Under the Bubble, Does Home Court Advantage Still Exist?

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Introduction

On March 11th, 2020, an NBA game that no one showed any interest in suddenly made it to the front-page headline of New York Times: “N.B.A. Suspends Season after Player Tests Positive for Coronavirus”. Shortly, three months after, NBA decided to resume the 2019-2020 season with all teams headed to Orlando Disneyland, “The Bubble”, which was designed as an isolation zone to protect players from the COVID-19 pandemic. The reason it was described as an isolation zone is that there were no fans allowed to enter the stadium, but the basketball court is surrounded by screens that cast virtual fans. As we know there are many factors that could affect the outcome of the game, but since all teams were competing within the same court, there were some factors that changed. As the players started to move in and play in The Bubble, they noticed the difference in the stands. Houston Rockets guards Eric Gordon said, “It's very different. The fans bring a different energy, which we don't have. ... You gotta make and create your own energy.” (Associated Press, 2020). What he mentioned is very similar to the so-called “home court advantage”. For instance, the home team wins approximately 58.57% of the time in the National Basketball Association (2010-2011 through the 2019-2020 seasons). Home court advantage is typically defined as the tendency of the home teams in sport competitions to win more than half of games played under a balanced home and away schedule (Courneya & Carron, 1991). Courneya and Carron point out these four aspects might be accounted for home court advantage: travel factor, rules factor, absolute crowd factor, and subjective decisions by the officials favor the home team. As if the games were held in the Bubble, there is no travel time for both home and away team; and the crowd effect on the referee doesn’t exist as well due to no spectator is in the stand. Rule factor is mainly applied to other sports than basketball, because there is no systematic unfairness with the rule of basketball for the home and away team.

So, for the purpose of this article, I want to find out when the game is located in the neutral court in the Orlando Bubble without any fans physically attending the game, how would that affect the outcome of the game compared to the game being held in their home stadium? In another word, does home court advantage still exist under the Orlando Bubble?

Data

The data for the study were accumulated during the course of the 2019-2020 National Basketball Association season, these data were directly downloaded from www.basketball-reference.com(Select Teams, and then select Schedule & Results). Specific data available are: the date of the game, home team, away team, opponent, and final score. For this study, only the 22 teams' data were collected because there were only 22 teams that were able to compete in the Bubble for the seeding games and playoffs. There also were three games during the regular season held overseas in a neutral court among the 22 teams, which was excluded from the data. In particular, all games held after March 11th, 2020, were located in the Orlando Bubble. Table 1 details the average home winning percentage, average points scored for 22 teams in their home court 2018-2019 season, 2019-2020 season, which was split to pre-Bubble and the Bubble period. In addition, this study also included the 2017-2018 through 2019-2020 season's playoffs' data, which was also directly downloaded from www.basketball-reference.com. From Table 1, there is a over 13% decrease on home team's winning percentage when the game is conducted in the Bubble compared to Pre-Bubble or previous season. Moreover, the away team average scores roughly 6 more points when compared to previous data. Is that difference significant, and is that difference purely caused by the Bubble?

Table 1.

Home Team Winning Percentage and Average Points Scored

	Total Games	Home Team Won	Home Team Lost	Winning Percentage	Home Average Points Scored	Away Average Points Scored
2018-2019	902	575	327	63.75%	113.28	108.96
Pre-Bubble	703	488	255	69.42%	114.15	109.40
Bubble	89	50	39	56.18%	116.87	115.24

Method

With the data obtained, the data are hypothesized to follow different linear regression models. For the base model, there are other variables that are correlated with the chance of winning and the independent variables. So, omitted variable bias exists in this model, but the purpose of this base model is to set a foundation for the following models, which will include other variables to minimize omitted variable bias.

The first method is an interrupted time-series approach, which identifies two key variables' effect on the outcome of the game. The two key variables are whether the game is held in the home court, and whether it is played in the Bubble. To address the hypothesis of this study, the first model is applied, which is to test what the probability of winning is within the 2019-2020 season for the home team; and when a restriction of prior to March 11th, 2019 is added, the result is home team's probability of winning prior to the Bubble period.

$$1.\ Prob(win)_i = \beta_0 + \beta_1(home)_i + u_i$$

The identifying assumption is that the probability of winning in games before March 11th, 2020, is higher than in the games played after March 11th, 2020. As the change of the game site was applied, any difference in the outcome variable winning percentage should be contributed by the Bubble itself. The probability of winning is the binary outcome variable on the independent

variable of whether or not the game is held in the Bubble. Where i represents the team, Bubble=1 if games were played in the Bubble, and win=1 if the team i wins. This will give us an estimate of the relationship between play in the Bubble and the chance of the probability winning the game.

