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Behavioral Economics and the Effects of Psychology on the Stock Market

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Behavioral Economics and the Effects of Psychology on the Stock Market

By

Justin L. Nagy

An Abstract of a Thesis
In
Applied Economics and Finance

Submitted in Partial Fulfillment
of the Requirements
for the Degree, of

Master of Arts
2017

Buffalo State College
State University of New York
Department of Economics and Finance

Abstract of Thesis

Behavioral Economics and the Effects of Psychology on the Stock Market

The purpose of this thesis is to study the contributions behavioral economics and finance have had on the understanding on how the stock market works. The idea that psychology plays a role in influencing the stock market can be dated back to Adam Smith who wrote about individual's behavior in his work *Theory of Moral Sentiments*. It wasn't until the latter half of the 20th century that behavioral economics became accepted as a counter to Eugene Fama's widely accepted theory of Efficient Market Hypothesis. This paper will analyze the development of behavioral economics, review the main contributors to the field and review main theories as it relates to the psychology of the human mind, and how it can influence the stock market.

Dedication

This thesis is dedicated to my amazing wife Kiersten, who never stopped encouraging me to finish this work. Thank you for always being supportive, and for tolerating me when I talk about the “sunk cost fallacy” and “opportunity costs”.

State University of New York
College at Buffalo
Department of Economics and Finance

Behavioral Economics and the Effects of Psychology on the Stock Market

A Thesis in
Economics and Finance

By
Justin L. Nagy

Submitted in Partial Fulfillment
of the Requirements
for the Degree of
Master of Arts
May 2017:

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Chapter One:
Introduction:

This paper tries to answer the question:

What can behavioral economics and finance teach us about decision making and the stock market?

Behavioral Economics explores the irrationality of humans when it relates to decision making. Classical economics will tell you that people are intrinsically rational, looking to maximize their utility, and that they make decisions that are best for oneself. Behaviorists conclude that people often times work irrationally, whether on purpose or not. Humans tend to let emotions and heuristics or rules of thumb dictate their decisions.

"Behavorialists" also argue against the *Efficient Market Hypothesis* (EMH) made famous by Eugene Fama in the 1970s. EMH which will be discussed further in Chapter Three argues that markets are practically efficient, because information is quickly absorbed into stock prices, which creates little chance for large profits from arbitrage. Behavorialists argue that this is not the case, that prices constantly fluctuate due to psychological triggers and factors that the EMH cannot account for. They believe there are limits to arbitrage create a market full of irrational investors who create a long-term effect on equity prices.

Andrei Shleifer explains:

> Behavioral finance has emerged as an alternative view of financial markets. In this view, economic theory does not lead us to expect financial markets to be efficient. Rather, systematic and significant deviations from efficiency are expected to persist for long periods of time. Empirically, behavioral finance both explains the evidence that appears anomalous from the efficient markets perspective, and generates new predictions that have been confirmed in data.[1]

The paper is broken into several chapters. Chapter two will discuss the valuation of security prices in equity markets. Here I will briefly discuss how technical analysis is used by looking for trends and patterns in stock prices in order to maximize profits. I'll then discuss fundamental analysis of stock prices as a tool to look for stocks that are above or below their intrinsic value. Chapter three will introduce the Efficient Market Hypothesis (EMH) and theory of "random-walk" in stock prices. We'll discuss briefly the basic theoretical and empirical foundations of EMH, as well as the different types of "forms", as well as some of the limitations of EMH. Chapter four will discuss the history and main contributors to what we now know as behavioral economics and finance. Chapter Five will focus on the fundamental ideas of behavioral economics and heuristics. Here we will also show results of several experiments performed on my peers, and compare them to notable studies showing how individuals often act irrational. Chapter six will consist of my concluding remarks.

*Note: in this paper, *Behavioral Economics* and *Behavioral Finance* are used interchangeable

[1] Andrei Shleifer, *Inefficient Markets: An Introduction to Behavioral Finance* (New York: Oxford University Press, 2000),2.

