Does Air Travel Adversely Affect Team Performance in Major League Baseball?

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ABSTRACT

Previous studies of the effects of air travel on team performance in baseball focused on jet lag, namely, teams that traveled across at least two time zones between games. But baseball teams that travel extensively up and down either the West or East Coast do not cross one (let alone two) time zones. For the years between 2019 and 2022 (including the COVID-19 pandemic-shortened 2020 season), the authors relate the difference between a team's season-long winning percentage at home less its winning percentage on the road to the total regular season-long number of miles traveled for the 15 teams in each league. Save for a pair of teams in the American League in 2020, the authors find that there is no statistically discernible relationship between the number of miles traveled per season and the difference between home and away team win percentages.

Introduction

Most Major League Baseball (MLB) teams enjoy a home-field advantage. That is, the home team wins more games than the visiting team. The home team enjoys the support of their fans. The home team takes advantage of their own park's peculiarities (how to play the fences and the caroms in the corners) better than any visiting team can. And, of course, the home team players enjoy home cooking and other comforts of home.

When ballclubs take road trips, major league teams travel by a charter airplane that is typically owned by the team. Despite customized airplanes that are more comfortable than commercial flights and hotels chosen by their proximity to the stadium and other amenities, a team's away winning percentage is usually lower than their winning percentage at home.

Song, Severini and Allada [1] use twenty years of MLB data (1992 – 2011) and find that jet lag (the authors define as travel across at least two time zones) affects home teams and away teams differently. The authors distinguish eastward travel from westward travel, but one has to wonder how robust their results are for Pacific Coast teams (like those in Los Angeles and the San Francisco Bay Area) that only travel westward when they are returning home from away games in another time zone.

In this short research note, the authors examine how the difference between a team's home and away winning percentage is affected by the number of miles the team travels in a given season. Home- and away-team effects are not analyzed separately. A ballclub may not play well on the road, not because it traveled far, but because the ballclub does not play well either at home or on the road. Hence, our emphasis is on the *difference* between a team's home and away winning percentage. Finally, the metric of interest is miles traveled per season, not time zones crossed. For example, major league baseball teams up and down the West (or East) Coast may travel extensively on the road and yet never cross into another let alone two time zones.

The Data

The data on the number of miles traveled for each of the 30 major league baseball teams in each of four seasons (2019 through 2022) were collected from [2]. The 2020 MLB regular season was shortened from 162 games to only 60 games due to the COVID-19 pandemic. The shorter season resulted in reduced travel (an average of only about 7700 miles per team in 2020 compared to over 35000 miles per team the year before, as shown in Table 1). Teams that traveled the most during the three full seasons were almost exclusively Pacific Coast teams (in Seattle, San Francisco, and Oakland). Teams that traveled the least during these three full seasons were almost exclusively Central Division teams in their respective leagues, National or American (in Chicago, St. Louis, and Pittsburgh).

Data on home and away team winning percentages between 2019 and 2022 were collected from [3] and appear in Tables 2 through 5 for each team, each season. The difference between the home and away winning percentage was greater than zero for 25 of 30 teams in each of the three full seasons (and 23 of 30 teams in the pandemic-shortened 2020 season). In 2021 and 2022, only one team, the Oakland Athletics, recorded a winning percentage on the road that was equal to or higher than their winning percentage at home. And, perhaps not surprisingly, the Oakland A's in 2023 began a relocation application process with Major League Baseball [4].

Methodology

To assess the effect, if any, of miles traveled on the difference between a team's winning percentage at home less their winning percentage on the road, we ran simple bilinear regressions, one each for the 15 teams in the National League (NL) and American League (AL), in each of four seasons, 2019 through 2022. All regressions were of the following form:

$$(1) \qquad win\_percent\_difference_{i,t} = \beta_0 + \beta_1 \, miles\_traveled_{i,t} + \varepsilon_{i,t}$$

for each team *i* in year *t* where ε denotes the disturbance term. The dependent variable *win_percent_difference* is the difference between team *i*'s regular season home minus away winning percentage and *miles_traveled* (in thousands) represents the total number of miles team *i* traveled during the regular season.

If one considers less travel good for a team, then the sign on b_1 (the estimated slope coefficient for β_1) will be positive. That is, as the amount of travel for each team increases, the gap between winning at home and winning away should widen.

The decision to use as the dependent variable in our regressions a team's winning percentage differential (between home and away regular season games) rather than only a team's away winning percentage was simple. A team's low away winning percentage may be unrelated to the amount of travel because this team's winning percentage may also be dismal at home. What matters is how the amount of travel affects winning on the road vis-à-vis winning at home.

