ASSET MARKET MANIPULATION: A FIELD EXPERIMENT WITH RACETRACK BETTING

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The possibility that asset markets could be strategically manipulated by large informed traders has fascinated social scientists and market observers for years. There is a well-known story of minions of Nathan Rothschild, who was thought to have the fastest carrier pigeons in London, selling shares during the Battle of Waterloo to drive the price down artificially (the news was actually good for British share prices) so others trading on his behalf could quietly buy up shares cheaply. This kind of attempt by informed speculators to fool markets by trading against their information, luring others to trade in the same way in order to profit later, was also observed in laboratory markets by Noth and Weber (1996), and Plott, Wit, and Yang (1996). More recently (in the late 1990s and 2000) the fact that intraday volatility of many NASDAQ is so extremely high has been attributed to speculators pushing up prices of thinly-traded stocks, knowing that "day traders" will often chase trends so the speculators can sell later at higher prices to the day traders.

Inspired by these observations, I conducted an experiment at horse racing tracks which allow bettors to cancel bets before a race is run (see Camerer, 1998 for details). The possibility of cancellation means that large bets can be made for free, to see whether observable movements in 'prices' (betting odds) manipulate markets as Rothschild is alleged to have done, and as the laboratory subjects tried to do. I have also been told that bettors in New Zealand and Australia have done this, with some success (see Auckland Sunday News, 1997).

Experimental manipulations of this sort can also reveal something about the microstructure of how diverse information is aggregated. If bettors bet more when they see that a large bet is made, this suggests they learn from observable prices, laying the foundation for fully-revealing rational expectations equilibrium. On the other hand, if bettors bet less when a large bet is made, this means they do not learn anything from prices and bet according to private information or opinions instead.

1. Experimental Design

American racetrack betting is 'parimutuel,' which means that bettors who bet on a horse and win share the money bet by everyone (after the track takes out a 15–20% share). The experiment used only win betting, which means that players earn money only if

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their horse wins. Notice that in the parimutuel system, bettors are essentially betting against each other. Beginning about thirty minutes before a race, the track displays the cumulative amount of money bet so far on that race, every minute or so. The track also computes the 'odds,' the net payoff per dollar for each horse, if that horse wins. In the parimutuel system, when more money is bet on a horse the odds fall because the winning bettors have to share the losers' bets (minus track take) with more winners.

My experiment used a within-race matched-pair design. In order to maximize the impact of a \$500 bet, I bet on longshot horses with odds of 20-1 or more. (Relatively less is bet on these horses, by definition, so the absolute movements in the odds is larger than it would be for more favored horses.) I chose races in which there were two or more horses with the same 'morning-line' (beginning) odds, and which had similar bet totals when the totals were first displayed, about thirty minutes before 'post time' (the projected starting time of the race; usually races start 2–3 minutes later than this). This procedure generated races with a pair of horses who are matched on pre-bet features. A temporary \$500 bet is made on one horse, chosen at random by flipping a coin, and movements in betting on that horse and on the unbet (control) horse were recorded. The unbet horse serves as a control for shocks which are idiosyncratic to a race but mostly common to two longshots within the race. Intuitively, the behavior of betting on the control horse provides an approximate answer to the question, 'What would have happened if the temporary bet was not made?' While this kind of matched-pair design is rarely used in experimental economics, it is extremely efficient for some purposes. (For example, identical twins are used as a pair that are matched on genes to separate environmental and genetic influences; in this experiment, the two horses are like 'race-twins'.)

The temporary bets were made 18–20 minutes before post time and were canceled about five minutes before post time. Fifty \$500 bets were made. An important feature of betting at these tracks is that bettors have little incentive to bet early, because the final odds are not determined until the race starts. Indeed, half the bets are made in the three minutes before post time.

Theory implies that the bets will have some effect if several assumptions hold: Bettors do not realize bets can be canceled (most do not); bets affect the odds visibly; bettors react to changes in odds in some way; and there is an asymmetry between their initial reaction when the bet is made and their reaction when the bet is canceled. (The asymmetry could result because the \$500 bet moves the odds more when it is made, and the total win pool is smaller, than when it is canceled because the total pool grows as the race approaches.)

