When Final Odds Are Not Sufficient: Last-Minute Market Movements and Return Predictability in Parimutuel Betting*

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Abstract

Most betting market models have employed static frameworks that condition decisions on final odds. Using a unique dataset of interim odds from Japanese central horse racing, this paper examines the validity of such static analyses by asking whether there is a systematic relationship between expected returns and the trajectory of odds. We find that realized returns are negatively related to last-minute changes in odds, and that these late movements attenuate the favorite-longshot bias by weakening the correlation between final odds and returns. This pattern suggests that informed bettors place wagers at the final stage based on private signals.

Keywords: Betting Markets, Favorite-Longshot Bias, Risk Preferences, Private Information
JEL code: D81, D84, G41

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1. Introduction

Parimutuel betting markets provide a transparent setting for analyzing equilibrium under uncertainty. A longstanding anomaly is the *favorite–longshot bias* (FLB), in which longshots yield systematically lower returns than favorites (Griffith 1949, Thaler and Ziemba 1988), shown in Figure 1. Previous work explains the FLB using static models that link final odds to winning probabilities (Weitzman 1965, Jullien and Salanié 2000, Snowberg and Wolfers 2010). Yet bettors cannot act contingent on final odds since wagers close before odds are finalized. This study asks whether final odds are sufficient statistics or whether odds dynamics matter.

To address this issue, we exploit the high-frequency interim odds provided by JRA-VAN, which allow us to track market expectations from the opening of betting until one minute before post time. While final odds determine payouts and summarize aggregate beliefs, interim odds are only snapshots of cumulative wagers. By extending the standard regression framework for the FLB to include these dynamics, we test whether horses with identical final odds but different odds trajectories yield systematically different returns. This approach provides a direct test of path dependence in betting markets.

Our analysis shows that last-minute declines in odds, reflecting surges in popularity, are associated with higher realized returns compared to horses with stable odds. The effect is concentrated in the final five minutes, consistent with informed bettors strategically wagering at the close. Once these dynamics are accounted for, the conventional negative relationship between final odds and returns weakens, indicating that final odds alone are insufficient statistics. These findings question static inference strategies and support information-based explanations of the FLB, in which simultaneous last-minute betting prevents the full incorporation of private information and leaves a "surprise" component embedded in final odds.

We begin by documenting several key empirical patterns regarding the dynamics of odds and their relationship with realized returns.

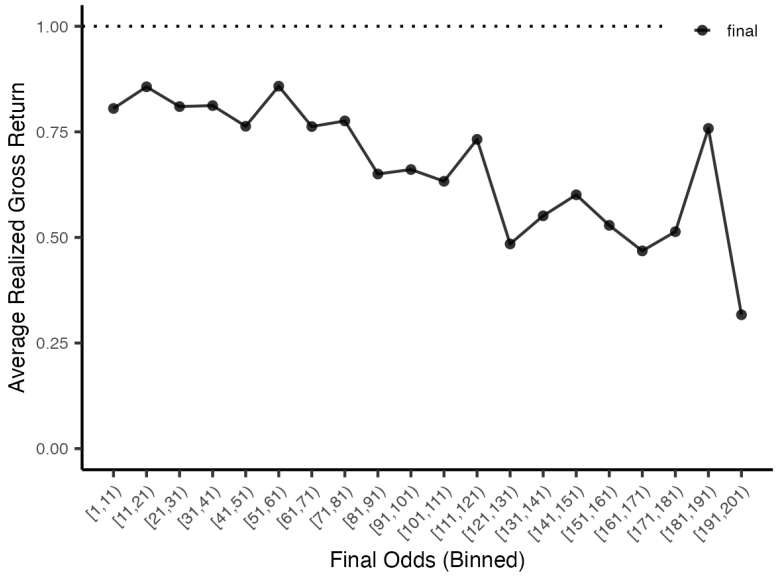


Figure 1: Odds versus Returns

Notes: The solid black line plots the average realized gross return for each odds group $g \in \mathcal{G}$, calculated as $\frac{1}{|I_g|} \sum_{i \in I_g} \mathbb{1}_{\{\text{win}_i=1\}} R_i^*$, where R_i^* denotes the final odds for horse i. Odds are grouped into intervals of width 10, and bins with fewer than 1,000 observations are excluded, following Jullien and Salanié (2000).

