The Effect of the Weather on Investors Estimates of Returns Earned

by

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Abstract

This study examines overconfidence in an investing environment to determine whether investors are aware of their past returns earned and whether the weather has an impact on their estimates. A survey was sent out to over 6,000 staff members at four South African universities assessing respondents' estimations of their returns earned in unit trusts in which they were invested, whilst keeping track of the weather on each day. 466 completed responses were obtained, of which **81** respondents indicated that they were invested directly in South African equity only unit trusts to allow for statistical testing. The data obtained was analysed for evidence of overconfidence by comparing respondents' estimates of fund returns against historical returns and then checking whether the weather had any influence on the estimates. The study found that investors were underconfident rather than overconfident. Furthermore, it was found that estimates were more accurate on cloudy days, when compared to sunny days.

Keywords: Overconfidence, Return Estimation, Weather

1. Introduction

"Over their lifetime, people base thousands of decisions on impressions of their skill, knowledge, expertise, talent, personality, and moral character" (Dunning et al., 2004). However, if these decisions are based on incorrect impressions of our knowledge, expertise, talent and skill we might be making the wrong decisions. This is not as a result of poor decision-making ability, but rather because of the behavioural biases which affect our impressions of how much we think we know.

Overconfidence has the ability to affect investment decisions through incorrect thought processes and incorrect belief in one's own abilities. Previous studies (notably Glaser and Weber (2007)) have set out how overconfidence affects an individual's abilities to estimate their past equity returns. Furthermore, Saunders (1993) and Goetzmann and Zhu (2002) both found that the NYSE exchange tends to earn positive returns on sunny days and mediocre returns on cloudy days, suggesting that the mood of market makers can influence returns. This suggests a researchable area: whether the weather has any influence on investors' abilities to estimate their past returns?

2. Literature Review

Research (Wegerif, Mercer, & Dawes, 1999; Williams & Gilovich, 2008) suggests that selfassessments of skill and character are often imperfect. In general, peoples' self-views hold only a tenuous to modest relationship with their actual behaviour and performance (Dunning et al., 2004). In addition to incorrect self-rating, people overrate themselves relative to their skill and performance level. The average person believes that they have an 'above average' level of skill and performance which flouts simple mathematical probability as only half of a population can be above average (College Board, 1977). Epley and Dunning (2006) noted that people fall prey to biases that leave their self-assessments flawed in systematic ways, from the start of their thought process all the way through to their final decisions. This carries significant implications such as wrong decisions and incorrect views of oneself (Dowie & Willows, 2014).

Benjamin Franklin highlighted the fact that it has always been especially difficult to produce unbiased self-assessments: "*There are three things extremely hard: steel, a diamond, and to know one's self*" (Franklin, 1750).

This literature review will set about looking at the behavioural biases that potentially affect the decisions and estimates' made of an individual's self-performance. These are most notably: overconfidence (Barber & Odean, 2001) and the weather (Saunders, 1993).

Overconfidence

Overconfidence influences an investors propensity to trade frequently yet unsuccessfully (Bailey et al., 2011), which is largely due to the fact that they overrate their knowledge and abilities and are overly optimistic about future prospects (Tourani-Rad & Kirkby, 2005). Alpert and Raiffa (1982) found that the confidence intervals that individuals assign to situations are far too narrow; their 98% confidence interval included the true quantity only 60% of the time.

Barber and Odean (2000) looked at the overconfidence of traders and found that the average net return of traders who trade frequently was 7.1% lower than the return made by investors who traded infrequently. Furthermore, overconfident investors tend to hold undiversified portfolios indicating that a lack of diversification was an investor choice and not as a consequence of institutional factors such as trading costs (Odean, 1998). Odean (1998) further showed that this lack of diversification was owing to an investors' unjustified belief in that stock.

Self-assessments of skill and character tend to be more imprecise than people suspect, which leads to overconfidence (Dunning et al., 2004). People possess only a modest level of insight into the character traits that they have and the skills they possess (Dunning et al., 2004). These factors contribute to the incorrect view that individuals hold of themselves.

