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Past performance is indicative of future beliefs

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Abstract. The performance of the average investor in an asset class lags the average performance of the asset class itself by an average of one percent per year over the past fifteen years, based on net investor mutual fund cash flows. We present a model in which a representative behavioral investor believes next year's returns will exactly match last year's returns and show that this leads to price adjustments on what would otherwise be random walk securities that effectively lower the future return of high performers and raise the future return of poor performers. The average predicted behavioral lag indeed matches the observed lag when asset returns are normally distributed with a mean and standard deviation equivalent to historical fifteen year averages of six percent and eighteen percent, respectively, and when the representative investor increases his allocation by 25% more than the return itself, a prediction for which we document empirical support. In other words, investors chase returns and in doing so create the conditions of their own demise.
Keywords: Behavioral finance, investor returns, fund returns, past performance, fund flows, rebalancing

1. Introduction

The S&P 500 earned a 6.66% annualized total return over the fifteen years ending December 2010, but average investors would not have received all of this performance. Figure 1 shows how this raw S&P 500 return decomposes.

The largest chunk of the return is inflation's 2.41%, measured as the annualized monthly Consumer Price Index data as obtained from the Bureau of Labor Statistics. The average tax cost of 1.30% is calculated assuming a 35% income tax and a 15% capital gains tax on annual profits across all funds. The annualized compounded expense ratio averaged 0.92% when weighted by year-starting fund assets.

This appears to leave a 2.03% real return net of taxes and fees to the investor. However, investors in funds tend to underperform the funds themselves because they tend to exit before gains and enter before losses. Investors who had simply remained invested in the S&P 500 without any attempts to time the market would indeed have earned 2.03% net of inflation, taxes, and fees. But the average investor hurt himself by attempting to time entry and exit, losing on average 1.00% from such activity. Over the past fifteen years, such investors would have earned only 1.03% per year. In other time periods, they can end up losing money in bull markets solely due to their trading tendencies.

In fact, an investor in a passive S&P 500 index fund would have faced even lower taxes and costs, estimated at 0.79% and approximately 0.20%, respectively. This represents an additional behavioral cost of $1.30 - 0.79 + 0.92 - 0.20 = 1.23\%$ to investors who choose to chase expensive and less tax efficient actively managed funds rather than inexpensive and more tax efficient passive investments. Thus, the total cost incurred by a behavioral investor is $1.00 + 1.23 = 2.23\%$. However, for the remainder of this paper we will focus on modeling only the behavioral trading costs of 1.00%, ignoring the additional effects of higher average taxes and fees.

Why is it that investors who attempt to time the market end up doing so poorly? In principle, investors who do the precise opposite of their natural inclinations could earn 1.00% on an annualized basis rather than losing it, thus ending with a net return of 3.03%. At the very least, investors who did no trading at all should have earned 2.03%.

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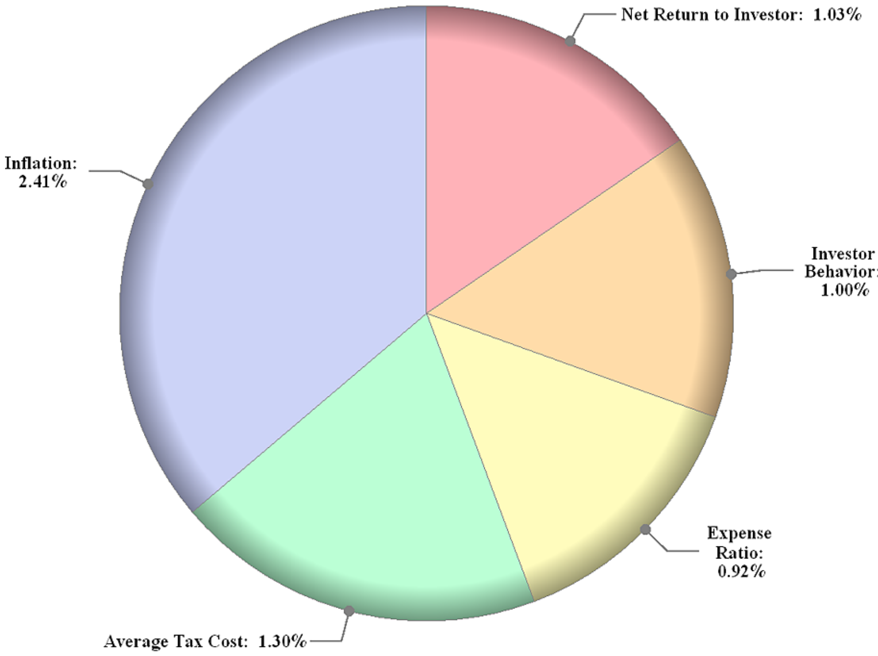

