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Positive Illusions and Forecasting Errors in Mutual Fund Investment Decisions

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This study examines the portfolio allocation decisions of 80 business students in a computer-based investing simulation. Our goal was to better understand why investors spend so much time and money on actively managed mutual funds despite the fact that the vast majority of these funds are outperformed by passively managed index funds. Participants' judgments and decisions provided evidence for a number of biases. First, most participants consistently overestimated both the future performance and the past performance of their investments. Second, participants overestimated the intertemporal consistency of portfolio performance. Third, participants were more likely to shift their portfolio allocation following poorer performance than following better performance, and this tendency had a negative impact on portfolio returns. We speculate that these biases in investor behavior may contribute to suboptimal investment decisions in real financial markets. © 1999 Academic Press

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Vast sums of time, energy, and money are invested in the stock market. Professional investors claim the ability to pick investments that will deliver higher returns than investments selected by random dart-throwers. The survival of actively managed mutual funds depends in part on their managers' abilities to select winning investments. However, the majority of mutual fund investors pay fees to fund managers who select investments that underperform the market. Why? This paper explores both psychological factors that may contribute to the pervasive belief among investors that they can beat the market and factors that may inhibit their ability to assemble portfolios that meet or exceed the market rate of return. Many other sources (e.g., Bogle, 1994; Evans & Malkiel, 1999) assert that most investors would be better off with index funds. The present paper attempts to specify some reasons why this advice is so rarely followed. We hope that understanding the psychological basis for decision making in this realm can help investors improve their results.

In nominal dollars, most mutual funds have performed very well in recent years; indeed, the market, as measured by the Standard and Poor's (S & P) 500 stock index, has gone up 16.4% per year on average from 1981 through 1996 (Burns, 1997). The years 1997 and 1998 each posted returns of roughly 30%. The result is that even poorly managed funds with excessive management fees have been able to produce what appear to be satisfactory returns. The average equity mutual fund produced an annual return of 14.3% between 1981 and 1996, a 24% return in 1997 (Egan, 1998), and a 14.1% return in 1998 (Laderman & Smith, 1999). At least 84% of actively managed mutual funds underperformed the market overall from 1981 through 1996 (Burns, 1997), and the relative superiority of index funds only grew in 1997 and 1998.

A logical alternative to actively managed funds is investment in passively managed index funds. Instead of searching for the best investment opportunities at any given time, index funds select a representative set of stocks for long-term investment. There are index funds for the Dow Jones Industrial Average, the Standard and Poor's 500 Index, the Russell 2000 Index of small companies, and others. Because these funds track whole segments of the market, they avoid the search costs of looking for promising new investments and the transaction fees associated with frequent buying and selling of stocks. The result has been that index funds have consistently provided higher returns with lower variance than the majority of actively managed mutual funds. Although index funds have received favorable attention recently, they still account for the minority of new money flowing into mutual funds, and index funds investments constitute less than 8% of money invested in the stock market (Waggoner, 1999). If most actively managed mutual funds underperform the market funds, why have the former been so popular with investors relative to the latter? We suggest that this behavior is due in part to psychological biases in judgment. In particular, we assert that *positive illusions, misperceptions of chance,* and *framing effects* contribute to the oversubscription of managed funds.

Positive Illusions

An abundance of research suggests that most people exhibit overly positive self-evaluations, an exaggerated perception of control or mastery over uncontrollable events, and unrealistic optimism (see Taylor & Brown, 1988). Examples of *overly positive self-evaluation* are the robust tendencies for most people to see themselves as more intelligent (Gabriel, Critelli, & Ee, 1994), more attractive (Gurman & Balban, 1990), and better drivers (Svenson, 1981) than average. More to the point, most investors view their ability to select investments as superior to the average (Wood, 1989, 1997). The *illusion of control* is illustrated by the tendency for participants in a dice-throwing game to bet more on the outcome before the dice are tossed than after the dice are tossed but before the outcome is disclosed (Strickland, Lewicki, & Katz, 1966). A second example is the tendency of participants in a raffle to value their tickets more highly when they are allowed to choose their numbers than when their numbers are assigned to them at random (Langer, 1975). The illusion of control may contribute to *unrealistic optimism* concerning future events that is commonly observed in empirical studies. For example, most people believe that they are less likely than their peers to be victims of crime (Perloff & Fetzer, 1986) or to have automobile accidents (Robertson, 1977).

In the context of investment decisions, overly positive self-evaluation may manifest itself as a tendency to overestimate the past performance of one's own investments; the illusion of control and unrealistic optimism may cause investors to overestimate the future performance of their investments.

H1a: Participants will overestimate the past performance of their own investments relative to the market.

H1b: Participants will overestimate the future performance of their own investments relative to the market.

