

MLB Qualifying Offer Analysis: Inspired by 2025 Trent Grisham

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To begin, I would like to acknowledge I have no problem with Trent Grisham. I would say indifferent is the strongest word I would use. My friend however does not feel this way. As a Yankees fan he was dissapointed Grisham was offered the qualifying offer (QO), and irate that he accepted it. His passion peaked my interest, as I was not sure if there was a fair way to judge a team for their judgement on when to offer this special deal. It has only existed since 2012, (history here: <https://www.mlb.com/news/history-of-mlb-qualifying-offer-decisions-c300602464>) and the book is not out on how to proceed perfectly for both player and front office. In fact, 2025 marked the most ever acceptances in one season. My question is, did the Yankees make a mistake, or can my friend feel better about this front office decision?

Project Topics

1. History of qualifying offer summary
2. Summary of year-to-year performance changed based on QO decision (including charts)
3. Accept or Reject QO prediction model (Is Grisham expected to accept, and why)
4. QO offered player performance by team
5. Team player retention based on QO
6. Grisham stat comparison to other hitters who accepted the QO

Data

- Qualifying Offer data: Sourced from MLB.com article (Linked above)
- Player performance statistics: Baseball Savant data (<https://baseballsavant.mlb.com/>)
- Player IDs: <https://www.smartfantasybaseball.com/tools/>

Data Dictionary

Qualifying Offer Dataset

Column	Description
Player	Player name
Year	Season in which the Qualifying Offer was made

Column	Description
Team1	Team that extended the Qualifying Offer
Team2	Team the player signed with if they rejected and left (NaN if stayed)
Decision	Player decision on the QO (Accepted , Rejected and Stayed , Rejected and Left)
Offer	Dollar value of the Qualifying Offer
Name_Clean	Cleaned player name used for merging datasets
MLBID	Unique MLB player identifier

Player Performance Statistics

Column	Description
home_run	Home runs hit during the season
k_percent	Strikeout percentage
bb_percent	Walk percentage
on_base_plus_slg	On-base plus slugging percentage (OPS)
woba	Weighted On-Base Average
xwoba	Expected Weighted On-Base Average
home_run_next_year	Home runs in the season following the QO
k_percent_next_year	Strikeout percentage in the following season
bb_percent_next_year	Walk percentage in the following season
on_base_plus_slg_next_year	OPS in the following season
woba_next_year	wOBA in the following season
xwoba_next_year	xwOBA in the following season

Derived Features

Column	Description
delta_home_run	Change in home runs from QO year to next season
delta_k_percent	Change in strikeout rate
delta_bb_percent	Change in walk rate
delta_on_base_plus_slg	Change in OPS
delta_woba	Change in wOBA

