

## I. ABSTRACT

The existence of “clutchness” in professional baseball has long been debated, yet remains difficult to quantify. This study investigates whether high-pressure situations influence player performance and whether distinct “clutch” archetypes exist. Using regular season and postseason data from Baseball Reference, we analyze three key performance metrics: On-Base Plus Slugging (OPS), Total Bases (TB), and Championship Win Probability Added (cWPA), to assess how players respond under varying levels of pressure. We employ hypothesis testing to determine statistical significance in performance differences, K-means clustering to classify players into archetypes, and logistic regression to forecast success in high-leverage situations. By integrating statistical analysis with sabermetrics, this study builds on the foundations of modern baseball analytics Baumer (2015) to provide a data-driven perspective on the existence of a possible “clutch gene” in baseball. Our findings have implications for player evaluation, recruitment strategies, and in-game decision-making, offering a more objective framework for understanding performance under pressure.

## II. OBJECTIVES

- Quantify the Existence of Clutch Performance
  - Examine whether OPS, TB, and cWPA meaningfully shift in postseason contexts, responding to longstanding skepticism around clutch hitting Birnbaum (2008).
- Discover Player Archetypes Using Unsupervised Learning
  - Apply K-means clustering on delta values ( $\Delta$ OPS,  $\Delta$ TB,  $\Delta$ cWPA) to identify underlying player groupings based on how performance changes under pressure.
- Model Likelihood of Postseason Success
  - Utilize logistic regression to estimate the probability of strong postseason performance, using regular season metrics as predictors—bridging

## III. DATA

Player-level statistics for both the regular season and postseason were collected from Baseball Reference (2025) using season-specific leaderboards. Datasets were constructed for the 2021 and 2023 MLB seasons. Each includes key performance metrics: On-base Plus Slugging (OPS), Total Bases (TB), Championship Win Probability Added (cWPA), At Bats (AB), along with unique identifiers to track players across seasons and contexts. To ensure statistical reliability and reduce noise from small samples, postseason data was filtered to include players with at least 10 at-bats, allowing for accurate comparisons between regular season and postseason performance.

## IV. METHODS

- Paired Sample T-Tests
  - Conducted to assess whether individual-level performance metrics—OPS, TB, and cWPA—differ significantly between regular and postseason contexts. By comparing each player to themselves across conditions, the test aims to isolate the potential effects of pressure while controlling for individual skill level.
- K-Means Clustering
  - Players were grouped into performance-based archetypes using changes in OPS, Total Bases (TB), and Championship Win Probability Added (cWPA) between the regular season and postseason (i.e.,  $\Delta$ OPS,  $\Delta$ TB,  $\Delta$ cWPA).
  - To aid interpretation and visualization, Principal Component Analysis (PCA) was used to reduce the dataset to two dimensions
- Logistic Regression Modeling
  - Designed to estimate the odds of a player improving in high-leverage situations. Regular season performance metrics and game context features served as independent variables; outcome based on postseason metric deltas.

## V. RESULTS & VISUALIZATIONS

### i. Summary Findings

Table 1: 2021 Metric  $\Delta$ s

Metric	Reg. Season $\bar{x}$	Postseason $\bar{x}$	$\Delta$ (PS - RS)
OPS	0.801	0.704	↓ 0.097
TB	176.500	13.500	0 (Normalized)
cWPA	0.661	0.149	↓ 0.512

Table 2: 2023 Metric  $\Delta$ s

Metric	Reg. Season $\bar{x}$	Postseason $\bar{x}$	$\Delta$ (PS - RS)
OPS	0.804	0.698	↓ 0.106
TB	197.250	14.667	0 (Normalized)
cWPA	0.703	-1.450	↓ 2.153

