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The Belief in the "Hot Hand" in the NFL: Evidence from Betting Volume Data

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Abstract: Evidence of bettors' belief in the "Hot Hand" -- bettors believing teams on winning streaks will continue winning -- exists in the NBA but not the NFL. Previous research assumed that book makers set point spreads to balance betting on games. Recent research shows imbalanced betting in most markets, suggesting the point spreads may not reflect behavioral biases like the "hot hand." We find a significant increase in bets on teams on winning streaks, suggesting that belief in the "hot hand" in the NFL exists, although simple strategies of betting against teams on a winning streak does not lead to excess returns.

JEL Codes: : L83, G12, D03

Key words: hot hand, sports betting, behavioral bias

I. Introduction

The "hot hand" hypothesis was applied to sports betting by Camerer (1989) and followed up by Brown and Sauer (1993). These studies investigated NBA betting market outcomes for evidence that teams became "hot" and that betting markets reflect this "hot" behavior. Both focused on a behavioral bias which may exist in financial markets: "hot" teams show improved short-run performance in games, which could lead these teams to both win multiple games in a row outright, and perform well against the point spread in consecutive games. These "hot" streaks could be real, changing both actual performance and betting market prices, or imaginary, existing only in the minds of bettors, which could affect point spreads under these conditions. McFall, et al (2009) examined the "hot hand" in the context of individual sports.

Camerer (1989) hypothesized that betting against teams on winning streaks could be profitable, as point spreads may respond to steaks, but game outcomes may not. Brown and Sauer (1993) illustrated that both pointspreads and game outcomes respond to the "hot hand" in the form of streaks. Brown and Sauer (1993) could not reject the Camerer's (1989) hypothesis of a mythical "hot hand" or the explanation (under rational expectations) that both team performance and the point spread respond to streaks. Paul and Weinbach (2005) also studied winning and losing streaks in the NBA and found support for the "hot hand" hypothesis in that the public bets more on teams that experience winning streaks.

Woodland and Woodland (2000) analyzed winning streaks in the NFL and betting on NFL games. They linked winning streaks by NFL teams to long-term stock market overreaction by investors who take contrarian strategies in terms of buying losers and selling winners (DeBondt and Thaler , 1985). Evidence suggests that these contrarian strategies can yield excess returns due to expectational errors made by investors about future earnings (La Porta, et al, 1997). Woodland and Woodland (2000) found that betting on or against streaks did not generate excess returns in the NFL betting market. Any real or imagined improvement or decline in team performance embedded in a winning or losing streak appeared to be incorporated into the final point spread. Unlike in the earlier evidence from the NBA, simple contrarian betting strategies when faced with teams on streaks did not earn statistically significant profits. We extend the research on betting on "hot" teams by examining the effects of winning and losing streaks in the NFL on betting volume.

At the time of these studies, the prevailing assumption about book maker behavior centered on the balanced book hypothesis. Under the balanced book hypothesis, book makers are assumed to set

prices (point spreads in this context) to attempt to attract an even amount of betting action on each side of the wagering proposition. Under this model, point spread movements are analogous to price movements in other financial markets. For instance, if more bettors wanted to wager on the favored team than on the underdog at a given point spread, the book maker would increase the point spread on the favorite, increasing the price of a contingent claim on the outcome of the favored team winning. Price movements were assumed to be due to the actions of bettors within the market, where book makers alter prices based on the flow of bets, which may reflect true information or bettor sentiment.

The balanced book hypothesis was challenged by Levitt (2004). He assumed that book makers set prices to maximize profits, rather than setting prices to balance volume of bets on either side of a wager. Using data from a betting tournament based on NFL games, not actual data from betting markets, Levitt showed that bettors tend to prefer certain wagers, such as road favorites, and book maker's behavior is consistent with the idea that these preferences are incorporated into prices in betting markets. With biased prices, book makers can earn higher profits by becoming an active participant in the wager, effectively wagering on the less-popular side of the proposition. Under the Levitt hypothesis, sportsbooks are not only good at forecasting game outcomes, but also know the likely biases of bettors, and are able to exploit these advantages through their pricing.