Column	Description
delta_xwoba	Change in xwOBA

Machine Learning Features

Column	Description
Offer_numeric	Numeric version of QO value used for modeling
Decision_binary	Binary target variable (1 = Accepted , 0 = Rejected)

```
In [163... import pandas as pd
qo = pd.read_csv("Qualifying Offers history.csv")
player_ids = pd.read_csv("SFBB Player ID Map - PLAYERIDMAP.csv")
hitter_stats = pd.read_csv("stats_hitters.csv")
pitcher_stats = pd.read_csv("stats_pitchers.csv")
```

```
In [164... qo["Name_Clean"] = qo["Player"]
player_ids["Name_Clean"] = player_ids["PLAYERNAME"]

if "MLBID" not in player_ids.columns:
    player_ids["MLBID"] = pd.NA

df_qo = qo.merge(player_ids[["Name_Clean", "MLBID"]], on="Name_Clean", how="left")
df_qo_next_year = df_qo.copy()
df_qo_next_year["Year"] = df_qo_next_year["Year"] + 1
```

```
In [165... hitter_stats["Position_Type"] = "Hitter"
pitcher_stats["Position_Type"] = "Pitcher"
all_stats = pd.concat([hitter_stats, pitcher_stats], ignore_index=True)
```

```
In [166... df_qo["MLBID"] = pd.to_numeric(df_qo["MLBID"], errors="coerce")
df_qo["Year"] = pd.to_numeric(df_qo["Year"], errors="coerce")
df_qo_next_year["MLBID"] = pd.to_numeric(df_qo_next_year["MLBID"], errors="coerce")
df_qo_next_year["Year"] = pd.to_numeric(df_qo_next_year["Year"], errors="coerce")
all_stats["player_id"] = pd.to_numeric(all_stats["player_id"], errors="coerce")
all_stats["year"] = pd.to_numeric(all_stats["year"], errors="coerce")
```

```
In [167... stat_cols = ["home_run", "k_percent", "bb_percent", "on_base_plus_slg", "woba", "xw"]

df_qo_stats = df_qo.merge(
    all_stats,
    left_on=["MLBID", "Year"],
    right_on=["player_id", "year"],
    how="left"
)
df_qo_next_stats = df_qo_next_year.merge(
    all_stats,
    left_on=["MLBID", "Year"],
    right_on=["player_id", "year"],
    how="left"
)
```

```
In [168... df_qo_next_stats_aligned = df_qo_next_stats.copy()
df_qo_next_stats_aligned["Year"] = df_qo_next_stats_aligned["Year"] - 1

next_year_stats = (
    df_qo_next_stats_aligned[
        ["MLBID", "Year"] + stat_cols
    ]
    .rename(columns={col: f"{col}_next_year" for col in stat_cols})
)
```

```
In [169... df_qo_combined = df_qo_stats.merge(
    next_year_stats,
    on=["MLBID", "Year"],
    how="left"
)
```

```
In [170... qo_final = df_qo_combined.copy()

qo_final = qo_final[
    (qo_final["Year"] >= 2015) &
    (qo_final["Year"] <= 2024)
]

for col in stat_cols + [f"{col}_next_year" for col in stat_cols]:
    qo_final[col] = qo_final.apply(
        lambda row: -row[col] if row["Position_Type"] == "Pitcher" else row[col],
        axis=1
    )
```

```
In [171... delta_cols = {}

for col in stat_cols:
    delta_name = f"delta_{col}"
    qo_final[delta_name] = qo_final[f"{col}_next_year"] - qo_final[col]
    delta_cols[col] = delta_name
```

```
In [172... df_delta = qo_final.dropna(subset=[f"{col}_next_year" for col in stat_cols])
```

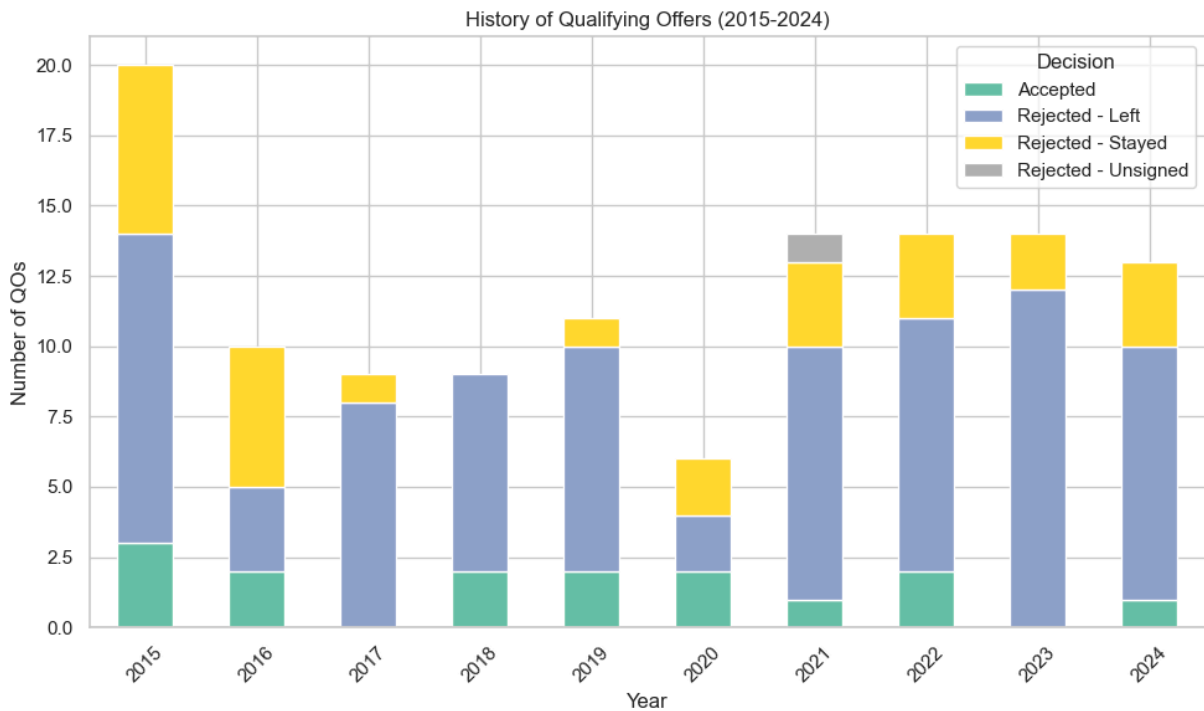
In [173...

```
import matplotlib.pyplot as plt

qo_history = qo_final.groupby(["Year", "Decision"]).size().unstack(fill_value=0)

qo_history.plot(kind="bar", stacked=True, figsize=(10,6), colormap="Set2")

plt.title("History of Qualifying Offers (2015-2024)")
plt.xlabel("Year")
plt.ylabel("Number of QOs")
plt.xticks(rotation=45)
plt.legend(title="Decision")
plt.tight_layout()
plt.show()
```



