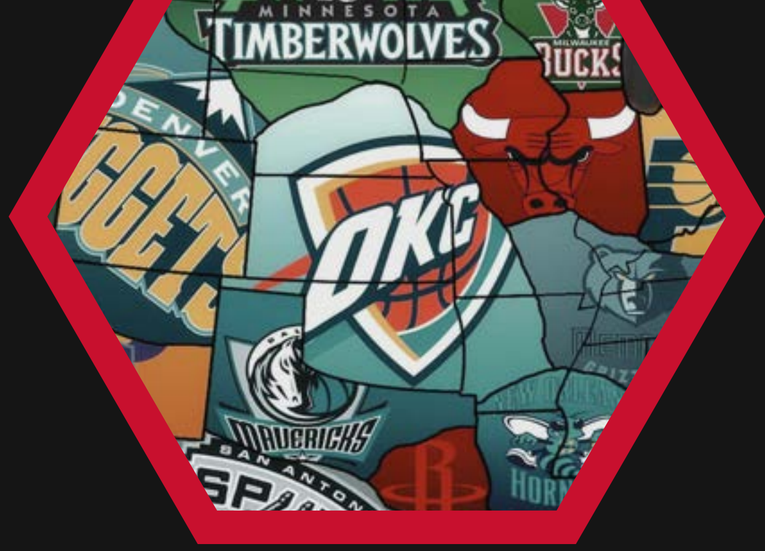
TEAM WIN PROJECTIONS



02. Win Projection Model

Features: Plus-Minus Rank, FG Pct Rank, TOV Rank, DREB Rank, BLK Attempt Rank, STL Rank

Target: “Pie %”: The percentage of total available wins captured by the team

- Total Available Wins = 41 home games * Number of teams
  - Predicting the percentage of total available wins, rather than the absolute number of wins, provides a scalable measure that remains applicable if the number of games or potential wins changes.

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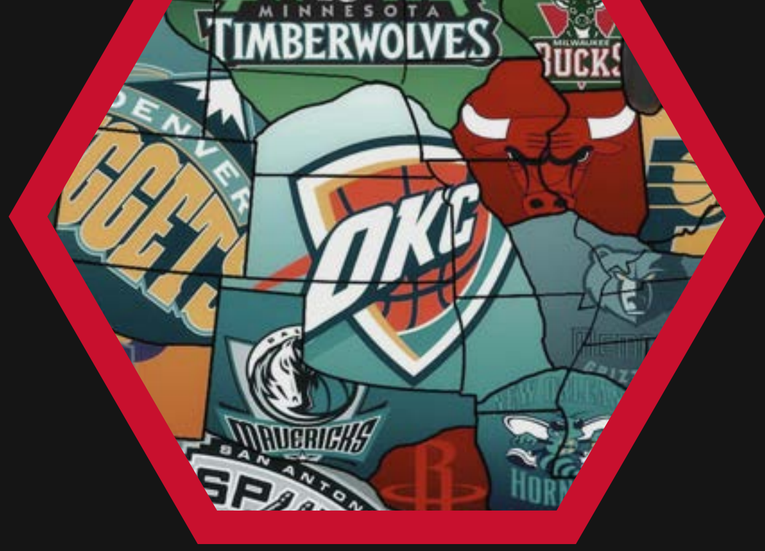
TEAM WIN PROJECTIONS



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Target: “Pie %”: The percentage of total available wins captured by the team