Certainly it is easier to maintain positive illusions in the face of positive reinforcement. In particular, the ease of making money in the booming markets of the 1980s and 1990s may have contributed to the willingness of investors in the real world to pay for actively managed investments. This may be because historically high overall returns have made investors less sensitive to the opportunity costs of foregoing index funds. Assuming that people evaluate the performance of their investments in part based on their knowledge of the recent history of booming U.S. stock markets, we speculate that they will have more difficulty maintaining positive illusions in depressed markets relative to booming markets. Hence:

H2: Participants will show a less pronounced tendency to overestimate the performance of their investments relative to the market in depressed markets than in booming markets.

Anchoring on Past Performance

A common error in investment strategies is to switch out of funds that have recently performed poorly and to switch into funds that have recently performed

well. If a fund has been very successful in the recent past, the seemingly logical assumption is that it will continue to grow as it has in the past. In actuality, a better prediction is that the fund will regress toward the market rate of return (Bogle, 1994; Carhart, 1997). Moreover, there is some evidence that stocks that have performed exceptionally well in the past tend to underperform the market whereas stocks that have performed exceptionally poorly in the past tend to outperform the market (Thaler & De Bondt, 1992).

Two well-documented psychological biases may cause people to overestimate intertemporal consistency in the face of disconfirming empirical data. First, studies have documented a tendency for people to make predictions (e.g., a student's GPA) based on an evaluation of associated cues (e.g., test scores), with little or no attention to the diagnosticity of that evidence (Kahneman & Tversky, 1973). Such behavior violates the statistical principle of regression toward the mean: If a cue is imperfectly correlated to an outcome, the best prediction is less extreme than the cue. In mutual funds, past performance is less than perfectly predictive of future performance. Hence, when predicting future performance from past performance, people may make predictions that are insufficiently regressive.

A second bias that may contribute to the overestimation of intertemporal consistency includes anchoring and insufficient adjustment (Tversky & Kahneman, 1974). In rendering judgments under uncertainty (e.g., predicting future fund performance), people often anchor on salient values that they have recently encountered (e.g., past fund performance) and fail to sufficiently adjust estimates in response to other relevant factors.

These two biases give rise to the following prediction:

H3: Participants will overestimate the tendency for their investments to perform in the future as they have in the past.

Framing Effects and Switching among Investments

People are generally more sensitive to nominal returns than they are to returns that are adjusted for inflation or opportunity costs. Shafir, Diamond, and Tversky (1997) describe several examples in which respondents' economic judgments and decisions (e.g., employment decisions, fairness judgments, evaluations of transactions) are more sensitive to nominal dollar amounts than they are to real, inflation-adjusted amounts. For example, the authors suggest that a person receiving a 2% raise in times of 4% inflation (positive nominal change, negative real change) will be more satisfied with the raise than a person receiving a 2% cut in times of no inflation (negative nominal and real change). The results of their experiments support the notion that people tend to focus on nominal rather than on inflation-adjusted changes in wealth.

There is some further evidence that the distinction between nominal losses and gains may influence investment decisions. Thaler, Tversky, Kahneman, and Schwartz (1997) conducted a computerized investment simulation in which

participants made investment decisions between two funds: Fund A gave returns drawn from a normal distribution with a mean real return per month of 0.25% and a standard deviation of 0.18%; Fund B gave returns drawn from a normal distribution with a mean real return of 1% and a standard deviation of 3.5% (these parameters were meant to correspond approximately to the returns of bonds and stocks, respectively). Hence, although Fund B offers higher mean payoffs, the monthly returns to fund B will more often be negative. Each participant made allocation decisions over 200 trials, with immediate feedback on the return of each fund and the portfolio, followed by a final allocation decision that would be binding for 400 trials. Despite the higher average payoff of Fund B, participants invested an average of only 42% of their money in this fund for their final allocation decision. A second group of participants evaluated the same investments in an environment of 10% inflation, so that the nominal returns of the higher variance fund were much less likely to be negative in any given period. These participants invested 72% of their money into Fund B. Thaler et al. interpreted this disparity as a manifestation of respondents' myopic sensitivity to short-term losses (see also Benartzi & Thaler, 1995).

A booming market provides higher absolute returns, though it holds relative returns constant. Because portfolios are less likely to realize a negative nominal return in a booming market than in a depressed market and because investors may evaluate the return of their investments partly based on a comparison with historical standards (i.e., prior experience outside the experiment), we predict:

H4: Booming markets will result in greater satisfaction than depressed markets.

We expect that higher satisfaction with a fund's performance in booming market conditions (H3) will provide investors less motivation for changing their investment strategies and that the expectation that current trends will continue (H2) will make people less likely to switch under a high-growth regime. As a result, we predict:

H5a: Booming markets will produce less switching than depressed markets.

We also expect this pattern to hold within subject. In other words, we expect that when participants' investments have performed well recently, they will be less likely to switch investments than when their investments have just done poorly.

H5b: Higher recent portfolio performance will be followed by less switching than will lower recent performance.