Chapter Two:

Fundamental Theories of the stock market:

Technical Analysis:

The technical analysis approach to stocks focuses solely on the market data, rather than information about the companies. A technical analyst, or technician, "believes the price of a stock depends on supply and demand in the marketplace and has little relationship value".[2] A technician argues that there is far too much information relating to a company for one to fully understand, or evaluate when trying to make a decision based on economic inputs alone. They believe the only important information in evaluating stocks is the volume, and price of the securities.

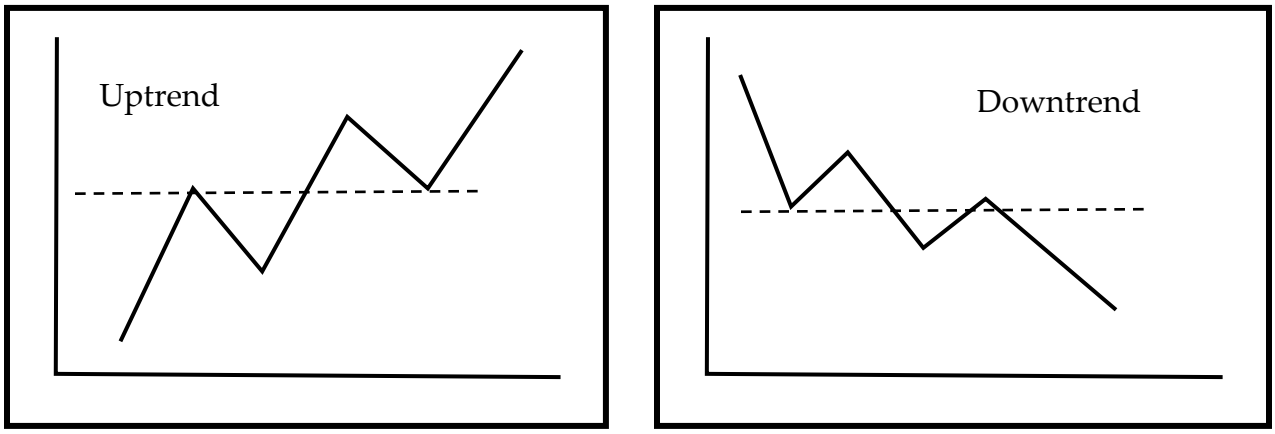
Technical analysis looks at various trends over a significant period of time. Trends occur until there is a definite break in the price movements of a stock. The main tool for technicians are stock charts, with moving averages, trendlines and other advanced statistics. They use these charts as they believe past price patterns can be used to predict future price movements.

The basic pattern a "chartist" looks for are uptrends and downtrends. As shown in *Figure 1,* an uptrend occurs when each new peak is higher than the last peak, and a downtrend is where the bottom is lower than the previous one. In a downtrend, the line horizontal from the previous high peak is called the "resistance level". If the a future stock

[2] David N. Dreman, *Psychology and the Stock Market: Investment Strategy Beyond Random Walk* (New York: Amacom, 1977), 21.

prices breaks through this resistance level, the price reinforces the uptrend, and produces a buy signal to a technician. The opposite is true on a downtrend. Instead of a resistance level, they look at the “support level”, or the imaginary horizontal line from the previous low. If a price breaks through this old support level, it signals a sell.

Figure 1. Uptrends and Downtrends in Security Prices.



Trendlines are also used by technician. There are numerous trendlines technicians use, common moving averages are the 50 day, 100 day, and 200 moving averages. When a stock “breaks through” these trendlines technicians believe, the pattern is about to break and a downtrend will swing upward or vice versa.

Fundamental Analysis:

Fundamentalists examines all relevant information affecting the price of a stock to determine the intrinsic, or real worth of a security. Intrinsic value is what fundamentalists

feel a stock is truly worth based on the law of supply and demand.[3] To a fundamentalist one can find the intrinsic value of the stock by carefully examining the company's financial reports, balance sheet, research & development plans, sales history, earnings, dividends, similar companies in their industry, and economic conditions. They look for undervalued stocks, as they feel the market can be wrong when assessing the value of a company.