The findings of Levitt (2004) may not generalize to actual betting markets, as the bet volume data he observed came from a season-long betting contest with an entry fee and no cost associated with the bets made as part of this contest. In this contest, participants paid a relatively small up-front entry fee and then made picks on specific games each week at the prevailing point spread. This tournament consisted of a rather small number of participants and the normal marginal incentives associated with each wager in a gambling market were not present.

Paul and Weinbach (2007, 2008) tested the Levitt model of sportsbook behavior using data from actual betting markets. Bets were shown to not be evenly balanced between favorites and underdogs (or overs and unders in the totals markets) in the NFL (Paul and Weinbach, 2007) and in the NBA (Paul and Weinbach, 2008), supporting Levitt's (2004) model. Unlike the assumptions of the traditional balanced book model, favorites received a disproportionate share of the betting dollars in these markets. In each sport, as the point spread on the favorite increased, the percentage of dollars bet on the favorite also increased. In addition, there was an additional increase in percentage of dollars bet on road favorites as opposed to home favorites.

These results cast doubt on the balanced book model of sports book behavior as the betting dollars definitely do not appear balanced on either side of most wagers. This has important implications for empirical investigations of behavioral biases such as the "hot hand" hypothesis. Bettors may believe that certain teams are "hot," but point spread data may not reflect these beliefs if book makers allow the majority of bets to accumulate on the "hot" team, without a corresponding change in the point spread. Therefore, "hot hand" effects may exist, but an analysis of point spread data may not reveal these effects if market prices do not reflect bettor sentiment. The use of actual betting percentages from book makers avoids this problem. Even if point spreads do not reflect "hot hand" effects, betting volume will; belief in the hot hand will lead some bettors to prefer bets on the "hot" team at any point spread, leading to imbalanced betting on "hot" teams, and also imbalanced betting on "cold" teams if they attract fewer bets.

This study analyzes NFL betting data to investigate effect of the "hot hand" on betting volume over five NFL seasons from 2005-06 to 2009-10. We find evidence that "hot hand" effects affect betting volume on NFL games. Teams on two and four game win streaks, and on two and four game win streaks against the spread, attract relatively more betting action than teams not on win streaks, holding the point spread on the game constant. These results confirm the presence of "hot hand" effects in NFL betting markets.

II. Betting Percentages and the "Hot Hand" Hypothesis

If book makers set point spreads, which can be interpreted as prices in this context, as a forecast of game outcomes and do it successfully, an even distribution of wins and losses for bets on teams on winning or losing streaks would be expected. Given that setting prices as a forecast can lead to unbalanced betting on games, it is still possible that bettors who believe in the "hot-hand" and over bet teams on winning streaks participate in the market, but the closing point spreads will not reflect the presence of these bettors, because book makers accept unbalanced betting on most games. However, data on betting volume on each side of propositions does not suffer from this limitation. Evidence of betting in response to "hot-hand" biases should be readily observable in betting volume data. This will occur if bettors believe in the hot hand, since teams on winning streaks should attract a higher percentage of bets than teams not on winning streaks. Likewise, teams on losing streaks should attract a lower percentage of bets compared to teams not on losing streaks.

To investigate this possibility, we construct a reduced form regression model of the determination of bet volume on home teams in in NFL betting markets to determine if hot hand effects exist in this market. The dependent variable is the percent of bets placed on the home team in each NFL game. We explain variation in the volume of bets on the home team using indicator variables for winning streaks and losing streaks of various lengths and other explanatory variables known to affect bet volume. We use a home/road distinction for teams due to the fact that either team in any given game could be on a winning or losing streak. If the dependent variable was the percentage bet on the team on a winning or losing streak, double counting occurs as both teams could be on streaks, resulting in multiple observations for the same game. Using this home/road distinction insures one observation for each game in the sample.

