Blowing Bubbles: Heuristics and Biases in the Run-Up of Stock Prices

Joseph Johnson
University of Miami

Gerard J. Tellis
University of Southern California, Los Angeles

Ads of stocks and mutual funds typically tout their past performance, despite a disclosure that past performance does not guarantee future returns. Are consumers motivated to buy or sell based on past performance of assets? More generally, do consumers (wrongly) use sequential information about past performance of assets to make suboptimal decisions? Use of this heuristic leads to two well-known biases: the hot hand and the gambler's fallacy. This study proposes a theory of hype that integrates these two biases; that a positive run could inflate prices, while a negative run could depress them, although the pattern could reverse on extended runs. Tests on two experiments and one event study of stock purchases strongly suggest that consumers dump "losers" and buy "winners." The latter phenomenon could lead to hyped-up prices on the stock market for winning stocks. The authors discuss the managerial, public policy, and research implications of the results.

Keywords: *heuristics and biases; financial products; behavioral decision theory; judgment and decision making*

The use of past sequential information is a common practice of consumers when making decisions under uncertainty. Examples include waiting before buying a new product because its prices are falling, waiting to refinance a home because home mortgage rates are declining, and rushing to buy a mutual fund because prices or asset values are increasing. Indeed, many analysts believe that the rise in the price of high-technology stocks until March 2000 was fed by prior increases in price rather than any underlying evaluation of their worth.

Marketers of mutual funds, stocks, and similar financial products exploit this practice of consumers by aggressively advertising the past positive performance of their offerings. Our informal survey of issues in 2 years of the magazine *Money* indicates that the ads for such products mostly emphasize past performance. Figure 1 gives examples of two such ads. Ironically, all these ads have a disclosure at the bottom (mandated by the Securities and Exchange Commission [SEC]) that "past performance is no guarantee of future returns." If that statement is indeed true, then all the information in the ad about past performance is mostly meaningless. Why then do ads emphasize past performance?

We suspect that advertisers provide information about past performance because they believe that consumers base their choices on past performance. Research in behavioral decision making shows that individuals do make decisions on the basis of sequences of information. Their reliance on sequential information leads to some well-known biases, two of which are the hot hand and the gambler's fallacy. The hot hand bias occurs when consumers wrongly project into the future an observed trend in a process that is essentially random (Andreassen 1988; DeBondt 1993; Zeckhauser, Hendricks, and Patel 1993; Dhar and Kumar 2001). An illustration of this phenomenon is consumers' prediction in the continued success of a basketball player who shoots a string of baskets. Observers refer to such a player as "hot" or as having a "hot hand." Gilovich, Vallone, and Tversky (1985) showed that this prediction is erroneous because shooting spells of

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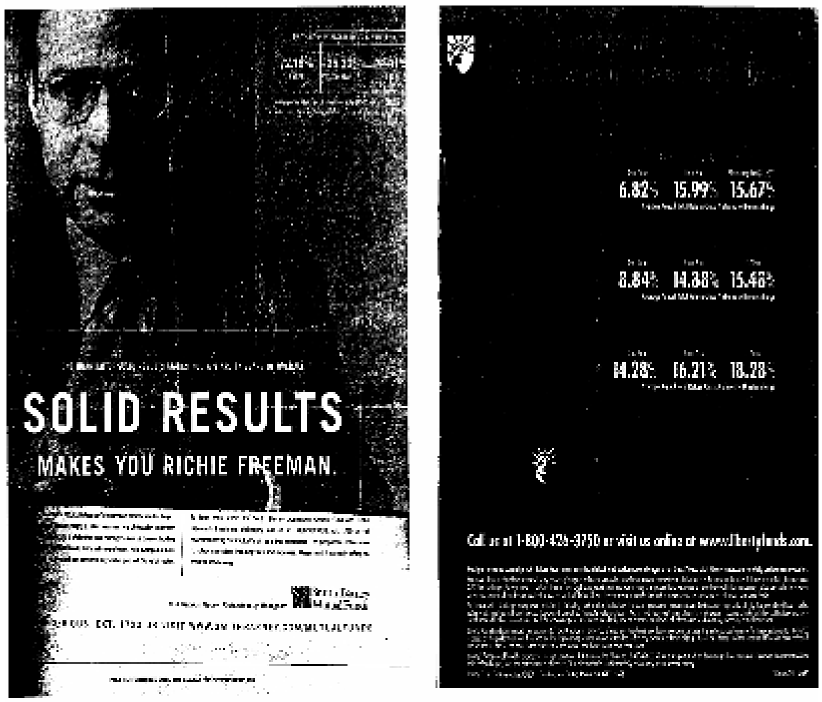
FIGURE 1
Examples of Advertisements for Financial Products



basketball players is essentially random. If marketers of financial products believe that consumers behave like this when choosing financial products, then they would have reason to design ads that emphasize past performance. Our review of ads suggests that marketers of financial products do subscribe to this view.

The gambler's fallacy occurs when consumers wrongly expect a reversal in a random sequence that happens to show a trend (Tversky and Kahneman 1971). They mistakenly believe that the trend must reverse because the individual draws are related rather than independent. This bias afflicts the gambler who mistakenly believes he will win after a string of losses. If consumers really believe in trend reversals, then the advertising of record-breaking strings of past successes of stocks or mutual funds would backfire, as consumers would expect an imminent loss and shun those products. Our review of ads suggests that marketers of financial products do not subscribe to this view.

Both the above patterns of behavior arise from consumers' basic misunderstanding of random events due to a mistaken belief that small samples should be representative of the underlying process (Kahneman and Tversky 1972). However, the dominant paradigm in finance asserts that the current price of a stock reflects the discounted future value of all available information about that stock until that point in time. Thus, any trends in stock prices are devoid of meaning, and the best estimate of the future price is the current price.

This thinking underlies the SEC's requirement of a fair disclosure in the ads for financial products. If consumers do indeed believe this theory, then marketers of financial products do not need to advertise past performance at all, nor would the SEC require advertisers to put such a disclosure in their ads. Apparently, their practice suggests that this is neither their belief nor their hope. But are they right in their beliefs? The key question is, which of these three patterns of behavior do consumers follow? In particular, how do individual consumers respond to information about the past performance of financial products when choosing to invest in them? This is the focus of the current study.

We propose that consumers typically do not ignore past information about products, even when they should. In particular, when faced with the performance of products in the form of a sequence of events, they develop beliefs about the future of the sequence that includes *both trend projection and trend reversal, depending on the length of the trend*. As a result, their behavior incorporates both effects described in the research in behavioral decision making: the hot hand (due to trend projection) and the gambler's fallacy (due to trend reversal). The importance of this behavior arises from the fact that this behavior is not justified by financial theories of the stock market or by an empirical test of the theories. Moreover, this behavior may explain two major findings unearthed by financial researchers during the past two decades: the existence of momentum in stock returns during short periods of 3 to 12 months followed by reversals during long periods of 3 to 5 years. Swaminathan and Lee (2000) stated that "the reconciliation of these two patterns represents an important challenge to financial researchers."

We test our thesis through three studies in the context of consumers' purchase of stocks on the basis of information about past earnings of those stocks. First, an experiment ascertains how sequences of increasing or decreasing earnings affect consumers' propensity to buy or sell a specific stock. Second, another experiment looks at process measures and ascertains whether the results are robust to mood manipulations. This study also looks at process measures. Third, an event analysis tries to detect if, because of such behavior of consumers, stocks show abnormal returns conditional on various sequences of increasing or decreasing earnings. In contrast to studies in economics or behavioral finance, our goal is not to focus on the efficiency or inefficiency of financial markets. (Such a test would have to go further to see if one could profitably exploit patterns in prices after accounting for transactions costs.) Rather, our goal is to research the systematic biases in consumers' behavior relative to the dictates of economic theory, because of sequences of information, and to test if such biases can be detected at the individual and the market level.