Selection of Index Funds

We assert that investors should pay more attention to the market rate of return in evaluating the performance of their equity investments. For example, if a particular fund appreciates by 12% in one period, an investor may be very

satisfied with its performance and leave the money in the fund, even if the market averaged a 15% increase for the same period. Obviously, to do so neglects the opportunity cost of forgoing investment in an index fund. We speculate that a lower return will be more likely to motivate a closer comparative examination of performance relative to the market, and hence more switching to index funds.

To the extent that there is more switching in depressed than in booming markets, and that positive illusions about one's investing skills are more difficult to maintain in depressed than in booming markets, we expect that investors will be more likely under the former regime to discover the superiority of the market fund. Hence, we predict:

H6: Depressed markets will be associated with more frequent selection of index funds than will booming markets.

METHOD

We created a simulated market based on real performance data of the nine largest mutual funds in 1985 plus an S&P 500 index fund. The game covered 10 years, which corresponded to the years 1985–1994 (though our participants did not know this). We organized the data into a computer-based environment in which participants were able to invest a set amount of money over the 10-year period. Every 6 months, participants had the opportunity to review the performance of their investments and move their money into new mutual funds, so the game consisted of 20 turns. Investors could allocate their money in any way among the 10 mutual funds in the game. In addition, they had the option of leaving their money in a money market account. All participants received complete information about the performance of each of the funds and the performance of the market as a whole, where market performance was measured by the S&P 500 stock index.

We then created two versions of the game[1] in which we manipulated the actual returns investors achieved. The market-performance manipulation modified the performance of all the mutual funds in the game and the overall market. Participants who played in a booming market saw the real returns from 1985–1994. Participants who played in depressed market saw the same pattern of returns, but all returns were adjusted downward by 3.5% every 6 months, or about 7% per year.

Participants. Eighty master's-level business students at the Kellogg Graduate School of Management at Northwestern University participated as a part of a class exercise for a class on managerial decision making. Participants came

[1] There was a second manipulation that modified the way in which participants received information about their investments. In the nominal feedback condition, participants saw all returns in nominal percentages. In the market feedback condition, participants saw all returns in market-adjusted terms. However, this manipulation had no effect on the dependent variables of interest, and so it has been omitted from the present analysis.

from a population that, on average, was 28 years old (age range 23–45) and had worked for 4.7 years before returning to business school. The population was largely male (69%) and white (81%). All were full-time students seeking master's degrees in management. There were 46 participants in the booming market condition and 34 participants in the depressed market condition.

Procedure. Each participant was given a diskette that included a copy of a program called "The Investor Game." The game asked participants to play the role of an individual who has $100,000 to invest over a period of 10 years. There were 10 mutual funds in which participants could invest. These 10 funds were the 9 largest mutual funds at the beginning of 1985 plus an S&P 500 index fund. The performance of each fund in the game reflected that fund's actual performance during the 10-year period from January 1, 1985, to December 31, 1994 (see Table 1). The study was run in February of 1997. Each fund was given a color name (e.g., the Maroon Fund) to hide its real identity. The order in which the funds were presented was sorted into nine different random variations to which participants were randomly assigned to rule out order effects. The name assigned to each fund was also randomly varied.

Participants were provided with a substantial amount of information about their investment choices. Each participant was given a reference sheet that listed the 10 funds, gave a brief description of each fund's investment strategy, and showed expense ratios and front-loaded fees.[2] Expense ratios for funds in the game ranged between .27% and 1.13%; front loads ranged from 0 to 8.5%. Within the game, participants could look up data on each fund that roughly mirrored the data available from sources like the Morningstar mutual fund reports. Participants could obtain information regarding the fund's past performance, fund expenses, fees charged, and fund size. Participants also had access to a lengthy written description of the fund's investment strategies taken verbatim from the Morningstar reports. Finally, participants also had information on the state of the economy, the consumer price index (a measure of the rate of inflation), the index of leading economic indicators, the Dow industrials, the S&P 500 stock average, and the rate of economic growth (as measured by the increase in the gross domestic product). Over the course of the game, all of these data were updated appropriately.

In addition to investing in mutual funds, participants had the option of leaving their money in the "bank" or investing it in a money market fund, which paid a modest but constant rate of return. Participants saw no explicit indication of the years from which returns were drawn. However, the instructions stated, "The mutual funds in this game and their performance are based on real funds and real fund performance patterns."

Before the game's first turn, participants were asked a few questions about their experience as investors. They were asked to report how much money they had invested, how long they had been investing, and how knowledgeable they

[2] Every fund charges management fees to its investors, and these fees are calculated as a percentage of one's investment. These fees come in the form of expense ratios (which are charged annually) and front loads (which are charged once for each new deposit).