Our explanatory variables include factors which have previously been shown to impact the percentage bet on teams. Paul and Weinbach (2008) used the pointspread as an explanatory variable, as it has been shown that the percentage bet on the favorite increases with each additional point of the point spread. Sapra (2008) used the point spread as an explanatory variable in a probit model. A dummy for road favorites is also included to account for the bias that bettors have for wagering on good teams on the road (teams which will qualify as road favorites), which is likely not captured in the pointspread due to the unbalanced book (Levitt, 2004).

To capture the impact of "hot hand" effects, we construct dummy variables indicating teams on two and four game winning streaks and losing streaks, like earlier studies of the "hot-hand" by Camerer (1989) and Brown and Sauer (1993). Since it is possible that the home team and road team could both be on winning or losing streaks simultaneously, individual dummies for home team on a 2-game winning streak, road team on a 2-game winning streak, home team on a 2-game losing streak, and road team on a 2-game losing streak are included in the regression model. Similar dummies are included for streaks of four games in a separate regression. We also construct indicator variables for teams on winning and losing streaks against the spread, as belief in the hot hand may extend to games against the spread. In this case, we identify teams that have "covered" or failed to "cover" the spread in multiple games.

The primary data source is Sports Insights, a company that collects detailed betting market data from four on-line book makers located in the Caribbean: 5Dimes.com, a licensed, bonded online sports book maker based in Costa Rica in operation since 1998, BetUS.com, a licensed and bonded sports book maker recognized in both Costa Rica and Canada in operation since 1994, CaribSports.com, a licensed online sports book maker based in Belize in operation since 1997, and Sportsbook.com, a licensed online

sports book maker and casino based in Costa Rica since 1996. These four sports book makers handle a large number of bets on a variety of professional and amateur sports worldwide.. Sports Insights collects a large amount of game-specific data on the NFL betting market, including point spreads, game outcomes, and bet volume, on both sides and totals betting.

Table I: Summary Statistics

Variable	Mean	Std. Dev.
Percent bet on Home Team	47.7	17.4
Closing Point Spread	-2.6	6.4
Road Favorite	0.330	0.470
Home Team 2 Game Win Streak	0.149	0.357
Visiting Team 2 Game Win Streak	0.189	0.391
Home Team 2 Game Losing Streak	0.185	0.389
Visiting Team 2 Game Losing Streak	0.153	0.360
Home Team 4 Game Win Streak	0.068	0.252
Visiting Team 4 Game Win Streak	0.063	0.242
Home Team 4 Game Losing Streak	0.069	0.253
Visiting Team 4 Game Losing Streak	0.064	0.245
Home Team 2 Game Win Streak Against the Spread	0.149	0.356
Visiting Team 2 Game Win Streak Against the Spread	0.149	0.356
Home Team 2 Game Losing Streak Against the Spread	0.160	0.367
Visiting Team 2 Game Losing Streak Against the Spread	0.153	0.360
Home Team 4 Game Win Streak Against the Spread	0.039	0.194
Visiting Team 4 Game Win Streak Against the Spread	0.034	0.182
Home Team 4 Game Losing Streak Against the Spread	0.029	0.168
Visiting Team 4 Game Losing Streak Against the Spread	0.032	0.176

Table I contains summary statistics from our sample of 1,278 games played over five NFL seasons from 2005-2006 to 2009-2010. The dependent variable is the fraction of bets placed on the home team in each game. From Table I, 47.7 percent of the bets were made on the home team in these games. This sample features imbalanced betting on the average NFL game. The average closing point spread is -2.6, suggesting that the home team was about a 2 and a half point favorite. 33% of the games involved a visiting team that was favored in the game.

