



American Finance Association

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Source: *The Journal of Finance*, Vol. 35, No. 4 (Sep., 1980), pp. 1039-1043

Published by: Blackwell Publishing for the American Finance Association

Stable URL: <http://www.jstor.org/stable/2327220>

Accessed: 28/11/2009 08:19

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Back on the Track with the Efficient Markets Hypothesis

ROBERT L. LOSEY and JOHN C. TALBOTT, JR.*

IN A 1978 ARTICLE [10] in this journal, Wayne W. Snyder makes an analogy between security markets and pari-mutuel betting on horse races, suggesting that similarities between the two markets form a basis for the application of the theory of efficient markets to pari-mutuel betting. Snyder's analogy is apt, and his weak form test based on his own findings and similar findings by other researchers [4, 6, 7, 8, 11], is a reasonable test of the weak form efficient markets hypothesis. Furthermore, Snyder's discussion of a strong form test provides a useful basis for the formulation of a test of market efficiency; and with further refinement, it can be transformed into a more powerful test that also provides additional insight as to the influence of handicappers' quoted odds on publicly determined odds. This note further clarifies the applicability of the efficient markets model to pari-mutuel betting markets, and defines and implements a strong form test¹ of the efficiency of pari-mutuel betting markets which is a logical extension of Snyder's work.

In laying the groundwork for his strong form test, Snyder correctly argues that "owners, trainers, jockeys, grooms, and clockers ... aspire to corner special information ..." The implication is that such "insiders" are sometimes able to realize above-average profits as a result of monopolistic access to information. He bases his test of the strong-form hypothesis on the odds predicted by another group, the handicappers whose "expert opinions" are published in the *Daily Racing Form*, daily newspapers, and the track program. There is doubt as to whether handicappers can be considered insiders in the sense of having monopolistic access to information, as the odds which they quote are based primarily on information available in the *Daily Racing Form*, which is widely disseminated to bettors at the track which is the subject of Snyder's study. Furthermore, handicappers' odds are published prior to races with the express purpose of providing handicapping aid to the betting public. Thus it is reasonable to view handicappers as the race track analogue to brokerage firm and other advisory service financial analysts who "handicap" the stock market. Both race track handicappers and financial analysts are "experts" whose primary sources of information are publicly available data used in handicapping their respective markets. In this context, it seems more appropriate to consider a test of the efficiency of pari-mutuel markets

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¹ As suggested in this paper, it may be more appropriate to consider both Snyder's original efforts and the test proposed in this paper as a test of the semi-strong rather than the strong efficient market hypothesis.

based on handicappers' prognostications as a test of the semi-strong hypothesis rather than of the strong form.

In Snyder's section on the strong form test of the efficient markets hypothesis, the analysis is based on five separate data sets which are compilations of the public prognostications of each of five "experts". Snyder graphically illustrates the relationship of returns on hypothetical bets made at published handicappers' odds to publicly determined odds and to the empirically determined probabilities of winning. These graphs show that "experts' rates of return are both larger (at low odds) and smaller (at high odds) than the public's rates of return." Snyder then obtains a quantitative measure of the degree of this divergence by calculating the root-mean-square difference for each paired set. He then alludes to the greater bias exhibited by the experts than the public in concluding that his ... "five strong tests of market efficiency have each failed to reveal any means of making a positive return after the track take is subtracted."

While Snyder has shown that publicly determined odds and experts' odds diverge systematically at both ends of the odds continuum, he has not inquired as to how knowledge of this divergence might allow a bettor to improve his chances of finding profitable betting opportunities.² A logical extension of Snyder's findings is to test for the presence of a learning lag or other phenomenon which causes the expert opinions of handicappers to be imperfectly incorporated into publicly determined odds.

In constructing a test for such imperfections, we observe that studies of pari-mutuel betting consistently report that long-shots are bet down to shorter odds than their empirically determined probabilities of winning warrant, and Snyder's study reveals that handicappers' odds err even further in this direction. Thus the possibility of using comparisons of handicappers' odds to publicly determined odds in order to find profitable long-shot bets is remote.³ However, as Snyder and the surveyed studies show, short-odds horses are underbet relative to their empirically determined probabilities; moreover, a subset of short-odds bets can be made at odds even longer than the typically generous odds quoted by handicappers.⁴ Such deviations of publicly determined odds from handicappers'

² It is important to keep in mind that bets can not necessarily be made at the odds quoted by handicappers, and that handicappers typically constrain their reported odds to take account of the track take-out. In light of the latter constraint, the average return on hypothetical bets made at handicappers' odds is a loss equal to the track take-out. The average return on such bets could be positive only if handicappers followed the deceptive practice of inflating their published odds across the board.

The divergence of handicappers' odds from publicly determined odds merely indicates a(n apparent) difference of opinion, the basis of which Snyder explains in his article [10, p. 1118]. The fact that handicappers' odds diverge more from an "unbiased prediction" than publicly determined odds proves only that handicappers err more than the public in predicting a horse's probability of winning.

³ A bettor whose strategy is to wager on all long shots with odds exceeding the published odds of handicappers would be wagering on almost every long-shot. The return from such a strategy would almost surely approximate the greater than average losses suffered by the typical long-shot bettor.

⁴ The odds quoted on the shortest odds bets by two of the five experts (*Daily News* and *Tribune*) would yield a positive return after the track take, if these odds were obtainable. *Daily Racing Form* odds on such bets result in a return which approximately compensates for the track take, and the return on hypothetical bets on the shortest odds horses averaged across all five "experts", appears to allow a slight profit after the track take-out.

reported odds can be used as a basis for a test of market efficiency. The crucial question is whether such cases reflect a failure on the part of the betting public to adequately incorporate expert opinions into their estimates of a horse's chances of winning. If the market imperfectly incorporates this information, this will allow an astute bettor an opportunity to make above average returns.