TABLE 1

The 10 Actual Funds Used in the Game and Their Percentage Returns for Each 6-month Period in the Game

6 months ending	Investment Co. of America	Vanguard Windsor	Fidelity Magellan	Affiliated	Dreyfus	Templeton World I	Colonial Strategic Income A	Pioneer II	T. Rowe Price New Horizons	Vanguard Index 500
Jun 85	16.1%	16.6%	22.1%	15.3%	15.2%	16.1%	9.6%	17.1%	14.0%	17.0%
Dec 85	14.8%	9.8%	17.2%	9.9%	8.6%	12.4%	9.7%	12.2%	9.1%	12.2%
Jun 86	21.0%	18.2%	30.0%	20.3%	17.3%	17.3%	6.0%	12.8%	16.2%	20.5%
Dec 86	0.7%	1.7%	−4.8%	2.4%	−0.9%	0.1%	−1.2%	−0.3%	−14.0%	−2.1%
Jun 87	21.1%	23.4%	26.1%	22.4%	19.9%	18.5%	19.3%	23.5%	20.0%	27.2%
Dec 87	−12.9%	−18.0%	−19.9%	−15.8%	−9.4%	−12.8%	−13.1%	−19.3%	−22.6%	−17.7%
Jun 88	10.2%	24.7%	19.3%	11.6%	7.9%	14.7%	14.4%	18.7%	20.9%	12.5%
Dec 88	2.8%	3.2%	2.9%	0.9%	0.8%	4.4%	2.0%	2.6%	− 5.7%	3.3%
Jun 89	16.4%	14.3%	20.0%	11.0%	12.4%	11.5%	6.0%	14.7%	16.9%	16.4%
Dec 89	11.2%	0.6%	12.1%	11.4%	10.0%	9.9%	3.7%	6.6%	7.9%	12.8%
Jun 90	3.5%	−1.6%	4.4%	−0.1%	4.0%	−1.0%	0.4%	0.7%	8.2%	3.0%
Dec 90	−2.8%	−14.1%	−8.5%	−5.2%	−7.1%	−15.1%	−7.2%	−12.6%	6.3%	−6.1%
Jun 91	11.3%	19.1%	20.1%	9.1%	9.7%	15.2%	13.7%	12.8%	23.5%	14.1%
Dec 91	13.7%	7.9%	17.5%	11.9%	16.7%	12.7%	12.8%	11.5%	23.2%	14.1%
Jun 92	−0.2%	10.1%	−0.1%	4.0%	−4.0%	4.3%	6.0%	1.9%	−11.9%	−0.8%
Dec 92	7.2%	5.9%	7.1%	8.2%	9.9%	−1.0%	3.5%	7.3%	25.6%	8.2%
Jun 93	4.6%	10.4%	15.6%	6.5%	0.1%	12.4%	8.0%	7.6%	3.6%	4.8%
Dec 93	6.6%	8.1%	7.8%	6.4%	6.3%	18.9%	7.1%	10.6%	17.8%	4.9%
Jun 94	−2.6%	1.9%	−6.0%	−2.1%	−5.1%	0.1%	−4.6%	−4.8%	−9.8%	−3.5%
Dec 94	2.8%	−2.0%	4.5%	6.1%	0.9%	0.8%	0.9%	3.2%	11.2%	4.8%

were on the topic. The game lasted 20 turns, and each turn covered 6 months of market time. The objective was to maximize one's net worth at the end of the game. After each turn, participants received feedback on the performance of their investments and could move money around into different funds. Not only were they told the total value of their portfolios, but participants also saw performance statistics on all the funds in the game.

After each turn, participants were asked, (1) "How satisfied are you with the performance of your investments during the previous 6 months?" (responses were on a 7-point Likert scale, where 1 = extremely dissatisfied, 4 = neutral, and 7 = extremely satisfied) and (2) "How much do you think your investments will increase in value during the next 6 months (in nominal or unadjusted percentage points)?" At the end of the game, participants were asked, (1) "How well would you guess that you did relative to the average student playing this game?" and (2) "How well do you think you did relative to S&P 500 stock index (one measure of the performance of the market as a whole)?"[3] Players rated their own performance using the following 1 to 7 scale: 1 (more than 15% below), 2(15 to 10% below), 3 (10 to 5% below), 4 (within 5%), 5 (5 to 10% above), 6 (10 to 15% above), or 7 (more than 15% above).

Participants played the Investor Game on computers at their own convenience. The game took a mean of 45 (SD = 26) min to play. After playing, participants returned the diskettes. Each of the diskettes contained a data file that recorded the decisions made by the participant. All participants were given detailed feedback on their decisions, and the exercise was debriefed during class time.

Design. Market performance was manipulated by modifying the returns provided by each fund in the game. In the booming market condition, participants played using the real performances of the mutual funds in the game from 1985 to 1994. In the depressed market condition, those investment returns were all adjusted downward by 3.5% for every 6-month period. For example, when the Fidelity Magellan Fund returned 12.1% in the first half of 1989, those in the depressed market condition saw a return of 8.6%.