The Results

A look at the regression results presented in Table 6 shows that in most cases the number of miles traveled does not have any discernible effect on the home-away win percentage differential. In two instances there was a statistically discernible effect (National League 2019 and American League 2020), but in opposite directions. In both years, two observations in each regression heavily influenced the results.

A scatterplot of the 2019 results for NL teams shows that if only the observations on the Chicago Cubs and the San Francisco Giants are excluded from the regression, the estimated slope coefficient on miles traveled is no longer significant ($p = 0.134$). The San Francisco Giants in 2019 traveled more miles than any other NL team that season.

Yet, as seen in Table 2, the Giants surprisingly enjoyed a much higher winning percentage on the road than at home. The Chicago Cubs in 2019 traveled fewer miles than any other NL team. Yet, as seen in Table 2, the Cubs surprisingly fared very poorly on the road relative to their performance that season at home.

A scatterplot of the 2020 results for AL teams shows that if the observations on the Houston Astros and the Texas Rangers are excluded from the AL regression, the estimated slope coefficient on miles traveled is no longer significant ($p = 0.280$). The two Texas teams logged more miles than all but one other AL team during the pandemic-shortened season. Yet, as seen in Table 3, they paid the price by winning a much smaller percentage of games on the road than they did at home.

In summary, save for a few specific teams in 2019 and 2020, the amount of travel did not adversely affect team performance in Major League Baseball.

Concluding Remarks

An analysis of the relationship between the amount of travel and the performance of MLB teams at home vis-à-vis their performance on the road shows that most teams most of the time are not adversely affected by miles traveled. Two teams in Texas (the Rangers in Arlington and the Astros in Houston) during the pandemic-shortened 2020 60-game season were, however, adversely affected as measured by the difference between their winning percentage at home and their much smaller winning percentage on the road.

Despite the surprisingly large number of baseball teams spanning four recent seasons (2019 – 2022) that adjusted quite well to the amount of travel, future research might examine the relationship between miles traveled and some of the metrics commonly used to explain winning. For examples, one could regress the difference between home and away team (i) slugging percentage (a common measure of the effectiveness of hitting, that is, the total number of bases divided by the number of team at-bats), (ii) earned run average (a common measure of pitching effectiveness, that is, the number of earned runs allowed divided by the number of innings pitched), and (iii) fielding percentage (a common measure of team defense, that is, the percentage of time defensive players properly handle a batted or thrown ball).

Finally, one could fine-tune the metric of season-long miles traveled for a regression model that relates wins and losses to miles traveled before each regular season game. After all, home games are occasionally played soon after an exhausting, long road trip. Hence the assumption that teams will invariably be more rested and thus more successful at home than away may not always be warranted.

References

1. A. Song, T. Severini, and R. Allada, "Jet Lag Impairs Major League Baseball Performance," *Proceedings of the National Academy of Sciences*, February 7, 2017, Vol. 114, No. 6, pp. 1407-1412.
2. *Baseball Savant* at https://baseballsavant.mlb.com/visuals/map for 2019 through 2022.
3. *TeamRankings* at https://www.teamrankings.com/mlb/trend/win_trends/is_home and https://www.teamrankings.com/mlb/trend/win_trends/is_home?sc=is_away for 2019 through 2022.
4. A. Gonzalez, "Athletics Have Begun Las Vegas Relocation Process, Rob Manfred Says," ESPN, July 11, 2023 at https://www.espn.com/mlb/story/_/id/37995930/athletics-begun-las-vegas-relocation-process-rob-manfred-says.

Table 1. Miles Traveled for MLB Teams, 2019 – 2022, by League

Year	Average	STD*	Min	Max
2019				
Both leagues	35276	6746	27673	52792
National League	33429	4797	27673 (Chicago Cubs)	41922 (SF Giants)
American League	37123	7997	27801 (Chicago White Sox)	52792 (Oakland A's)
2020				
Both leagues	7701	3295	3931	14707
National League	6798	2435	3962 (Milwaukee Brewers)	11332 (Colorado Rockies)
American League	8603	3850	39311 (Baltimore Orioles)	14707 (Texas Rangers)
2021				
Both leagues	32714	6669	23822	47459
National League	31912	5929	24407 (St. Louis Cardinals)	42001 (SF Giants)
American League	33516	7456	23822 (Chicago White Sox)	47459 (Seattle Mariners)
2022				
Both leagues	33331	5475	25306	46386
National League	31995	4700	25306 (Pittsburgh Pirates)	38852 (Miami Marlins)
American League	34668	6014	27734 (Baltimore Orioles)	46386 (Seattle Mariners)

*Standard deviation

Table 2. Miles Traveled and Winning Percentages, by Team, in Major League Baseball, 2019