In implementing our test of market efficiency, we have used data from the Arlington Park summer meet, although for 1978 rather than 1975, as the 1975 Arlington Park data used by Snyder were not readily obtainable. In order to provide a more extensive basis for our test, we have augmented the Arlington Park data with data from the Chicago area's Hawthorne meet which follows Arlington. Analytical results from both data sets were essentially identical, and were pooled in the results reported herein.

Our test makes hypothetical bets on all horses listed by the Racing Form handicapper at 3-1 or less which actually go off at longer odds than those reported by the handicapper. If we can rely on the handicapper's opinion, bets on these "handicapper's overlays" (HOs) should yield above average returns because they are underbet in the public wagering relative to their actual chances.⁵ A measure of the extent of the divergence of handicapper's odds from publicly determined odds on a given horse, herein termed the overlay ratio, is obtained by dividing the final pari-mutuel (publicly determined) odds by the handicapper's odds. If we believe that handicappers are truly expert assessors of racing performance, then higher values for the overlay ratio should tend to indicate higher expected returns for the bets in question.

However, neither the average rate of return generated by hypothetical bets on all HOs, nor a further examination of returns for overlay ratios when the data are subdivided by range into three subsamples supports a belief in handicappers' acumen. In fact, the 28.4 percent rate of loss on HO system bets significantly exceeds the 17 percent track take-out, the outcome expected from a random choice strategy.⁶ Moreover, it is observed that bets on horses exhibiting higher overlay ratios yield higher losses, a finding which directly contradicts expectations if handicappers' odds are indeed expertly determined.

⁵ An analogous strategy in the stock market would be to purchase only those stocks that can be bought at a price less than an analyst's recommended purchase price. The return on wagers selected by the HO test tend to be biased toward above average returns (below average losses) for two reasons unrelated to the expertise of handicappers:

1) A significant majority (72%) of the bets selected by this method are at odds of 5-1 or lower. Snyder's study and the studies cited by him show that horses with publicly determined odds of 5-1 or less yield above average returns (though still negative after track take-out).

2) As pointed out by Snyder [10, p. 1117], the odds quoted by handicappers on short-odds horses tend to understate their actual chances of winning. As all bets made under our system are on horses originally quoted by handicappers at 3-1 or shorter odds, this also suggests that results should be biased toward above average returns.

The fact that results of the HO test reveal significantly greater than average losses in spite of these biases reinforces the validity of our findings.

⁶ The legislated track take-out is 16%. However, because pay-offs are always calculated to the nearest lower \$.10 on the dollar, the take-out on win-pool bets approximates 17%.

Table I

Relationship between the "overlay ratio" and return per dollar wagered for HO system bets⁷

The "Overlay Ratio" (Ratio of pari-mutuel odds to handicapper's odds)	1.01-1.32	1.33-1.72	1.73+
Mean pari-mutuel (handicapper's) odds within range	3.05:1 (2.60:1)	4.43:1 (2.82:1)	7.28:1 (2.80:1)
Percent return per dollar wagered	-21.6	-32.8	-32.7

Overall mean of HO system bets = - 28.4%*

Data consists of the 579 qualifying bets drawn from 1305 races.

* Significantly different at the 5% level from the average bettor's return of -17%.

With regard to the implications of our results for market efficiency, if we accept Snyder's implicit definition in which the absence of profit potential indicates efficiency, we conclude that we have insufficient evidence to indicate that pari-mutuel markets are inefficient. However, if we employ the more general test of market efficiency articulated by Fama [5, p. 404], and alluded to by Snyder in the first paragraph of his *Journal of Finance* article, namely that "... prices fully reflect all available information," the results of our test suggest that pari-mutuel markets are inefficient.⁸

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⁷ As an example consider a representative wager from the middle column of overlay ratios. (The data in Table 1 is divided into the lowest, middle, and highest thirds of the overlay ratios.) Such a wager would have been listed by the handicapper at approximately 2.82:1, but closed at publicly determined odds of about 4.43:1. An average bettor wagering \$100 on all available 4.43:1 shots should expect a return of *over* \$83 since 4.43:1 shots win often enough on average to partially offset the 17% track take-out. However, the subset of bets clustering around 4.43:1 chosen by the HO system generates a return of \$67.20 per \$100 wagered (\$100 less 32.8% loss of \$32.80), a result that calls into question both the expertise of handicappers and the efficiency of pari-mutuel markets.

⁸ The betting patterns observed in our test are easily explained if a significant part of the betting public mistakenly places its trust in handicappers' opinions and bets on HOs so as to lower the pari-mutuel odds on these supposed overlays, thereby preventing the odds from rising to a level indicative of horses' actual chances of winning.

Our analysis implies that a bettor can raise his expected return above the average by shunning the low-return bets selected by the HO system. It is not implausible to expect that an astute bettor may find other inefficiencies in pari-mutuel markets, each of which contributes marginally to improve the bettor's chances. On occasion, the sum of the marginal advantages may exceed the 17% track take, and thus allow bets to be made that have positive expected returns.

An interesting implication of the poor performance of handicappers in our test of market efficiency is that there is a pari-mutuel market analogue to the theory of contrary opinion often referred to by stock market analysts. (For a discussion of "contrary opinion" see [2].)

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