APPLIED BEHAVIORAL FINANCE: INVESTOR BIASES, PERFORMANCE REVERSION TO THE MEAN and TREND FORMATION

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Summary
In the pursuit of understanding the behavior of the market player, the basic argument relays on the supposition that the risk appetite increases exactly at the worst moment - when the capacity to assume additional risk decreases significantly. People view a sample randomly drawn from a population as highly representative and quasi similar to the population in all its essential characteristics. They expect any two samples drawn from a particular population to be more similar to one another and to the population than is statistically justifiable. This behavior is different from the tenets of classic finance theory.

The paper aims at demonstrating that investor psychological biases lead to investment performance to tilt to the mean in the long run and by following the trend, the financial market population do not enjoy significant sustainable benefits. As a reflection of the behavioral biases and influences, the statistical demonstration supports the conclusion that markets do not random walk.

Key words: Psychology, biases, efficiency, individual investment

Classification:
REL 5F, 5G, 5K, 7J, 7K, 7L, 10B, 10F
JEL: G11, G12, G14

1. The Introduction and the Study Context
In a seminal Harvard Business Review article co-authored by psychologist and Nobel laureate Daniel Kahneman gives a checklist approach to decision making at an institutional level to avoid biases. According to the article, the potential for distortions are so high that knowing biases were not enough to eliminate these. The authors illustrate the reflective and intuitive thinking process. In intuitive thinking, we don’t focus on doing things, we just do them. Intuitive is good at making contextual stories. This is when cognitive failures happen, as there is no way of knowing when they are happening. According to the authors, talking doesn’t eliminate biases. A more methodical approach is needed. A study observed that eliminating biases achieved 7% points’ higher returns. Kahneman and team suggest eliminating biases can improve decision making profitably. So, if the method works for businesses, the approach should also work for investors and markets, and could be an improvement on the three-year reversal cycles of behavioral finance where worst stocks outperform the best. We reviewed Kahneman’s checklist for decision makers to see if the approach also assists an investor. Is there any reason to suspect motivated errors (or errors driven by the self-interest of recommending team)? Now, this could be a good business checklist but the markets are known to have a manipulation element, the zero-sum game instruments, your loss is my gain. Above that, we are living at a time of educating society about ethics and conflict of interest. Markets are full of motivated errors.

Have the people making the recommendation fallen in love with it? From a market perspective, advisory services are ranked based on their recommendations. And, few take a detour on a previous forecast. So, market analysts can be assumed to be mostly in love with their forecasts.

What if there are dissenting opinions within the recommending team? Though there are always dissenting opinions among market advisories, there is always a clear skew either on the buy or on the sell side. More often on buy than on sell. Hence, dissenting views are not polarized enough in markets. A question that decision makers should ask the team making recommendations - could the diagnosis of the situation is overly influenced by salient analogies?

Trading volume and new highs are known to have an undue influence on investors. Other questions include: Can investor see the halo effect? Do you know where the numbers came from? If you had to make the decision again in a year, what information would you want?

Are people making the recommendation overly attached to past decisions? Investors generally buy companies with an aura. Investors don’t just buy numbers, as there are many variables in markets. Hence, stories are bought or sold, not numbers. Few investors learn from mistakes, as there is less annual review. If 80% of investing is momentum, the past trend exerts an excessive influence on investors.

2. The Reversion to the Mean theory

The mean reversion theory suggests that prices and returns eventually move back towards the mean or average. This mean or average can be the historical average of the price or return or another relevant average such as the growth in the economy or the average return of an industry. This theory has led to many investing strategies involving the purchase or sale of stocks or other securities whose recent performance has greatly differed from their historical averages. However, a change in returns could be a sign that the company no longer has the same prospects it once did, in which case it is less likely that mean reversion will occur. Percent returns and prices are not the only measures seen as mean reverting; interest rates or even the price-earnings ratio of a company can be subject to this phenomenon.

![Images](a.png)  ![Images](b.png)  ![Images](c.png)  ![Images](d.png)

Figures 1: how markets pressure to mean reversion

However many times after falling below mean markets don’t revert back to the absolute mean (illustration b).