RESULTS

Participants reported that they had an average of $20,500 ($SD$ = $26,100) of their own money invested in stocks and mutual funds, and that they had been investing for an average of 4.7 (SD = 1.53) years. Participants rated their own knowledge about investing at an average of 2.73 (SD = 1.53) on a 1 to 7 scale (1 = novice, 4 = amateur, 7 = expert), about halfway between novice and amateur.

[3] Recall that participants were provided with information after each round concerning the performance of their investments and the performance of the S&P 500.

Positive Illusions

Forecasts. To test Hypothesis 1a, which predicted that investors would overestimate the performance of their investments relative to the market, we first compared participants' predictions about how much their investments would increase in the coming 6 months with the actual increase in their investments. A mixed ANOVA, using market condition (booming vs depressed) as a between-subjects factor, with repeated measures on performance source (predicted vs actual increases), reveals a main effect of performance source: Participants consistently predicted that their portfolios would go up more (mean predicted 6-month increase = 8.13, $SD = 3.67$) than they actually did (mean actual increase = 5.50, $SD = 1.95$), $F(1, 78) = 42.39$, $p < .001$.

The same mixed ANOVA served as a test for Hypothesis 2, which predicted that participants in the booming market would be more overoptimistic in their forecasts than participants who played in a depressed market. The performance source by market condition interaction effect is not significant, $F(1, 78) = 2.83$, *ns*, representing a failure to support H2. Not surprisingly, the main effect for market condition is significant: Participants in the booming market condition both predicted and obtained larger 6-month increases than participants in the depressed market, $F(1, 78) = 47.34$, $p < .001$.

Retrospective evaluations. We next tested Hypothesis 1b, that investors would overestimate the past performance of their investments relative to the market. Although participants, on average, reported at the end of the game that they believed they had matched the market's performance, players in both conditions performed, on average, significantly below the market. The average participant obtained a total return that was 8% below the S&P 500 market index, $z = 5.34$, $p < .001$. Recall that at the end of the game, participants evaluated their own performances relative to the market on a 1 to 7 scale. We can compare participants' self-reports on this scale with their actual performances. Table 2 displays the number of participants whose self-rated and actual performance fell into each category. If participants were perfectly calibrated, they would fall along the main diagonal of Table 2. Instead, most participants fall to the left of and below the main diagonal. On average, participants rated their performance roughly one category ($M = .92$, $SD = 1.97$) above where their investments actually performed. Of the 80 participants, 47 overestimated their actual performance, 15 were perfectly calibrated, and 18 underestimated their actual performance ($p < .01$ by sign test).

We carried out a mixed ANOVA on performance relative to the market, using market condition (booming vs depressed) as a between-subjects factor, with repeated measures on performance source (self-rating vs actual performance). The result shows a main effect of performance source: Participants retrospectively rated themselves as having performing better, relative to the market ($M = 4.07$, $SD = 1.35$), than they actually did ($M = 2.40$, $SD = 2.68$), $F(1, 78) = 22.10$, $p < .001$. This represents support for H1b in retrospective ratings of one's own performance. Note that this misperception existed in the face of unusually clear data to refute it: Participants had seen their own performances

TABLE 2

Actual Performance Compared with Self-Rated Performance Relative to the S&P 500 Stock Index

Self-rated performance relative to the market	Actual performance relative to the market							
	>15% below	10–15% below	5–10% below	Within 5%	5–10% above	10–15% above	>15% above	
>15% below								0%
10–15% below	4		2	4	1			14%
5–10% below	2	3	**2**	5	1		1	18%
Within 5%	6	7	3	**11**	2	1		38%
5–10% above	3		2	7	**1**			16%
10–15% above	1			2	2	**1**	1	9%
>15% above	2	1		2				6%
	23%	14%	11%	39%	9%	3%	3%	100%

Note. Counts of participants are in each cell.

compared with that of the market each turn for the whole game. The main effect of market condition is not significant, $F(1, 78) = 3.84$, *ns*. Likewise, the interaction between performance source and market condition is not significant, $F(1, 78) = .61$, *ns*. This represents a failure to support H2, which predicted that participants in the booming market would overestimate their own performances more than participants in the depressed market.

Anchoring on the Past

Participants in both conditions overestimated the correlation of performance across years. Recall that every 6 months, after having allocated their money, participants were asked to report, in percentage terms, how much they expected their investments to increase in value during the coming 6 months. If we compare each individual's predictions with actual performance, an interesting pattern emerges. Participants' reports reveal that they expected their portfolios to continue their most recent trends. The average correlation between participants' estimation of the performance of their investments in the coming 6 months and the performance of their investments in the preceding 6 months is .16 ($N = 80$, $SD = .30$). We tested this relationship using a hierarchical linear model (Bryk & Raudenbush, 1992). The hierarchical linear model allowed us to measure the correlation between prior performance and predictions of future performance across all 1600 observations (80 subjects over 20 turns) as a fixed effect. The model also includes the 80 subjects as random effects to account for the fact that some variance will be attributable to individual differences between participants. Table 3 shows the results of this hierarchical linear model. This model can be written as follows.