The main difference between technicians and fundamentalists is that technicians ignore economic and company related information when selecting stocks. They feel this information is already reflected in the security price, and "value is not intrinsic but what the market says it is by its current price"[4]

[3] John J. Murphy, *Technical Analysis of the Financial Markets: A Comprehensive Guide to Trading Methods and Applications (New York, New York Institute of Finance, 1999), 5.*

[4] Dreman, *Psychology of the Stock Market*, 33.

Chapter Three: The Efficient Market Hypothesis (EMH):

> The efficient… market theory hypothesizes that all available information is continually analyzed and reanalyzed by literally millions of investors. It holds that in this kind of market, news of say, an earnings increase, is quickly and accurately assessed by the combined actions of investors and immediately reflected in the price of the stock. …whether you buy the stock before, during, or after the earnings news, or whether you buy another stock, you can expect a fair rate of return commensurate with the risk of owning whatever security you buy.[5]

Efficient Market Hypothesis

In the early 20th century the central belief was that markets were irrational driven by Herds. John Maynard Keynes believed that the "stock market was mostly a beauty contest in which judges picked who they thought other judges would pick, rather than who they considered to be most beautiful"[6]. By the mid-1970s there was more evidence that there was true randomness in earnings, and researchers were looking for a new hypothesis to build on the random walk theory. Random-walk suggests that all price changes are unrelated to previous prices of that stock price, or take a random-walk. The logic behind it is that "the flow of information is unimpeded and information is immediately reflected in stock prices, then tomorrow's price change will reflect only tomorrow's news and will be independent of prices changes today.[7]

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[5] Ibid., 36.

[6] Andrea Devenow and Ivo Welch, "Rational Herding in Financial Economics," *European Economic Review* 40, (1996): 605.

[7] Burton G. Malkiel, "The Efficient Market Hypothesis and Its Critics," *Journal of Economic Perspectives* 17, no. 1 (Winter 2003): 59.

The efficient market hypothesis (EMH) is related to the "random walk" theory that dominates much of economics, The EMH was coined by Eugen Fama, a University of Chicago economist. The foundation of EMH is "the rational expectations hypothesis, enunciated first by Muth. Muth believed expectations are the same as economic theory predictions. If all market participants have access to the same information set, then the rational expectations assumption requires that they all agree on the distribution of market returns. Thus, the EMH effectively rules out differences in expected returns that result from differences in ability to process information."[8] In short, the EMH implies that market prices will fully reflect all information available to investors, and therefore investors cannot use arbitrage strategies to beat the market in the long-run.

At its core, the EMH maintains that it is difficult to make a lot of money through a buy-low, sell-high strategy as markets adjust quickly to new information. The idea is that the "smart money", or smartest investors would be looking for opportunities to make large profits by looking for under or over-priced assets. If the smart money found ways to make profits through this strategy, the net effect would be to drive security prices to their true values.[9] Therefore, while some money can be made, it's difficult to become rich off this strategy. Shiller argues that the EMH implies intelligence and effort play no role in investing[10]. The common saying is that a monkey throwing darts at a dart board has a good a shot picking winning stocks as does an average investor looking for under-valued securities. Finally, the EMH shows professional investors, institutional money managers,

[8] J.F. Muth, "Rational Expectations and the Theory of Price Movements," *Econometrica* 29, no 3 (1961): 319.
[9] Robert J. Shiller, *Irrational Exuberance: Revised and Expanded Third Edition* (Princeton: Princeton University Press, 2015), 196.
[10] Ibid., 197.

or securities analysts do not seem to have any reliable ability to outperform the market as a whole…once account is taken of transactions cost and management fee"[11]

Theoretical Background

As this hypothesis states that a security price always fully reflects all available information, there is no way for an average investor to consistently beat the market, and efforts used by these investors by analyzing, picking and trading securities are wasted.[12] The efficient market hypothesis assumes that all investors are rational, and therefore rational in their approach to investing. However, in the event that some investors act irrationally, stock prices will not be affected as their trades will be canceled out due to their randomness.[13] Finally, in the event that investors are irrational in similar ways, their influence on prices will be corrected by rational arbitrageurs.[14]

The key concepts in these assumptions are *rational investors* and *arbitrageurs*. As Shleifer notes:

> When investors are rational, they value each security for its fundamental value: the net present value (NPV) of its future cash flows, discounted using their risk characteristics. When investors learn something about fundaments values of securities, they quickly respond to the new information by bidding up prices when the news is good, and bidding them down when the news is bad. As a consequence, security prices incorporate all the available information almost immediately and prices adjust to the new levels corresponding to the new net present values of cash flows.[15]

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[11] Ibid., 198

[12] Andrei Shleifer, *Inefficient Markets: An Introduction to Behavioral Finance* (New York: Oxford University Press, 2000), 1.