While sometimes after getting oversold (overvalued) and staying above the mean attempting to get back to mean value, markets or asset prices stay overbought and get more overbought (overvalued) (illustration c).

Sometimes there is a clear disregard to mean value, markets ignore the mean totally (see illustration d).

A continuous mean-reverting time series can be represented by an Ornstein-Uhlenbeck stochastic differential equation $dx_t = \theta(\mu - x_t)dt + \sigma dW_t$.

Ideal mean reversion in illustration 'a' is how markets should express mean reversion. The overbought (overvalued should push back to an absolute mean and vice versa). Where $\theta$ is the rate of reversion to the mean, $\mu$ is the mean value of the process, $\sigma$ is the variance of the process and $W_t$ is a Wiener Process or Brownian Motion. In a discrete setting the equation states that the change of the price series in the next time period is proportional to the difference between the mean price and the current price, with the addition of Gaussian noise.

One critical assumption is to consider the return distribution as normal or lognormal. In a normal distribution, return distribution intervals have a constant measure, in a lognormal distribution, the intervals value depends on the relative value of stock price. If stock price variations are independent, the return distribution is normal, and if log differences are independent and have a finite variance, the price distribution is lognormal. An efficient, fair market should preclude any investor to infer immediate evolution based on past evolution.

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2 Bodie, Zvi; Alex Kane; Alan J. Marcus. (1989); Investments, Irwin; p 342
Human brain has a limited capacity to process, assimilate and understand the huge volume of information and stimuli that assault us every second. The decisions and judgments investors undertake daily (hundreds) are constrained by personal circumstances, time pressure, psychological and emotional factors, and are at the crossfire of a rational and non-rational influences. People often ignore a good decision for the simple fact that they are, in general, more interested by simple, reasonable and feasible solutions to their investment dilemmas.

The perception, especially when it comes to money, are distorted and biased by investment performance history, present circumstances and future expectations. Attitudes and decisions in the financial area are a cocktail of rational and non-rational motives. Investors reach a certain conclusion and implement the subsequent decision based on what they know at the moment, anchoring themselves in information considered relevant, losing the larger perspective.

Financial decisions are sometimes suboptimal due to simplistic, heuristic and emotional logic. Through the basic feature of human nature of search for enjoyment, investors are attracted by interesting, colored and attractive information that conforms to their hard-embedded beliefs and creeds.

The investors are short sighted, but most of the value comes from long term investing. The Behavioral biases drives markets booms and busts but bring some fun to life. One logical question debated in the manual is whether a behavioral managed portfolio can outperform, on a risk adjusted basis an actively managed investment. A behavioral approach would mean trading against the cycle of emotions, buying when others are panicked and selling when others are enjoying their new found fortunes. This tactic, however, does not answer to the most critical answers, how much, when, what if initially market short term trend proves you wrong? Why are these questions important? Because even an agile investor smartly decides to buy when the market falls abruptly, probably she will buy only a small amount, since it is so emotionally difficult to overcome fear of an extended correction.

Investors either buy too little (too soon) or sell too little (too late), so a strong behavioral based strategy can prove to be insufficient for the overall portfolio performance. Administration of investors’ emotions is not simply equivalent with market timing. Proper selection without sufficient allocation does not improve long term investment performance, on a risk – adjusted basis.

Volatility is a key stress element for the investor. Risk is not equivalent to volatility but a permanent loss of capital, not a random price fluctuation. Romanian market volatility is high during recessionary time and will remain high during recovery times, and cheap stocks can become cheaper and expensive assets can become more expensive.
Robert Shiller’s’ Paper on ‘The Volatility of Stock markets Prices’ published in 1987 uses dividend data and real interest rates to seek evidence that true investment value changes through time sufficiently to justify the price changes. His paper concluded that most of the volatility of the stock market prices appears unexplained. Shiller volatility or fluctuations prove that behavior of markets is not normal. Non normal distribution series is a widely followed proof of inefficiency in prices.