1.1. Realized Returns and Final Odds

Figure 1 illustrates the relationship between realized returns and both final and interim odds. Horses are grouped into bins based on their odds—either final or interim—using fixed-width intervals (e.g., $[1, 11), [11, 21), \ldots$). For each group $g \in \mathcal{G}$, we compute the average realized *gross return* as

$$\frac{1}{|I_g|} \sum_{i \in I_g} \mathbb{1}_{\{win_i = 1\}} R_i^*, \tag{1}$$

where I_g denotes the set of horses in group g, and R_i^* represents the final odds for horse i, inclusive of the original stake. Losing horses yield zero returns and therefore do not contribute to the group average.

The figure reveals a clear negative relationship between final odds and realized returns: horses with lower final odds (favorites) yield higher average returns, whereas those with higher odds (longshots) generate lower returns. This pattern is consistent with the well-established FLB, whereby bets on longshots systematically underperform those on favorites.

1.2. Temporal Distribution of Bets

Figure 2 shows the temporal distribution of wagering activity across races. For each race, the cumulative amount wagered by post time is normalized to one, and the figure plots the proportion of total bets placed at each point prior to post time. The data reveal a sharp acceleration in betting activity as the race approaches: approximately 25% of wagers are submitted by 20 minutes before post time, whereas nearly 50% are concentrated within the final five minutes. This clustering of late bets highlights a substantial concentration of wagering in the closing minutes of the betting window, consistent with a strategic intensification of behavior near the deadline.

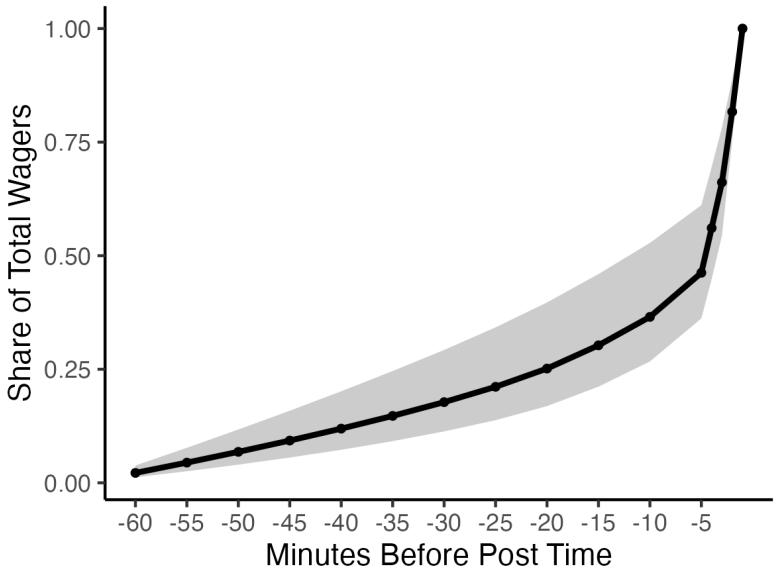


Figure 2: Temporal Distribution of Wagering Activity Before Post Time

Notes: The figure plots the share of cumulative wagers placed at five-minute intervals from 60 minutes to 5 minutes before post time, and at one-minute intervals during the final five minutes. For each race, total betting volume by post time is normalized to one. The solid black line indicates the median share at each time point, and the shaded region denotes the 95% interval across races.

1.3. Odds Changes and Outcomes

We next examine how interim odds dynamics relate to the association between final odds and realized returns. Figure 3 presents a series of comparisons based on whether a horse's odds increased or decreased during specific time intervals prior to post time. Panel (a) focuses on the final five-minute window and classifies horses according to whether their odds rose or fell during this period. The results show that, conditional on similar final odds, horses whose odds declined—suggesting a late surge in betting interest—consistently yield higher average realized returns than those whose odds increased.

