Pay to Play?
An Analysis Between Team Payroll vs. Performance

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INTRODUCTION

This study sought to understand the relationship between team payroll and performance, focusing on Major League Baseball (MLB) due to the sport not having a salary capacity
- This is crucial consideration for any financial manager or owner of the team when deciding contract management and budgeting and seeks to answer the question: How effective is the pay to play strategy?
  - There is a preconceived notion that more money translates to more wins
- This study analyzes the batting and pitching statistics to predict the payroll for the team, showing if they are under or overpaying for the on-field performance they are receiving

LITERATURE REVIEW

- During the regular season, there was a positive and statistically significant relationship between the two variables. Higher payroll spending is associated with an increase in regular season winning percentage (Shorin, 2017)

- Unequal distribution of salaries resulted from "star" players receiving significant portion of the payroll may discourage other players to put in effort – ultimately undermining the overall team performance (Lu et al., 2018)

- A rise in team payrolls increases the team's winning percentage, but only to a certain extent before decreasing winning percentage. The study also looked at the effect of winning percentage from increasing Pitcher and Hitter Salaries; increase in pitcher salary was more beneficial than increasing hitter salary (Lu et al., 2018)
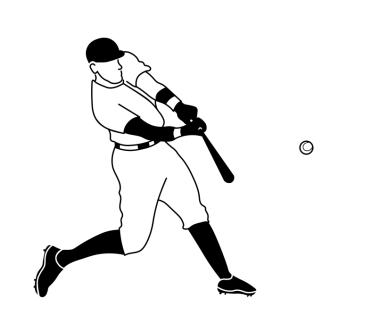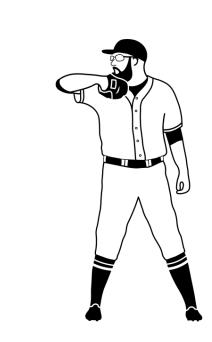
Table 1.
Descriptive Statistics for Analyzed Variables

	Minimum	Maximum	Mean	Std. Deviation
TeamPayroll	22,062,600	334,233,332	127,856,800.6	51,301,477.68
BatAge	25.4	32.8	28.262	1.0560
HR	95	307	182.86	39.863
R	513	947	717.82	78.909
OPS+	73	124	97.46	8.622
PAge	26.0	31.9	28.541	1.0959
ERA+	75	145	102.01	11.660
SO9	6.1	10.4	8.306	.8104
WP	26	98	58.42	13.099
Playoffs	0	1	.34	.476

METHOD

- Analysis of batting, pitching, and playoff stats for all 30 MLB teams for 10 seasons (2013-2023, excluding shortened 2020 season)
- Data gathered from Baseball Reference
- Hierarchical linear regression model made utilizing the three groups:
  - Batting stats (Batter age, HR, R, OPS+)
  - Pitching stats (Pitcher age, SO9, WP, ERA+)
  - Playoffs appearance (whether the team made the playoffs)
- Utilizing team payroll as dependent variable in model
- Second and final model run utilizing only significant variables

RESULTS

Table 2
Final Predictive Model

Variable	Coefficient	Coefficient t-statistics	Significance
(Constant)	-838962484	-10.434	< .001
BatAge	16662297.47	7.504	< .001
HR	239871.382	3.651	< .001
PAge	12889759.61	5.777	< .001
SO9	12759509.00	4.020	< .001
WP	-373693.141	-2.119	.035
		F-statistic	47.118
		Significance	< .001
		R^2	.445
		Adjusted R^2	.435

- Our model predicts that 44.5% of the variance in team payroll is explained by average batter age, number of homeruns, average pitcher age, strikeouts over nine innings, and number of wild pitches

- Payroll increases by $239,871 with every homerun and decreases by $373,6934 with every wild pitch

- Performance Factors: High home run totals (HR), high number of strikeouts (SO9), and less wild pitches (WP) further contribute to increased team payrolls

- Team Strategies: "Undervalued" teams could benefit from targeted veteran acquisitions to boost experience and potential performance. "Overvalued" teams may need to re-evaluate player contracts and consider different talent acquisition approaches

IMPLICATIONS

Table 3
Predicted vs. Actual Payroll (Overpaid)

Team	Average Payroll	Predicted Payroll	Amount Overpaid
Los Angeles Dodgers	$230,382,167	$166,648,835	$63,733,332
Boston Red Sox	$189,187,837	$146,512,778	$42,675,060
New York Yankees	$214,401,903	$177,671,150	$36,730,753
Philadelphia Phillies	$159,142,467	$126,199,629	$32,942,838
Los Angeles Angels	$162,617,123	$130,149,214	$32,467,909
Seattle Mariners	$163,854,140	$133,103,100	$30,751,040
Detroit Tigers	$140,466,232	$120,099,631	$20,366,601
Texas Rangers	$138,805,055	$122,934,109	$15,870,947
St. Louis Cardinals	$137,726,707	$124,367,360	$13,359,347
Chicago Cubs	$145,532,627	$135,069,392	$10,463,235
Colorado Rockies	$118,744,915	$110,417,621	$8,327,295
Chicago White Sox	$117,339,592	$109,587,190	$7,752,402
San Diego Padres	$125,519,185	$118,104,104	$7,415,081
New York Mets	$158,820,431	$152,190,926	$6,629,505
Atlanta Braves	$124,075,738	$117,627,355	$6,448,383
Washington Nationals	$144,751,802	$144,272,429	$479,373

- World Series Won:
  - Underpaying Teams: 4
  - Overpaying Teams: 6
- Playoff Series Wins Averages:
  - Underpaying Teams: 3.3
  - Overpaying Teams: 3.6

- MLB Implications: The strong link between team age and payroll warrants further analysis by the league. Understanding this dynamic can help MLB promote competitive balance and financial fairness across teams
- Since the postseason was recently expanded, the Playoffs predictor may become more significant in the future

Table 4
Predicted vs. Actual Payroll (Underpaid)

Team	Average Payroll	Predicted Payroll	Amount Underpaid
Oakland Athletics	$70,333,136	$121,532,548	$51,199,412
Tampa Bay Rays	$69,369,729	$119,291,385	$49,921,656
Milwaukee Brewers	$98,705,659	$136,194,939	$37,489,280
San Francisco Giants	$116,191,848	$150,889,953	$34,698,104
Cleveland Guardians	$87,834,018	$116,547,092	$28,713,074
Miami Marlins	$71,968,095	$99,902,097	$27,934,002
Pittsburgh Pirates	$73,142,425	$96,198,631	$23,056,205
Houston Astros	$116,707,587	$135,617,665	$18,910,078
Baltimore Orioles	$94,496,352	$107,897,127	$13,400,775
Arizona Diamondbacks	$99,159,100	$112,207,605	$13,048,505
Cincinnati Reds	$107,989,168	$120,288,550	$12,299,382
Minnesota Twins	$111,264,998	$120,985,717	$9,720,719
Toronto Blue Jays	$146,241,462	$154,958,400	$8,716,938
Kansas City Royals	$100,932,520	$108,236,961	$7,304,442