Graph 1: Robert Shiller’s’ Paper on ‘The Volatility of Stock markets Prices’

Graph 2: Silent competition among Central Banks. different agendas, sometimes colluding sometimes colliding interests

Central Banks rates FED, BCE and BNR

Resuming consumption and investment lending in sustainable conditions is still far away, while taking into consideration the prolonging and intensification of cross-border financial deleveraging, monetary accommodation competition between the large central banks. The context is critical in any financial and

Fortunately, over optimism is a basic tenet of human species. In general, people do not spend too much time on looking and understanding the bad news. Investors would rather prefer to focus on the bright side of the moon an, most of the time, they do not see things that they do not expect to see. What you see is what you look for.
Positive thinking and planning (a to do-list, applicable when facing the unexpected black swan) can bring a sense of control and a release of anxiety and stress in the heat of the moment when the investor loses money so hard earned, and evidently she cannot think clearly and long term. By discipline and clear thinking, the investor can learn from past mistakes and rather than worry on things that she cannot control, should focus on how to position her existing portfolio to the eventual market rebound, by discipline, innovation and planning.

As recent market gyrations inefficient and aggressive rebalancing of the portfolio, especially on a downward trend, is highly detrimental to the overall active performance of the portfolio. By fear of losing opportunity for additional profit, investors that are not keeping their temper, act impulsively by extrapolation of short-term trend into a medium and long-term investment attraction. As consequence of their actions, their risk profile is changed and the investors appear to be able to bear more risk that would be otherwise reasonable, advisable and economic rational. An investor analyzing the table below probably would be interested in the Romanian market:

### Table1: 2014, Over recession but prolonged crisis: Equity Risk, Credit premiums

<table>
<thead>
<tr>
<th></th>
<th>Real GDP Growth</th>
<th>Real Earnings Growth</th>
<th>Dividend Yield</th>
<th>Expect Real Return</th>
<th>Real Bond Yield</th>
<th>Impli ed ERP</th>
<th>Expected Inflation</th>
<th>Expect. Nominal Return</th>
</tr>
</thead>
<tbody>
<tr>
<td>US</td>
<td>3.0</td>
<td>3.0</td>
<td>1.8</td>
<td>4.8</td>
<td>1.5</td>
<td>3.3</td>
<td>2.0</td>
<td>6.8</td>
</tr>
<tr>
<td>Japan</td>
<td>1.5</td>
<td>1.5</td>
<td>1.7</td>
<td>3.2</td>
<td>0.8</td>
<td>2.4</td>
<td>0.5</td>
<td>3.7</td>
</tr>
<tr>
<td>UK</td>
<td>2.8</td>
<td>2.8</td>
<td>3.2</td>
<td>6.0</td>
<td>-1.0</td>
<td>7.0</td>
<td>2.0</td>
<td>8.0</td>
</tr>
<tr>
<td>Romania</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>4.0</td>
<td>2.5</td>
<td>1.5</td>
<td>2.5</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>+2.5</td>
<td>3.5</td>
<td>3.5</td>
<td>7</td>
<td>3</td>
<td>4</td>
<td>2.75</td>
<td>6.75</td>
</tr>
<tr>
<td></td>
<td>+5</td>
<td>4</td>
<td>4.5</td>
<td>8.5</td>
<td>2</td>
<td>6.5</td>
<td>5.0</td>
<td>11.5</td>
</tr>
<tr>
<td>EU</td>
<td>0.3</td>
<td>2.3</td>
<td>2.9</td>
<td>5.2</td>
<td>-1.0</td>
<td>6.1</td>
<td>2.0</td>
<td>7.2</td>
</tr>
<tr>
<td>World</td>
<td>2.5</td>
<td>2.5</td>
<td>2.3</td>
<td>4.8</td>
<td>0.4</td>
<td>4.4</td>
<td>1.8</td>
<td>6.6</td>
</tr>
</tbody>
</table>

However, the absolute performance is less relevant than the relative return that investor assigns in her value judgment. The stock market mechanism evaluates and rewards economic performance objectively, transparently and instantly: on such alert and competitive market, if investor loses 4% when the relevant benchmark is down 6%, she is well regarded; however, gaining only 4% when the index rose 6% in a specific period is considered poor investment performance.