Fig. 1. Decomposition of 6.66% annualized S&P 500 ETF return for the fifteen years ending December 2010. (Colors are visible in the online version of the article; http://dx.doi.org/10.3233/RDA-2011-0038.)

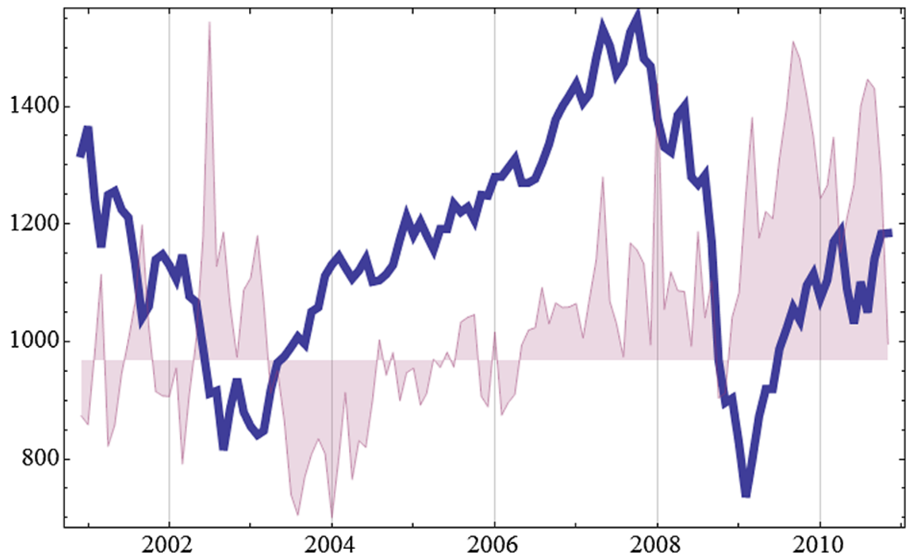

Fig. 2. S&P 500 (blue line) versus excess net inflow to bond funds over equity funds (red area). (The colors are visible in the online version of the article; http://dx.doi.org/10.3233/RDA-2011-0038.)

We argue that the essence of the investor's trading strategy is to replace recent underperformers with recent outperformers. For example, Fig. 2 graphs the S&P 500 and the excess of the net inflows to bond funds over the net inflows to equity funds across the past fifteen years. Peak inflows to bond funds occur after market corrections such as in 2002 and recently in 2008–2009. In other words, when one asset class underperforms another, individuals tend to switch from the former to the latter.

Ben-Rephael, Kandel and Wohl [1] document that shifts between bond and equity funds generate shortterm price movements that are reversed within a few months. They interpret this as evidence of noise in aggregate market prices. We will instead interpret this in the context of our model of investors who hurt their own performance by shifting assets away from recent losers and into recent winners, specifically investors for whom past performance is indicative of their future beliefs.

The fact that investor returns underperform fund returns is not new. Dalbar [3] has issued reports of investor returns for more than a decade and a half. Our paper contributes to the extant literature on this phenomenon by demonstrating how the investor reallocation activity may itself be generating the very underperformance that plagues the investors.