Our work has some similarity to that of Barberis, Shliefer, and Vishny (1998), who tried to model consumers as either having a mean-reverting mind-set (akin to gamblers fallacy) or a continuation mind-set (akin to hot hand), when faced with past earnings of a firm. However, they demonstrate their main thesis by simulation. We do so by experimentation and market analysis, as Raghubir and Das (1999) urged. We first conduct a test of our thesis by analyzing the responses of experimental subjects to earnings strings of varying length. We then conduct a market analysis of returns of stocks to the same sequence of information. Thus, we address two critical questions not addressed by Barberis et al. (1998): Which of these two mind-sets do consumers adopt? and How do they make the transition from one mind-set to the other? In particular, the latter question is one that financial researchers have not been able to explain. As Swaminathan and Lee (2000) stated, "Even less is known about the transitional dynamics between these two effects (mean-reverting and continuation mind-sets)." In contrast, we show how the varying length of the run of past information can cause this transition.

The purchase of financial products is just one context in which to test our thesis. Our thesis applies to a number of different contexts where consumers can act on the basis of a sequence of information about the past performance of a product. Examples include the frenzied bidding in auctions, the overvaluation of celebrity endorsers until they suddenly become unpopular (Agarwal and Kamakura 1995), the rapid growth of new products until a sudden drop in sales (Goldenberg, Libai, and Muller 2002), the escalation in real estate prices in a hot market until a sudden reversal, and the rise and fall of fads. We contend that in *all* such scenarios, trend projection could be *one explanation* for the initial hype that surrounds a product's popularity, followed by its implosion when trend reversal sets in. These contexts differ from the stock market scenario in which a strongly developed theory suggests that past trends *are not informative of future performance*. As such, we can devise a formal test of the thesis in the context of the stock market. For auctions, we can ascertain the true value by the price in markets outside of the auction. However, one would need a creative test to establish the overvaluation in the other contexts.

We divide the rest of this paper into the following parts. We first review the relevant literatures. We then present a definition of *hype* and other terms. Next, we integrate past theory to derive specific hypotheses that are tested in three separate studies. Finally, we discuss the implications and limitations of these studies.

LITERATURE: HOW PAST INFORMATION AFFECTS CONSUMERS' CHOICES

There is a small but growing literature in marketing that looks at stock market returns to marketing events or announcements, such as brand extensions (Lane and Jacobson 1995), new product introductions (Chaney, Devinney, and Winer 1991), and celebrity announcements (Agarwal and Kamakura 1995). Relative to those studies, our research focuses on the rationale for advertising the past performance of stocks and mutual funds, and its impact, if any, on the abnormal returns to those financial products. It could also provide a unifying theory for momentum and reversal effects documented by financial researchers. It draws on the literature of biases and heuristics, which has begun to interest marketers (e.g., Raghubir and Das 1999).

As indicated above, past sequences of information about a stock could affect consumers' expectations of the future performance of the stock in two alternative ways: the hot hand (trend projection) and the gambler's fallacy (trend reversal). Both these responses arise from a consumer's basic misunderstanding of random events.

Consumers mistakenly believe that small samples should be representative of the underlying process. This misunderstanding has been called the *representativeness heuristic* or the *law of small numbers* (Kahneman and Tversky 1972). This heuristic causes people to judge the probability of an event "by the degree to which it is (i) similar in essential properties to its parent population and (ii) reflects the salient features of the process by which it is generated" (Kahneman and Tversky 1972:430). In contrast, the dominant view in economics and finance is that past trends in stock prices do not contain any information about its future price, because the current price encapsulates all past information.

Here we briefly review the literature behind these three related issues: the gambler's fallacy, the hot hand, and the random walk. We then clearly delineate the focus and contribution of the current research.

The Gambler's Fallacy

One of the earliest known statistical mistakes people made was the assumption of dependence in a sequence of independent events such as outcomes of a coin toss. This phenomenon came to be called the *gambler's fallacy*, because the error was common among gamblers who persisted in playing in the face of losses, because they wrongly believed that success must follow a string of losses. Tversky and Kahneman (1971) proposed that this fallacy arises because consumers do not realize that each draw is an independent event, and thus a loss is as likely after a string of losses as on the first trial.

The gambler's fallacy may be the underlying cause of an anomaly in the stock market. Shefrin and Statman (1985) and Odean (1998) showed that consumers hold on to their losing stocks too long and sell their winning stocks too fast. We posit that the gambler's fallacy identified at the individual level may be the probable cause for the phenomenon of holding on to losers at the aggregate level. In both cases, consumers wrongly expect a reversal in what are essentially random events. The gambler expects the losing streak to reverse. Similarly, consumers hold on to losing stocks expecting the string of losses to reverse. So, hanging on to losing stocks would enable them to recoup their losses on the reversal. The gambler's fallacy seems to conflict with the other bias in processing sequences of information under uncertainty: the hot hand.

The Hot Hand

Gilovich, Vallone, and Tversky (1985) originally coined the term *hot hand* to describe the public's beliefs about the performance of basketball players. A player has a *hot hand* when he has had a run of successful baskets. The authors found that Philadelphia 76er basketball fans, players, and coaches believed that a player has a higher probability of making a basket after a streak of successful baskets. However, their empirical tests showed that players' performance was no better than chance. Tversky and Gilovich (1989) showed that this behavior was due to the fact that individuals did not see independence in the string of random events. Camerer (1989) showed that at the aggregate level, the discrepancy between expectations based on the hot hand and performance of "hot" players was not strong enough for consumers to profit from.

The hot hand phenomenon in sports is analogous to phenomena in behavioral finance called overreaction and momentum investing. DeBondt and Thaler (1985) conducted the study that sparked off this debate. They argued that consumers who rely on past information become overly pessimistic about past losers and overly optimistic about past winners. As a result, past losers come to be undervalued and past winners come to be overvalued. This heuristic-driven bias causes prices to deviate from their fundamental value. So, DeBondt and Thaler (1985) predicted that stocks with extreme performance over an extended time period would display a reversal, as consumers realized the stocks' fundamental value. Through empirical research, DeBondt and Thaler (1987, 1989, 1990) showed that, in the long run, extreme losers outperformed the market and extreme winners underperformed the market.

Chopra, Lakonishok, and Ritter (1993) confirmed this phenomenon by showing that even after carefully controlling for size and risk, past losers still earned excess returns. In addition, Chopra et al. (1993) and La Porta, Lakonishok, Shleifer, and Vishny (1994) showed that corrections occur after earnings announcements. This result implies that consumers believe in a positive trend until they are disappointed by a negative earnings result. Consistent with this finding, momentum studies such as those by Jegadeesh and Titman (1993) found that prior winners continue to outperform prior losers in the short run, which could result from trends projected by individual consumers.

The phenomenon of the hot hand identified at the individual level is the probable cause for the overreaction phenomenon at the aggregate level in stock markets. The tendency of consumers to misinterpret random runs, see trends in them, and project the trends into the future is probably the underlying process that gives rise to both phenomena. Indeed, DeBondt and Thaler (1985) did offer a similar explanation under the rubric of the representative heuristic. The glorification in ads of past growth for stocks, mutual funds, and similar products shows that advertisers think that consumers either subscribe to this view or will do so in response to the ads.

The theory that stocks essentially follow a random walk contrasts with the above two views of consumer behavior (the hot hand and the gambler's fallacy).

The Random Walk Theory and Efficient Markets

The dominant theory in finance about the behavior of prices is the *random walk*. The theory posits that stock prices behave as if each day's price comes from a random draw. Hence, the best estimate of tomorrow's price is today's price. Thus, past prices are of no consequence when predicting future prices. Tests of the random walk theory attempt to see if future prices can indeed be forecasted using past prices. Such tests conclude that in the prediction of the next period's prices, all that matters is today's price.

Over the years, the random walk has withstood numerous criticisms (see, e.g., Fama 1998). In particular, Samuelson (1965) showed that properly anticipated stock prices are random, although they fully reflect the present value of the discounted future cash flows. These ideas led to Fama's efficient market hypothesis (Fama 1970, 1991). Two key propositions of this theory are that stock prices adjust instantaneously to information so that they fully incorporate past information and future expectation.

Today, a "semistrong" form of the efficient market hypothesis is the dominant view in the financial profession (Fama 1991; Jensen 1978). It holds that prices reflect all "public" information. Security analysts formulate value based on public information available to all consumers. Aggregation of estimates from a large number of independent analysts leads to a "fair value."