Professional survivorship depends essentially on how adaptive is the investment behavior relative to the attitude of other market participants. The tension between authenticity and adaptation generates the professional competition that makes a market winner. One way to cope with the inherent professional stress of money management business is to adapt and conform to the governing rules of the group investor belongs to and to which she is compared in real time; contrarians decisions that resulted in negative results are penalized much more severely that are rewarded those with positive results.

If markets should follow a Random Walk, that feature would be a strong argument against behavioral finance – that predicts that due to investor biases and emotions, market moves are forming patterns that can be profitable to exploit. After Louis Bachelier – the inventor of the concept of Random Walk or Fair Game (expected return for a speculator is zero), his outstanding research follower Eugen Fama won a Noble Prize in Economics Science in 2013. [http://www.nobelprize.org/nobel_prizes/economic-sciences/laureates/2013/fam-facts.html](http://www.nobelprize.org/nobel_prizes/economic-sciences/laureates/2013/fam-facts.html)
For a comprehensive/composite, BET C:

**BETC Index**

Regression: $\ln(I_t) = \mu + \rho \ln(I_{t-1}) + \varepsilon_t$

Dependent Variable: L_BETC
Method: Least Squares
Sample (adjusted): 2 2721
Included observations: 2720 after adjustments

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>0.001408</td>
<td>0.002354</td>
<td>0.598049</td>
<td>0.5499</td>
</tr>
<tr>
<td>L_BETC(-1)</td>
<td>0.999828</td>
<td>0.000319</td>
<td>3135.660</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

R-squared: 0.999724
Adjusted R-squared: 0.999724
S.E. of regression: 0.015933
Sum squared resid: 0.690009
Log likelihood: 7400.523

According to the regression equation that was tested, the $\phi_1$ coefficient is statistically significant. We can infer that there is linear dependence between daily returns, and the index series of BETC does not follow a random walk pattern. Other factors could influence this evolution, and they are persistent and consistent. Further, is the base case too optimistic? Is the recommending team overly cautious? Is the worst case bad enough? This depends on the investment style. A contrarian approach is counter intuitive. A contrarian never works with an optimistic base case. When he invests or recommends, s/he suggests taking risk, not be cautious. A contrarian looks at the worst case. The checklist again proves momentum investing is full of biases and hence poor decision making. And, the only way to control our own intuition could be to embrace the objective contrarian approach. Buy the worst and sell the best.

Regression $\varepsilon_t = \phi_0 + \phi_1 \varepsilon_{t-1}$

Dependent Variable: RESID_BETC
Method: Least Squares
Sample (adjusted): 3 2721; Included observations: 2719 after adjustments

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>-6.30E-06</td>
<td>0.000301</td>
<td>-0.020929</td>
<td>0.9833</td>
</tr>
<tr>
<td>RESID_BETC(-1)</td>
<td>0.168923</td>
<td>0.018905</td>
<td>8.935166</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

R-squared: 0.028546
Adjusted R-squared: 0.028188
S.E. of regression: 0.015703
Sum squared resid: 0.669969
Log likelihood: 7437.371

According to the regression equation that was tested, the $\phi_1$ coefficient is statistically significant. We can infer that there is linear dependence between daily returns, and the index series of BETC does not follow a random walk pattern. Other factors could influence this evolution, and they are persistent and consistent. Further, is the base case too optimistic? Is the recommending team overly cautious? Is the worst case bad enough? This depends on the investment style. A contrarian approach is counter intuitive. A contrarian never works with an optimistic base case. When he invests or recommends, s/he suggests taking risk, not be cautious. A contrarian looks at the worst case. The checklist again proves momentum investing is full of biases and hence poor decision making. And, the only way to control our own intuition could be to embrace the objective contrarian approach. Buy the worst and sell the best.