[13] Emma Lindhe, "Herd Behavior in Stock Markets: A Nordic Study", (Master's Thesis, Lunds University, 2012), 7.

[14] Shleifer, *Inefficient Markets*, 2.

[15] Ibid., 2.

Sharpe and Alexander define "arbitrage as the simultaneous purchase and sale of the same, or essentially similar security in two different markets at advantageously different prices".[16] For example, if you owned a stock that became overvalued in relation to its fundamental value due to irrational investors, the security you won now becomes a "bad buy" since the price exceeds in NPV. Observing this mispricing, arbitrageurs would sell this stock, or possibly short it for a seemingly similar security. Arbitrageurs can make a profit by selling it, or shorting their overpriced security, and then purchasing the undervalued similar security. Under EMH "arbitrage is quick and effective enough because substitute securities are readily available and the arbitrageurs are competing with each other to earn profits, the price of a security can never get far away from its fundamental value, and indeed arbitrageurs themselves are unable to each much of an abnormal return".[17] While arbitrageurs returns maybe small due to how rapidly the market adjusts, irrational investors are buying overpriced securities, while selling underpriced substitute securities. Famous Chicagoan economist Milton Friedman points out that this is causing them to earn lower returns than passive and irrational investors, as they cannot lose money forever: they must become much less wealthy and eventually disappear from the market. If arbitrage does not eliminate their influence on asset prices instantaneously, market forces eliminate their wealth.

[16] William F. Sharpe and Gordon J. Alexander, *Investments: Fourth Edition* (Englewood, NJ: Prentice Hall, 1990), n.p.
[17] Shleifer, *Inefficient Markets*, 4.

Empirical Foundations of EMH

According to Shleifer, the empirical predictions of the EMH can be divided into two broad categories.

> First, when news about the value of a security hits the market, its price should react and incorporate this new both quickly, and correctly. The 'quickly' part means that those who receive the news later – for instance by reading it in the newspapers or in company reports – should not be able to profit from this information. The 'correctly' part means that the price adjustment in response to the news should be accurate on average: the prices should neither underreact nor overeat to particular news announcements.[18]

Secondly, the price of the stock should represent the fundamental value of the security, meaning that prices of stocks should not change if there is no news regarding the fundamental value of the stock. Therefore, the prices should not fluctuate based on changes of supply and demand alone.[19]

Three Forms of EMH

To distinguish different types of stale information, Fama gave rise to three forms of the EMH. There are three forms of market efficiency; weak, semi-strong, and strong.

I. Weak Form: All past price and volatility information is incorporated in the current price of the stock. This states that any attempt to study past prices for misprices stocks is futile, meaning there is no discernable pattern and past prices will not give any further

[18] Shleifer, *Inefficient Markets,* 5.
[19] Ibid.

information to future pricing. This would negate any use of technical analysis. In essence “it is impossible to earn superior risk-adjusted profits based on the knowledge of past prices and returns”[20]

II. *Semi-Strong*: Includes all the characteristics of *weak form*, in addition it includes all public information. This can include earnings, management changes, innovations and investments in R&D, and other company information. All of which is almost immediately reflected in the company’s stock price. Under this scenario, going through a company’s financial records to look for misprices securities would be in vain, as the price would already reflect this information. Therefore, fundamental analysis would not allow for any arbitrage and would be a waste of resources.

III. *Strong Form*: Includes all details of the weak, and semi-strong conditions, but also includes non-public information being quickly reflected into the company’s stock price. In the strong form, even insiders could not benefit from arbitrage as the price would be reflect this information almost immediately as it would be leaked to the public. Not to mention, that using private knowledge to use for personal trading could be deemed illegal, such as having prior knowledge of a merger/acquisition taking place before it’s made public.