Researchers have devised a number of experiments to measure how quickly a market adjusts to new information. According to the efficient market hypothesis, this adjustment has to occur very quickly so that alert consumers do not profit from it. In Fama's (1970, 1991, 1998) surveys, the vast majority of those studies were unable to reject the "efficient markets" hypothesis for common stocks. These early studies led one prominent researcher to conclude that "there is no other proposition in economics which has more solid empirical evidence supporting it than the efficient market hypothesis" (Jensen 1978).

Summary

Thus, the dominant view in finance is that the stock market is efficient and stock prices are random. As such, no individual could beat the market consistently over the long haul. Indeed, several studies have shown that even professionals, like managers of mutual funds, do not beat the market consistently. The crux of the issue is whether consumers believe in the random walk and efficient markets. Marketers of stocks and mutual funds apparently do not think that consumers believe in the random walk and efficient markets or advertise in the hope that consumers would not do so. Marketers routinely market such products by advertising the past performance of their favorite stocks or their own mutual funds, despite the SEC disclosure at the bottom. Apparently, they hope and believe that consumers are influenced by past performance, suffering from the hot hand fallacy, but not the gambler's fallacy. Is this belief true?

This is the focus of the current research. We propose that, in contrast to the dictates of financial and economic theory, consumers do not ignore past information of stocks and mutual funds. In particular, when faced with the performance of stocks in the form of a sequence of outcomes, they develop beliefs about the future of the sequence that includes *both trend projection and trend reversal, depending on the length of the sequence*. As a result, their behavior incorporates both effects described above: the hot hand (due to trend projection) and the gambler's fallacy (due to trend reversal). This position integrates the two phenomena, as response to sequences of information, differing only by the length of the sequence.

Three studies ascertain whether (a) information in the form of a sequence of positive or negative earnings affect preferences, (b) the affective process of mood moderates these preferences, and (c) consumers' biases at the individual level are manifest as anomalies in aggregate markets.

We next build a theoretical framework that leads to testable hypotheses.

CONCEPT OF HYPE IN CONSUMERS' PURCHASE OF FINANCIAL PRODUCTS

We develop the concept of hype in the context of consumers' processing of sequential information. To clarify the discussion, we define some of the key terms we use. A *sequence* or *string* is a series of either positive or negative numbers. The term *run* refers to a sequence of increasing or decreasing numbers. We use the term *positive run* to refer to a sequence of increasing positive numbers and a *negative run* to refer to a sequence of decreasing positive numbers. Thus, a sequence of earnings per share (all numbers in dollars) of 2, 4, 6 is a sequence of increasing positive earnings or a positive run. The sequence 6, 4, 2 is a sequence of decreasing positive earnings or a negative run. We use the term *run length* to refer to the length or total number of numbers in the run.

We propose an integrated heuristic that we call *hype* that reconciles the conflicting predictions of the hot hand and the gambler's fallacy. We use the term *hype* to describe a mental process by which consumers overvalue or undervalue an asset, relative to its true or market value, because of a run of information about its past performance. We posit that this evaluation is not linear. Initially, in the face of a sequence of increasing positive earnings, consumers overvalue an asset, suffering from the hot hand fallacy. As the run lengthens, skepticism (gambler's fallacy) sets in, leading to a reversal in valuations and a rejection of the asset. The latter phenomenon is akin to the gambler's fallacy. We believe that for either pattern, the same underlying misinterpretation of probabilities occurs, that is, consumers misunderstand the essential randomness in a sequence of events. Relative to the literature, the key contribution we make is to assert that consumers suffer from *both* the hot hand and the gambler's fallacy, depending on the length of the run they face.

We test this framework in the context of consumers' and the market's response to stocks conditional on a run of earnings of those instruments. We do so in three studies, each of which we now describe.

STUDY 1: STOCK PREFERENCES IN THE PRESENCE OF HYPE

Study 1 elaborates on a theory of how hype could affect consumers' preferences to trade stocks at the individual level. The theory leads to certain testable hypotheses, which we validate through an experiment. We next present the theory, experiment, results, and discussion of Study 1.

Theory: Does Hype Affect Consumers' Trading of Stocks?

Our concept of hype integrates two separate biases: the hot hand and the gambler's fallacy. At the level of the individual consumer, both these factors occur in tension. Initially, the hot hand fallacy leads to an increasing bias in consumers' evaluation and trading of stocks. After a period of sustained increase, another bias—the gambler's fallacy—probably dominates leading to a reversal in this trend. This pattern leads to a nonlinear, inverted U-shaped response to information about a stock. We explain this nonlinearity in greater depth below.

We believe that the phenomenon holds symmetrically for the buying and selling of stocks, with sequences of increasing and decreasing positive earnings, albeit in opposite directions. In the interest of parsimony, we initially develop the hypotheses in the context of buying stocks with a sequence of increasing positive earnings or a positive run and selling stocks with a sequence of decreasing positive earnings or a negative earnings run.

Consider consumers faced with the task of buying stocks, such as when they have cash from tax rebates, winnings, savings, or inheritances. When consumers choose stocks for investing, Lakonishok, Shliefer, and Vishny (1994) have shown that consumers rely on past information about these stocks, such as earnings and sales growth, as guides to the value of a stock. As such, they are likely to arrive at biased conclusions of the value of the stocks. This result occurs because consumers are not perfect information processors and tend to use heuristics to collect information, reduce uncertainty, and form expectations (Van Raaij 1991).

The use of sequential information as a heuristic, such as a run of past earnings of a stock, leads to special problems (Johnson, Tellis, and Macinnis forthcoming). Craik and Lockhart (1972) have shown that existing knowledge structures serve as internalized frames of reference that encode incoming stimuli. This encoding affects how consumers evaluate sequential information. Consider first an increasing sequence of earnings. Consumers observe the initial rising trend in the sequence and conclude that the stock is of good value and are enthusiastic about it. As the sequence grows, the new stimuli in the form of further increases confirm their forecasts and further bias their valuations in the direction of the existing judgment. Hence, their enthusiasm grows. This response is consistent with Einhorn and Hogarth (1978), who suggested that people search for confirming evidence for their beliefs. So, as the sequence of earnings continues upward, consumers place higher value on the stock and tend to buy it. Examples of such behavior are well documented (Andreassen 1988; Zeckhauser et al. 1993). Shefrin (2000) discussed how bullishness increases after the market has gone up and bearishness increases after the market has fallen. However, we posit that this bias persists up to a point, after which the gambler's fallacy probably takes precedence.

As the trend continues, skepticism arises, because of consumers' common experience and belief that "no good thing lasts for ever." As the sequence of earnings grows, consumers are likely to be subject to the gambler's fallacy and revise their forecast. The reason is probably due to consumers' misunderstanding of probabilities. Tversky and Kahneman (1971) suggested that people mistakenly believe that chance sequences are locally representative, so every part of the sequence must appear equally random. They wrongly believe that the laws of probability preclude very long sequences. Thus, they think they need to see some losses in a long positive run or some gains in a long negative run. Failing to see that, they expect a reversal and act accordingly. Similarly, Shefrin (2000) showed that participants in a coin-tossing experiment expect a reversal after a long sequence of tails or heads. This is the mental process that gives rise to the gambler's fallacy.

Applied in the present context of stock purchases, consumers will expect a reversal after a very long run of positive earnings. As a result, they disfavor stocks whose earnings show a very long positive run and are less likely to buy it. Hence, we hypothesize the following:

> *Hypothesis A1:* Faced with a positive earnings run for a stock, consumers' preference for buying the stock will at first increase for a small to moderate positive earnings run, but after some critical run length, consumer preference for buying the stock will eventually decrease.

And conversely,

Hypothesis A2: Faced with a negative earnings run for a stock, consumers' preference for buying the stock will at first decrease for a small to moderate negative run, but after some critical run length, consumer preference for buying the stock will eventually increase.

Now, consider consumers facing a task of selling stocks to pay for taxes, children's education, or major purchases. We expect the chain of causation that affects consumers who want to buy stocks with a sequence of increasing earnings to hold symmetrically for consumers who want to sell stocks with a sequence of decreasing earnings. Initially, consumers in the latter condition are negatively biased by the sequence of declining earnings. As a result, they tend to shun the stock of the firm that reports such a sequence and tend to sell it. However, for reasons discussed earlier, beyond a critical point, as the sequence of earnings keeps decreasing, these consumers tend to reverse their valuations of these stocks. Their aversion to the stocks is less severe, and they are less prone to sell such stocks. Hence,

Hypothesis A3: Faced with a positive earnings run for a stock, consumers' preference for selling the stock will at first decrease for a small to moderate positive run, but after some critical run length, consumer preference for selling the stock will eventually increase.