In [174...

```
summary = (
    df_delta
    .groupby("Decision")[[f"delta_{col}" for col in stat_cols]]
    .agg(["mean", "median", "count"])
    .round(4)
)
print(summary)
```

	delta_home_run			delta_k_percent		
	mean	median	count	mean	median	count
Decision						
Accepted	-5.7500	-9.5	12	1.7833	1.75	12
Rejected - Left	-2.3733	-1.0	75	1.7573	1.30	75
Rejected - Stayed	-4.5833	-2.5	24	1.0583	0.80	24

	delta_bb_percent			delta_on_base_plus_slg
	mean	median	count	mean
Decision				
Accepted	0.6250	0.15	12	-0.1202
Rejected - Left	-0.4253	-0.60	75	-0.0644
Rejected - Stayed	0.1833	0.00	24	-0.0636

	delta_woba		delta_xwoba	
	median	count	mean	median
Decision				
Accepted	-0.1045	12	-0.0444	-0.0400
Rejected - Left	-0.0370	75	-0.0233	-0.0150
Rejected - Stayed	-0.0765	24	-0.0256	-0.0315

	count
Decision	
Accepted	12
Rejected - Left	75
Rejected - Stayed	24

In [175...

```
import matplotlib.pyplot as plt
import seaborn as sns
import math

sns.set(style="whitegrid")

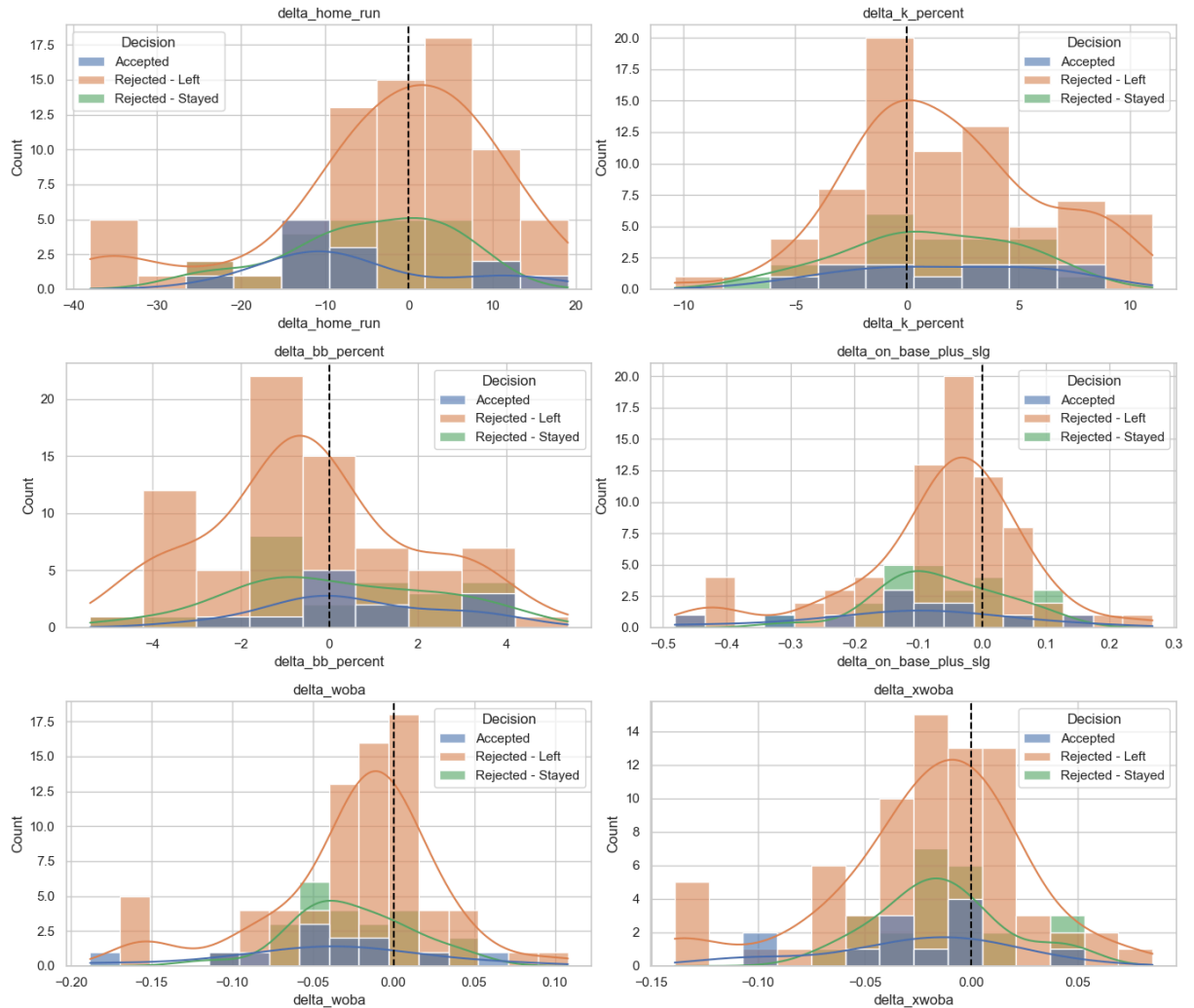
delta_cols = [f"delta_{col}" for col in stat_cols]
n_cols = 2
n_rows = math.ceil(len(delta_cols) / n_cols)

fig, axes = plt.subplots(n_rows, n_cols, figsize=(14, 4*n_rows))
axes = axes.flatten()

for ax, col in zip(axes, delta_cols):
    sns.histplot(
        data=df_delta,
        x=col,
        hue="Decision",
        kde=True,
        ax=ax,
        alpha=0.6
    )
    ax.axvline(0, color="black", linestyle="--")
    ax.set_title(col)

for ax in axes[len(delta_cols):]:
    ax.remove()
```

```
plt.tight_layout()
plt.show()
```



In [176...

#Predicts accept or reject