R-Square = 0.9113

OPTIMAL N SELECTION

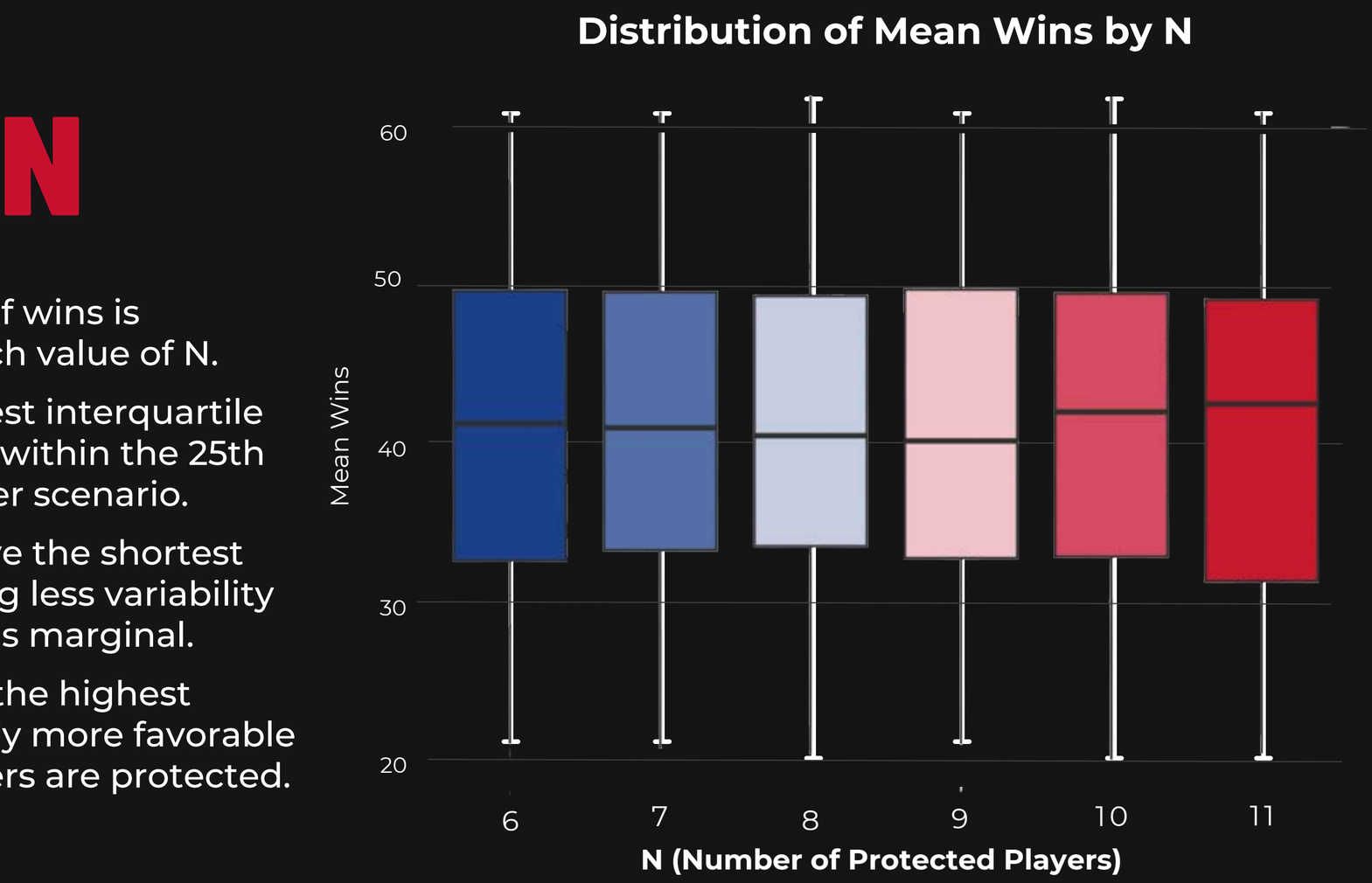
Determining optimal value of N as the value that maximizes competitive balance

The Optimal N should achieve the following:

- The smallest range of projected wins (a tight distribution)
- Expansion team wins as close as possible to the league mean
- An equal or larger number of teams with records above and below a .500 winning percentage
- The fewest teams with more than three players from clusters 7 and 8, minimizing the concentration of lower-tier players per team, and indicating a balanced distribution of talent

