

# Is timing everything in horse betting? Bet amount, timing and bettors' returns in pari-mutuel wagering markets

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## Abstract

Noise trader models suggest that 'smart money' profits from uninformed speculators. This paper investigates how rates of return are associated with the timing of a bet and the amount staked in a pari-mutuel horse betting market. We employ a novel data set measured at the level of individual bettors on the Finnish monopoly operator's online platform. Our findings suggest that, relative to other bets, late high-stakes wagers are more profitable. This implies that, along with timing, bet sizes should be accounted for when analysing market efficiency.

Forthcoming in *Economics Letters*

**Keywords:** bet size, individual-level data, market efficiency, pari-mutuel betting, timing

**JEL:** D80, G14

## 1. Introduction

The theory of noise traders suggests that informed traders profit from uninformed speculators ('noise') in financial markets (Black, 1986; Shleifer and Summers, 1990). In the literature, the racetrack betting market has been regarded as a laboratory-like version of a financial market (Thaler and Ziemba, 1998; Sauer, 1998). Hence, as an analogue to financial markets, betting markets can be regarded as being populated by informed bettors (the 'smart money') and uninformed bettors (e.g. Gandhi and Serrano-Padial, 2015). In a pari-mutuel market, the 'smart money' may delay betting until close to race time (Ottaviani and Sørensen, 2009). First, there is high volatility early in the betting period and therefore it is hard to identify value bets since it is hard to predict the final odds on which pay-offs are based. Second, placing the bet will itself change the odds and this risks triggering a bandwagon effect among other bettors which will worsen returns. Empirical evidence suggests that timing is indeed important and late bets earn higher returns (e.g. Asch et al., 1982; Gandar et al., 2001; Gramm and McKinney, 2009), which is consistent with the 'smart money' hypothesis.

However, previous studies have not been able to investigate how bet sizes relate to bettors' returns because they have relied on representative agent models and aggregated data. These models assume identical bettors, bet sizes that are independent of odds, and bettors' indifference with respect to odds between betting choices (Feess et al., 2016). Yet modelling betting behaviour without accounting for the amount staked may not be harmless (Bradley, 2003). It has also been suggested that uninformed bettors are unlikely to wager substantial sums of money (Sung et al., 2012, Feess et al., 2016). These findings relate to the noise trader models where unrealistic market prices attract informed traders who assume aggressive positions with larger stakes (Black, 1986).

This paper investigates how the amount bet and timing *together* predict the bettor's payoffs by using individual-level data on bettors' wagers and the timing of their bets. We contribute to the literature by showing that *late* and *large* bets earn higher returns. Thus, our paper demonstrates that, along with timing, bet sizes should be accounted for when analysing market efficiency using individual-level betting data. That is, timing on its own may not be indicative of the 'smart money'.

This paper proceeds as follows. In Section 2, we describe the research design. Section 3 presents the results. Section 4 concludes.

## 2. Research design

Our data are measured at the level of an individual bettor. They consist of wagers placed at the online betting platform of the monopoly operator for pari-mutuel horse race betting in Finland in August 2012. There are 18,640 bettors who could bet on 749 races either at the track or in off-track betting shops (together 47% of betting volume) or by using the online platform (53% of betting volume), all of which form a common pool. All betting formats use the pari-mutuel system where the operator takes out a predetermined percentage from the pool formed by stakes and the remainder is returned to the winning bettors in proportion to their stakes. We focus on single-race betting types which include Win (the horse that finishes first), Quinella (two horses that finish first irrespective of their order), Place (the chosen horse finishes first, second or third) and Trifecta (the first three finishing horses in the correct order). A betting slip may contain multiple bets on a single race, which are aggregated here to the level of a race. It also has a time stamp measured at the precision of a second. Since a bettor may have several slips on the same race, we use the time stamp of the median ticket and apply the precision of a minute as a proxy for bet timing.