```
from sklearn.model_selection import train_test_split
from sklearn.ensemble import RandomForestClassifier
from sklearn.metrics import classification_report, confusion_matrix
import numpy as np

df_delta["Offer_numeric"] = (
    df_delta["Offer"]
    .replace(['\$', ','], '', regex=True)
    .astype(float)
)

feature_cols = stat_cols + ["Offer_numeric"]

X = df_delta[feature_cols].fillna(0)
y = df_delta["Decision"].apply(lambda x: 1 if x=="Accepted" else 0)

X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)
rf = RandomForestClassifier(n_estimators=200, random_state=42)
rf.fit(X_train, y_train)
```

```
y_pred = rf.predict(X_test)
print(confusion_matrix(y_test, y_pred))
print(classification_report(y_test, y_pred))
```

```
<>:10: SyntaxWarning: invalid escape sequence '\$'
<>:10: SyntaxWarning: invalid escape sequence '\$'
C:\Users\slleh\AppData\Local\Temp\ipykernel_9596\4104537297.py:10: SyntaxWarning: in
valid escape sequence '\$'
    .replace('[\$,]', '', regex=True)
C:\Users\slleh\AppData\Local\Temp\ipykernel_9596\4104537297.py:8: SettingWithCopyWar
ning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/u
ser_guide/indexing.html#returning-a-view-versus-a-copy
    df_delta["Offer_numeric"] = (
```

```
[[21  1]
 [ 1  0]]

              precision    recall  f1-score   support

         0       0.95        0.95        0.95         22
         1       0.00        0.00        0.00          1

   accuracy                0.91         23
  macro avg       0.48        0.48        0.48         23
 weighted avg       0.91        0.91        0.91         23
```