If bettors believe in the “hot-hand”, teams on winning streaks should attract more bets and teams on losing streaks should attract fewer bets. To determine the effects of streaks on bet volume, we constructed a series of indicator variables for teams on winning and losing streaks of two and four

games. The fraction of games involving teams on these streaks in the sample can be seen at the bottom of Table 1. Given that the regression model is constructed from the point of view of the home team, home team on a 2 (4) game winning streak and road team on a 2 (4) game losing streaks would be expected to have a positive sign and be significant if bettors believed in the "hot-hand". Likewise, negative and significant coefficients would be expected for the dummies relating to road team on a 2 (4) game winning streak and home team on a 2 (4) game losing streak.

OLS estimates of the parameters of our regression model are presented on tables II and III. The standard errors have been corrected for heteroscedasticity using the standard White-Huber "sandwich" correction. We assume, like much of the recent research on point spread betting, that the closing pointspread is exogenous due to presence of an unbalanced book and the sportsbook pricing as a forecast of game outcomes. We recognize, however, that some may believe that book makers set prices to attract a certain level of betting on a specific side of the wagering proposition. This would result in the closing point spread possibly being endogenous in this model. With this in mind, two-stage least squares estimation was also performed using the opening line set by the sportsbook as a instrument (in addition to the other dummy variables within the model) as a robustness check. Since the opening line is set before any betting takes place, this should be a good instrument for the closing point spread. We present the Two-Stage Least Squares estimates in the appendix. The regression results are nearly identical under either approach.

Table II: OLS - Straight-Up Results – Hot Hand NFL

Dependent Variable - % Bet on Home Team

	Model I	Model II
Intercept	50.43***	50.07***
	(67.96)	(68.63)
Closing Pointspread	-0.908***	-1.07***
	(-9.74)	(-11.60)
Road Favorite Dummy	-15.81***	-15.34***
	(-13.45)	(-12.98)
Home 2-Game Win Streak vs. Non 2-Game Win Streak	2.78***	
	(3.09)	
Road 2-Game Win Streak vs. Non 2-Game Win Streak	-3.12***	
	(-3.86)	
Home 2-Game Loss Streak vs. Non 2-Game Loss Streak	-0.874	
	(-1.059)	
Road 2-Game Loss Streak vs. Non 2-Game Loss Streak	2.78***	
	(2.97)	
Home 4-Game Win Streak vs. Non 4-Game Win Streak		0.134
		(0.097)
Road 4-Game Win Streak vs. Non 4-Game Win Streak		-3.73***
		(-3.27)
Home 4-Game Loss Streak vs. Non 4-Game Loss Streak		0.491
		(0.440)
Road 4-Game Loss Streak vs. Non 4-Game Loss Streak		1.169
		(0.976)
R-squared	0.630	0.619
N	1278	1278

t-statistics in parentheses. ***: significant at 1% level. **: Significant at 5% level.

Table III: Wins Against the Spread – Hot Hand Effects in the NFL

Dependent Variable: Percentage Bet on Home Team

	Model I	Model II
Intercept	49.55***	49.72***
	(66.77)	(69.64)
Closing Pointspread	-1.048***	-1.092***
	(-12.13)	(-12.27)
Road Favorite Dummy	-15.396***	-15.244***
	(-13.29)	(-12.84)
Home 2-Game Win Streak vs. Non 2-Game Win Streak	3.15***	
	(3.92)	
Road 2-Game Win Streak vs. Non 2-Game Win Streak	-2.71***	
	(-3.10)	
Home 2-Game Loss Streak vs. Non 2-Game Loss Streak	-0.461	
	(-0.541)	
Road 2-Game Loss Streak vs. Non 2-Game Loss Streak	3.139***	
	(3.87)	
Home 4-Game Win Streak vs. Non 4-Game Win Streak		3.483**
		(2.53)
Road 4-Game Win Streak vs. Non 4-Game Win Streak		-1.946
		(-1.23)
Home 4-Game Loss Streak vs. Non 4-Game Loss Streak		-0.392
		(-0.272)
Road 4-Game Loss Streak vs. Non 4-Game Loss Streak		2.358
		(1.36)
R-squared	0.631	0.619

t-statistics in parentheses. ***: significant at 1% level. **: Significant at 5% level.