OPTIMAL N SELECTION

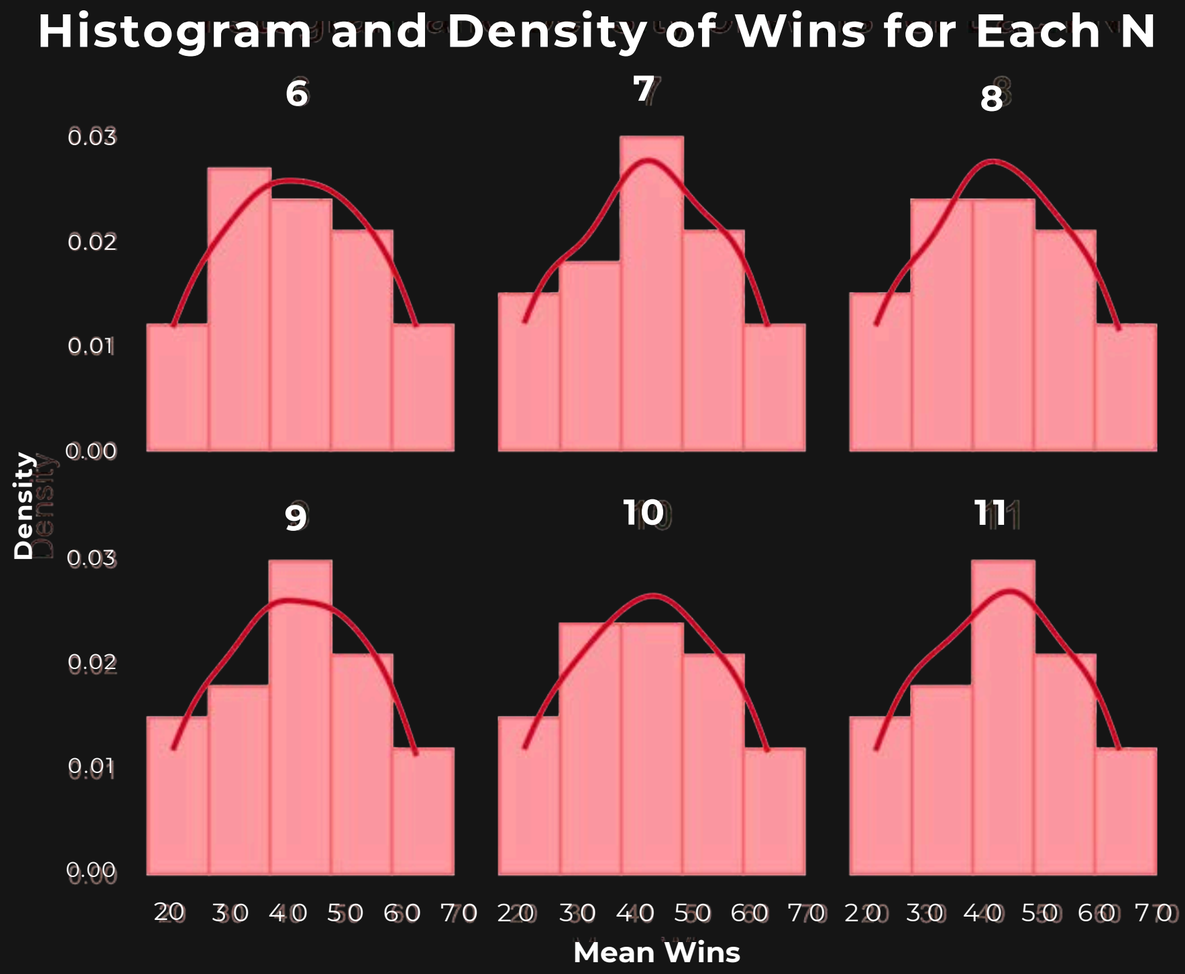
- **Median Wins:** The median number of wins is consistently around 41 games for each value of N.
- **Tightest IQR**: N=8 features the tightest interquartile range (IQR), with more teams falling within the 25th and 75th percentiles than in any other scenario.
- **Shortest Whiskers**: N=7 and N=9 have the shortest whiskers on their box plots, indicating less variability in team wins, though the difference is marginal.
- **Highest Median Wins:** N=11 exhibits the highest median wins, suggesting a potentially more favorable outcome for teams when more players are protected.



OPTIMAL N SELECTION

For N=7, N=9, and N=11, the distribution of team wins appears to be somewhat normal, with the majority of teams clustered around the mean, approximately at 41 wins.