In [177... *#Would Trent Grisham accept*

```
player_row = pd.DataFrame([{
    "home_run": 34,
    "k_percent": 23.6,
    "bb_percent": 14.1,
    "on_base_plus_slg": 0.812,
    "woba": 0.353,
    "xwoba": 0.366,
    "Offer_numeric": 22025000
}])

player_row = player_row[feature_cols]

prediction = rf.predict(player_row)[0]
prob_accept = rf.predict_proba(player_row)[0][1]

print("Predicted Decision:", "Accepted" if prediction == 1 else "Rejected")
print(f"Probability of Accepting: {prob_accept:.2%}")
```

Predicted Decision: Rejected
Probability of Accepting: 4.00%

In [178... *#The model thought his stats were to good to accept and that he could find a better*

```
accepted = df_delta[df_delta["Decision"] == "Accepted"]
rejected = df_delta[df_delta["Decision"] == "Rejected"]
```



```

for stat in ["woba", "xwoba", "on_base_plus_slg"]:
    accepted_pct = (accepted[stat] < player_row[stat].iloc[0]).mean()

    print(f"{stat.upper()}:")
    print(f"    Percentile among Accepted: {accepted_pct:.1%}")

```

WOBA:

Percentile among Accepted: 76.9%

XWOBA:

Percentile among Accepted: 84.6%

ON_BASE_PLUS_SLG:

Percentile among Accepted: 61.5%

In [179...

```
# Player stat changes year after Q0 by team
```

```

team_summary = (
    df_delta.groupby("Team1")
    .agg({
        "delta_woba": "mean",
        "delta_on_base_plus_slg": "mean",
        "Decision": "count"
    })
    .rename(columns={"Decision": "Num_Q0"})
    .sort_values("delta_woba")
)
print(team_summary)

```

	delta_woba	delta_on_base_plus_slg	Num_Q0
Team1			
Angels	-0.068444	-0.194889	9
Reds	-0.057333	-0.150000	3
Twins	-0.056500	-0.150500	2
Yankees	-0.055750	-0.142750	4
Giants	-0.047714	-0.133714	7
Dodgers	-0.045182	-0.111364	11
Mariners	-0.041000	-0.103000	1
Rays	-0.041000	-0.105000	1
Orioles	-0.040333	-0.106000	6
Rangers	-0.035333	-0.098000	3
Rockies	-0.032000	-0.068500	2
Royals	-0.029750	-0.083000	4
Diamondbacks	-0.026500	-0.073000	2
Phillies	-0.022000	-0.055000	3
Blue Jays	-0.021667	-0.051833	6
Brewers	-0.021000	-0.054000	1
Cleveland	-0.017000	-0.052000	1
Red Sox	-0.016600	-0.048200	5
Astros	-0.014500	-0.039833	7
Nationals	-0.006000	-0.024750	4
Cubs	-0.005667	-0.008333	6
Braves	-0.003000	-0.018250	4
Mets	0.004000	0.011700	12
Padres	0.006750	0.012250	4
Cardinals	0.009250	0.024250	4
White Sox	0.047000	0.104500	2