And conversely,

Hypothesis A4: Faced with a negative earnings run for a stock, consumers' preference for selling the stock will at first increase for a small to moderate positive run, but after some critical run length, consumer preference for selling the stock will eventually decrease.

Recall, however, that the efficient market hypothesis is the dominant hypothesis in finance and suggests that the past may not be an indicator of the future. Similarly, the SEC requires that ads have a disclosure that past performance is no indicator of future performance. Therefore, if consumers believe in the efficient market or the SEC-mandated disclosure in ads, then they would not be influenced by the past run of earnings. Thus, we propose the following null hypothesis:

Hypothesis 01: The length of an earnings run of a given stock does not affect consumers' preference for purchase or sale of its stock.

Experimental Validation

We conducted an experiment to study how past earnings of stocks affect consumers' preference for those stocks. Here we present the design, sample, and procedure of the experiment.

Design, Procedure, and Sample

The study used a 3 (Run Length) × 2 (Trade Type) × 2 (Valence) factorial between-subjects design. Run Length (3, 7, or 11) and Type of Trade (buy or sell) were the two between-subjects factors. Valence (positive or negative runs) was a within-subjects factor.

For positive runs, participants saw a sequence of increasing positive earnings. For negative runs, participants saw a decreasing sequence of *positive* earnings (see Appendix). So in both cases, we used positive sequences for two reasons. First, in real markets, it is difficult to come across long runs of negative earnings. Second, consumers treat a decrease, albeit in positive earnings, as a negative signal. We kept the mean (but not the variance) of the increasing and decreasing series constant.

People usually buy stocks when they have money to invest from tax rebates, winnings, inheritances, or savings. They sell stocks when they want cash to pay for taxes, children's education, or major purchases. We therefore developed two separate scenarios for the buy and sell conditions.

In the buy condition, participants were told that they had received a tax rebate of $1,000, which they intended to invest in the stock market for a short period of one quarter. We focused on a quarter because it is well known that people suffer from temporal myopia (Hayes-Roth and Hayes-Roth 1979). They sought their broker's advice who presented them with two firms. These firms were identical, except that one stock (the winning stock) had a positive run of increasing positive earnings, and the other (the losing stock) had an equally long but negative run of decreasing positive earnings. The stocks took on fictitious names, Haloo and Andaz, which were randomized over conditions. The earnings per share for each stock were then presented in a tabular format. Depending on which of three run-length conditions the participants were in, they saw run lengths of 3, 7, or 11 for *both* the winning and losing stock. (See Appendix for an example with run length of 11.)

In the sell condition, participants were told that they had inherited a small portfolio of $20,000 of which they were planning to use $1,000 to buy a computer. To decide on which stock to sell, they approached their broker, who presented them with two stocks, identical except that they differed in their sequence of past earnings. The rest of the experiment was the same as for the buy condition.

We measured participants' preference for the winning and losing stocks on a 5-point scale. The scale ranged from

FIGURE 2
Predicted Preferences for Buying and Selling From Study 1

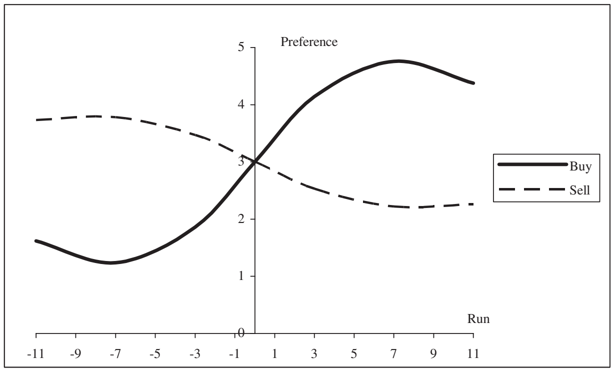


TABLE 1
Estimates of Regression of Preference on Run Length

Variable	*Estimate*	*Probability*
Intercept	3.000	.0001
Buy × Length	0.474	.0001
Buy × Length^2	–0.032	.0001
Sell × Length	–0.191	.0002
Sell × Length^2	0.011	.0309

$R^2 = .53$
F value = 77.866 (.0001)
N = 278

sure preference for the winning stock to sure preference for the losing stock, with the center being a point of indifference. Participants were also asked how they would split their $1,000 between the two stocks. Additional questions assessed participants' knowledge of, and experience in, the stock market.

We used a sample of 139 senior business undergraduates at a large university.

Results

To test the hypotheses with the experimental data, we ran the following multiple regression model, with linear and quadratic terms to capture the nonlinearity in predictions:

$$\text{Preference Rating} = \text{Intercept} + \beta_1 (\text{BUY} \times \text{LENGTH}) + \beta_2 (\text{BUY} \times \text{LENGTH}^2) + \beta_3 (\text{SELL} \times \text{LENGTH}) + \beta_4 (\text{SELL} \times \text{LENGTH}^2) + \varepsilon, \quad (1)$$

where BUY and SELL are experimental conditions reflecting whether participants had to buy or sell stocks, LENGTH is the length of run of winning or losing stocks, betas are parameters to be estimated, and epsilon are errors assumed to be IID normal. To analyze the data, we use a regression with dummy variables and interactions. The model in (1) captures both linear and nonlinear effects. (Figure 2 graphically presents the effects captured by the regression estimates.)

Results are pooled over the alternate fictitious stocks (Haloo or Andaz) that participants faced. (Separate analyses for each did not show significant differences in coefficients.)

Table 1 presents the parameter estimates, *p*-values, and fit statistics for the pooled sample.

The findings from this experiment support Hypotheses 1, 2, 3, and 4. Hypothesis 1 stated that for an increasing sequence of earnings, the longer the run length, the greater the preference to buy the stock. The positive and highly significant coefficient for Buy × Length (0.474, $p < .0001$) shows that consumers do indeed prefer to buy the winning stock when its run length increases.

Hypothesis 2 stated that for increasing sequences beyond a certain critical point, consumers would be less favorable to buying the stock. The coefficient for Buy × Length^2 is negative and highly significant (–0.032, $p < .001$), supporting this hypothesis.

Conversely, Hypothesis 3 stated that for a decreasing sequence of earnings, the longer the run, the greater preference to sell the stock. The Sell × Length term in Table 1 is negative and highly significant (–0.191, $p < .002$), showing that as run length increases in the negative direction (Loser), consumers prefer to sell the stock.

Hypothesis 4 stated that for a decreasing sequence of earnings, beyond a critical point, consumers would lower their selling preferences for the stock. The positive and highly significant coefficient (0.011, $p < .0309$) for Sell × Length^2 supports this hypothesis. All the results completely contradict the null hypothesis, Hypothesis 01.

Based on parameters of the regression, Figure 2 shows the predicted preferences as a function of trade type and run length. We plot run length along the x-axis, preference along the y-axis, and heavy and light curves for the buy and sell conditions. The negative numbers on the x-axis reflect run lengths of *decreasing positive* earnings.

Note from the figure that in the buy condition as the run of earnings increases gets longer, participants' preference for the winning stock first rises sharply and then falls a little. In the sell condition, as the run of increasing earnings lengthens participants' preference for selling, the winning stock first falls and then flattens out. The reverse holds for buying losing stocks (with decreasing earnings) or selling losing stocks. A Wald test for checking $\beta_1 = \beta_3$ was rejected, $\chi^2(1) = 89.8$, $p < .001$. Similarly, the Wald test for

$\beta_2 = \beta_4$ was rejected, $\chi^2(1) = 35.47$, $p < .001$). This shows that the slopes are indeed different as hypothesized.

Discussion

These results show that participants' preferences to buy and sell stocks differ dramatically depending on whether these stocks are winners (have increasing earnings) or losers (have decreasing earnings). At least up to a point, participants prefer to buy winning stocks and sell losing stocks. However, as the run length of the winning or losing streak continues, both of these patterns tend to flatten out or reverse. The reversal is a little sharper in the realm of buying than that in selling. We did not have a hypothesis about the asymmetry nor have any clear explanation for it. Note that run length was a between-subjects manipulation. *Thus, the reversal was not a demand artifact*.