Team	*League*	*Miles traveled*	*Winning Percentages*	
			Home	*Away*
Arizona Diamondbacks	NL	35207	.543	.506
Atlanta Braves	NL	34311	.607	.578
Baltimore Orioles	AL	29223	.309	.358
Boston Red Sox	AL	39140	.481	.568
Chicago Cubs	NL	27673	.630	.400
Chicago White Sox	AL	27801	.488	.407
Cincinnati Reds	NL	29270	.506	.420
Cleveland Indians	AL	29168	.605	.543
Colorado Rockies	NL	29918	.531	.346
Detroit Tigers	AL	28476	.272	.317
Houston Astros	AL	37724	.714	.575
Kansas City Royals	AL	31602	.375	.346
Los Angeles Angels	AL	45875	.481	.420
Los Angeles Dodgers	NL	37587	.714	.578
Miami Marlins	NL	39782	.370	.333
Milwaukee Brewers	NL	28851	.605	.488
Minnesota Twins	AL	30365	.561	.663
New York Mets	NL	33776	.593	.469
New York Yankees	AL	37587	.698	.554
Oakland Athletics	AL	52792	.650	.556
Philadelphia Phillies	NL	29255	.556	.444
Pittsburgh Pirates	NL	31910	.438	.420
San Diego Padres	NL	41391	.444	.420
Seattle Mariners	AL	50346	.432	.392
San Francisco Giants	NL	41922	.432	.519
St. Louis Cardinals	NL	29360	.600	.500
Tampa Bay Rays	AL	42374	.602	.577
Texas Rangers	AL	38328	.556	.407
Toronto Blue Jays	AL	36050	.432	.395
Washington Nationals	NL	31217	.607	.567

Sources: Miles traveled at https://baseballsavant.mlb.com/visuals/map?team=&year=2019; Home and away winning percentages, respectively, at https://www.teamrankings.com/mlb/trend/win_trends/is_home?range=yearly_mlb_2019 and https://www.teamrankings.com/mlb/trend/win_trends/is_home?range=yearly_mlb_2019&sc=is_away.

Table 3. Miles Traveled and Winning Percentages, by Team, in Major League Baseball, 2020

Team	*League*	*Miles traveled*	*Winning Percentages*	
			Home	*Away*
Arizona Diamondbacks	NL	9110	.533	.300
Atlanta Braves	NL	7297	.656	.533
Baltimore Orioles	AL	3931	.433	.414
Boston Red Sox	AL	7405	.333	.448
Chicago Cubs	NL	4042	.531	.556
Chicago White Sox	AL	4750	.600	.546
Cincinnati Reds	NL	4626	.552	.469
Cleveland Indians	AL	5213	.563	.567
Colorado Rockies	NL	11332	.400	.467
Detroit Tigers	AL	4285	.444	.367
Houston Astros	AL	13954	.714	.344
Kansas City Royals	AL	6726	.500	.367
Los Angeles Angels	AL	10458	.500	.345
Los Angeles Dodgers	NL	10291	.719	.733
Miami Marlins	NL	8799	.483	.563
Milwaukee Brewers	NL	3962	.500	.419
Minnesota Twins	AL	5999	.719	.414
New York Mets	NL	5322	.414	.433
New York Yankees	AL	5396	.700	.452
Oakland Athletics	AL	12458	.697	.500
Philadelphia Phillies	NL	5375	.567	.345
Pittsburgh Pirates	NL	5693	.400	.214
San Diego Padres	NL	7668	.656	.556
Seattle Mariners	AL	14012	.583	.367
San Francisco Giants	NL	9000	.567	.370
St. Louis Cardinals	NL	4132	.520	.516
Tampa Bay Rays	AL	10866	.710	.633
Texas Rangers	AL	14707	.533	.200
Toronto Blue Jays	AL	8881	.654	.469
Washington Nationals	NL	5326	.433	.407

Sources: Miles traveled at https://baseballsavant.mlb.com/visuals/map?team=&year=2020; Home and away winning percentages, respectively, at https://www.teamrankings.com/mlb/trend/win_trends/is_home?range=yearly_mlb_2020 and https://www.teamrankings.com/mlb/trend/win_trends/is_home?range=yearly_mlb_2020&sc=is_away.