Frazinni and Lamont [6] examine the period of 1980–2003 and document that high individual investor sentiment predicts low future expected returns. They estimate that reallocations cost an average of 0.85% in using an average of 2159 equity-only mutual funds per year. They argue that this evidence suggest simply that investors are dumb and making a mistake. In contrast, we use all available mutual fund data rather than only equity funds, and focus on the most recent fifteen years. Further, we present a specific model of investor behavior that not only matches the empirical results, but shows that the investors are not simply routinely unlucky, but that their trading activity is the actual and proximate cause of their lowered earnings.

Dichev [4] computes the difference between stock returns and investor returns in stocks using a novel measure for stock dollar-weighted averaging based on changes in market capitalization, and concludes that the historical equity premium and the equity cost of capital may be substantially lower than previously assumed. Dichev and Yu [5] explore the same difference for hedge funds and find that hedge fund investor returns also significantly underperform the returns on hedge funds. Here, we focus on mutual fund data and in addition to documenting the known effect in mutual funds, we also provide a behavioral model to explain the difference.

Friesen and Sapp [7] examine 7125 equity mutual funds in the period of 1991–2004 and find that reallocations cost an average of 1.56% annually. They find that poor investor behavior is significantly associated with risk-adjusted excess return but that the higher alpha is essentially erased by the behavioral trading decisions. Our universe is somewhat more recent and broader, including mutual funds from all asset classes, but note that Friesen and Sapp also report that they separately tested bond mutual funds and money market mutual funds and found a nearly zero performance gap. They conclude that their results are consistent with return-chasing behavior. However, they do not posit a specific model of investor behavior, as we do here, and they do not acknowledge the possibility that the trading activity of individual investors may itself be the cause of their underperformance.

Braverman, Kandel and Wohl [2] do present a model to explain this phenomenon. They propose an overlapping-generations model with two groups of investors, one of whom is always in the market and the other of whom may enter and exit the market for long periods, who differ in their demand. Here, however, we show that the results hold even if there is only one type of investor; indeed, even if there is only a single representative investor who chases returns, he will end up performing worse than he would have if he were a single representative buy-and-hold investor.

2. Model

Securities are independently and identically normally distributed with annual expected returns of μ and annualized standard deviations of σ. A representative investor has a time horizon of one year and believes that last year's realized return is next year's expected return. His annual rebalancing affects prices in such a way that their remaining expected returns, from his perspective, are μ. For simplicity, and because estimates of volatility are more precise than estimates of drift [9], the investor always believes future volatility will be the true volatility σ.

For example, when the representative investor observes that a security has increased by ten percent in the last year, he believes the security will increase by ten percent in the subsequent year. If the required expected return is $\mu = 0.06$, then he will increase the price by $\frac{1.10}{1.06} - 1 = 0.0377$, or just under four percent. After doing so, the remaining return from the perspective of the representative investor is precisely μ, so he will become indifferent to any further purchases or sales of the outperformer. This momentum effect is offset by the worse true returns of the security, because the true return will be decreased by the amount it has already increased from rebalancing. In the numerical example above, instead of returns being drawn from a distribution with a mean $\mu = 0.06$, they will be drawn from a distribution with a mean of $0.06 - 0.0377 = 0.0223$. When the second year's return is drawn, the investor repeats his price-adjustment mechanism until he is again indifferent. Note that the investor's price manipulations do not aggregate: if the second year's return was randomly drawn as 6% for example, equal to the investor's required expected return, then the investor would not re-adjust prices further at all, because that random draw already accounted for his past actions and thus actually represented an outperformance of 3.77%. The investor, however, is unaware of this hidden outperformance and merely concludes that the asset grew as expected. If the asset had actually grown as expected at 2.23%, then the investor would believe the third year would also grow at 2.23%, and so he would sell the asset by $\frac{1.0223}{1.06} - 1 = 3.56\%$ until he was again indifferent.