Other causal factors have been found to contribute to overly optimistic predictions are people neglecting important information or their own past experience when making decisions (Read & Van Leeuwen, 1998). When people predict how they think they will behave or react in certain situations they fail to consider the worst-case scenarios that could easily be created, choosing rather to dwell on the positives (Newby-Clark et al., 2000). And when people neglect their own past experience when making decisions, they are often ignoring the most relevant information (Dunning et al., 2004).

Barberis and Thaler (2003) stressed that overconfidence as a bias might originate from two other behavioural biases: self-attribution bias and hindsight bias. Self-attribution bias, is a person's

tendency to attribute any success that they may have to their own talent and good choice whilst ascribing any failure to bad luck rather than bad decisions and incompetence (Barberis & Thaler, 2003). When people do this repeatedly, they come to the incorrect conclusion that they are in fact very talented when this is often not the case (Barberis & Thaler, 2003). Hindsight bias happens when people believe that they predicted an event before it happened (Barberis & Thaler, 2003). If people begin to believe that they have been able to predict the past better than they actually did, then there is a strong likelihood that they will start to think that they can predict the future better than they actually can (Barberis & Thaler, 2003). This leads to a greater self-attribution bias as well as a higher level of overconfidence (Barberis & Thaler, 2003).

In conclusion, investors are overconfident. This overconfidence will lead an investor to overestimate the returns that they have generated.

The weather effect

The weather has been shown to impact the behaviour of humans in both survey and clinical psychological experiments (Saunders, 1993). According to Shakespeare: "It is the very error of the moon, she comes more near the earth than she was wont, and makes men mad" (Othello, Act V, Scene ii).

Hirshleifer and Shumway (2003) argue that the weather could have an effect on the behaviour of market traders, which would consequently be reflected in the returns of stocks. A decade earlier, Saunders (1993) investigated the NYSE returns and found that the exchange tends to earn positive returns on sunny days and mediocre returns on cloudy days. Furthermore, the medically documented seasonal affective disorder (SAD), in which the shortness of days in the winter months leads to depression in many individuals, has been found to heighten risk aversion (Kamstra, Kramer, & Levi, 2002). Using data from numerous stock exchanges, Kamstra et al. (2002) reported stock returns to be significantly related to the amount of daylight.

Investigating the relationship between stock market returns and the temperature, Cao and Wei (2005) hypothesised that lower temperatures should be reflective of higher stock returns and higher temperatures to be related to higher or lower stock returns. Examining stock markets across the world, Cao and Wei (2005) found a negative correlation between returns and temperature.

Kamstra, Kramer and Levi (2000) found that the outcome of major sport events' as well as changes to daylight savings affected the mood of market makers. These findings show that emotions can play a large part in investor decisions. Furthermore, if these emotions are affected by external sources, the estimate of returns by investors could be biased resulting in incorrect assessments.

In contrast to this literature, Goetzmann and Zhu (2005) found no differences in an individual investors likelihood of buying or selling equities on cloudy days as opposed to sunny days. Goetzmann and Zhu (2005) were of the opinion that the relationship between returns and weather is not as a result of individual investors trading patterns, but rather the mood of market makers. Supporting these findings, Pardo and Valor (2003) found the weather to have no influence on stock prices on market index returns in the Spanish market.

There is a wealth of evidence strongly indicating that people make substantial errors when they evaluate their "abilities, attributes, and future behaviour" (Dunning et al., 2004). Overconfidence has a major effect on all individuals and the mood or emotions of market makers can play a large part in investor decisions. The effect of the weather on these moods has opposing opinions from the literature reviewed.

3. Methodology

3.1 Research Questions

The literature has shown that individuals overestimate their returns and are overconfident. They are also prone to their emotions when making investment decisions. In light of these findings; the following research questions were proposed:

1. Do investors overestimate their returns?

2. Are investors' estimations influenced by the weather?

The null hypothesis is that there is no difference between the actual and estimated returns earned by investors ($H_{0,1}$), and that estimates are not influenced by the weather ($H_{0,2}$).

