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Technical Fouls Effect on Momentum Change: Does the Season (Regular vs. Playoffs) Matter?

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Abstract: In a follow-up to Tenenbaum et al.'s (2024) study we explored differences in momentum shift between regular season and playoff matchups, considering home vs. away games and score at the time of the technical foul call (leading or trailing). Analyzing 4,196 cases of technical fouls (TFs) against coaches from 2000-2021 (3,950 in the regular season, 246 in playoffs), logistic regression revealed a significant ($p < .03$) season by location interaction showing that in the regular season, home games TFs resulted in a 44%-win rate versus 28% in away games. In the playoffs, this changed to 50% at home and 23% away. The findings provide insights and practical considerations for the TF-momentum shift phenomenon.

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Research Note: Technical Fouls Effect on Momentum Change: Does the Season (Regular vs. Playoffs) Matter?

Technical fouls (TFs) are frequently linked with penalizing inappropriate behavior, yet they carry significant implications and consequences for the progression of a game. Although TFs frequently occur during player confrontations on the court, they are also observable among coaches who exhibit disrespect towards game officials or breach the rules (Tenenbaum et al., 2023). Recently, Tenenbaum et al. (2024) elucidated the complexities of momentum-shifting processes within NBA games, exploring the strategic maneuvers employed by coaches to transform negative momentum into a positive trajectory. Our study uses Tenenbaum et al.'s NBA data to examine the differences between regular season matchups and playoff encounters, which were not addressed in Tenenbaum's study, considering factors such as home versus away games as well as examining how these dynamics unfold when a team is in a leading or trailing position. We note that while the regular season typically encompasses pre-planned and sometimes unexciting games involving all NBA teams, playoff contests feature 16 teams competing for the title within intensified pressure from spectators, and management. The intense excitement of the NBA playoffs often gives rise to the concept of "choking," (Morgulev & Galily, 2018).

The aim of this analysis is to elucidate the intricate process of momentum alteration during regular season and playoffs, particularly through the strategic deployment of TFs by coaches to redirect negative momentum toward a positive trajectory. This comprehensive analysis spans over two decades, from 2000 to 2021, enabling us to delve into the multifaceted relationship between TFs and momentum shifts. We evaluate these shifts using statistical performance metrics, differentiating between regular and playoff seasons, home and away matchups, and exploring how these dynamics manifest when a team is leading or trailing throughout the four quarters which constitute the entire game.

Coaches strategically use TFs to alter referees' perspectives and game momentum. While Gómez et al. covered TFs by bench personnel from 2010 to 2013, recent research by Tenenbaum et al. (2024) conducted a comprehensive analysis of 21 years of NBA games. The study analyzed TFs calls to coaches across three timeframes: immediate, short-term, and medium-term. The findings presented compelling evidence of the psychological momentum change phenomenon, along with associated psychosociological factors influencing the momentum shift. For example, the likelihood of

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transforming negative momentum (e.g., a disadvantage) into a positive one (e.g., winning) following a TF call decreases significantly from the first two quarters through the third to the fourth quarter. In other words, the sooner a coach is called a TF, the higher the chances for their team to shift momentum and win the game. Moreover, according to Tenenbaum et al. across locations and the game's four quarters, when a coach was called a TF while his team was in a leading position, the chances of winning the game significantly increased. In the current study, we use the same NBA pool of data used by Tenenbaum et al. to uncover whether their findings can be generalized across regular and playoff seasons.

Contrasting NBA Seasons: Regular and Playoff Dynamics

The NBA playoffs are comprised of several stages, including the first round, conference semifinals, conference finals, and NBA finals; all contested in a best-of-seven series format. In this context, home advantage assumes a significant role, with approximately 65% of games won by the home teams, impacting team strategies and performance (Morgado & Barreira, 2023).

Teramoto and Cross (2010) examined the relative importance of performance factors in winning NBA games over a decade, from the 1999-2000 to the 2008-2009 seasons. Their findings suggest that defense becomes more critical in the playoffs compared to the regular season, while shooting efficiency and turnovers remain significant in both contexts. Rebounding gains additional weight as the playoffs progress. Contrastingly, García et al. (2013) reported differences in performance indicators between regular season and playoff games. While winning teams dominated in assists, defensive rebounds, and successful 2 and 3-point field-goals in regular season games, their superiority was mainly evident in defensive rebounding in playoff games.