### ii. Distribution of Metric $\Delta$ s

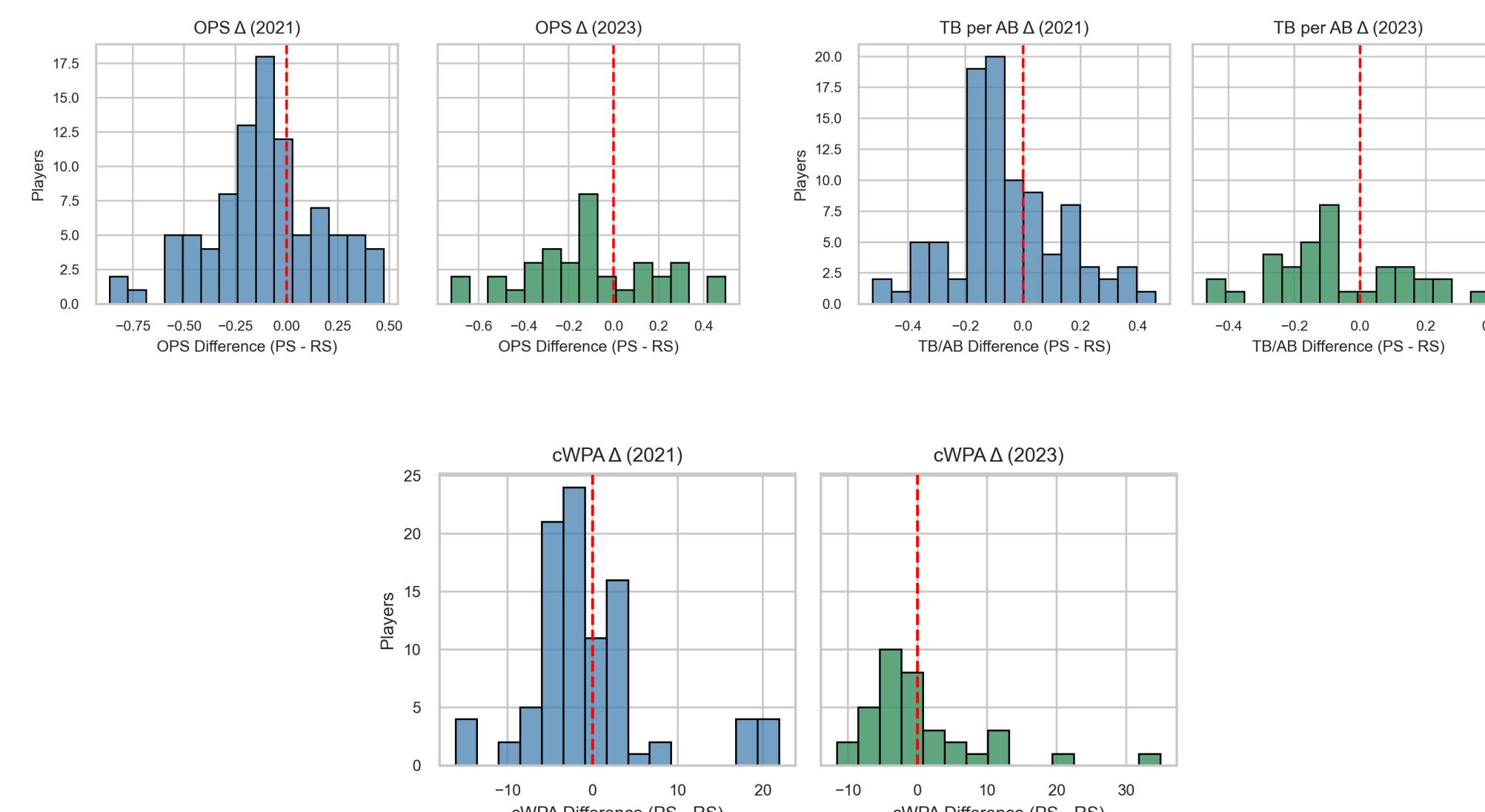


Figure 1: “Distributions of postseason vs. regular season deltas for OPS, total bases per at-bat, and clutch WPA, showing shifts in player performance.”

- T-tests: Statistically significant drops in all three metrics for both 2021 & 2023
- $\Delta$  Distribution: Most players decline under pressure, but a few improve.

### iii. K-Means Clustering

- Players grouped by  $\Delta$ OPS,  $\Delta$ TB,  $\Delta$ cWPA and visualized with PCA for dimension reduction.