In other words, the (post-rebalancing) outperformance of a security comprises two portions: the first portion is the actual random performance that it experienced last year, and the second portion is the amount by which the representative investor bids up the security because of the erroneous expectation that past performance is indicative of future results. If the random performance were r, and the required expected return were μ, this second portion of the observed return would be $\frac{1+r}{1+\mu} - 1$.

To determine the behavioral costs of rebalancing, we further need an algorithm for the representative investor's allocation to the asset as a function of its return. Two specific algorithms are easily expressible, the buy-and-hold algorithm and the constant-exposure algorithm.

If the investor merely buys-and-holds, then his new position size π_t equals his old position size π_{t-1} multiplied by one plus the return just realized $1 + r_t$:

$$\pi_t = \pi_{t-1}(1 + 1 \cdot r_t).$$

If the investor constantly rebalances to always have exactly one unit invested, then his new position size is always equal to his old position size:

$$\pi_t = \pi_{t-1}(1 + 0 \cdot r_t).$$

In general, an investor is parameterized by how much he chases prior returns in his allocations:

$$\pi_t = \pi_{t-1}(1 + \theta \cdot r_t),$$

where $\theta = 0$ represents an investor always investing exactly one unit, $\theta = 1$ represents the buy-and-hold investor, $\theta = 0.5$ represents an investor who rebalances halfway to a constant allocation, and $\theta = 1.5$ or $\theta = 2$ represents a returns-chasing investor who respectively allocates either fifty percent more or twice as much to an asset as its outperformance dictates.

Consider the results when there is only one security. Table 1 shows the average behavioral trading costs for simulations for various values of μ, σ and θ. The highlighted boxes represent $\mu = 0.06$ and $\sigma = 0.18$ for the different values of θ. The average empirical behavioral trading cost of 1.00% likely occurs halfway between $\theta = 1.0$ and $\theta = 1.5$, at around $\theta = 1.25$.

3. Data

The universe of data is from Morningstar and is free of survivorship bias. Each year, we looked only at funds that had both asset data and returns data during that year. We calculated the rolling annual fund returns and average investor returns using the methodology described in the Appendix. For each rolling window of 13 months (the first month is required to know the initial asset size), we require complete data on assets and on returns. However, we only require this complete data on each 13-month rolling window; we do not require funds to have all data for every month for the past fifteen years.

Figure 3 plots the equally weighted average trailing annual behavioral cost across all mutual funds for each month. It is always a net cost, with occasional very high peaks.

We can also use this data to estimate the empirical multiple of returns θ by regressing monthly asset changes on the corresponding monthly returns. The result of such regressions are listed in Table 2. In all cases, the empirical estimates are economically near the predicted value of 1.25 and statistically significantly above 1.00 and below 1.50, conforming with the predictions of our model.

4. Conclusion

Investors chase returns and by doing so harm themselves. They chase returns by allocating more to funds that perform well and by adjusting prices to reflect their mistaken beliefs that past performance will repeat. Simulation results using historical means and standard deviations predict that investors will allocate about 25% more to outperforming funds as would be

Table 1

Simulated behavioral trading costs

Panel 1A: $\theta = 0$

	$\sigma = 4$	$\sigma = 8$	$\sigma = 12$	$\sigma = 16$	$\sigma = 20$
$\mu = 2$	−0.42	−2.07	−4.73	−7.58	−9.30
	[0.05]	[0.25]	[0.52]	[0.86]	[0.76]
$\mu = 4$	−0.41	−1.81	−3.47	−5.82	−8.83
	[0.04]	[0.20]	[0.43]	[0.55]	[0.91]
$\mu = 6$	−0.37	−1.79	−3.61	−5.45	−8.4
	[0.04]	[0.23]	[0.49]	[0.52]	[0.81]
$\mu = 8$	−0.29	−1.21	−3.12	−5.37	−8.73
	[0.04]	[0.12]	[0.36]	[0.56]	[0.89]