We had only a weak suspicion that this reversal would take place around a length of 7 given the experimental context we chose. Furthermore, we believe that the turning point is due to the number of pieces of information, rather than the real time implied by them. That is, we think that the turning point would have occurred around 7 for our participants, irrespective of whether returns were in months, quarter, or years. However, we have no strong predictions about what these turning points would be in real situations.

We did collect responses on the "fraction of a budget" participants would spend on each stock. The results did not show any patterns. We suspect that the participants misunderstood the task. So we do not present the analysis here.

The results for the preference measure clearly support the advertising strategy of marketers of stocks or mutual funds. Consumers do buy on the basis of positive runs and do sell on the basis of negative runs, at least to a point. Thus, such marketers should continue to emphasize past performance, as long as it is not illegal.

The results provide underlying support at the individual consumer level for findings of overreaction or momentum investing at the aggregate level as cited in the literature review (e.g., DeBondt and Thaler 1985; Chopra, Lakonishok, and Ritter 1993; Jegadeesh and Titman 1993; La Porta et al. 1994).

The results suggest where the possible turning points may fall in our experiments. For the buy side, it is around 7.4 ($0.474/2 \times 0.032$), and for the sell side, it is –8.7 ($-0.191/2 \times 0.011$).

Neither experience nor knowledge seems to mediate these patterns. Thus, the hot hand bias seems to be a deep enduring fallacy in stock trading. This result seems consistent with casual observation of the stock market. At the height of the Internet boom in 2000, not only amateurs were trying to make a quick profit (many day traders), but even experts consistently made "buy" recommendations. They were all caught up in the euphoria of an ever-increasing stock market. Study 2 explores the consumer choice process further by checking if the affective process of mood can delay the onset of the gambler's fallacy. Study 2 also examines process measures that allow us a deeper insight into how consumers make the switch between the hot hand and the gambler's fallacy.

STUDY 2: ROLE OF MOOD IN TRADING WINNERS AND LOSERS

Consumer researchers have shown that both cognitive and affective processes affect decision making. Is the pattern of chasing winners and dumping losers moderated by affective factors such as emotions and mood? The issue is particularly relevant, because bull markets are often associated with euphoria (e.g., the Internet boom), while bear markets are often associated with gloom (e.g., the current situation). This study looks at how optimistic (euphoric) or pessimistic (dysphoric) moods affect the biases in Study 1. The issue is important because we think that mood could also affect whether an individual adopts the hot hand or the gambler's fallacy or when that individual switches from one to the other. At the height of the Internet boom, euphoria raged as investors raved about their success in stock picking. In recent years, dysphoria is common as investors lick their wounds and shun stocks.

We next present the theory, experiment, results, and discussion of Study 2.

Does Mood Affect Investor Preferences?

The effect of mood on information processing is well documented (Isen 1989). Mood reflects a temporary emotional state that can affect our judgment. If we are in a positive mood, we are more likely to recall positive information, and if we are in a negative mood, we are more likely to recall negative information. Affective states are stored as a node in memory that is linked to the information processed with it (Isen 1989). Also, we process information in more detail when mood is more intense.

We therefore contend that a positive mood about the stock market will accentuate the effect of the hot hand bias in buying stocks. Specifically, consumers in a euphoric mood will have a greater preference for buying a stock that has an increasing positive run length of earnings than consumers in a dysphoric mood. Thus, we hypothesize the following for a positive earnings run:

Hypothesis A5: Consumers in an optimistic mood will have a greater preference to buy the stock with a positive earnings run than those who are in a pessimistic mood.

Mood also affects the choice between selling winners versus selling losers. How would consumers who feel optimistic about the stock market choose between selling a stock that has a sequence of positive earnings versus one that has a sequence of negative earnings? In an optimistic scenario, a stock that has a negative run may be seen as a bad stock, and thus consumers may want to get rid of it. However, as the negative run length increases, there will be a turnaround in preference as people feel like holding on to a stock because it may turn around.

This effect will be more pronounced in a pessimistic scenario. In a market that has a gloomy outlook, stocks that have a positive run will be seen as more valuable than stocks that have a negative outlook. Consumers will therefore prefer to dump losers. Thus,

Hypothesis A6: Consumers in a pessimistic mood will have a greater preference to sell the stock with a negative earnings run than those who are subject to an optimistic mood.

We also postulate that the hot hand bias cannot continue to grow indefinitely. At some stage it will be weakened by the gambler's fallacy. Mood interacts with the onset of the gambler's fallacy. Specifically, consumers in an optimistic mood will tend to be more prone to the hot hand fallacy than to the gambler's fallacy at every run length. In contrast, for consumers in a pessimistic mood, the onset of the gambler's fallacy will tend to be more prominent at every run length. This interaction of mood with the hot hand and the gambler's fallacy will affect consumers' preference to buy and sell stocks.

When consumers who feel optimistic about the prospects of the stock market face a stock with a positive earnings sequence, they are likely to conclude that the trend will continue. Conversely, when consumers who feel pessimistic about the prospects of the stock market face a stock with a positive earnings sequence, they are likely to conclude that the trend will turn around. The belief that the sequence will turn around will come at a later point when they are optimistic than when they are pessimistic. This is because the gambler's fallacy is more pronounced when consumers are in a pessimistic mood. As the sequence of increasing earnings rises, skepticism sets in and consumers feel that a turning point is around the corner. Hence,

Hypothesis A7: For consumers in an optimistic mood, the turning point in preferences for buying a winning stock occurs later than for consumers in a pessimistic mood.

Consumers who want to sell and are in an optimistic mood will expect a turnaround for short sequences of negative runs of earnings, and thus their preferences to sell the losing stock will be lower than for consumers in a pessimistic mood. This is because consumers in a pessimistic mood are likely to think that negative runs will continue.

FIGURE 3
Observed Preferences Optimistic Versus Pessimistic Buying

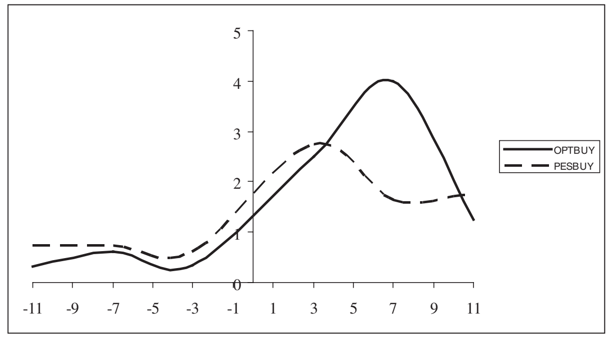
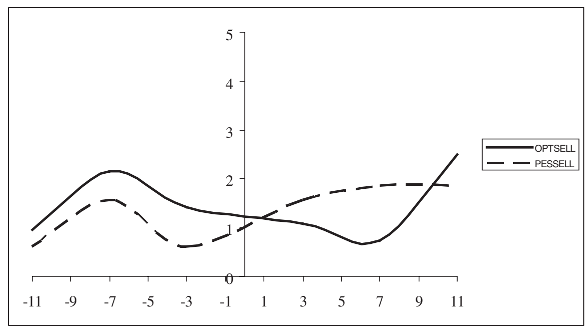


FIGURE 4
Observed Preferences Optimistic Versus Pessimistic Selling



Thus, we see that when people have to sell and are faced with a choice of negative or positive runs, optimism and pessimism will cause the gambler's fallacy to kick in at different points in time as run length increases. Thus,

Hypothesis A8: For consumers in an optimistic mood, the turning point of preferences for selling a losing stock occurs earlier than for consumers in a pessimistic mood.

The efficient market hypothesis ignores the role of mood in predicting preferences for buying or selling. Therefore, consumers should remain unaffected by the optimistic and pessimistic state they are in. Thus, we propose the following null hypothesis:

Hypothesis 02: Consumers' propensity to buy or sell will remain unaffected by their mood.

Experimental Validation

This experiment is similar to the previous one in scope, with the major difference being that we now manipulate participants' mood and collect free responses for their choices. The pessimistic-mood scenario was created by describing the possible drag the U.S. war in Iraq would have on the economy, while the optimistic-mood scenario was created by describing the benefits of finding stocks that are undervalued and may present good prospects of future growth.