Taking into consideration Tenenbaum et al.'s (2024) findings on the effect of coaches' TFs calls on momentum shift during regular season, we expect a stronger effect of momentum shift during the playoffs. Specifically, we expect that the TFs calls will result in higher percentage of momentum shifts (e.g., winning followed by a TF call) at home than away games while leading than trailing, and toward the end of the game (e.g., quarters 3 and 4) than the earlier stages of the game (e.g., quarters 3 and 5).

Method

TFs Sampling

During the regular season of the NBA (before the playoffs), each team plays 82 games (41 at home and 41 away), totaling 1,230 games in a regular season. The average number of TFs per game during the season is 0.5, thus the estimated total technical fouls in a regular season are estimated around 615. During the playoff season, the number of games is smaller, and consequently the number of called TFs is smaller as well. Specifically, 8 teams with the highest winning record in each of the geographic regions/conferences (i.e., eastern or western) qualify for the playoffs. Each of the playoff series consists of the "best of seven games" method. In the current study, we analyzed the data of 4,196 cases, which were used in Tenenbaum et al.'s (2024) study, where TFs were called against coaches during the years 2000-2021 in the regular season. During 21 years of regular-season games, we identified 3950 cases in which a TF was committed by the coach, while in the playoff periods, we identified 246 such cases. The statistical data on TFs by coaches in NBA games were extracted from the NBA play-by-play box-score on the official NBA website using a custom Python program. The software identifies the coaches against whom a TF was called, their team, the home or away team, the season (regular or playoff), and the game status (e.g., advantage vs. disadvantage at TF commencement).

The study was approved by the university's Institutional Review Board (IRB). The IRB approval number for this study is P_2023011. **Transparency and openness**: We report how we determined our sample size, all manipulations, and all measures in the study. All data, analysis code, and research materials are available at https://osf.io/um4tx/

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Measures

Game Location: Playing at home stadium or at the away stadium of the opposing team.

Game's score position at the time of the technical foul: A dichotomous variable indicating either an advantage or disadvantage over the opposing team at the time the TF has been called.

Game's quarter: Four independent quarters lasting net 13 min each comprise the total game time.

Final score: A dichotomous variable indicating either a win or a loss by the team its coach has been called a TF.

Season: A dichotomous variable indicating either regular season or playoff season.

Statistical Analysis

To estimate the effects of the coaches' TF on shifting the games' momentum accounting for score status (advantage vs. disadvantage), game's location (home vs. away), season (regular vs. playoff), game's quarter (Q1 – Q4), and their interactions we conducted a logistic regression. Quarter was dummy coded in a manner that compares Q2 to Q1, Q3 to Q2, and Q4 to Q3. Given that inclusion of interaction terms may bias the interpretation of the main effects in logistic regression, we analyzed two models. The first model included only the main effects and the second model included the main effects and the interaction terms. Data analysis was conducted using IBM SPSS 27.

Results

The logistic regression results for the main effects model are presented in Table 1. Significant main effects for score status, game's location, and quarter emerged. Identical to the Tenenbaum et al.'s (2024) findings, the chances of shifting momentum and winning were higher when the team was in advantage prior to the coach foul and when called in home games. Non-significant shift of momentum difference evident between Q1 and Q2, yet chances of winning significantly decreased when the coach was called a TF in Q3 and further declined when the TF was called in Q4. The analysis failed to obtain a main effect for season.

Table 1. Game's score, location, and quarter as predictors of momentum shift (e.g., winning): A logistic regression analysis using two models: 1. Main effects, and 2. Interactions' effects.

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	Main effects model		Interaction effect model	
	Odd Ratio	P value	Odd Ratio	P value
Model 1 (main effects)	.55	<.001		
Location			0.76	.172
Score status	7.76	<.001	2.46	<.001
Season	.84	.293	0.92	.860
Q12	.91	.397	0.93	.716
Q23	.74	.001	0.47	<.001
Q34	.66	<.001	0.37	<.001
Model 2 (interactions' effects)				
Score status × Location			0.61	.184
Season × Location			0.38	.034
Location × Q12			0.54	.015
Location × Q23			1.72	.017
Location × Q34			0.93	.812
Score status × Season			0.32	.390
Score status × Q12			1.56	.166
Score status × Q23			3.69	<.001
Score status × Q34			3.23	.002
Season × Q12			1.72	.337
Season × Q23			0.84	.744
Season × Q34			1.00	.998
Score status × Location × Season			11.51	.145
Score status × Location × Q12			2.80	.029
Score status × Location × Q23			0.26	.001
Score status × Location × Q34			2.27	.134
Score status × Season × Q12			1.27	.872
Score status × Season × Q23			0.86	.877
Score status × Season × Q34			1.00	.998
Score status × Location × Season × Q12			0.48	.696
Score status × Location × Season × Q23			1.76	.659
Score status × Location × Season × Q34			0.41	.999

Note. Score: Disadvantage = 0, Advantage = 1; Location: Home = 0, Away = 1; Season: Regular = 0, Playoff = 1; Q12 = Q2 vs. Q1; Q23 = Q3 vs. Q2; Q34 = Q4 vs. Q3.