In [180...

```
# team retention

team_retention = (
    df_delta
    .groupby("Team1")["Decision"]
    .value_counts(normalize=True)
    .rename("Rate")
    .reset_index()
)

team_retention_pivot = team_retention.pivot(
    index="Team1",
    columns="Decision",
    values="Rate"
).fillna(0)

team_retention_pivot["Accept_Rate"] = team_retention_pivot.get("Accepted", 0)
team_retention_pivot["Reject_Rate"] = team_retention_pivot.get("Rejected", 0)

team_retention_pivot = team_retention_pivot.sort_values("Accept_Rate")

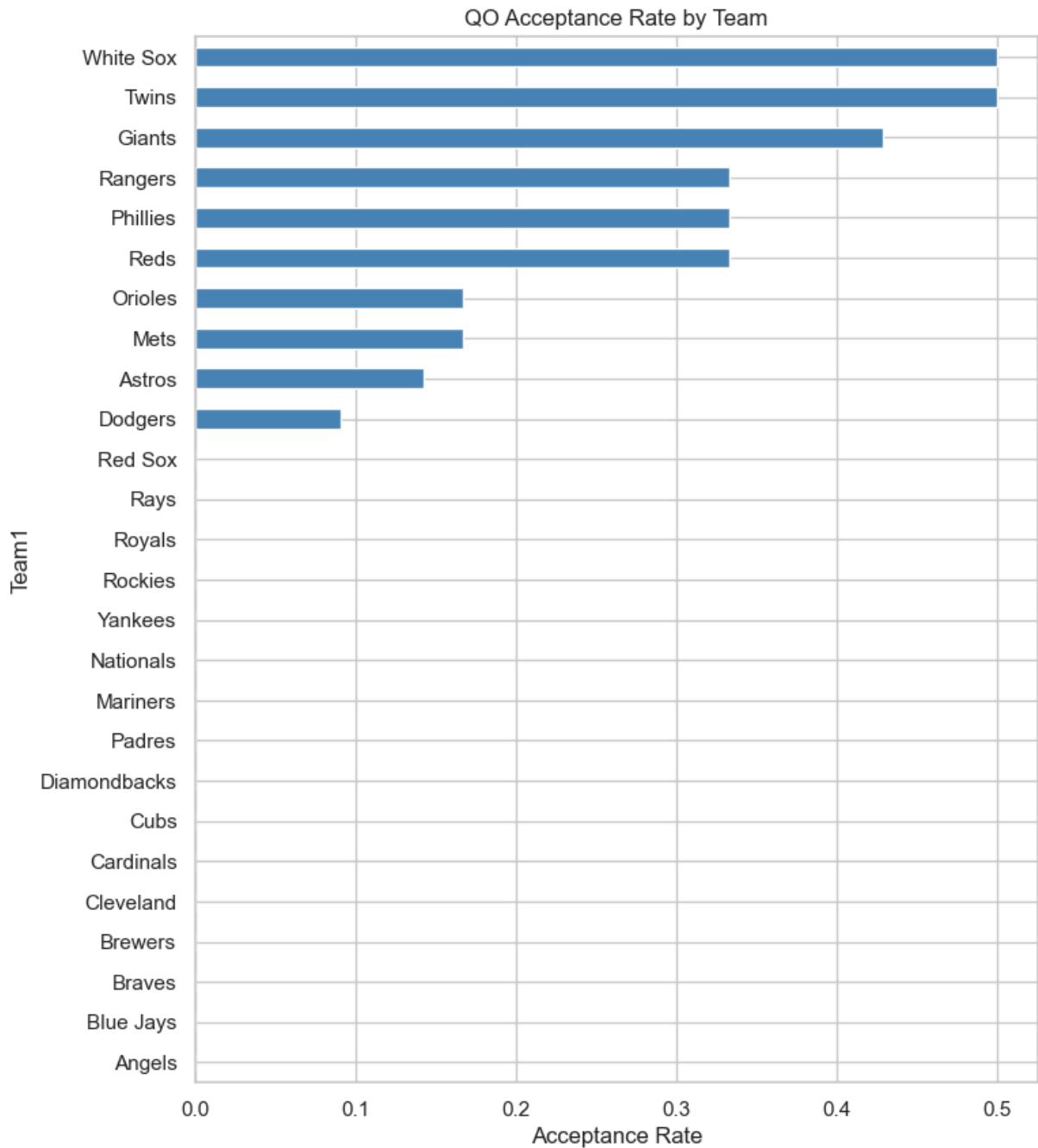
print(team_retention_pivot)
```