From Table II, the straight-up winning and losing streak results, the percentage bet on the home team increases significantly for teams on winning streaks compared to teams not on winning streaks.

The intercept is close to 50%, indicating that the average game has balanced betting holding the point spread constant, while the point spread and road dummy variables are significant at the 1% level. Road favorites attract a significantly higher percentage of bets; the percentage of bets on the home team is shown to change with the pointspread (bigger home favorites attract more bets). When the home team is on a two-game winning streak, the percentage bet on the home team rises by nearly 3% (2.778%). When the road team is on a two-game winning streak, the percentage bet on the home team falls by slightly more than 3% (3.116%) (the percentage bet on the road team rises by 3%). Both of these results are found to be statistically significant at the 1% level. These results indicate the presence of "hot hand" effects in the bet volume in NFL games.

When teams are on two-game (straight-up) losing streaks, the volume of bets on road teams on these streaks was found to be significantly lower, but home team losing streaks were not associated with lower betting volume. When the road team is on a two-game (straight-up) losing streak, the percentage bet on the home team increases by nearly 3% (2.775%). When the road team is on a losing streak, bettors wager significantly more on the home team. Bettors do not respond in a significant manner when the home team is on a losing streak, perhaps because bettors believe a home team is more likely to break a streak than continuing to lose.

In relation to the four-game (straight-up) streaks, the results are not as strong as the results for two-game streaks. The only situation where there is a statistically significant change in betting percentages is when the road team is on a 4-game (straight-up) winning streak, where the home team sees a significant drop in betting percentage by nearly 4% (3.726%). The four-game streaks are far less common than the two-game streaks and this could contribute to the limited change in betting percentages due to 4-game streaks.

The Against-The-Spread (ATS) results resemble the results of the Straight-up streaks. As can be seen from Table III, particularly for 2-game ATS streaks, the percentage bet on the home team changes based on winning and losing streaks. The intercept is again found to be close to 50%, while the pointspread and road dummy variables are significantly different from zero at the 1% level. Road favorites attract a significantly higher percentage of bets; while the percentage of bets on the home team is shown to change with the pointspread (bigger home favorites attract more bets).

When the home team is on a two-game (ATS) streak, the percentage bet on the home team increases by more than 3% (3.1507%). When the road team is on a two-game winning streak, the road

team sees an increase in bets of slightly less than 3% (-2.7063%) of the bets (home teams receive fewer bets). In the same fashion as the Straight-Up results, when the home team is on a two-game losing streak, significant changes in the number of bets are not seen. When the road team is on a two-game losing streak, however, the home team sees an increase in the percentage of bets by slightly more than 3% (3.1394%).

In relation to the four-game streaks, shown on regression Model II on Table III, the only significant effect occurs when the home team was on a 4-game winning streak. When the home team is on a four-game winning streak, the percentage bet on the home team rises by nearly 3.5% (3.483%). The other results were not found to be significant, perhaps due to the relative infrequency of four-game streaks against the spread in the NFL during this period.

Overall, two-game streaks (and one case in four-game streaks) are associated with an increased percentage bet on the team on the winning streak and the percentage bet on teams on a losing streak significantly decreases. Given that the betting percentages increase (decrease) when teams are on winning (losing) streaks, it is important to establish if wagering against winning streaks (or on losing streaks) generates profitable results. To address this issue, we perform simple betting simulations based upon these two contrarian strategies in this sample of NFL data.

III. Betting Simulations based on the "Hot Hand" Hypothesis

Given the existence of this a behavioral bias in this market, it is important to establish if there are profitable betting strategies associated with wagering on (or against) "hot-hand" effects of winning and/or losing streaks in the NFL. To illustrate these returns, tables IV and IV present the results of simulations of the return to two simple betting strategies, betting with (against) 2 or 4 game winning streaks and losing streaks, in this sample. The winning and losing streaks simulations are calculated in two ways, straight-up (team won or lost the game outright) and against-the-spread (team won or lost compared to the pointspread).