Our empirical model that tests for the effects of timing and the amount bet on the bettor's return is

$$ROR_{i,t} = \beta_0 Intercept_{i,t} + \beta_1 BetAmount_{i,t} + \beta_2 Timing_{i,t} + \beta_3 BetAmount \times Timing_{i,t} + \sum_j \beta_j Controls_{i,t} + \varepsilon_{i,t} \quad (1)$$

in which  $i = 1, \dots, 18640$  indexes bettors and  $t = 1, \dots, 749$  indexes the number of the race a bettor has wagered on. We are mainly interested in variation between bettors, which could result from some bettors being permanently smart and some being always noise traders. However, it is also possible that there is variation within bettors as a bettor may sometimes have private information on a particular race. To account for both types of variation, we use a random-effects (RE) rather than a between-effects regression model because its estimates are a weighted average of between and within estimates<sup>1</sup>. In addition, this estimation strategy

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<sup>1</sup> The between-effects model yielded results that were qualitatively similar to the random-effects model.

allows for inclusion of time-invariant control variables for bettors' characteristics in the regression model.

We measure the bettor's success using his or her rate of return (*ROR*) which is computed by dividing the net return from bets placed on a race by the amount wagered on it. The variables of interest include the median time a bettor's wagers on a race were placed (*Timing*), measured in minutes before race time, the total amount staked (*BetAmount*), and an interaction term between the two variables (*BetAmount* × *Timing*). If timing and the amount wagered work together to predict the bettor's rate of return, the interaction term is statistically significant. We estimate two regression models. Model 1 omits the interaction term, whereas Model 2 includes it.

### 3. Results

Table 1 reports the descriptive statistics of the data. An average bettor is a 49 year-old male. He wagers on 16 races in a month using approximately 11 euros and three betting slips per race. While the mean for the bettor-race betting time is 95 minutes, the median is 36 minutes before the post time. The mean race turnover is 54,176 euros. The distribution of betting volume is highly skewed in time as approximately 80% of the volume is placed within the last hour. The average rate of return across all the bettor-race observations is -0.24. In general, positive net return bets on a race tend to be slightly larger by bet size and placed later than negative net return bets on a race<sup>2</sup>.

**Table 1** Descriptive statistics

	Mean	Median	Min	Max
<b>Focus variables</b>				
<i>Rate of return</i>	-0.24	-1.00	-1.00	925.80
<i>Bet amount (euros)</i>	10.81	5.87	0.50	6,759
<i>Timing (minutes)</i>	94.60	36.29	0	8,864.72
<b>Control variables</b>				
<i>Age (years)</i>	48.46	49	18	103
<i>Male (= 1 for male)</i>	0.81	1	0	1
<i>Experience<sup>#</sup> (= 1 for high experience)</i>	0.50	0.50	0	1
<i>Race turnover (euros)</i>	54,176.22	22,186.25	1,500	1 357,717
<b>Betting attributes by bettor</b>				
<i>Number of races bet per month</i>	16.10	5.5	1	375
<i>Number of betting slips per race</i>	2.72	2	1	46

*Notes: The number of bettors: 18 640. <sup>#</sup>The variable was constructed using the bettors' identification numbers which are provided in consecutive order with lower values corresponding to earlier registration dates. The bettors are divided into high (= 1) and low (= 0) experience groups using the median identification number as a cut-off point.*

<sup>2</sup> Detailed descriptive statistics available upon request from the authors.

Table 2 reports the results for the RE regression model. Perhaps surprisingly, the coefficient estimates on *Timing* and *BetAmount* are not statistically significant in Model 1: neither timing nor bet amount is individually a predictor of the rate of return<sup>3</sup>. Model 2 adds the interaction term *BetAmount* × *Timing* to the mix. Now, the coefficient on *BetAmount* ( $2.45 \times 10^{-4}$ ) is significant and suggests that each additional hundred euro staked increases the rate of return by 2.45 percentage points. The coefficient on *Timing* remains insignificant. However, the interaction term ( $-2.11 \times 10^{-6}$ ) is significant and indicates that the bettor's rate of return is associated with the combination of bet amount and timing working together.