Decision	Accepted	Rejected - Left	Rejected - Stayed	Accept_Rate \
Team1				
Angels	0.000000	0.888889	0.111111	0.000000
Blue Jays	0.000000	0.666667	0.333333	0.000000
Braves	0.000000	1.000000	0.000000	0.000000
Brewers	0.000000	1.000000	0.000000	0.000000
Cleveland	0.000000	1.000000	0.000000	0.000000
Cardinals	0.000000	1.000000	0.000000	0.000000
Cubs	0.000000	0.666667	0.333333	0.000000
Diamondbacks	0.000000	1.000000	0.000000	0.000000
Padres	0.000000	1.000000	0.000000	0.000000
Mariners	0.000000	0.000000	1.000000	0.000000
Nationals	0.000000	1.000000	0.000000	0.000000
Yankees	0.000000	0.250000	0.750000	0.000000
Rockies	0.000000	1.000000	0.000000	0.000000
Royals	0.000000	0.500000	0.500000	0.000000
Rays	0.000000	1.000000	0.000000	0.000000
Red Sox	0.000000	1.000000	0.000000	0.000000
Dodgers	0.090909	0.454545	0.454545	0.090909
Astros	0.142857	0.714286	0.142857	0.142857
Mets	0.166667	0.500000	0.333333	0.166667
Orioles	0.166667	0.500000	0.333333	0.166667
Reds	0.333333	0.666667	0.000000	0.333333
Phillies	0.333333	0.000000	0.666667	0.333333
Rangers	0.333333	0.666667	0.000000	0.333333
Giants	0.428571	0.571429	0.000000	0.428571
Twins	0.500000	0.500000	0.000000	0.500000
White Sox	0.500000	0.500000	0.000000	0.500000

Decision	Reject_Rate
Team1	
Angels	0
Blue Jays	0
Braves	0
Brewers	0
Cleveland	0
Cardinals	0
Cubs	0
Diamondbacks	0
Padres	0
Mariners	0
Nationals	0
Yankees	0
Rockies	0
Royals	0
Rays	0
Red Sox	0
Dodgers	0
Astros	0
Mets	0
Orioles	0
Reds	0
Phillies	0
Rangers	0
Giants	0

Twins 0
White Sox 0

```
In [181...] team_retention_pivot["Accept_Rate"].plot(  
    kind="barh", figsize=(8,10), color="steelblue"  
)  
  
plt.title("QO Acceptance Rate by Team")  
plt.xlabel("Acceptance Rate")  
plt.show()
```



```
In [182...] qo_accepted_hitters = qo_final[  
    (qo_final["Position_Type"] == "Hitter") &  
    (qo_final["Decision"] == "Accepted")  
].copy()
```

In [183...

```
rank_stats = [
    "woba",
    "xwoba",
    "on_base_plus_slg",
    "k_percent"
]

rank_results = {}

player_row = pd.DataFrame([
    "home_run": 34,
    "k_percent": 23.6,
    "bb_percent": 14.1,
    "on_base_plus_slg": 0.812,
    "woba": 0.353,
    "xwoba": 0.366
])

for stat in rank_stats:
    if stat == "k_percent":
        rank = (qo_accepted_hitters[stat] > player_row[stat].iloc[0]).mean()
    else:
        rank = (qo_accepted_hitters[stat] < player_row[stat].iloc[0]).mean()

    rank_results[stat] = rank

for stat, pct in rank_results.items():
    print(f"{stat}: {pct:.1%} percentile among Q0 acceptances")
```

woba: 66.7% percentile among Q0 acceptances

xwoba: 83.3% percentile among Q0 acceptances

on_base_plus_slg: 33.3% percentile among Q0 acceptances

k_percent: 50.0% percentile among Q0 acceptances

In [184...

```
stats = [
    "home_run",
    "k_percent",
    "bb_percent",
    "on_base_plus_slg",
    "woba",
    "xwoba"
]

stat_names = {
    "home_run": "Home Runs",
    "k_percent": "Strikeout Rate (%)",
    "bb_percent": "Walk Rate (%)",
    "on_base_plus_slg": "OPS",
    "woba": "wOBA",
    "xwoba": "xwOBA"
}

player_name = "Trent Grisham (2025)"

n_stats = len(stats)
n_cols = 3
```

```

n_rows = (n_stats + n_cols - 1) // n_cols

fig, axes = plt.subplots(n_rows, n_cols, figsize=(5*n_cols, 4*n_rows))
axes = axes.flatten()

for ax, stat in zip(axes, stats):
    qo_accepted_hitters[stat].dropna().hist(
        bins=20, alpha=0.7, ax=ax
    )
    ax.axvline(
        player_row[stat].iloc[0],
        linestyle="--",
        linewidth=3,
        color="green",
        label=player_name
    )
    ax.set_title(f"{stat_names[stat]} among Hitters Who Accepted the QO")
    ax.set_xlabel(stat_names[stat])
    ax.set_ylabel("Count")
    ax.legend()

for ax in axes[n_stats:]:
    ax.remove()

plt.tight_layout()
plt.show()

```