Wins, losses, pushes, the win percentage of betting with the "hot-hand" streak, and the results of the standard log likelihood ratio test for a fair bet, with the null hypothesis that the (win percentage is equal to 50% are presented for each scenario. The results for straight-up winning streaks are presented in Table IV below.

Table IV: Summary of Betting Returns, Straight-Up Results

	Bet Team on Streak (Wins)	Bet Against Team on Streak (Wins)	Pushes	Bet Team on Streak Percentage	Log Likelihood – Fair Bet
2 Game Win vs. Non 2-Game Win	214	208	10	50.71%	0.085
4 Game Win vs. Non 4-game Win	79	81	6	49.38%	0.025
2 Game Loss vs. Non 2-Game Loss	215	205	8	51.19%	0.238
4 Game Loss vs. Non 4-Game Loss	87	80	3	52.09%	0.294

Table V: Summary of Betting Returns, ATS Results

	Bet Team on Streak (Wins)	Bet Against Team on Streak (Wins)	Pushes	Bet Team on Streak Percentage	Log Likelihood – Fair Bet
2 Game Win vs. Non 2-Game Win	188	185	7	50.40%	0.024
4 Game Win vs. Non 4-game Win	44	46	4	48.89%	0.044
2 Game Loss vs. Non 2-Game Loss	183	205	12	52.83%	1.248
4 Game Loss vs. Non 4-Game Loss	42	36	0	53.84%	0.462

Tables VI and V show that betting with or against winning or losing streaks does not earn profitable returns in this sample. In fact, using the log likelihood ratio test for a fair bet, winning percentages are not shown to be significantly different from 50%. The null hypothesis of the point spreads on these games being optimal and unbiased forecasts of game outcomes cannot be rejected.

If book makers were pricing to balance betting on either side of propositions (i.e. setting point spreads which would even the betting action between favorites and underdogs), these results would suggest that the market incorporates the "hot-hand" as any true change in quality of the teams (which reveal themselves as winning or losing streaks as teams actually improve or deteriorate with respect to performance) is reflected in the closing point spread. Given that betting is significantly imbalanced and betting against teams on winning streaks did not generate profitable returns, it does not appear that sportsbooks shade the pointspread toward the "hot" team (or against the "cold" team) to exploit bettor

biases, in a manner suggested by Levitt (2004), as all win percentages related to streaks are close to 50% in this sample.

III. Conclusions

The presence of "Hot Hand" effects in NFL betting markets from 2005-06 to 2009-10 was investigated. This potential behavioral bias, where bettors believe in a mythical "hot hand" and overbet teams on winning streaks, was previously shown not to exist using data on game outcomes versus the point spread. Under this approach, if a mythical "hot hand" did exist, closing point spreads would be expected to be too high, leading to a profitable wagering strategy of betting against teams on winning streaks (or betting on teams on losing streaks). Given that these profitable betting strategies did not exist, either bettors do not believe in the "hot hand" or a real "hot hand" effect exist with point spreads and game outcome changing accordingly. These tests implicitly assumed a balance book on the part of the sportsbook. Under the balanced book model, the bookmaker is assumed to set a price (pointspread) to balance the betting dollars evenly between the favorite and the underdog. Any betting imbalances are assumed to move the pointspread in the appropriate direction to eliminate the imbalance. Therefore, by the market close, all available information is assumed to be incorporated into the closing point spread through the actions of bettors.