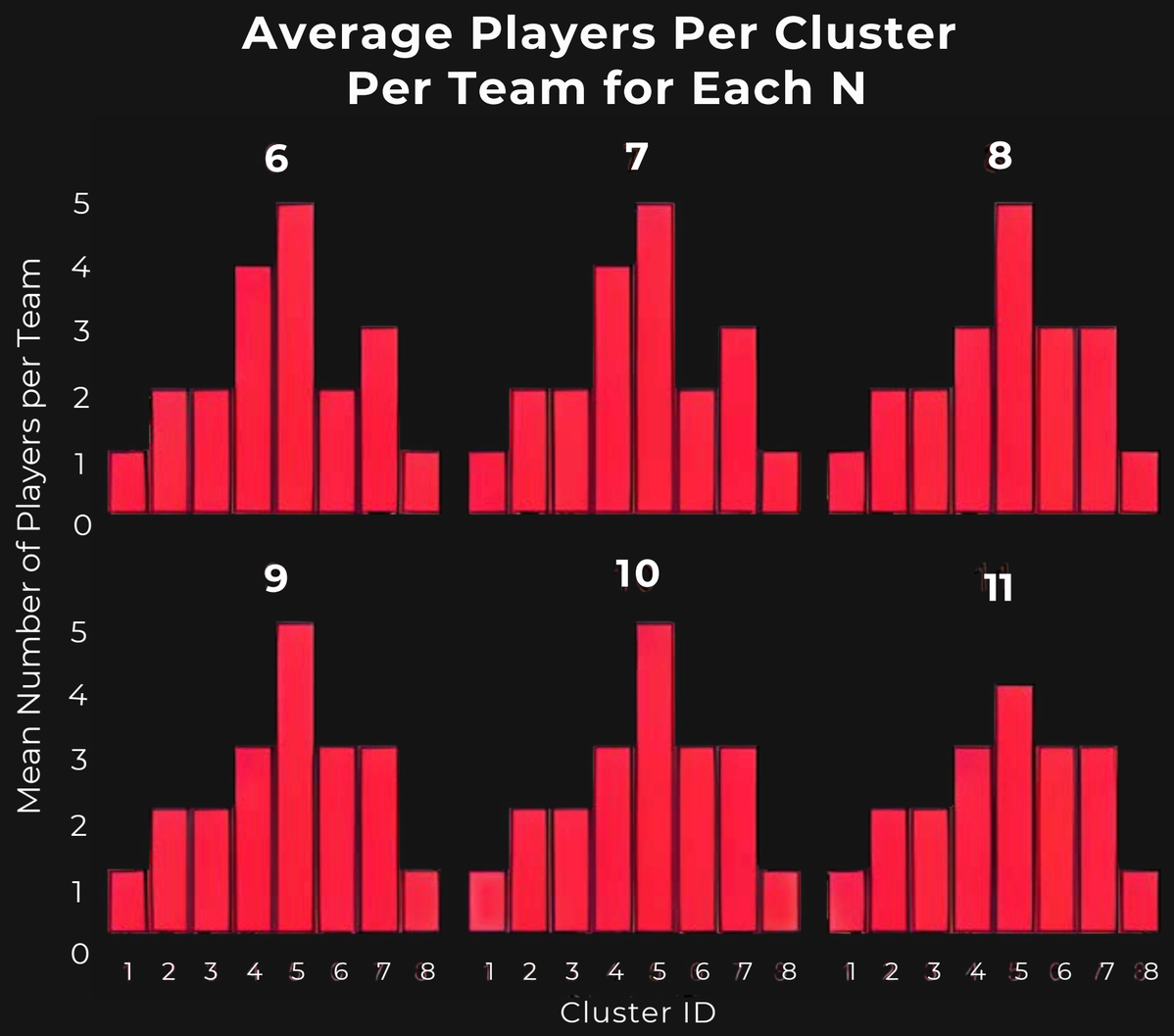
Under all scenarios except for N=9, at least half (16) of the teams have a record of .500 or better.



OPTIMAL
N SELECTION

Once N exceeds 7, the distribution of team wins begins to skew left, suggesting an increase in the average number of lower-performing players from higher clusters per team.

When N < 8, teams have 4 Cluster 4 players on average. This number then decreases as N continues to increase.