Table 4. Miles Traveled and Winning Percentages, by Team, in Major League Baseball, 2021

Team	*League*	*Miles traveled*	*Winning Percentages*	
			Home	*Away*
Arizona Diamondbacks	NL	36359	.395	.247
Atlanta Braves	NL	31704	.557	.562
Baltimore Orioles	AL	26974	.333	.309
Boston Red Sox	AL	33529	.609	.523
Chicago Cubs	NL	25070	.482	.395
Chicago White Sox	AL	23822	.646	.482
Cincinnati Reds	NL	26191	.543	.482
Cleveland Indians	AL	25702	.488	.494
Colorado Rockies	NL	34566	.593	.325
Detroit Tigers	AL	25196	.519	.432
Houston Astros	AL	38464	.629	.539
Kansas City Royals	AL	28633	.482	.432
Los Angeles Angels	AL	42389	.482	.475
Los Angeles Dodgers	NL	37001	.713	.575
Miami Marlins	NL	39878	.519	.309
Milwaukee Brewers	NL	24835	.554	.602
Minnesota Twins	AL	32339	.469	.432
New York Mets	NL	28667	.580	.370
New York Yankees	AL	29043	.568	.568
Oakland Athletics	AL	44805	.531	.531
Philadelphia Phillies	NL	28313	.580	.432
Pittsburgh Pirates	NL	28517	.457	.296
San Diego Padres	NL	39203	.556	.420
Seattle Mariners	AL	47459	.568	.543
San Francisco Giants	NL	42001	.655	.651
St. Louis Cardinals	NL	24407	.556	.549
Tampa Bay Rays	AL	36701	.639	.578
Texas Rangers	AL	37757	.444	.296
Toronto Blue Jays	AL	29925	.580	.543
Washington Nationals	NL	31969	.432	.370

Sources: Miles traveled at https://baseballsavant.mlb.com/visuals/map?team=&year=2021 ; Home and away winning percentages, respectively, at https://www.teamrankings.com/mlb/trend/win_trends/is_home?range=yearly_mlb_2021 and https://www.teamrankings.com/mlb/trend/win_trends/is_home?range=yearly_mlb_2021&sc=is_away.

Table 5. Miles Traveled and Winning Percentages, by Team, in Major League Baseball, 2022

Team	*League*	*Miles traveled*	*Winning Percentages*	
			Home	*Away*
Arizona Diamondbacks	NL	35924	.494	.420
Atlanta Braves	NL	30220	.675	.554
Baltimore Orioles	AL	27734	.550	.469
Boston Red Sox	AL	31572	.531	.438
Chicago Cubs	NL	26828	.457	.450
Chicago White Sox	AL	30135	.457	.543
Cincinnati Reds	NL	25574	.413	.358
Cleveland Guardians[a]	AL	28771	.577	.560
Colorado Rockies	NL	29708	.506	.333
Detroit Tigers	AL	34104	.439	.375
Houston Astros	AL	37977	.693	.644
Kansas City Royals	AL	28719	.482	.321
Los Angeles Angels	AL	44038	.494	.407
Los Angeles Dodgers	NL	36694	.699	.651
Miami Marlins	NL	38852	.420	.432
Milwaukee Brewers	NL	28557	.568	.494
Minnesota Twins	AL	31759	.568	.395
New York Mets	NL	34686	.655	.580
New York Yankees	AL	32755	.686	.506
Oakland Athletics	AL	42918	.363	.378
Philadelphia Phillies	NL	34313	.596	.500
Pittsburgh Pirates	NL	25306	.420	.346
San Diego Padres	NL	38460	.553	.539
Seattle Mariners	AL	46386	.561	.541
San Francisco Giants	NL	35027	.543	.457
St. Louis Cardinals	NL	26772	.639	.494
Tampa Bay Rays	AL	34320	.630	.422
Texas Rangers	AL	38945	.420	.420
Toronto Blue Jays	AL	29880	.566	.556
Washington Nationals	NL	32999	.321	.358

[a]At the end of the 2021 season, the Cleveland Indians changed their name to the Cleveland Guardians.
Sources: Miles traveled at https://baseballsavant.mlb.com/visuals/map?team=&year=2022; Home and away winning percentages, respectively, at https://www.teamrankings.com/mlb/trend/win_trends/is_home?range=yearly_mlb_2022 and https://www.teamrankings.com/mlb/trend/win_trends/is_home?range=yearly_mlb_2022&sc=is_away.

Table 6. Regression Results, 2019 – 2022, by League

Dependent variable: The difference between the team's home and away winning percentage

Year	Constant	Miles traveled	R^2
2019			
National League	0.439*	-0.011*	0.444
	(3.89)	(-3.22)	
American League	-0.079	0.003	0.100
	(-0.79)	(1.20)	
2020			
National League	0.093	-0.003	0.006
	(1.08)	(-0.28)	
American League	-0.022	0.020**	0.324
	(-0.29)	(2.50)	
2021			
National League	-0.047	0.005	0.097
	(-0.36)	(1.18)	
American League	0.104	-0.001	0.046
	(1.60)	(-0.79)	
2022			
National League	0.204	-0.004	0.126
	(2.01)	(-1.37)	
American League	0.168	-0.003	0.042
	(1.27)	(-0.75)	

*$p < 0.01$ **$p < 0.05$