The direction of the effect will depend on whether bettors think there is information in odds movements or not. If bettors have private information or opinions, and do not think price movements contain information they need to know, they will bet less on the temporary-bet horse (relative to the control) because the bet simply lowers the odds and makes the potential payoff unattractive. As a result, the odds on the temporary-bet horse should drift up over time while the bet is still live (before it is canceled), as the flow of money into that horse is inhibited. Oppositely, if bettors have rational expectations then they believe the post-bet odds are correct and will bet accordingly (betting more on the temporary-bet horse than on the control), maintaining a steady path of odds over time. If the asymmetry assumption holds – these reactions are stronger when the bet is first made than when it is canceled – then the final odds will be higher on temporary-bet horses (compared to the control) if opinion bettors are influential, and lower if rational-expectations bettors are influential.

2. Experimental Results

One way to look at the data is to treat the bets as events and use the kind of 'event study' popular in financial economics. An event study looks at a time series of price anticipations and reactions to an event, defines time at which the event occurs as zero, and lines up all the time series relative to event time. Each slice of time – say, time -5 – then gives a cross-section of data showing what tends to happen five time units before an event.

Figure 1 shows such a time series. The graph displays the geometric mean odds, across fifty temporary bets, for temporary-bet horses and control horses. The thinner lines at the bottom of the graph show the frequency distribution of the times at which bets were made ('number of INs') and canceled ('number of OUTs'). Both horses start at about 20-1 odds. As the bets are made, between 21 and 16 minutes before post time, the temporary-bet horse odds fall, because of the experimental bet. After the bets are in, the temporary-bet horse odds are about half as large as the matched-pair control, so the effect is large and visible. (A couple of times people at the track commented, within earshot of us, on the drop in odds.) While the bets are on, between times -16 and -5 or so, the temporary-bet horse odds drift upward. This shows that bettors do not all infer information from odds movements (otherwise the odds would stay flat). After the bet is canceled, from five to three minutes before post, the control and temporary-bet horse odds are almost exactly the same.

A more powerful test exploits the matched-pair control. To do this, we compute the change in the percentage of the pool bet on a horse, from two minutes before the bet is made to two minutes after the bet is canceled. Then we take the difference in these changes between the control horse and the temporary-bet horse. This difference has a mean of 0.00211 ($t(48) = .74$, insignificant), so there is a very slight tendency for the temporary-bet horse to attract more money over time than the control horse, but the tendency is nowhere near significantly different from chance.

Perhaps the \$500 bets are too small, or were made too early or canceled too early to appear informative. To measure the effect of larger, later bets a second sample of 33 bets were made at smaller racetracks with substantially smaller amounts of betting. The bets were \$1000 and were made in two \$500 waves, about 13 and nine minutes before post time. (These bets are 7% of the entire win pool when they are placed.) Bets were canceled later as well, three and one minutes before post.

The results from this second sample are much like the first. After both waves of betting are done, around 8 minutes before post time, the temporary-bet horse odds are