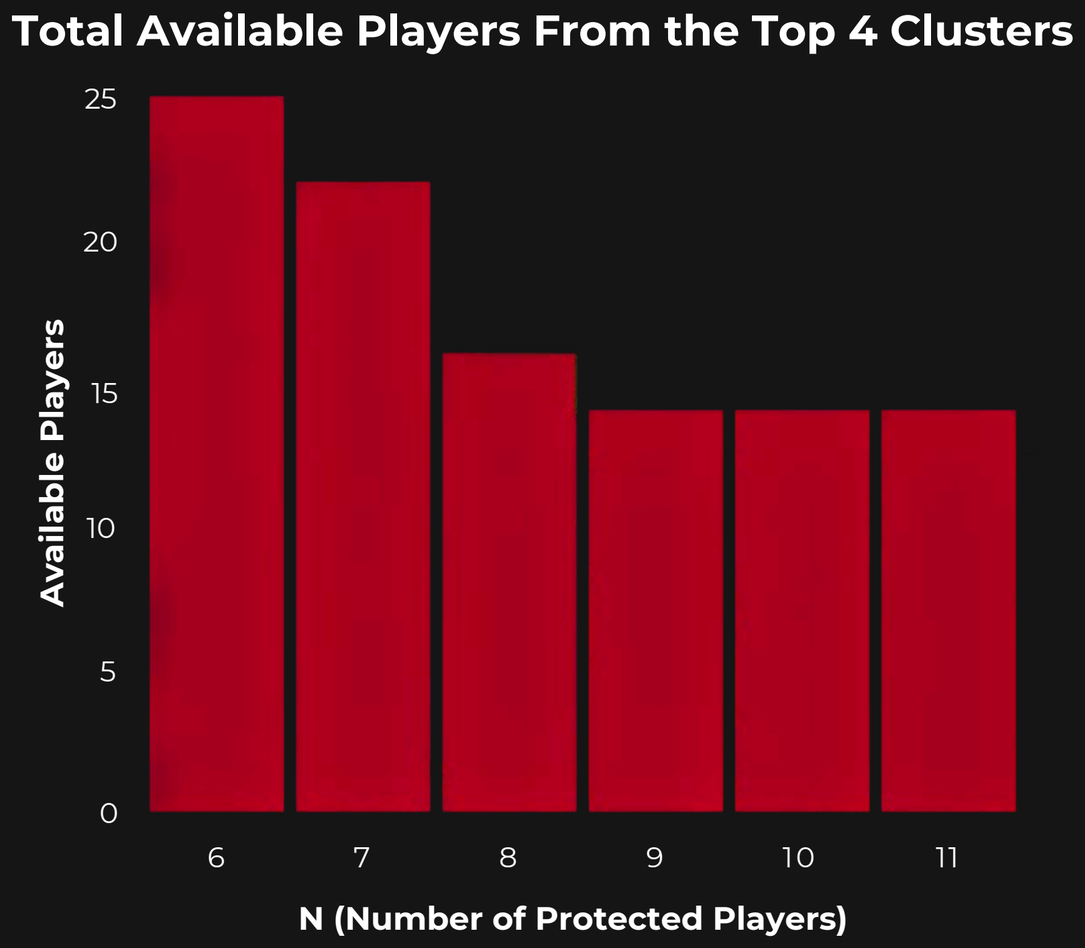
OPTIMAL N SELECTION

The largest reduction in available players from the top 4 clusters occurs when N increases from 7 to 8.

No players from clusters 1 and 2 are available in any scenario

Players from clusters 3 and 4, often starters or sixth men, average 26 minutes and contribute approximately 11 points per game.

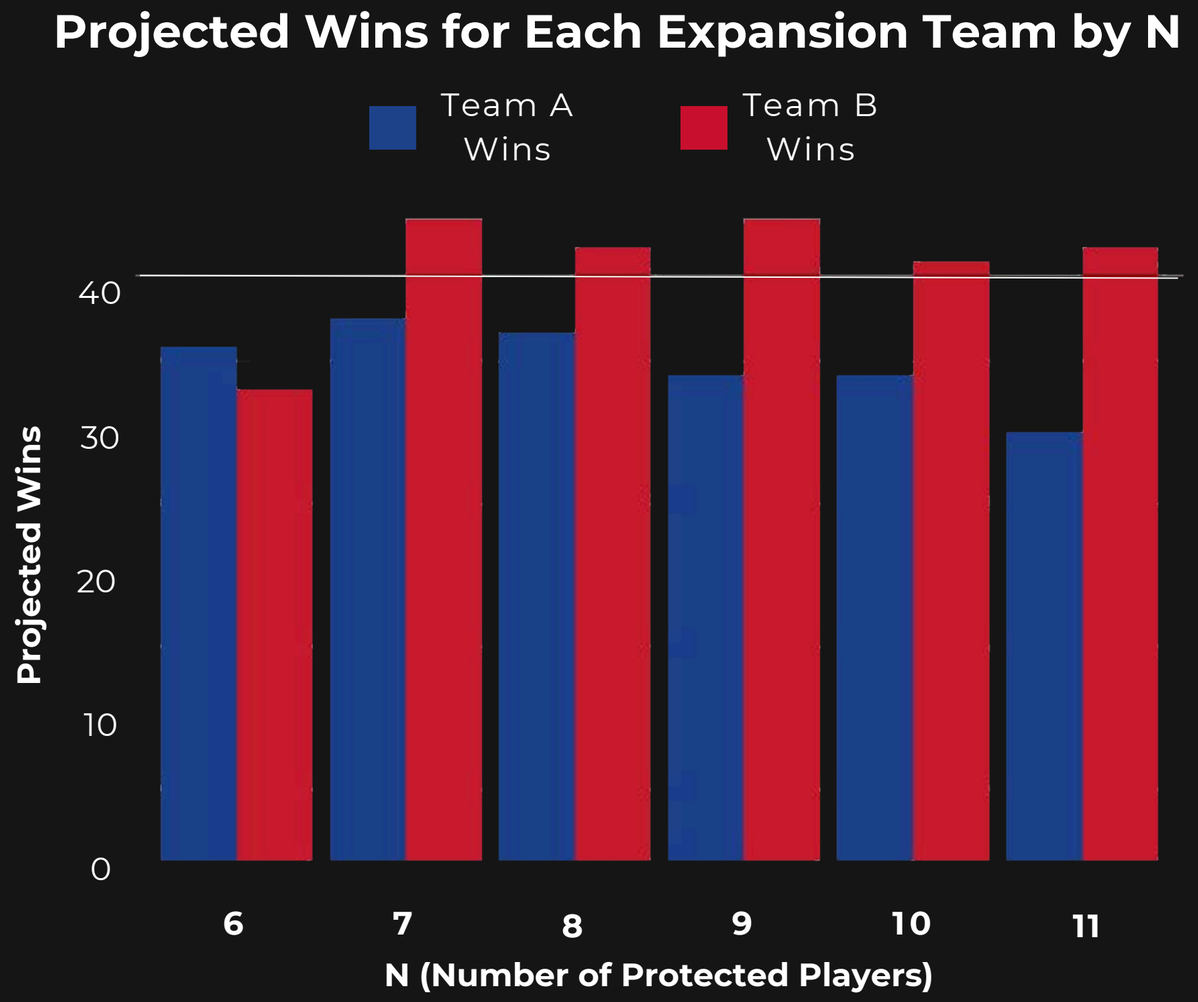
Players from cluster 5, typically coming off the bench for 17 minutes per game, see a notable decrease in performance, contributing around 6 points per game.