Design

This study used a $3 \times 2 \times 2$ full factorial design, with run length (3, 7, 11), trade type (buy vs. sell), and mood (euphoria and dysphoria) all as between-subjects factors.

The sample contained 91 undergraduate and graduate business majors from a large university.

Results

To test the hypotheses, we plotted the observed means across the different conditions. These plots are shown in Figures 3 and 4.The figures plot preferences for the winning stock on the y-axis and run length on the x-axis. We plot separate graphs for the buy and sell conditions, with separate curves for the pessimistic and optimistic conditions within each.

Hypothesis 5 states that consumers in an optimistic mood will have a greater propensity to buy the stock with a winning run than consumers in a pessimistic mood. A test for the difference of mean preferences of participants in the optimistic condition differed significantly from the mean preferences of participants in the pessimistic at run length 7 ($p < .05$) (Figure 3). This result partially supports Hypothesis 5.

Hypothesis 6 states that consumers in a pessimistic mood will have a greater propensity to sell the losing stock than a consumer in an optimistic mood. A test for the difference of mean preferences of participants in the optimistic condition versus participants in the pessimistic condition was not significant (Figure 4). Thus, Hypothesis 6 was not supported.

Hypothesis 7 states that for consumers who are buying, the turning point for preferences of stocks with positive runs will come later for consumers in the optimistic condition than for those in the pessimistic condition. The curves in Figure 3 show that the peak of the optimistic buy is indeed higher than the peak of the pessimistic buy, thus supporting Hypothesis 7.

Hypothesis 8 states that for consumers who are selling, the turning point for preferences for stocks with negative runs will come earlier for those in the optimistic condition than for those in the pessimistic condition. We could not detect any significant difference across the mood conditions for the sell condition (Figure 4). Thus, hypothesis 8 was not supported.

TABLE 2
Classification of Reasons: Buy Condition (in percentages)

Reason	*3*	*7*	*11*
Hot hand	64	67	67
Gambler's fallacy	14	7	0
Rational	7	0	20
Blank	14	13	13
Others	0	13	0
Total	100	100	100

TABLE 3
Classification of Reasons: Sell Condition (in percentages)

Reason	*3*	*7*	*11*
Hot hand	39	23	71
Gambler's fallacy	17	38	0
Rational	22	8	12
Blank	11	15	18
Others	11	15	0
Total	100	100	100

Manipulation Check

We tested the strength of our mood manipulation. This was measured on a 10-point scale, where 10 was coded as optimistic and 1 was coded as pessimistic. The mean measure for optimism for participants in the optimistic condition was 5.98, and the mean for those in the pessimistic condition was 5.83. This is not significant, showing that the mood manipulation was not strong enough.

Process Measures

To investigate the mental process that underlies these preferences and how consumers switch between the hot hand and the gambler's fallacy, we asked participants to list their reasons for their choices. For this analysis, we collapsed the responses across mood conditions. The responses were coded by two independent judges into five categories: hot hand, gambler's fallacy, rational, blank/cannot interpret, and others. Differences were resolved through discussion. The intercoder reliability was .98. Table 2 shows the proportion of people who fell into the various categories across the buy and sell conditions for the three run lengths.

Table 2 shows that for the buy condition, the proportion of participants who are subject to the hot hand fallacy remains almost constant across run lengths at a relatively high level. The proportion of participants who fall for the gambler's fallacy falls as run length increases. This shows that the presence of the hot hand fallacy dominates the gambler's fallacy for all run lengths in the buy condition.

Table 3 shows that for the sell condition, the proportion of participants who are subject to the hot hand fallacy first decreases and then turns around. The gambler's fallacy, on the contrary, first increases and then decreases dramatically. This shows that for short run lengths, the hot hand fallacy dominates the gambler's fallacy. This pattern flips for moderate run lengths as the gambler's fallacy gains ascendancy. Finally, for longer run lengths, this flips again, with the hot hand dominating again. This shows why the proportion of people who chose to sell losers dropped as run length increased and then rose as run length increased further.

Overall, these results show that the hot hand dominates in the buy and sell conditions for most run lengths. These results imply that consumers in general tend to buy winners and sell losers.

Discussion

The results of our second experiment partially support our hypotheses on mood as a moderator of the biases, especially in the buy condition. We found support for the hypothesis that the onset of preference reversals because of the gambler's fallacy came much later when they were optimistic versus when they were pessimistic (Figures 3 and 4). We did not get stronger support (e.g., in the sell condition), probably because our mood manipulation was not strong enough.

Consistent with Study 1, we found people continued to chase winners in the buy condition and dump losers in the sell condition. Thus, the tendency to buy winners and sell losers seems to be quite strong and robust.

Perhaps the most useful aspect of this study is the look at process measures. The study shows how participants are more likely to switch between the biases as run length changed. These results show that for the buy condition, the hot hand remains a powerful bias across run length, while for the sell condition, the hot hand fallacy is mitigated by the onset of the gamblers' fallacy.

STUDY 3: HYPE AT THE MARKET LEVEL

Study 3 determines whether biases of individual consumers identified in the above experiments lead to aggregate effects that are visible or can be validated at the market level. Consistent with our experiments, the sequence of information we choose here are the quarterly earnings announcements of firms. In addition to being closely linked to our experimental design, no research in finance has examined aggregate market levels' responses to *sequences* of information about quarterly earnings. The closest study is by Swaminathan and Lee (2000), who showed that stock prices overreact to earnings news. However, they model this effect as a function of earnings surprises and not of sequences information, for which theory and our experiments show systematic biases. If a sequence of information leads to trend projection, then stocks will be overvalued as the sequence of positive earnings increases. We can detect this overvaluation by the drop in valuation when the sequence is broken. Conversely, stocks will be undervalued as the sequence of negative earnings increases, and this undervaluation can be detected by the rise in valuation when the sequence breaks.

Note, this study does not purport to determine the financial efficiency of the market or the ability of consumers to profit from it. Such a goal would require in addition a means to predict the turning point in a run of earnings. Such a predictive model is beyond the scope of this study. Rather, the goal of the study is to show if biases of individual consumers due to sequences of information visible in our experiments can be validated at the aggregate market level. Furthermore, the market study basically tests the market-level implication of the hot hand phenomena that we explained in Study 1. We first present our hypotheses, then the method of estimation, and finally the results.

Hypotheses: Stock Returns Conditional on Earnings Runs

Recall that the efficient market hypothesis implies that prices immediately incorporate all available information. So runs in past earnings of a stock would be unrelated to current or future prices of the stock. One of the key pieces of information analysts normally track is the quarterly earnings of different firms. If prices at any time fully reflect past information and future expectations, the current returns of a stock would not be related to various runs of its past earnings.

Hence, the null hypothesis, based on the efficient market hypothesis, is as follows:

> *Hypothesis 03:* Market returns of a stock are not conditional on the positive or negative earnings run of that stock.

However, our theory and findings show that individuals are not able to correctly forecast the stochastic process of earnings. They are subject to hype and systematically overvalue or undervalue past trends. Note that our earlier theory shows that they first fall victim of the hot hand and then the gambler's fallacy. Chance itself could confirm their forecasts by providing a run in the same direction and increasing their confidence in the stock. In fact, based on Fama and French (2000), as the positive or negative run of a stock's earnings lengthens, the conditional probability of the continuation of the run decreases. We found that people buy winners rather than losers. Also, people prefer to sell losers rather than winners. Thus, any stock that shows a run in earnings is likely to rise because those who do not have the stock want to buy it, and those who already own it are reluctant to sell. Once the run breaks, consumers realize their forecasting errors and readjust their expectations. The extent of this readjustment depends on the length of the run—the longer the run, the greater the effect of hype because of the hot hand fallacy, and the greater the adjustment, although as the run extends, the onset of the gambler's fallacy mitigates the biases for both buyers and sellers, thus reducing the size of the fall. Hence, we hypothesize the following for a positive run of earnings:

Hypothesis A9: The longer a positive earnings run of a stock, the greater the negative returns after a break in earnings, but after some critical run length, the negative returns become smaller.