$$2.\, Prob(win)_i = \beta_0 + \beta_1(Bubble)_i + u_i$$

For the next model, I want to find if playing in the Bubble would have an impact on the outcome of games. The interaction model below is designed to determine what the probability of winning is, whether it is the home team, whether it is played in the home court, and with an interaction term of home court and if played in the Bubble. The coefficient β_3 is what I will be focused on, because it represents the change in probability of winning for the home team played in the Bubble compared to the change in probability of winning for the away team played in the Bubble period.

$$3.\, Prob(win)_i = \beta_0 + \beta_1(Bubble)_i + \beta_2(home\ court)_i$$
$$+\beta_3(Bubble * home\ court)_i + u_i$$

The following model is designed to perform a falsification test for the Model 3. Does home court, the Bubble, and the interaction term would affect home margin (home final score minus away final score) the same way as to the probability of winning? The hypothesis is that there is no significant difference in home margin for the games held in the Bubble.

$$4.\, Home\ margin = \beta_0 + \beta_1(Bubble)_i + \beta_2(home\ court)_i$$
$$+\beta_3(Bubble * home\ court)_i + u_i$$

Last but not least, Model 5 is designed to test if there is a difference in home-court advantage for the games held after March 11th in the 2018-2019 season, which will be called Fake Bubble, and games prior to March 11^{th,} 2019. Where Fake Bubble =1 if the game was held

after March 11th, 2019 within the 2018-2019 season. The hypothesis is that there is a significant difference in home court advantage in the Fake Bubble.

$$5.\, Prob(win) = \beta_0 + \beta_1(fake\ bubble) + \beta_2(home\ court)$$
$$+\beta_3(fake\ bubble * home\ court) + u$$

The last model is designed to test if the home court advantage is different among different playoffs seasons, 2017-2018, 2018-2019, and 2019-2020 season, where 2019-2020 season's playoff is conducted within the Orlando Bubble. So, the hypothesis of this model is that there is a significant home court advantage in 2017-2018 and 2018-2019 season, but not as much or none home court advantage in the 2019-2020 season.

$$6.\, Prob(win)_{it} = \beta_0 + \beta_1(Bubble)_{it} + \beta_2(home\ court)_{it}$$
$$+\beta_3(Bubble * home\ court)_{it} + u_{it}$$

Results

Table 2.

Model Variables	(1) Win	(1.5) Win
Home	0.129***	0.130***
	[0.0246]	[0.0261]
Constant	0.500***	0.508***
	[0.0174]	[0.0184]
Observations	1,594	1,416
R-squared	0.017	0.017

Standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

Table 2 above showed Model 1 and when Model 1 is one the constraint of games prior to March 11th, 2020, which is called Model 1.5. As I look at the result, I can conclude that within the 2019-2020 season, the home team has a 62.9% chance of winning the games, statistically

significant at 99% level. Conclude that home court has a statistically significant impact on the outcome of the game. If we look at the last column, when the game is held in each home stadium, the probability of the home team winning the game is 63.8%, 1 percentage point higher than the 2019-2020 season in general.

Table 3.

Model	(2)	(3)
Variables	Win	Win
Bubble	-0.0720*	-0.0695
	[0.0394]	[0.0553]
Home		0.130***
		[0.0261]
HomeBubble		-0.00596
		[0.0782]
Constant	0.572***	0.508***
	[0.0132]	[0.0184]
Observations	1,594	1594
R-squared	0.002	0.019

Standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

Results for Model 2 suggests is that the team's winning percentage decrease by 7.2% when the game is held in the Bubble, significant at the 90% level. This model included all factors that affects the outcome of the game under the Bubble circumstance. The coefficient of the constant means that the teams' chance of winning outside of the Bubble is 57.2%, and it is statistically significant at 99% level. With that being said, I can confirm that the home team does have a better chance at winning the game at their home court. Overall, Model 2 indicates that playing in the Bubble lower the chance of home team winning the game, which means home court advantage does not or partially exist in the Orlando Bubble.