OPTIMAL N SELECTION

Performance at N ≥ 7: When N is 7 or higher, one expansion team is consistently projected to exceed the mean of 41 wins.

Optimal Scenario for Both Teams: At N = 7, the other expansion team comes closest to achieving the 41-win mark (38 wins), indicating a balanced outcome for both teams.



OPTIMAL N SELECTION

N	Range of Projected Wins	Mean Projected Wins	Expansion Team A Proj. Wins	Expansion Team B Proj. Wins	Expansion Team A Wins Off Mean	Expansion Team B Wins Off Mean
6	**40 (21-61)**	41.0	36	33	-5	-8
7	**40 (21-61)**	**41.1**	**38**	**45**	**-3**	**+4**
8	42 (20-62)	41.0	37	43	-4	+2
9	**40 (21-61)**	41.0	34	45	-7	+4
10	42 (20-62)	41.0	34	42	-7	+1
11	41 (20-61)	**41.1**	30	43	-11	+2

OPTIMAL N SELECTION

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11	41 (20-61)	41.1	30	43	-11	+2

SAMPLE EXPANSION TEAMS

Under N=7

Where existing NBA teams protect 7 players each.

SAMPLE EXPANSION TEAMS

TEAM A

Naji Marshall
(F)

Kelly Olynyk
(C)

Nic Batum
(F)

Christian Braun
(G)

Quentin Grimes
(G)

Other Notable Players: **Dorian Finney-Smith, Isaiah Joe, Ayo Dosunmu, Terrence Ross**

TEAM B

Corey Kispert
(F)

Al Horford
(C)

Aaron Nesmith
(F)

Marcus Smart
(G)

Bogdan Bogdanović
(G)

Other Notable Players: **Duncan Robinson, Alec Burks, Tyus Jones, Gary Payton II**

FUTURE CONSIDERATIONS & POTENTIAL ENHANCEMENTS

The following considerations could be explored if additional time and resources were available:

- I**ntegrate Contract Dynamics**: Incorporate contract values and identify less favorable contracts into the protection logic.
- **Consider Player Development:** Include factors such as players' ages, potential for development, and career trajectories in the protection strategy.
- **Project Long-Term Performance:** Extend projections of each player's and team's performance to upcoming seasons, considering historical data and anticipated career paths.
- **Assess Long-Term Competitive Balance**: Evaluate the impact on competitive balance over a more extended period, such as three or five seasons, to gauge sustained effects.

FUTURE ANALYTICS STARS

EXPANSION DRAFT

laurenmanis2@gmail.com

https://github.com/laurencmanis/NBA-Expansion-Draft-Simulation

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