Panels (b)-(f) extend the analysis to earlier five-minute windows: 10 to 5, 15 to 10, 20 to 15, 25 to 20, and 30 to 25 minutes prior to post time. Unlike the final interval, odds movements in these earlier periods display no systematic association with subsequent returns, suggesting that early fluctuations carry little predictive content.

Taken together, these findings indicate that interim odds dynamics are informative about expected returns only in the final stages of the betting period. This pattern underscores the distinct role of late-stage wagering activity in shaping final prices and highlights the importance of accounting for path dependence in empirical analyses of betting markets. In the next section, we formalize these insights within an econometric framework to quantify the magnitude of these dynamic relationships.

2. Econometric Strategy and Results

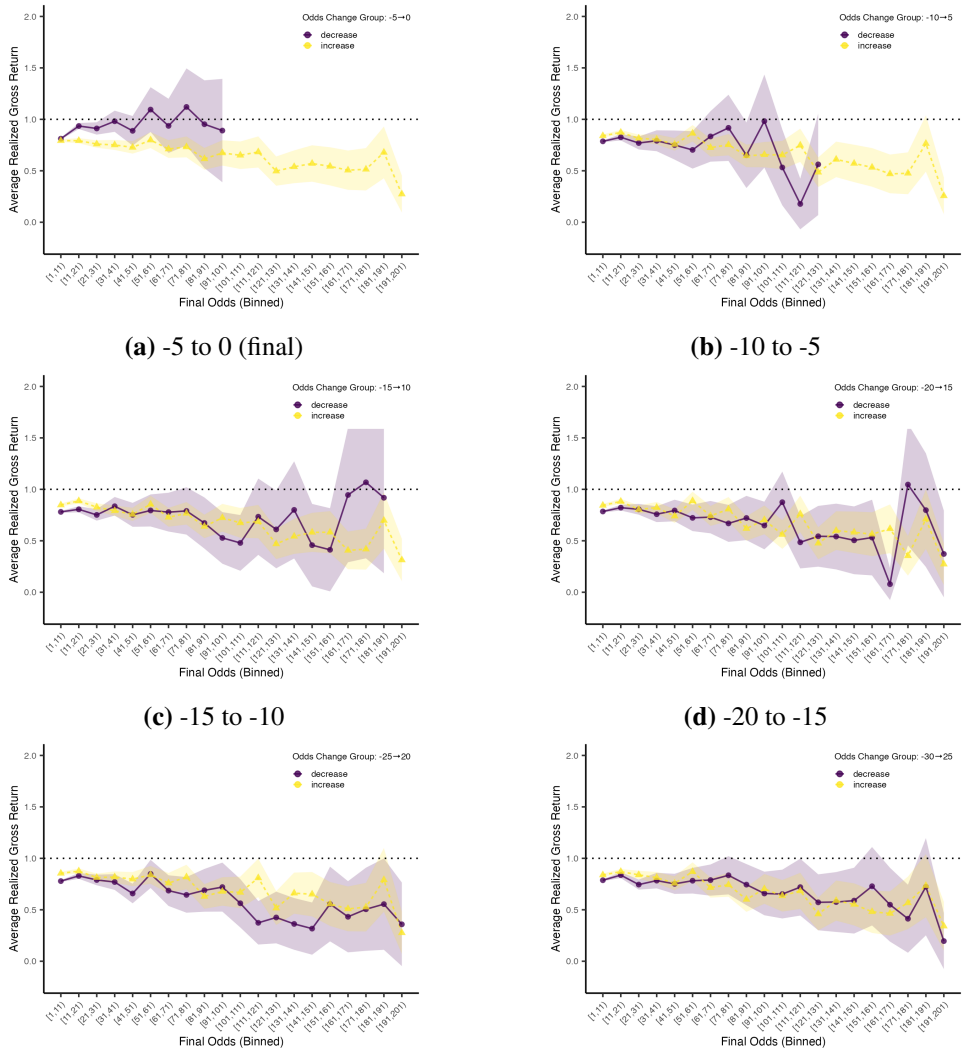
We estimate

$$\mathbb{1}\{win_i = 1\}R_i^* = \alpha + \beta R_i^* + \delta\, OddsChange_i + \gamma R_i^* \times OddsChange_i + \varepsilon_i, \tag{2}$$

where R_i^* is the final odds of horse i, and $OddsChange_i$ captures interim odds movements. Under rational expectations and risk neutrality, $\beta = \delta = \gamma = 0$, with $\alpha = 0.8$ reflecting the 20% takeout.