Conversely, the same heuristic affects people facing a negative run of earnings. As negative information continues to accumulate over successive quarters, consumers are apt to extrapolate further declines into the future. The heuristics they use may result in biases that cause them to project much lower earnings than the underlying stochastic process would suggest. People who already possess the stock would like to sell their losers while finding few buyers for it, and thus the price falls. This effect depends on the length of the run. As the run lengthens, prices tend to fall more until the onset of the gambler's fallacy mitigates the effects on both buyers and sellers, reducing the size of the rise. Hence, we hypothesize the following:

Hypothesis A10: The longer a negative earnings run of a stock, the greater the positive return after a break in earnings, but after some critical run length, the positive returns become smaller.

Method

The empirical method seeks to determine whether returns of a stock, beyond those that are normal for the market, are related to a positive or negative run of past earnings. This subsection describes the method for computing abnormal returns and data preparation. The term *abnormal returns* refers to returns that are above or below what is normal for the market. It is a measure of the impact of an event on the value of the stock. In our case, the event is the reversal of quarterly earnings of a firm. To establish abnormal returns, we need to arrive at what normal returns are. We define normal monthly returns, R_{it}, measured at the month's end, for firm, i, as a change in price between month t and $t-1$ plus cash dividends D_{it} earned during the month, t. Thus,

$$R_{it} = (P_{it} - P_{it-1} + D_{it}) / P_{it-1}) \tag{2}$$

Let τ be an index for time in quarters, while t is time in months. Then, by definition,

$$\tau = t + (t+1) + (t+2) \tag{3}$$

So quarterly returns can be defined as follows:

$$R_{i\tau} = \sum_{t=0}^{2} R_{it} \tag{4}$$

Classical finance theory holds that the return to a firm's stock is determined by the unique performance of each stock (unsystematic risk) and the performance of the general market or other environmental conditions (systematic risk). The effect of the latter portion can be captured by regressing a stock's return on the return for the whole stock market. Thus,

$$R_{it} = \alpha_i + \beta_i \times R_{mt} + \varepsilon_{it}, \tag{5}$$

where

R_{mt} = market rate of return, that is, the average return of the S&P 500 at month t
α_i = the time invariant idiosyncratic effect of firm i on its own return
β_i = effect of the entire market on the return of firm i
ε_{it} = errors with $E[\varepsilon_{it}] = 0$ and $\text{Var}[\varepsilon_{it}] = \sigma^2_{\varepsilon}$

The expected value of equation (5) gives the normal return, $E[R_{it}]$, to stock i for period t, given the performance of the market as a whole. The abnormal return, AR_{it}, of a stock is its actual return minus the normal return over the same period. Thus,

$$AR_{it} = R_{it} - E[R_{it}] \tag{6}$$

To relate this term to earnings that are released quarterly, we define cumulative abnormal returns for firm i in quarter τ as follows:

$$AR_{i\tau} = \sum_{t=0}^{2} AR_{it} \tag{7}$$

We use event analysis to test our hypotheses (Fama, Fisher, Jensen, and Roll 1969). This technique has been widely used in finance and increasingly used in marketing (Aaker and Jacobson 1994; Agarwal and Kamakura 1995;

Lane and Jacobson 1995). The method allows us to determine the abnormal returns for any information that arrives in the stock market. In our case, the event is a reversal in earnings or the end of an earnings run.

Data Preparation

The starting point in the preparation of the data is to choose a portfolio of stocks to represent the market and serve as a basis for the analysis. We chose S&P 500 stocks (as of 1998), because it is a widely followed index containing large successful firms (Campbell, Lo, and MacKinlay 1996). We use the monthly level for collection of stock returns as the best compromise between quarterly data that are too crude and daily data that are too detailed and noisy (Campbell et al. 1996). The Compustat and Center for Research in Security Prices (CRSP) data sets from the Wharton Research Data Services database at Wharton formed the source of our data. The data extraction was done through a series of steps in two stages. We wrote a modular program for each step.

Stage 1

Stage 1 used the Compustat database and had six steps: the first step was to select the firms that comprised the S&P 500 as of December 31, 1998. The second step was to extract the earnings (Compustat Data 7: diluted earnings per share) figures for these firms from the Compustat tapes. Earnings figures are reported quarterly, and 60 to 70 percent of the firms announce their results within the first 3 weeks of the quarter. The data were cleaned to ensure that only firms that reported earnings within the first month of the quarter appeared in our data set.

The third step was to identify sequences of earnings of each firm after correcting for seasonality. The fourth step was to compute all the various runs of earnings for each firm, by identifying the break in the sequence of earnings. The fifth step was to sort all runs of equal length. The sixth step was to identify the month at which the run ended. We then switched to Stage 2. We did not adjust the portfolio for the additions and changes to the S&P 500 over the period of the sample.

Stage 2

Stage 2 used the CRSP database and had six steps. The first step was to link firms in the Compustat database with those in the CRSP database. The second step was to determine the date on which the run of earnings ended and compute the returns of that particular firm for 30 months prior and 3 months after that date. The returns included changes in price and cash dividends paid out as defined in equation (2). We use this long 30-month window to estimate the normal returns for each stock to avoid temporal idiosyncrasies.

TABLE 4
Abnormal Returns for Runs of Positive Earnings

Run Length	*Abnormal Return (%)*	t *Value (test vs. previous level)*
+2	0.16	–0.22
+3	–1.83	–2.38
+4	–2.79	–2.25
+5	–4.70	–2.81

TABLE 5
Abnormal Returns for Runs of Negative Earnings

Run Length	*Abnormal Return(%)*	t *Value*
–3	–0.011	–1.398
–4	0.028	1.544
–5	0.012	0.46

TABLE 6
Size of Abnormal Returns Versus Run Length

Variable	*Coefficients*	t *Statistic*	*p-Value*
Intercept	–1.201	–2.530	0.053
Abnormal returns	–0.361	–2.933	0.033
R^2 = .78			

The third step is to extract monthly returns for each firm and sort them by run length of earnings. The fourth step is to compute expected normal monthly returns for each firm using equation (5). The fifth step was to compute abnormal monthly returns for each firm using equation (6). The sixth step is to compute cumulated abnormal returns for each firm for the quarter using equation (7) and to aggregate returns with the same run length. We then compared the length of earnings' run with the total abnormal returns for that particular run length. The number of firms in this stage varied with run length.

Results

Table 4 shows the results for positive runs. Not only are returns significantly different from zero, but they also show a clear trend with increasing run length. The greater the positive run length, the greater the drop in (abnormal) returns (relative to the market). This result is consistent with Hypothesis 9. It suggests that the expectations of consumers for the continuation of positive runs of successful stocks leads to inflated valuation of those stocks and abnormal declines when the run breaks. Because of declining number of observations as run length increased, we could only study up to run lengths of 5. Thus, in these analyses, we could not analyze any nonlinearities associated with the onset of the gambler's fallacy.

Table 5 shows the results of the estimation for negative runs. The results show that there are no systematic abnormal returns for negative runs. Indeed, the results tie in with the predictions of the efficient market hypothesis. Thus, Hypothesis 10 was not supported.

This points to an asymmetry in consumers' response to a negative run relative to a positive run. Also, the number of firms with decreasing run lengths was fewer. This is probably because they went out of business or were bought over. Furthermore, managers are less and less likely to report a large sequence of negative earnings. The use of managerial discretion to smoothen earnings is a widely accepted accounting practice (Subramanyam 1996).

To see the effect of run length on returns, we regressed the abnormal returns across various run lengths. The results are in Table 6.

Table 6 shows that the coefficient for abnormal returns is significant and negative. This means that the greater the positive run length, the steeper the fall after the run length breaks. Conversely, the greater the run length of negative runs, the more the abnormal returns jump when the run length breaks.

DISCUSSION

This section summarizes the results, clarifies the contribution, draws some implications, and discusses the limitations of the current research.

Summary of Results

The research has the following main results:

- Study 1 shows that the length of a run of earnings of a firm has a nonmonotonic influence on consumers' decision to buy or sell the stock of that firm. As a positive run increases, participants initially prefer to buy the stock; as the run lengthens, they prefer to sell the stock. Conversely, as a negative run increases, participants initially prefer to sell the stock and then prefer to buy the stock. The hot hand dominates the buy condition, while the gambler's fallacy plays a bigger role in the sell condition.
- Study 2 shows that mood may affect the onset of the gambler's fallacy. This study also investigates the self-reported reasons why participants chose their respective stocks and provides some insights into consumers' internal processes. We see the percentage of people who relied on each heuristic at different run lengths and how the two biases change in proportion in each condition with change in run length.
- Study 3 shows that, at least for positive runs, stocks have abnormal returns that increase with the length of the run.