Inspection of the interaction effect model presented in Table 1 indicates a significant ($p < .03$) season by game's location interaction. The interaction results are presented in Figure 1. In general, the coaches' TF call was more effective during the playoff season than during the regular season when the TF was called in home games, and the opposite in away games. Specifically, during the regular season, when the TF was called at home, the chances of winning in home vs. away games was 44% vs. 28%, respectively (d = 16%). In contrast, the difference in shifting momentum changed during the playoff season after a TF call. The chances of winning increased to 50% at home games and decreased to 23% in away games (d = 27%). The season's period failed to interact with any of the other factors.

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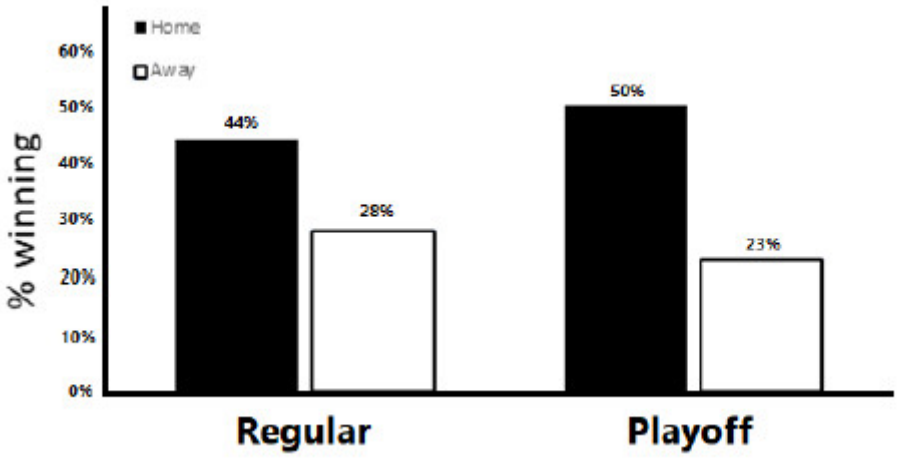

Figure 1. Percentage of shifting momentum (e.g., winning) as a function of season and game's location.

Discussion

Through comprehensive analysis which spans over two decades (from 2000 to 2021) our study aimed to elucidate the intricate process of momentum alteration during regular season and playoffs, particularly through the strategic deployment of TFs by coaches to redirect negative momentum toward a positive trajectory.

Taking into consideration Tenenbaum et al.'s (2024) findings on the effect of coaches' TF calls on momentum shifts during the regular season, and Lev et al.'s (under review) study, pertained to the differences between TF calls on momentum shifts during each NBA quarter in the regular season, using the same NBA data, our findings show no differences between the playoffs and the regular season regarding metrics such as quarters and different game's score position (leading vs. trailing). Although we expected a stronger effect of momentum shifts during the playoffs in several aspects of the game due to increased pressure, such as heightened aggressiveness in defense (Teramoto & Cross, 2010) and more defensive rebounds (García et al., 2013), the findings counter our hypothesis. Nevertheless, the findings are in-line with our second assumption in which we expected that TFs will result in a higher percentage of momentum shifts during playoffs at home rather than away games. All in all, this is the only predominant difference we have found between regular season and playoffs in terms of link between TF calls and momentum shifts.

More precisely, the findings enable us to discern noticeable shifts in momentum and chances of winning, influenced by the season and game location (see Figure 1). As the findings enable us to discern, during the regular season, the chances of winning an NBA game are 44% when a TF is committed at home versus 28% when a TF is committed away. In the playoffs, the chances increase to 50% for winning a game at home, compared to only 23% for winning a game when a TF is committed away. Considering these conclusive findings, it is evident that in both the regular season and the playoffs, the home court provides a significant advantage in winning the game after a coach commits a TF. Nevertheless, the findings indicate a 6% increase in the chances of winning at home when a TF is committed during the playoffs. More specifically, the gap between home and away settings is significantly greater during the playoffs, with a 16% advantage at home during the regular season compared to a 27% advantage during the playoffs. Accordingly, during the playoffs, there is a 5% decrease in the chances of winning a game when a TF is committed away and a 6% increase in the chances of winning when a TF is committed at home.