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3. Conclusions

People tend to discount the eventual implications of low probability-high negative impact events, but these events, due to their apparent low probability, seem to happen less often than anticipated. The most expected outcome of these possible yet less probable events can have, however, disastrous effects on the prospect value of investor portfolio. High emotional impact events, although rare, have a major, indelible impact on the emotional registry of a person. Any subsequent decision is affected by historical record of successes and failures. In general, investor that succeeds and survives on the long term, makes small gains systematically (or wins more and more times than they lose). Their investment success is not a simple luck of result of a continuous stream of rational and correct material decisions but of a disciplined and focused approach, prime access to information and ability to assemble on time and correctly the available data, coupled with the ability for innovation and adaptation to the continuous change and challenge of the market game. Investment managers have to prove their repeatable professional ability and sustainable value-adding capability on a continuous basis to their employers, employees, and investment public. Although the business of managing investment assets is much more complicated, competitive, rewarding and challenging than ever, and investors are increasingly sophisticated, their emotional attributes remain as simple as always - fear of losses and desire to make money. Mental cognitive errors are frequently caused by heuristic simplifications - logical shortcuts by which decision makers use simple rules to solve complex problems. When this approach is used inappropriately for complex problems solving, investors’ biases could lead to systematic mental mistakes.

These errors of investment performance estimation are predictable, then exploitable, by smarter, more rational decision makers. An example debated in the paper refers to under reaction of investors to information. This late reaction is a direct consequence of an excess of self-confidence in the ability to process and understand new information. The individual is anchored in past opinions and is mentally closed to new information that contradicts the old set of beliefs. An interesting example of mental anchoring is price discount posting in a sales interlude: suggested price by the producer > retail price > sales price in this period. The gradual exemplification of the three figures, anchors mentally the prospective buyer into an opportunity for a great deal. People buy compulsively not because of apparently reduced prices but for the reasons that are certain, they have just found an excellent deal. Our wardrobes are a good example of that.

The paper advances the idea that the investor psychological biases lead to investment performance to tilt to the mean in the long run and by following the trend, the financial market population do not enjoy significant sustainable benefits. As a reflection of the behavioral biases and influences, the statistical demonstration supports the conclusion that markets do not random walk.

The article reviews some psychological concepts relevant and used in the study, in an interdisciplinary effort of understanding the correlation or causality between psychology and finance. The paper aims at demonstrating whether investor psychological biases lead to investment performance to tilt to the mean in the long run. As a reflection of the behavioral biases and influences, the statistical demonstration supports the conclusion that markets do not random walk. By following the trend, the financial market populations do not enjoy significant sustainable benefits. In the research reported here investigated the market pattern zigzag to see any predilections or biases or a random walk. Analyzing the data for this study leads to the interesting conclusion that individual psychological biases and differences should not be confounded with noise within econometric models but rather manifest a solid influential role on the dependent variable – investment outcome. Data base source for the article shows that psychological characteristics have salient relationships with various aspects of investment decision making process making and the transactional activity of the individual investor. The statistical interrogation describes the sampling methodology, the frequency of data and the empirical methodology that lead to analysis of the results and concluding remarks. The study provides details on raw statistical test scores, regression results and analysis. In this study, I evaluate the association between investors’ behavior and her portfolio results.

The findings suggest that psychological biases can have an impact on risk return optimization, asset allocation on investment portfolios and finally on investment outcome. The sources of investor biases that lead to investor finance errors the investment management industry can apply the data for the development of products and services (automated pilot investing) that may help save investors from sabotaging their financial standing and future prospects. Also, new behavioral portfolio construction methods should combine evidently classic finance math with rigorously quantified psychological metrics to improve models for operators use in giving financial advice and crate investor portfolios that enhance investors chances for reaching their life time financial goals.

The future research

Students of Behavioral Finance still have much to research on influence of psychological profile dissimilarities between individuals and how these dissimilarities manifest in real financial investment decision and behavior. Personality and other individual circumstances and differences systematically influence investment decisions.
4. Bibliography