Panel 1B: $\theta = 0.5$

	$\sigma = 2$	$\sigma = 8$	$\sigma = 12$	$\sigma = 16$	$\sigma = 20$
$\mu = 2$	−0.30	−1.00	−1.99	−3.64	−4.70
	[0.03]	[0.11]	[0.21]	[0.40]	[0.45]
$\mu = 4$	−0.22	−0.87	−2.11	−3.73	−4.79
	[0.03]	[0.09]	[0.21]	[0.47]	[0.46]
$\mu = 6$	−0.19	−0.78	1.89	−3.26	−6.21
	[0.02]	[0.10]	[0.26]	[0.31]	[0.63]
$\mu = 8$	−0.15	−0.69	−1.31	−2.79	−3.92
	[0.02]	[0.07]	[0.11]	[0.33]	[0.37]

Panel 1C: $\theta = 1.5$

	$\sigma = 4$	$\sigma = 8$	$\sigma = 12$	$\sigma = 16$	$\sigma = 20$
$\mu = 2$	0.21	0.97	1.02	1.22	1.02
	[0.03]	[0.10]	[0.31]	[0.73]	[0.85]
$\mu = 4$	0.22	0.88	1.10	1.22	2.03
	[0.03]	[0.08]	[0.27]	[0.40]	[0.71]
$\mu = 6$	0.22	0.90	1.28	1.98	0.33
	[0.02]	[0.10]	[0.14]	[0.50]	[0.85]
$\mu = 8$	0.20	0.80	1.35	2.43	2.77
	[0.02]	[0.08]	[0.15]	[0.36]	[0.52]

Panel 1D: $\theta = 2.0$

	$\sigma = 4$	$\sigma = 8$	$\sigma = 12$	$\sigma = 16$	$\sigma = 20$
$\mu = 2$	0.45	1.42	1.20	−0.23	−0.49
	[0.04]	[0.13]	[0.62]	[1.01]	[1.17]
$\mu = 4$	0.45	1.31	2.41	0.39	−2.55
	[0.05]	[0.11]	[0.35]	[0.92]	[1.39]
$\mu = 6$	0.45	1.45	2.78	2.67	1.30
	[0.05]	[0.15]	[0.21]	[0.45]	[1.05]
$\mu = 8$	0.29	1.37	3.14	2.96	1.99
	[0.04]	[0.15]	[0.28]	[0.46]	[0.85]

Notes: All numbers above are in percentages. The first number is the average, based on 100 simulations, of the behavioral trading cost for a single asset with returns normally distributed with the given expected return μ and standard deviation σ, traded by a representative investor who forecasts future performance to exactly equal past performance, and who rebalances his portfolio based on a multiple θ of the realized return. The second number [in brackets] is the standard error. Not shown, the numbers for $\theta = 1.0$ are all zero because by definition there are no behavioral costs of buy-and-hold.