Research Approach

The application of this study looks at investors estimates of past returns, in particular equity returns. This approach is supported by Glaser and Weber (2007) who analysed equity market data. A list of funds at investment houses was made, restricted to funds classified as local equity i.e. funds with no foreign equity holdings. The Pareto Principle (Sanders, 1992), which reasons that 80% of the wealth could sit with 20% of the investors, was then applied to the collective investment schemes ('unit trusts'). The funds that comprised 80% of the total assets under management were determined by finding the smallest number of funds that comprise the required 80% of the wealth. The funds were ranked in size order, according to the closing value of funds under management on the 30th of June 2013, from most funds under management to least. It was calculated that the 13 biggest funds represented slightly more than 80% of the total funds and these funds were thus selected to be tested.

Research Strategy

An online survey was sent out to obtain investors estimates of their past returns. The survey was cognitively tested by 10 people to evaluate the wording of the survey, its design and to help ensure the completeness of responses received from participants (Presser et al., 2004; Willimack et al., 2004). The suggestions from this testing were then analysed and, where appropriate, changes were made to update the original questionnaire.

Respondents were asked if they directly invest (i.e. not via a pension fund, provident fund or retirement fund) in an equity only unit trust as being indirectly invested was perceived as not being in control of money allocations and thus not of relevance to this study. If directly invested, respondents were then asked to estimate what annualised return they thought they have earned over the preceding 12 months, 3 years, 5 years and 10 years for the period ending 30th of June, dependent on how long they indicated they had been invested in the fund.

A record was also kept of the weather on the days that responses were received from respondents to assess whether respondents estimates were influenced by the weather on the day the estimate was made. The estimated returns made for each fund were then benchmarked against the

actual annualised returns of each fund, as obtained from Bloomberg. Bloomberg is a New York based financial and news service founded in 1981.

Research Method

To improve the robustness of results, incremental sampling was used to obtain as many responses to the survey as possible. The first sample were staff members at the University of Cape Town. Following from that staff members at other Universities who agreed to participate, such as the University of Stellenbosch, the University of the North West (NWU) and the Nelson Mandela Metropolitan University (NMMU), were contacted. Ethical clearance was obtained at all participating universities. In total, over 6 000 participants were contacted with final completed responses received from 466.

Of the 466 participant's responses obtained, 81 participants were directly invested in equity only unit trusts. Certain respondents were invested in more than one unit trust and were invested for different periods of time. Thus some investors returned one data point (i.e. only gave one estimate and no adjusted estimates) while other investors were invested in five unit trusts and could supply up to forty data points (four estimates for all five unit trusts, 20 estimates, and an additional 4 adjusted estimates for those unit trusts, another 20 estimates). After removing any anomalies and invalid responses, the final data contained 407 data points that could be analysed.

The distribution of these 407 data points were tested to ensure that there weren't a small number of respondents comprising a large proportion of the data points i.e. if a small number of respondents were invested in multiple funds over multiple periods, then whichever bias' they presented would carry a larger weight on the total sample. The testing showed that 66% of the respondents amounted to 80% of the data points and further visual testing showed the data points to be randomly distributed. This enabled the testing of the data points which comprised a bigger sample, over the number of respondents (a smaller sample) going forward.

Limitations

This study lacked an individualised accurate return being available for comparison for each individual investor. Due to investors withdrawing and investing money throughout the periods being surveyed there is the possibility of an individual investors' returns differing from those of the fund. This difference in returns could lead to less statistically significant variances in actual performance but it could also be the case that they lead to more statistically significant results. However, it was stated by Tippett (1994) that money weighted and time weighted returns are actually not significantly different over a 'short enough' time interval (less than 10 years) and thus the fact that the investors actual results were not the same as the funds did not matter. Additionally, Willows and West (2015) showed that 90% of investors invested in unit trusts over the five year period from 1 January 2007 to 31 December 2011 made no lump sum contributions, withdrawals or transfers into or out of the fund. However, Willows and West (2015)'s sample was drawn from a single third party investment house and the results did not take debit orders into account.