Level 1 model:

$$Y = B0 + B1 * (X1) + R$$

Level 2 model:

$$B0 = G00 + G01 * (X2) + U0$$

$$B1 = G10 + G11 * (X2) + U1,$$

where Y is the dependent variable, in this case expectations of future performance; X1 is the level 1 independent variable, in this case actual performance in the prior turn; X2 is the level 2 independent variable, in this case market condition; B0, G00, and G01 are the intercepts; B1, G01, and G11 are the slopes; and R, $U0$, and $U1$ are the random variance components.

For the models presented here, independent variables have been mean-centered. Market condition has been centered on its grand mean, and performance has been centered on the group means. The coefficients for the fixed effects in Table 3 reveal that there is a significant positive relationship between participants' expectations of future performance and the actual performance of their investments in the prior 6 months, $t(78) = 4.07$, $p < .001$. These results lend support to Hypothesis 3, which predicted that participants would base their expectations for the market's future performance on the recent past.

Although participants, on average, expected the market to continue its most recent trend, the market tended to regress to its mean performance. An extreme performance tended to be followed by one closer to the average historical performance of the market. This pattern can be seen in a weak negative serial correlation for the performance of the average fund in our sample over time ($r = -.08$). The average individual correlation between participants' estimation

TABLE 3

Results of the Hierarchical Linear Model for Predictions of Future Performance as a Function of Performance in the Prior Turn

Fixed effects	Coefficient	Standard error	t
For intercept 1 ($B0$)			
Intercept 2 ($G00$)	.082	.004	20.18**
Effect of a booming market ($G01$)	.022	.008	2.66**
For the effect of prior performance ($B1$)			
Intercept 3 ($G10$)	.050	.012	4.07**
Effect of a booming market ($G11$)	.040	.025	1.61
Random effects	**Standard deviation**	**Variance component**	χ^2
Intercept 1 ($U0$)	.036	.001	2082**
Slope: prior performance ($U1$)	.083	.007	188**

** $p < .01$.

of how much their own investments would go up and the actual increase in value of those investments is −.11 (N = 80, SD = .23). We used another hierarchical linear model to test this relationship (see Table 4). There is, indeed, a significant negative relationship between participants' predictions of the future and what actually occurred, $t(78) = -3.63$, $p < .01$. In other words, although participants expected the return to their portfolio to continue its most recent trend, it tended, if anything, to reverse itself.

Satisfaction and Switching

Our manipulation of the market's overall performance had powerful consequences for how our participants responded to the game. Not surprisingly, at the end of the game, participants who played with booming markets were more satisfied (M = 5.57 on a 1–7 scale, SD = 1.05) than people who played with depressed markets (M = 4.12, SD = 1.3), $F(1, 78) = 30.48$, $p < .001$. Likewise, for average semiannual ratings, people who played in booming markets reported greater average satisfaction every turn than people who played in depressed markets, $F(1, 78) = 4.26$, $p < .05$. These results support Hypothesis 4, which predicted greater satisfaction in booming markets, and suggest that participants paid attention to nominal returns and not just to returns relative to the markets in which they played.

Participants did a fair amount of actively moving their money between funds. Only 12 individuals (15% of the sample) selected a single portfolio allocation in the first turn and did not move their money for the rest of the game. The average participant switched 7% of assets (SD = 9%) during each 6-month period. Switching money between funds was associated with lower performance. For each subject we calculated the mean percentage of assets switched per turn and the average portfolio appreciation (holding market condition constant), and found that switching behavior and performance were negatively

TABLE 4

Results of the Hierarchical Linear Model for Predictions of Future Performance as a Function of Performance in the Subsequent Turn

Fixed effects	Coefficient	Standard error	t
For intercept 1 ($B0$)			
Intercept 2 ($G00$)	.081	.004	20.38**
Effect of a booming market ($G01$)	.022	.008	2.63**
For the effect of subsequent performance ($B1$)			
Intercept 3 ($G10$)	−.032	.009	−3.63**
Effect of a booming market ($G11$)	−.030	.018	−1.72

Random effects	Standard deviation	Variance component	χ^2
Intercept 1 ($U0$)	.035	.001	1748**
Slope: subsequent performance ($U1$)	.022	.000	86

** $p < .01$.

correlated across individuals ($r = -.47$, $N = 80$, $p < .01$). The significant negative correlation tells us that that the more money one tended to switch, the less money one made overall. A regression equation predicting standardized net worth at the end of the game, using switching behavior, produced the following result:

$$\text{Ending net worth} = \$379{,}920 - \$274{,}148 * \text{SWITCHED}$$

Here, SWITCHED is the mean percentage of assets switched each turn. In other words, for every 1% of assets switched each turn, on average, investors sacrificed $2741 in ending net worth, or .053% every 6 months. The R^2 for this regression equation indicates that this model accounts for 21% of the variance in ending net worth, $F(1, 78) = 22.32$, $p < .001$.