If the balanced book hypothesis is not valid, however, it is still quite possible this behavioral bias exists without being incorporated into the closing prices in this market. As first suggested by Levitt (2004) based on data from a betting tournament and later confirmed with testing of actual on-line sportsbook data by Paul and Weinbach (2008a, 2008b, 2009), the balanced book hypothesis has been soundly rejected in data from sports betting markets. Bettors consistently prefer favorites (particularly road favorites) and bets were shown not to be balanced in most games. With this in mind, this paper tested to see if winning streaks and/or losing streaks (and thus the "hot hand") caused bettors to wager more (less) on the perceived "hot" ("cold") team.

The results of a reduced form regression model show that teams on winning (losing) streaks attract a higher (lower) percentage of the betting action than teams who are not on streaks. Results were consistent for straight-up streaks (winning or losing outright) and for streaks against the pointspread. This shows that bettors do have a behavioral bias related to teams on streaks. The mythical "hot hand" does appear to exist, as bettors overbet teams based on recent performance in

terms of winning and losing streaks. Analysis of betting market data on bet volume confirms the existence of behavioral biases, such as “hot hand” effects in these markets. Belief in the “hot hand” , may actually exist in the minds and actions of bettors even when these biases are not reflected in the closing market prices set by the book makers.

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Appendix Table I: Two-Stage Least Squares -Straight-Up Results

Dependent Variable: Percentage Bet on Home Team

Closing Point Spread Endogenous, Instrument is opening point spread

	I	II
Intercept	50.3502***	49.8032***
	(61.9441)	(61.6947)
Pointspread	-0.9228***	-1.1132***
	(-8.4663)	(-10.2642)
Road Favorite Dummy	-15.6623***	-14.8729***
	(-11.7630)	(-11.0994)
Home 2-Game Win Streak vs. Non 2-Game Win Streak	2.7518***	
	(3.0646)	
Road 2-Game Win Streak vs. Non 2-Game Win Streak	-3.0985***	
	(-3.8346)	
Home 2-Game Loss Streak vs. Non 2-Game Loss Streak	-0.8574	
	(-1.0408)	
Road 2-Game Loss Streak vs. Non 2-Game Loss Streak	2.7425***	
	(2.8895)	
Home 4-Game Win Streak vs. Non 4-Game Win Streak		-0.0050
		(-0.0036)
Road 4-Game Win Streak vs. Non 4-Game Win Streak		-3.6308***
		(-3.1610)
Home 4-Game Loss Streak vs. Non 4-Game Loss Streak		0.5784
		(0.5147)
Road 4-Game Loss Streak vs. Non 4-Game Loss Streak		0.9864
		(0.8071)
R-squared	0.6302	0.6186

Appendix Table II: Two-Stage Least Squares - ATS Results – Hot Hand NFL

Dependent Variable: Percentage Bet on Home Team

Closing Point Spread Endogenous, Instrument is opening point spread

	Model I	Model II
Intercept	49.3147***	49.4185***
	(61.2228)	(62.7517)
Closing Pointspread	-1.0865***	-1.1412***
	(-10.7704)	(-10.9974)
Road Favorite Dummy	-14.9773***	-14.7063***
	(-11.4261)	(-10.9821)
Home 2-Game Win Streak vs. Non 2-Game Win Streak	3.1305***	
	(3.8855)	
Road 2-Game Win Streak vs. Non 2-Game Win Streak	-2.6917***	
	(-3.0833)	
Home 2-Game Loss Streak vs. Non 2-Game Loss Streak	-0.4445	
	(-0.5223)	
Road 2-Game Loss Streak vs. Non 2-Game Loss Streak	3.1095***	
	(3.8322)	
Home 4-Game Win Streak vs. Non 4-Game Win Streak		3.4354***
		(2.4824)
Road 4-Game Win Streak vs. Non 4-Game Win Streak		-1.8808
		(-1.1883)
Home 4-Game Loss Streak vs. Non 4-Game Loss Streak		-0.3536
		(-0.2438)
Road 4-Game Loss Streak vs. Non 4-Game Loss Streak		2.2774
		(1.3193)
R-squared	0.6312	0.6185

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