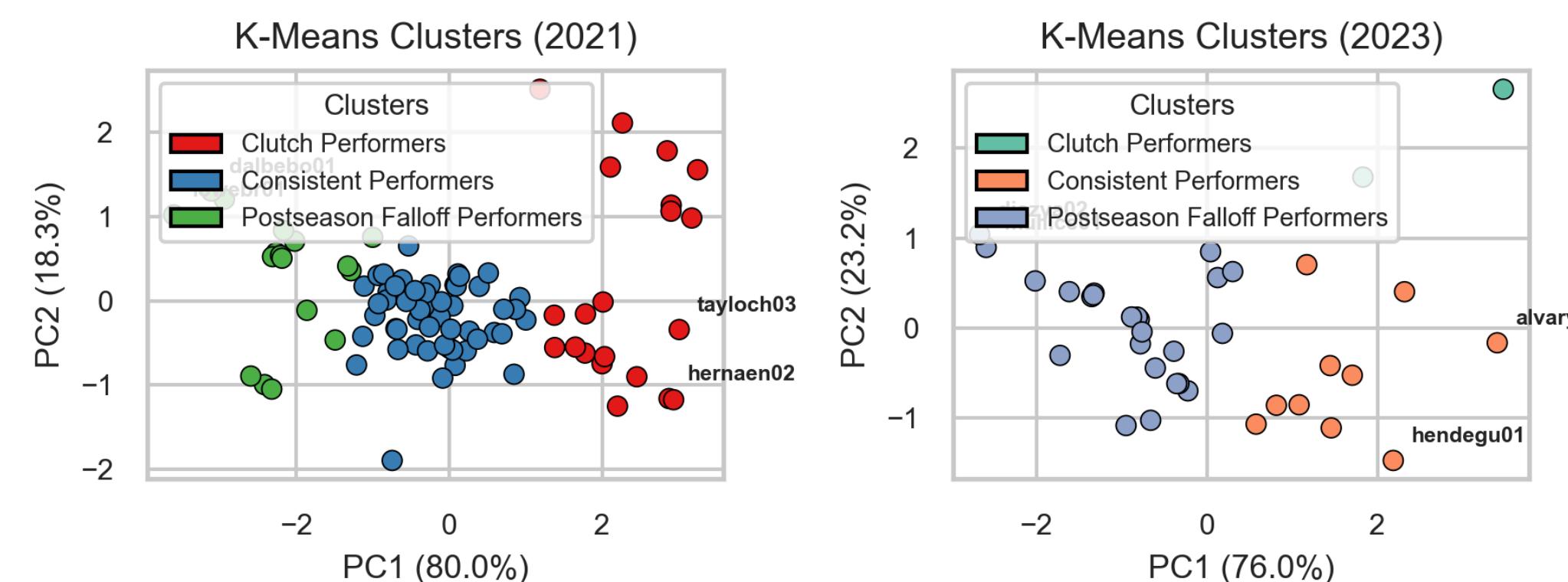


Figure 2: “K-Means clustering of 2021 and 2023 player deltas, projected via PCA to show groupings based on offensive and clutch performance shifts. Each cluster represents a distinct player response pattern to postseason pressure.”

## VI. INTERPRETATION

### i. Does “Clutchness” Exist?

Players show measurable differences between regular and postseason performance, with many concentrated just below the 0.0 delta line, indicating that pressure impacts outcomes. Paired t-tests confirm these changes are statistically significant.

### ii. Do Distinct Performance Profiles Emerge?

These patterns suggest systematic differences rather than random variance, consistent with theories of pressure-influenced performance proposed by Hibbs (2010).

## VII. CONCLUSIONS

### i. Rethinking “Clutchness”

This study provides a data-driven challenge to the narrative that “clutch” performance is merely anecdotal or unmeasurable. By comparing postseason and regular season data, statistical testing, and unsupervised learning methods, we demonstrate that performance under pressure can be measured, labeled, and learned from.

### ii. Key Takeaways

“Clutchness” is not random — it emerges from data and persists across seasons. Clustering reveals hidden player profiles that average metrics miss. This quantitative framing gives credibility to traits often dismissed as intangible.

### iii. Looking Forward

Future extensions of this framework could explore how clutch performance profiles connect to deeper player characteristics — including biomechanical markers, mental resilience traits, and career-long trends.

### iv. Broader Impact

Integrating these dimensions could advance how teams evaluate players, bridging the gap between performance analytics and qualitative assessment. As organizations push beyond surface stats, quantifying clutch behavior may help unite analytics and intangibles — two areas long treated as a mutually exclusive pairing.

## BIBLIOGRAPHY

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