This correlation does not tell us whether poor performance led to switching, as we expected, or whether switching led to poorer performance. Switching was not influenced by the market's overall performance, in the sense that there is no significant difference between booming ($M = 12\%$, $SD = 10\%$) and depressed ($M = 10\%$, $SD = 6\%$) market conditions in the percentage of assets participants tended to switch between funds, $F(1, 78) = .67$, *ns*. Hence, Hypothesis 5a, which predicted that booming markets would result in less switching behavior, is not supported. Hypothesis 5b predicted that, within subject, participants would react to lower performance of their investments by switching their money into new investments (cf. Thaler et al., 1997). To test this we performed a hierarchical linear model that regressed switching in one turn on performance in the prior turn. In order to compare performance across turns, each subject's performance was standardized by turn in the following way: We subtracted from each subject's performance the performance of the market on that turn, recalculated as if all players had been playing in a booming market, and

TABLE 5

Results of the Hierarchical Linear Model for Switching as a Function of Performance (Standardized) in the Prior Turn

Fixed effects	Coefficient	Standard error	*t*
For intercept 1 ($B0$)			
Intercept 2 ($G00$)	.066	.010	6.41**
Effect of a booming market ($G01$)	.015	.021	.72
For the effect of prior performance ($B1$)			
Intercept 3 ($G10$)	−.244	.105	−2.33**
Effect of a booming market ($G11$)	.005	.206	.03
Random effects	**Standard deviation**	**Variance component**	χ^2
Intercept 1 ($U0$)	.086	.007	620**

** $p < .01$.

constrained the random variance in the effect of performance on switching to zero. The fixed effect of performance on switching is significant, indicating that the worse the participants performed in one turn, the more they tended to switch in the following turn, supporting H5b (see Table 5).

Even though poor performance leads to switching, the reverse—that switching leads to poor performance—also could be true. Any negative effect of switching on performance is partly due to the front-loaded fees that some mutual funds charged on new investments. Participants were aware of these fees. However, even without these switching fees, the correlation between the average percentage of assets switched each turn and the overall performance of one's investments is $-.24$ ($N = 80$, $p < .05$).

To explore whether switching led to poorer performance, we tested the effect of switching in one turn on performance in the next turn. We carried out a hierarchical linear model that regressed switching in each turn on performance in the following turn (see Table 6). In order to compare performance across turns, each subject's performance was standardized as above. In addition, we took out any penalties players would have paid for switching due to loads or fund fees. The results of this hierarchical linear model show a significant negative relationship between switching and performance. Switching, then, appears to have been both a cause and a consequence of poor performance.

Across all participants, there was a modest negative correlation of $-.19$ between switching and investment in the index fund, but this correlation was only marginally significant ($N = 80$, $p = .10$). To compute this correlation, we first calculated averages for each participant for percentage of assets invested in the index fund and percentage of assets switched each turn. These two figures were then correlated across all 80 participants. It is noteworthy that

TABLE 6

Results of the Hierarchical Linear Model for Performance (Standardized, Excluding Loads) as a Function of Switching in the Prior Turn

Fixed effects	Coefficient	Standard error	*t*
For intercept 1 (*B*0)			
Intercept 2 (*G*00)	−.001	.001	−1.06
Effect of a booming market (*G*01)	.003	.001	1.56
For the effect of prior switching (*B*1)			
Intercept 3 (*G*10)	−.008	.004	−2.33*
Effect of a booming market (*G*11)	.003	.008	.37

Random effects	Standard deviation	Variance component	χ^2
Intercept 1 (*U*0)	.003	.000	86
Slope: switching (*U*1)	.012	.000	38

* $p < .05$.

the exclusion of two outliers from this analysis increases the magnitude of this correlation to −.32 and brings it into statistical significance ($N = 78$, $p < .05$).[4]

Investment in the Index Fund

Investment in the index fund was calculated by averaging the percentage of total assets invested in the index over the course of the game. For the entire game, there was no difference between booming ($M = 18\%$, $SD = 21\%$) and depressed ($M = 17\%$, $SD = 23\%$) markets in rates of investment in the index fund. Hypothesis 6, then, was not supported.

DISCUSSION

The present evidence provides support for Hypotheses 1a, 1b, 3, 4, and 5b. Participants overestimated their own performance relative to the market, both prospectively (H1a) and retrospectively (H1b). Our participants showed a tendency to assume that the market would continue its most recent trend, when in fact it tended to regress toward its mean (H3). Satisfaction was higher in booming markets (H4), and participants responded to poor performance of their investments by switching their money between funds (H5b), despite the negative consequences of doing so.

Positive Illusions

Consistent with the literature on positive illusions (Taylor & Brown, 1988), our participants tended to be overly optimistic in predicting the future performance of their investments. In addition—and this is even more remarkable—at the end of the game, participants overestimated their own *past* performance relative to the market, despite the fact that they had been provided with information on their own performance and on market performance throughout the game. In particular, participants reported that they had matched the performance of market indices that they had seen throughout the game, though, in fact, they had performed significantly worse.