Furthermore, the town i.e. location of the respondent answering the questionnaire was not garnered in the survey. This meant that certain responses had to be excluded for the analysis of the effect of the weather. However, for the majority of respondents the location could be tracked owing to the staggered release of the questionnaire to different Universities.

4. Results

The two research questions stated above were each looked at and analysed separately during testing. A broad overview of the data obtained is discussed and presented below.

The minimum estimate obtained from participants was '0' and the maximum estimate was 150%. It was noted that no investor estimated a negative return over any of the investment periods under question. The median for the estimated and adjusted estimate fund return were also calculated and can be seen in Table 1.

Table 1 Summary of Data

Variable	N	Min	Median	Max
Estimate	407	0%	5%	150%
Actual fund return	407	-4%	17%	58%

Do investors overestimate their returns?

The distribution of investors estimates of their fund returns was non-normally distributed (Appendix 1) therefore the Wilcoxon sign test was used to test for overconfidence among investors' estimates of their returns. Both a two-sided and one-sided test was performed. The two-sided test was used to determine if there was either over or under estimation by the investor in comparison to the actual fund return. The one-sided test was then performed to determine if the significant difference, identified in the two-sided test, was either an over or underestimation.

Table 2 Testing for Overconfidence

	Wilcoxon Sign Test					
	Two Sided test	p-value	One-sided test	p-value		
Estimate vs. Actual Fund Return	a	< 0.001	b	1.000		

- a) For the two-sided test, the following hypothesis was tested: Ho: Median of Estimate - Fund returns = 0 vs. Ha: Median of Estimate - Fund returns not equal to 0
- b) For the one-sided test, the following hypothesis was tested: Ho: median of Estimate - Fund returns ≥ 0 vs. Ha: median of Estimate - Fund returns < 0

The p-value of the two-sided test is significant at the 5% level, showing a difference in the medians of the estimated and the actual fund returns. The p-value of the one-sided test is not significant, indicating that investors are underestimating their fund returns rather than overestimating them, as was shown by Glaser & Weber (2007).

A possible explanation for this result might be the financial crisis of 2008 (Appendix 2) being fresh in investors' minds. This might lead investors to think that the returns they have earned are less than what they have actually achieved.

Are investors' estimations influenced by the weather?

A Wilcoxon-Mann-Whitney test was used to determine if there was any correlation between the weather on the day the estimate was made and the actual estimate made. As under-confidence, rather than overconfidence, had been identified in research question 1 it was necessary for the returns on cloudy days to be higher than those on sunny days to show that individuals are less underconfident/biased on non-sunny days. The results from the two-sample Wilcoxon Mann-Whitney rank-sum test are displayed in Table 3.

	Wilcoxon Rank Sum Test (Mann-Whitney)						
	Observation	Rank Sum	Expected	p-value			
Cloudy	199	37665	35322.5	0.012			
Sunny	155	25170	27512.5				
Combined	354	62835	62835				

 Table 3 Weather Testing

The p-value of 0.012 obtained in this test is significant at the 95% confidence level, indicating that there is a statistically significant difference between the estimates made on cloudy days versus sunny days. The rank sums for cloudy days were higher than those on sunny days indicating that the estimates on cloudy days were higher and hence more accurate due to the underestimation identified in research question one. This is in support of Hirshleifer and Shumway (2003)'s argument that the weather influences the behaviour of market traders, but not in agreement with Saunders (1993) who noted higher returns on sunny days.

5. Conclusion

The population tested was found to be underestimating their past returns, with there being three times as many negative variances between initial estimates and actual fund returns than positive variances. Upon comparison of estimates on sunny vs cloudy days, it was found that investors were more accurate with their predictions on cloudy days.

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Appendices

1. Distribution of estimate data points



2. JSE All Share Index (Willows & West, 2015)