For the interaction Model 3, the change in the winning probability for away team in the Bubble compared to the pre-Bubble decreased by approximately 7%, but it is statistically insignificant, which means there is no statistically difference between away teams' winning probability in the Bubble compared to pre-Bubble. The additional change in winning percentage for the home team in the Bubble compare to the change in winning percentage for the away team in the Bubble is -0.5%, with a p-value of 0.939, which means there is no statistically significant difference for the chance of winning for the home and away team in the Bubble.

Table 4.

Model	(4)
Variables	Home margin
Bubble	-1.434
	[1.529]
Home	4.987***
	[0.723]
HomeBubble	-1.638
	[2.163]
Constant	-0.240
	[0.509]
Observations	1,594
R-squared	0.033

Standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

Table 5.

Model	(5)
Variables	Win
Fake Bubble	0.0718*
	[0.0384]
Home	0.226***
	[0.0264]
HomeFakeBubble	-0.112**
	[0.0540]
Constant	0.421***
	[0.0186]
Observations	1,804
R-squared	0.042

Standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

Table 4 shows that there is -1.6 points home margin for games held in the Bubble, not statistically significant at all levels. Confirm the results of there not a significant difference for home team's winning percentage compared away team's winning percentage in the Bubble. And table 4 also shows that the home team has a 5 points margin in the pre-Bubble period. Under the Bubble circumstance, that advantage does not exist anymore.

Table 5 concluded the result of Model 5. The additional change in winning percentage for the home team compare to the change in winning percentage for the away team in the fake

Bubble is -11.2%, with a p-value of 0.039, which means home team is more likely to lose the game in the Fake Bubble period. The reason for that might vary, possibly is that most of the teams that we sampled from are the top teams in the league that have secured their spot in the playoffs, so for the purpose to let players rest well and avoid injuries during a unimportant regular season game, they tend to tank a couple of games at the end of a season. This phenomenon is normal in the NBA or other sports league. With that being said, the result from the last model is crucial to this study, because every team in the playoffs has one goal and one goal only, stay in the series as long as possible, until that get the Larry O'Brien Championship Trophy.

Table 6.

Model Variables	(6) Win
Bubble	0.170**
	[0.0712]
Home	0.269***
	[0.0653]
HomeBubble	-0.305***
	[0.100]
Constant	0.348***
	[0.0465]
Observations	393
R-squared	0.043

Standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

As shown in the table above, the winning probability for the home team prior the Bubble in a playoff game is 61.7%, significant at 99% level. The additional change in winning percentage for the home team in the Bubble compare to the change in winning percentage for the home team in the last two years of playoffs is -30.5%, with a p-value of 0.003, which is statistically significant at 99% level. Meaning that home team's winning probability is 30.5%

lower than the away team, with a 48.2% chance of winning every home game, which is lowest for the past ten years in NBA history, the second lowest is 56.1%(2014).

Conclusion

From the results of the regression I acquired, I conclude that there is a significant advantage for the home team to win the game when the game is held in their home stadium at both regular season and playoffs level, the results might be different for any specific period of a season, but in general the odds favor the home team when in its home court. When the game is held in the Bubble, the results show there is no statistical difference of winning probability for the home team and the away team. Moreover, the home team's winning probability is 30.5% lower than the away team in the playoffs. The pattern shown a home court disadvantage in the Orlando Bubble during playoffs. Home court advantage does not exist in the Bubble among the 22 teams that competed. As a matter of fact, there might be some reasons for these results. As I mentioned at the very beginning, there are four aspects that take consideration to the existence of home court advantage, as recent studies have examined the role of travel factor in the home-court advantage (Entine & Small, 2008), which have found "travel schedule does seem to be a real, although not dramatic factor contributing to the NBA's home team advantage"; audience influence on basketball officiating (Lehman & Reifman, 2001), which concluded that officials are influenced by crowd reaction, specifically officials reacting to pressure from the home crowd. And lastly, by conducting a natural experiment to determine the crowd effect upon home court advantage (Boudreaux, Sanders & Walia, 2017) concluded crowd effects are sizable in motivating a home team to win, raising the likelihood of such an event by between an estimated 21 and 22.8 percentage points. So, these factors were taken away under the Bubble situation, I would assume that when these factors combined, it would make an impact on the outcome of the

game, which we call Home Court Advantage. There are some limitations to this study. Because only 22 teams were able to compete in the Bubble, which were the top 11 teams of the western and eastern conference, it would be biased to apply the result I have to the league in general. But a follow-up study would be interesting to do, since the 2020-2021 season will be held at each home stadium, but without any fans. Does home court advantage still apply to that circumstance?

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