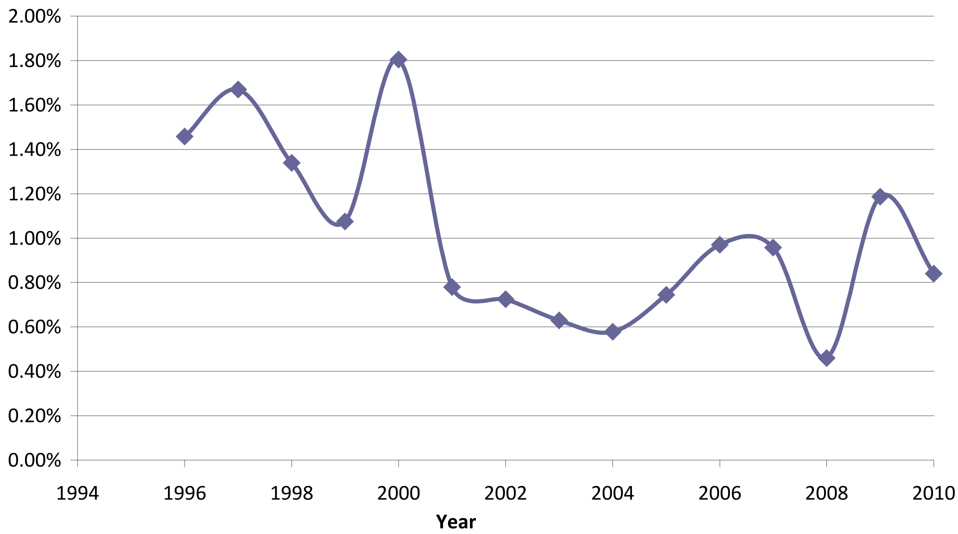

Fig. 3. Average annual behavioral trading cost. (Colors are visible in the online version of the article; http://dx.doi.org/10.3233/RDA-2011-0038.)

expected solely from their performance, and this prediction is borne out by the data.

Future research could include a positive required expected return for all securities, or a required Sharpe

Table 2

Empirical behavioral returns chasing multiple

	With a constant	Without a constant
All funds and all months where assets exceeded \$1mm	$\underset{[0.0009]}{0.0385} + \underset{[0.0186]}{1.2021} r$	$\underset{[0.0185]}{1.2985} r$
All funds and all months where assets exceeded \$5mm	$\underset{[0.0004]}{0.0221} + \underset{[0.0089]}{1.1618} r$	$\underset{[0.0088]}{1.2182} r$
All funds and all months where assets exceeded \$10mm	$\underset{[0.0004]}{0.0176} + \underset{[0.0079]}{1.1409} r$	$\underset{[0.0078]}{1.1862} r$
All funds and all months where assets exceeded \$20mm	$\underset{[0.0002]}{0.0130} + \underset{[0.0052]}{1.1195} r$	$\underset{[0.0051]}{1.1535} r$
All funds and all months where assets exceeded \$50mm	$\underset{[0.0002]}{0.0093} + \underset{[0.0040]}{1.0960} r$	$\underset{[0.0040]}{1.1207} r$

Notes: The table above shows the results of regressing the monthly increases in assets of a fund against the corresponding month's performance return r, for different minimum required fund asset sizes. A coefficient in excess of one indicates that assets grew faster than can be accounted for by profits alone. The standard error of the coefficients are reported [in brackets].

ratio for each security to adjust the expected return for the security's volatility. Furthermore, following the empirical and theoretical results of Maymin and Maymin [8], the representative investor could be mistaken not only about estimates of expected return but also about estimates of volatility. These errors could lead to more complex interactions between past performance and present price adjustments on the basis of erroneous future forecasts. Finally, multiple investors or investor types could be introduced to make more specific predictions about trading volume and price impact.

Appendix: Calculation of fund returns and investor returns

Given a list of 13 consecutive monthly assets $a_0, \ldots, a_{12}$ and 12 corresponding monthly returns $r_0, \ldots, r_{12}$ for a particular fund, the total yearly fund return R_{Fund} is computed as:

$$R_{\text{Fund}} = \prod_{i=1}^{12} (1 + r_i) - 1.$$

The average investor return is solved numerically as the internal rate of return required such that the investor who started with assets a_0 would have ended with the final assets a_{12} after adjusting for all of the intermediate cashflows $a_i - a_{i-1}(1 + r_i)$ for $i = 1, \ldots, 12$. Specifically, if r_{IRR} is the numerical solution satisfying the following:

$$a_0 + \sum_{i=1}^{12} \frac{a_i + a_{i-1}(1 + r_i)}{(1 + r_{\text{IRR}})^i} - \frac{a_{12}}{(1 + r_{\text{IRR}})^{12}} = 0,$$

then the yearly investor return R_{investor} is:

$$R_{\text{investor}} = (1 + r_{\text{IRR}})^{12} - 1$$

and the behavioral trading costs C for that particular fund, for that particular time period, are:

$$C = R_{\text{Fund}} - R_{\text{investor}}.$$

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