It is important to note an alternative explanation for participants' estimates of their own performance, both relative to the market and relative to others. Perhaps it should not be surprising that participants in the depressed market expected better gains than they got, since they were playing with a market that was quite a bit worse than the actual investment market at the time the experiment took place. Although this alternative explanation can explain the difference in satisfaction between booming and depressed markets, it suggests that participants ignored the clear data that they were given about overall performance of the market, and it cannot readily account for the overly optimistic self-appraisal in the booming market. Participants in the booming market

[4] These two outliers switched dramatically more than other participants. They each switched over 45% of their assets on the average turn, which is four standard deviations above the mean.

were overly optimistic in comparison with the incredibly strong market in which they played: The market went up an average of 8% per 6 months, a remarkable 10-year run. The similar patterns of excessive optimism in both conditions are instructive.

Forecasting Errors

Investors' predictions for the performance of their portfolios were positively correlated with the recent past, but their predictions were negatively correlated with the future. These results suggest that participants failed to appreciate the extent to which the stock market regresses to its mean performance (Bogle, 1994; Carhart, 1997; Thaler & De Bondt, 1992). Participants in the present experiment expected their investments to continue their most recent trend. However, their investments tended to do the opposite.

Switching Between Investments

Although the experimental manipulation of market performance did not influence switching behavior (a failure to support H5a), investors did respond to poor performance of their investments by switching their money to new investments (H5b). The tendencies of participants to switch their money between funds in search of the best performer supports the argument that our investors believed they could improve their own performance by actively searching for the best fund in which to invest. However, the evidence speaks against their faith, both in this game and in real investment decisions (Clements, 1998; Odean, 1998a, 1998b).

The more participants switched their investments, the less they tended to earn. There was a significant and negative correlation between the two. In addition to the time and energy one must expend seeking out investments and trying to predict which will perform best, there are transaction fees associated with moving one's money in and out of different investment vehicles. However, even after recalculating returns by removing any fees associated with switching, switching and performance were still negatively correlated. The evidence from this study is consistent with other evidence indicating that predicting the future performance of the market overall or of specific funds within the market is exceedingly difficult (Jasen, 1998; Malkiel, 1973). The control that our investors believed they had over the performance of their investments by switching them between funds, then, was indeed illusory.

Alternative Investment Strategies and Index Funds

The mutual fund market offers index funds as an alternative to actively managed mutual funds. Index funds strive to match market performance by investing in a specified set of representative stocks. Positive illusions and anchoring on past performance should decrease the attractiveness of index funds. There is some modest evidence for this, provided by the marginally

significant negative correlation between switching behavior and investment in the index fund. The same participants who believed they could improve the performance of their portfolio by moving money to chase winning funds were also less likely to invest in the index fund. However, our manipulation of the market's overall performance did not influence the tendency to invest in the index fund, and this represents a failure to support Hypothesis 6. It is possible that a floor effect interfered with obtaining a significant effect here: On average, participants had only 18% of their assets invested in the index fund.

It is also possible that the significance of an index fund was lost on the investors who played our game. Despite the fact that the participants were business school students with a self-reported average of over $20,000 of their own money invested, they also rated themselves as relatively naive investors. When we asked them to report their knowledge as investors on a 1 to 7 scale ranging from novice to expert, participants rated themselves a mean of 2.7 (SD = 1.5), significantly below the midpoint of the scale. Participants may have failed to identify the significance of the index fund. Unlike real index funds, the game's index fund did not include the word "Index" in its fund name. Participants would have had to inspect information we provided them on investment strategies of the various funds to identify the index fund. It is worth noting that self-rated investing expertise was not significantly correlated with investment in the index fund, switching funds, performance of one's investments, or other dependent variables of interest.

Limitations of the Present Study

This study has all the limitations inherent in a controlled laboratory experiment. Also, our participants did not have any real money at stake in their investment decisions, and their grades did not depend on performance. However, there is some reason to think that high stakes do not debias actual decisions (Lichtenstein, Kaufmann, & Bhagat, 1998). It might even be argued that decisions in the present study were actually *less* prone to bias than real investment decisions (Wood, 1989, 1997). The information that participants in the present experiment received was more accessible, interpretable, and standardized than is most real information about investments. The provision, in the real world, of large amounts of information about the various investment opportunities opens the possibility that investors may pay attention to irrelevant information and may distort that information (Russo, Medvec, & Meloy, 1996). Also, investors' familiarity with their investment opportunities was controlled in the present study. There is evidence that real investors tend to gravitate toward investment opportunities with which they are familiar (Huberman, 1997).

In conclusion, the present study offers some evidence that investment decisions are susceptible to positive illusions and an overestimation of intertemporal consistency. These biases influence judgment, satisfaction, and behavior in some consistent ways that can cost investors dearly.

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