All considered, the findings strongly echo prior research (Courneya & Carron, 1992; Tenenbaum et al., 2024; Sors, 2023), which has shown that home teams enjoy a noticeable advantage over visiting teams. While this pattern is reflected in both the regular season and the playoffs, we suggest that the greater advantage during the playoffs derives from the tremendously high stakes, which ramp up

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exponentially (Morgulev & Galily, 2018). The "tailwind" provided by the home crowd holds great influence and value to the players through the support they feel while on "home turf." Notably, the presence of a supportive home crowd contributes to momentum generation (Levental et al., 2022; Risser et al., 2018). In this regard, while momentum is contagious, with exceptional individual performances inspiring the entire team to elevate their collective effort (Barsade, 2002; Zumeta et al., 2016), we suggest that during the playoffs season, players draw more emotional encouragement and energy from enthusiastic fans compared to the regular season, thereby boosting their game (Moskowitz & Wertheim, 2011; Sors, 2023). Thus, while our findings do not align with Belk et al. (2017), which show no disparities between the regular season and playoffs in the NBA, they are in line with Morgado and Barreira (2023), who demonstrate that home advantage assumes a significant role during the NBA playoffs season, impacting team strategies and performance. However, it must be stressed out that one should not belittle the so-called "lower" percentages as presented on Figure 1. We strongly argue that 23% can still trigger momentum shifts, positively influencing a team's trajectory. This can perhaps justify a coach committing a TF when their team is playing away during playoffs season.

Moreover, while NBA referees tend to be biased in favor of coaches following the commission of a TF (Tenenbaum et al., 2024), we suggest that the home crowd pressure following a TF call on a home team coach during the playoffs significantly influences referee bias in favor of that coach. After all, the well documented connection between home-court advantage and referee's bias in professional sports reveals that referees often exhibit a tendency to make decisions favoring the home team (Moskowitz & Wertheim, 2011; Sors, 2023). Hence, when a home team coach commits a TF, thus breaching the flow of the game, the home crowd tends to erupt with support for the coach, swaying the referee's demeanor towards the affected team.

In summary, this research delves into the impact of 4,196 TFs committed by coaches across two decades of NBA seasons, shedding light on the differences between regular season matchups and playoff encounters, considering factors such as home versus away games as well as examining how these dynamics unfold when a team is in a leading or trailing position. The implications of our findings extend to the practical realm for NBA coaches, particularly within the context of regular season vs. playoffs. Firstly, considering that TFs can potentially shift momentum, particularly at home, coaches might use TFs strategically to boost their team's energy and provoke the crowd during critical playoff moments. Additionally, recognizing the significant impact of home-court advantage during the playoffs, coaches should prioritize strategies that enhance crowd involvement and energy. It's also crucial for coaches to be mindful of potential biases and cultivate positive relationships with referees to minimize adverse effects. By understanding referee tendencies and maintaining professionalism, coaches can increase their chances of receiving favorable calls in high-stakes playoff situations. Finally, utilizing game analytics to discern patterns of momentum shifts related to TFs can help coaches in making informed decisions. This data can help pinpoint the optimal moments for TFs and other strategic actions.

Limitations

The strength of the current research lies in its quantitative approach, which provides valuable insights. However, it is limited in capturing additional events between the studied time frames that could potentially influence the game trajectory. Additionally, the research has constraints in deeply exploring the psycho-social processes involved when a coach commits a TF due to its exclusive reliance on quantitative methods and the absence of qualitative methodology.

Future Research Directions

Continued exploration of the impact of TFs on professional basketball is recommended. Specifically, broadening the scope beyond male NBA players to include the Women's National Basketball Association (WNBA) is crucial for comprehensive comparative data, offering insights into how TFs influence dynamics in women's basketball games. Additionally, given the differences in rules, such as the length of the game, exploring the impact of TFs in the Euro-League can also be

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interesting, especially as the diffusion of players and coaches increases annually. Finally, a qualitative analysis involving the observation of live games and the examination of immediate reactions to TF calls can illuminate the behavioral and contextual processes influenced by the execution of a TF.

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