Baseline regressions in Table 1 confirm the FLB: returns decline with final odds. Adding last-minute odds changes shows that horses with odds decreases in the final five minutes yield higher returns, conditional on final odds. The effect diminishes when using earlier intervals. Incorporating odds dynamics reduces the magnitude of the FLB, indicating that static models relying only on final odds overstate biases.

We also test and support information-based explanations (Ottaviani and Sørensen 2009). When informed bettors wager at the last minute, final odds embed a "surprise" component that cannot be fully incorporated. We further test robustness using race fixed effects, racetrack conditions, and exotic betting pools (quinella). Results show that FLB weakens under poor track conditions and in quinella markets, consistent with theoretical predictions.



(a) -5 to 0 (final)

(b) -10 to -5

(c) -15 to -10

(d) -20 to -15

(e) -25 to -20

(f) -30 to -25

Figure 3: Expected Return versus Interim Odds Changes

Note: The horizontal axis represents final odds, grouped into bins of width 10. Panels (a)-(f) compare average realized returns for horses whose odds increased versus decreased during specified five-minute intervals prior to post time. Panel (a) covers the final interval (-5 to 0 minutes), while Panels (b)-(f) examine earlier intervals: -10 to -5, -15 to -10, -20 to -15, -25 to -20, and -30 to -25 minutes, respectively. Within each panel, the two lines plot average realized returns for horses with increasing and decreasing odds during the corresponding interval. Shaded areas denote 95% confidence intervals. Consistent with Jullien and Salanié (2000), bins are excluded if either subgroup contains fewer than 1,000 observations.

3. Conclusion

Final odds alone are not sufficient statistics. Last-minute odds movements matter for expected returns, challenging static empirical strategies that infer risk preferences from final odds. Our findings underscore the role of institutional design—such as the absence of limit orders—in shaping market efficiency and suggest broader implications for dynamic price formation in deadline-driven markets.

Table 1: Estimation Results: Winning Odds

	(1)	(2)	(3)	(4)	(5)
Constant	0.8338	0.8452	0.8443	0.8435	0.8423
	(0.0074)	(0.0080)	(0.0082)	(0.0082)	(0.0082)
R_i^*	-0.0016	-0.0012	-0.0012	-0.0013	-0.0014
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
$\frac{\Delta R_{i,[-5,0]}}{R_{i,-5}}$		-0.3559			
		(0.0381)			
$\frac{\Delta R_{i,[-10,0]}}{R_{i,-10}}$			-0.1674		
			(0.0250)		
$\frac{\Delta R_{i,[-15,0]}}{R_{i,-15}}$				-0.1052	
				(0.0210)	
$\frac{\Delta R_{i,[-20,0]}}{R_{i,-20}}$					-0.0702
					(0.0176)
$R_i^* \times \frac{\Delta R_{i,[-5,0]}}{R_{i,-5}}$		0.0002			
		(0.0003)			
$R_i^* \times \frac{\Delta R_{i,[-10,0]}}{R_{i,-10}}$			0.0000		
			(0.0002)		
$R_i^* \times \frac{\Delta R_{i,[-15,0]}}{R_{i,-15}}$				0.0001	
				(0.0001)	
$R_i^* \times \frac{\Delta R_{i,[-20,0]}}{R_{i,-20}}$					0.0001
					(0.0001)
Num.Obs.	894127	894127	894127	894127	894127
R2	0.001	0.001	0.001	0.001	0.001
R2 Adj.	0.001	0.001	0.001	0.001	0.001

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