**Table 2** Regression results

	<b>RE Model 1</b>	<b>RE Model 2</b>
	Coefficient (Robust standard error)	Coefficient (Robust standard error)
<b>Focus variables</b>		
<i>Timing</i>	$2.17 \times 10^{-5}$ ( $4.75 \times 10^{-5}$ )	$3.55 \times 10^{-5}$ ( $5.04 \times 10^{-5}$ )
<i>BetAmount</i>	$2.56 \times 10^{-5}$ ( $6.48 \times 10^{-5}$ )	$2.45 \times 10^{-4}$ * ( $1.04 \times 10^{-4}$ )
<i>BetAmount</i> × <i>Timing</i>		$2.11 \times 10^{-6}$ * ( $7.18 \times 10^{-7}$ )
<b>Control variables</b>		
<i>Male</i>	0.017 (0.017)	0.017 (0.017)
<i>Age</i>	-0.001* ( $4.34 \times 10^{-4}$ )	-0.001* ( $4.35 \times 10^{-4}$ )
<i>Experience</i>	0.036* (0.011)	0.035* (0.011)
<i>Race controls</i> <sup>#</sup>	Yes	Yes
<i>Betting type controls</i> <sup>##</sup>	Yes	Yes
Number of bettors	18,640	18,640
Number of observations	581,560	581,560
Overall R <sup>2</sup>	0.0003	0.0003

Notes: \*Statistically significant at 5%. <sup>#</sup>Race controls: the average odds of all bets placed on a race by the bettor, turnover in euros and dummy variables for the two main race meetings of week separately, a night race meeting and a race meeting abroad. <sup>##</sup>Betting type controls: The shares of Place, Win and Trifecta bets, which relate to the division of stakes between different bet types for an individual bettor's wagers on an individual race. The share of Quinella is used as the reference category.

To see how the amount staked and timing together predict the rate of return, consider the following relationship using the estimated coefficients from Model 2:

$$ROR = 0.000245 \times BetAmount + 0.0000355 \times Timing - 0.00000211 \times BetAmount \times Timing \quad (2)$$

<sup>3</sup> We also estimated the models using bet size relative to the total betting volume as an alternative focus variable. The results were qualitatively similar to the ones reported here though the relative bet amount was statistically significant in Model 1.

Since the signs of the estimated coefficients are negative for  $BetAmount \times Timing$  and positive for  $BetAmount$ , the combined effect can be analysed by taking a derivative with respect to the latter variable:

$$\frac{\partial ROR}{\partial BetAmount} = 0.000245 - 0.00000211 \times Timing \quad (3)$$

Setting (3) equal to zero and solving for  $Timing$  yields 116 minutes, which is the time that offsets the (positive) impact of the bet amount on the rate of return. That is, bet size is a positive predictor of the rate of return for bets (the large majority) placed within 116 minutes of race time; and the marginal effect of bet size is enhanced the closer to race time the wager is placed.

Regarding the variables controlling for bettors' characteristics, the results suggest that younger bettors appear to be 'smarter' bettors because the coefficient on  $Age$  is negative.  $Experience$  indicates that high experience is positively associated with higher rate of return. However, gender is insignificant.

#### 4. Discussion

Our results indicate that late large bets earn higher returns. This suggests that timing alone does not signal 'smart money' but rather it is large bets placed late which characterise the behaviour of informed traders. It could be argued that the relative profitability of the late high stakes bets is consistent with the 'smart money' hypothesis because bettors with superior information prefer to withhold their information to mitigate a large wager's impact on odds (Sauer, 1998). Consequently, this is consistent with the assumption that informed traders profit from noise traders in financial markets.

#### Acknowledgements

The authors wish to thank Pertti Koskenniemi and Reijo Antila from Veikkaus Ltd (formerly Fintoto Ltd) for providing the data. The authors also acknowledge The Emil Aaltonen Foundation and the Finnish Foundation for Alcohol Studies for financial support.

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