Contribution

Our article makes five important contributions:

- Two major heuristics in decision making, the gambler's fallacy and the hot hand, can be related to each other by *run length* of sequential information to which individuals are exposed.
- At short runs, individuals succumb to the hot hand fallacy, but at very long runs, individuals succumb to the gambler's fallacy.
- Individuals' responses to run length *reverse* depending whether they are in a buying or selling mode.
- This pattern of response at the individual level may explain financial behavior at the aggregate level, where momentum in the short run is followed by a reversal in long run.

Prices of *stocks* show distinct overreaction *based on run length of earnings* (overreaction and underreaction studies are based on *portfolios* of best performing or worst performing stocks over time and not on run length).

Implications

This research has important implications for marketing and public policy, behavioral decision theory, and finance.

Marketing and Public Policy

Marketers of financial products, especially of stocks and mutual funds, currently advertise their products by emphasizing past performance, despite an SEC-required disclosure at the bottom. Study 1 suggests that policy is reasonable, because consumers are motivated to buy on the basis of short runs of positive information. However, from a public policy perspective, our results are troubling. To the extent that consumers focus on past performance (prominent in ads), they may well make suboptimal decisions.

We tested our thesis in the context of consumers' purchase of stocks. However, we suspect the same phenomenon could occur in other marketing contexts. In such a scenario, trend projection could be responsible for the initial hype that surrounds a product's popularity, followed by its implosion when trend reversal sets in. Examples include the frenzied bidding in auctions, the overvaluation of celebrity endorsers until they suddenly become unpopular, the rapid growth of new products until a sudden drop in sales (Goldenberg et al. 2002), the escalation and decline in prices for real estate, and the rise and fall of fads. In the past, analysts have tended to explain such reversal by external events. Our research suggests that changes in the expectations of consumers themselves may be at least partly responsible for the sudden and sharp reversal in valuations.

Behavioral Decision Theory

Research in behavioral finance and behavioral decision making has demonstrated the effect of the hot hand phenomenon and the gambler's fallacy. Many studies have documented how these effects occur because of the biases with which consumer process information on performance runs. However, past research has not suggested that these two effects could work in tandem. For example, DeBondt (1998) discussed how experts and individual consumers use these heuristics separately. Our experiment shows that consumers may exhibit both, the hot hand and the gambler's fallacy, depending on the length of the run of information that they face. For example, when facing a run of positive information, consumers may initially resort to trend projection and suffer from the hot hand problem. As the run lengthens, they may reverse their prediction and suffer from the gambler's fallacy.

Financial Markets

Our research serves to show that perhaps the one explanation for the momentum and reversal phenomena so widely reported in the finance literature has its origins in the way people process sequential information. The tendency of consumers to overweight past trends and reverse them after a certain length may explain why phenomena such as bubbles occur. Such phenomena, as gross overvaluation of asset prices and their subsequent implosion, have been well known in the history of financial markets, from the 16th-century tulip mania to the more recent Internet bubble. Why do people bid up the value of assets and then reverse their valuations at a later date? We suggest that an internal change in valuation of an asset, in response to the run-up of information about it, may be an explanation. Consumers switch from trend projection (hot hand) when the run is short to skepticism (gambler's fallacy) when the run gets very long.

The results of our econometric section also show that in a market situation, investors can hold subrational (Karpoff 1986) views and thus affect prices without rational players automatically correcting from them and thus causing overreaction to persist (Cooper 1999; Shiller 1990).

Limitations and Future Research

This study has many obvious limitations, some of which we need to discuss. Several of these can lead to future research.

First, this study used stocks as the subject of consumers' choice and earnings as the run of information. Subsequent studies could determine the generalizability of this research by examining other contexts and other runs of information such as new products and their sales, celebrity endorsers and their contracts, or auctions and bids.

Second, this study found a small asymmetry in the response to positive runs and negative runs. In both experimental and market studies, our theory and hypotheses were better or fully confirmed in the domain of positive runs than in that of negative runs. We suspect that one reason may be our definition of a negative run of information. In all our analyses, we considered a negative run as a decline in earnings, which were all *still positive*. Since the earnings were still positive, they may not have triggered as strong a negative response initially. Subsequent research could investigate the effect of a string of *increasing losses*.

Third, this study did not evaluate the actual efficiency of the stock market, in terms of whether consumers can profit from the biases that we discovered. Future research could determine whether investing in various portfolios of winners or losers would lead to better returns than from a random selection of stocks.

Fourth, we have not shown the effects of the gambler's fallacy in the aggregate case, perhaps because we could not find long enough sequences of increasing or decreasing returns. Such sequences could be found if one started out with a large sample of stocks to begin with.

Fifth, our experimental results could be open to rival explanations. For example, the rate of increase or decrease of the earnings may influence consumer choice of the winning and losing stock. We would need to conduct more experiments to rule out these explanations.

Sixth, the econometric study at the aggregate market level could be conducted using buy-and-hold portfolios instead of using the event study method. In addition, more refined models incorporating more variables can be used to rule out rival explanations such as the effect on discount rates versus the effect on cash flow as firms break their strings of earnings. Use of transaction-level data such as the purchase and sale information of funds by individual investors could be a better data set to conduct the market-level analyses.

APPENDIX
Presentation of Task and Run Length to Participants (for runs of length 11)

This is an exercise in investing. Your answers are entirely anonymous.

You have just received a tax rebate of $1,000. You intend to invest it in the stock market, for a short time of one quarter. You ask your broker to recommend a couple of stocks based on certain criteria you specify. He comes up with two stocks, Haloo and Andaz, that meet most of the criteria you set. However, they differ substantially in recent earnings. Haloo has had 11 quarters of increasing earnings, while Andaz has had 11 quarters of decreasing earnings, as follows:

Haloo Inc.:

	Year										
	2001				*2002*				*2003*		
Quarter	*Q1*	*Q2*	*Q3*	*Q4*	*Q1*	*Q2*	*Q3*	*Q4*	*Q1*	*Q2*	*Q3*
EPS($)	0.23	0.28	0.32	0.45	0.51	0.64	0.81	0.91	0.99	1.19	1.26

Andaz Inc.:

	Year										
	2001				*2002*				*2003*		
Quarter	*Q1*	*Q2*	*Q3*	*Q4*	*Q1*	*Q2*	*Q3*	*Q4*	*Q1*	*Q2*	*Q3*
EPS($)	1.18	1.02	0.94	0.88	0.82	0.69	0.59	0.48	0.43	0.34	0.21

NOTE: EPS = earnings per share.

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ABOUT THE AUTHORS

Joseph Johnson (jjohnson@miami.edu), Ph.D., is an assistant professor of marketing at the University of Miami. His research interests are studying consumer biases in the context of financial products, measuring stock market response to new product introductions, and the optimal customization of marketing promotions. His research has appeared in the *Journal of Consumer Research* and the *Journal of Optimization Theory and Applications*. His teaching interests are international marketing, marketing strategy, and marketing research.

Gerard J. Tellis (tellis@usc.edu), Ph.D. Michigan, is the Neely Chair in American Enterprise, director of the Center for Global Innovation, and professor of marketing in the Marshall School of Business at the University of Southern California, Los Angeles. He has been Visiting Chair of Innovation, Marketing, and Strategy at the Judge Institute of Management, Cambridge University, United Kingdom and a Distinguished Visitor, Erasmus University, Rotterdam. He specializes in the areas of global innovation, new product growth, market entry, advertising, sales promotion, and pricing. He has published more than 60 papers and books on these topics (see http://www-rcf.usc.edu/~tellis/publicat.htm). His articles have won numerous awards, including four of the most prestigious awards in the field of Marketing: the Frank M. Bass, William F. Odell, Harold D. Maynard (twice), and American Marketing Association (AMA)-Berry awards. He consults with major multinational corporations and has been on the editorial review boards of the *Journal of Marketing Research*, the *Journal of Marketing*, and *Marketing Science* for several years.