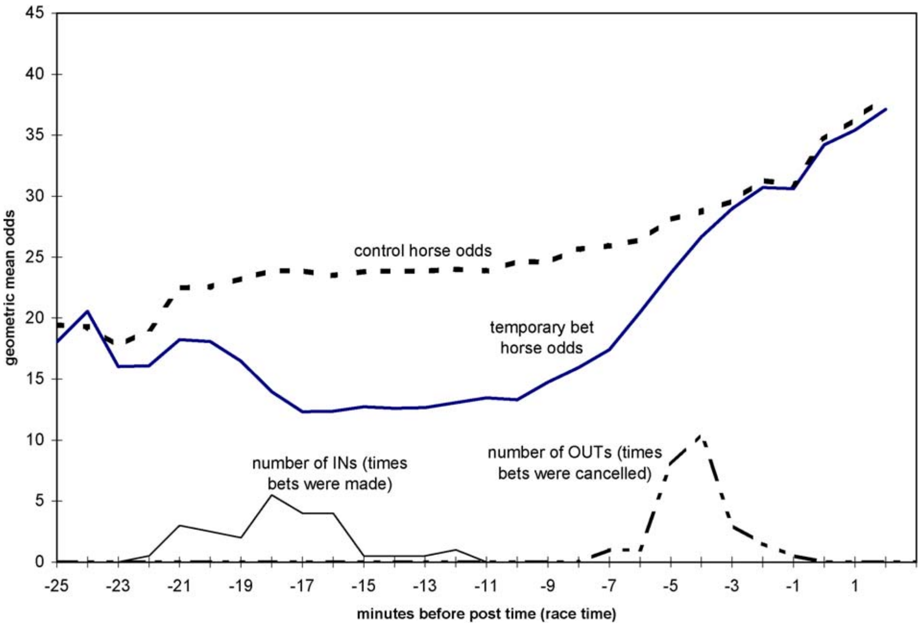

Figure 1. Geometric mean odds on temporary-bet horses vs control horses (Camerer, 1998).

less than half of the control horse odds. While the bets are live, between −8 and −3, the odds drift upward substantially, indicating the presence of some opinion bettors who are betting against a horse they think is 'overbet.' After the bets are all canceled, two minutes after post time, the temporary-bet horse odds are visibly lower than the control horse odds. The within-pair test described above gives a difference in post-bet minus pre-bet percentage changes of 0.006734 ($t(31) = 1.23$, $p = .24$ one-tailed).

Pooling these results with the first sample gives an overall percentage change difference of .00395 ($t(81) = 1.43$, $p = .16$). A conservative sign test shows that 50 of 83 differences are positive (i.e., 50 times there was a larger change toward the temporary-bet horse than toward the control horse, and 33 times the opposite), which is marginally significantly different from chance ($z = 1.91$, $p = .06$). Thus there, is very modest evidence that the temporary bet tends to draw money toward the horse which is bet (consistent with rational expectations) rather than pushing money away from the temporarily-bet horse. But the effect is small and only marginally significant.

3. Conclusion

My studies were designed to test whether active naturally-occurring markets could be manipulated experimentally in a way that permitted statistically powerful identification of whether manipulation generally works (rather than anecdotal evidence). The studies also serve as a reminder that true experiments can sometimes be conducted in the field, cheaply; we should seize those opportunities when they arise, or create them.[1]

The answer to the primary research question seems to be that these markets can be very weakly manipulated. I made temporary $500 or $1000 bets on longshot horses, roughly cutting the posted odds on the temporary-bet horse in half. About 60% of the time more money was eventually bet on the temporary-bet horse, relative to a similar control horse in the same race, and 40% of the time more was bet on the control horse. This result indicates a slight tendency toward rational expectations, in which bettors infer information from price movements about a horse's chance of winning. (This rational-expectations tendency is only a mistake here, of course, because our bets were not informative, but most bettors do not know that large bets can be canceled costlessly.) However, the effect is very small in magnitude (one could not profit from it) and only marginally significant, even with two large samples of 50 and 33 bets.

More generally, the inability of these large bets to move the market systematically is a blow to the beliefs of those who think markets are easily and routinely manipulated by large investors. For those who do not believe manipulation is common, and instead are inclined to marvel at the mysterious collective intelligence of centralized markets populated by self-interested traders, the general immunity of these markets to substantial, systematic attempts at manipulation may represent something new to explain, or at least marvel at.

References

Auckland Sunday News (1997). "New rules hit pro punters". August 17, p. 43.

Camerer, Colin F. (1998). "Can asset markets be manipulated? A field experiment with racetrack betting". Journal of Political Economy, 457–482.

Lucking-Reiley, David H. (1999). "Using field experiments to test equivalence between auction formats: Magic on the Internet". American Economic Review 89 (5), 1063–1080.

Nöth, Markus, Weber, Martin (1996). "Insider detection in experimental asset markets". Manuscript, Mannheim, Lehrstühle für Finanzwirtschaft.

Plott, Charles R., Wit, Jörgen, Yang, C. Winston (1996). "Parimutuel betting markets as information aggregation devices: Experimental results". Manuscript, Pasadena, California Institute of Technology.

[1] In one ingenious example, Lucking-Reiley (1999) created internet auction markets to sell trading cards, in order to test theories of the effects of reserve prices on bids, which are hard to test with naturally-occurring data. Opportunities to conduct field experiments like his and mine are now more limited by imagination and energy than by technology or research funds.