[20] Ibid., 6.

Limitations of EMH:

There are several limitations to the EMH which will me mentioned here, and further discussed in this work. First, it is difficult to believe that people are fully rational all the time. The late American economist Fischer Black found that investors tended to trade on "noise" instead of information. They follow the advice of friends, TV financial experts, investors trade too often, they don't diversity, and tend to sell winners too soon and hold losing stocks for too long. They are also loss averse, looking at the total levels on gains and losses, and not associating it to a reference point. All of these points will be discussed in Chapter Five.

Investors also tend to become irrational due to *bounded rationality*. Bounded rationality is a concept where decision makers become irrational due to having limited or unreliable information to answer a complex scenario with an inadequate amount of time. In buying stocks, you often times can't wait weeks, or days, let alone hours to purchase a stock at the optimal time in order to create arbitrage.

Speculative bubbles also limit the validation of the EMH. If prices are instantaneously reflected with all information, we should not see stock market bubbles. Bubbles show that the market is often driven by the emotions of buyers and sellers, or as Alan Greenspan called it, "irrational exuberance". Bubbles typically form due to overconfidence in the market, in oneself, and when investors are buying into the current fads. These bubbles are often created by herd mentality, later discussed in this work.

Chapter Four: Animal Spirits and Irrational Behavior: Keynes to the Present.

Keynes view on efficient markets:

The belief that markets are not entirely efficient can go back prior to Fama's EMH theory, to the early 1900s. Famed economist, John Maynard Keynes believed that the markets were not completely efficient. In his masterpiece, *The General Theory of Employment, Interest and Money*, Keynes believed "the element of real knowledge in the valuation of investments by those who own them or contemplate purchasing them has seriously declined" as stocks become widely dispersed.[21] In the early twentieth-century stocks were mainly held by mangers and family. As stocks began to be sold to the general public and away from the internal affairs of the business, it was harder to know the true valuation of the stock.[22]

Keynes did not believe that that the market could be predicted long-term due to uncertainty in the market environment. In *General theory of employment…* Keynes compared investing in stocks to a "beauty contest", where "competitors have to pick out the six prettiest faces from a hundred photographs, the prize being awarded to the competitor whose choice most nearly corresponds to the average preferences of the competitors as a whole".[23] The competitor not only has to decide which faces they find prettiest, but decided what the other competitors will deem the prettiest. However, all

[21] John Maynard Keynes, *The General Theory of Employment, Interest, and Money* (Lexington: Stellar Classics, 2016), 66.
[22] Richard H. Thaler, *Misbehaving: The Making of Behavioral Economics* (New York: W.W. Norton & Company, Inc., 2015), 209.
[23] Keynes, *The General Theory*, 67.

other competitors are having this same struggle. This is counterintuitive to how one normally sets out to win. We are forgoing our knowledge of what we know, in order to try and decide not only what others know and feel, but how they are going to play the competition, or engaging in "a battle of wits".

Keynes also argued against the theory that professional investors would keep markets efficient, especially in the long-run. Keynes argued that many professional speculators would lead to greater mispricing in the market, instead of bringing prices back to their fundamental value as professionals tend to "concentrate on foreseeing changes in the conventional basis of valuation a short time ahead of the general public".[24] "[Professionals] are concerned, not with what an investment is really worth to a man who buys it 'for keeps', but with what the market will value it at, under the influence of mass psychology, three months or a year hence."[25] While it can be understood that the everyday investor can act irrationally on emotions, so to can professional investors. Professional investors face pressures to match and surpass the yield of their competitors, so purchasing stocks that are no longer in demand can cause them to fall behind to their foes.

Finally, Keynes argued that psychology of the human mind caused unforeseen volatility and fluctuations in the stock market. He said the "animal spirits" or the "spontaneous urge to action rather than inaction" affect behavior.[26] It's these "animal spirits" that heavily influence the equities markets. Keynes argued that even in a time of

[24] John Cassicy, *How Markets Fail: The Logic of Economic Calamities* (New York: Picador, 2009), 170.
[25] Keynes, *The General Theory*, 66.
[26] Ibid., 175.

stability with no turmoil it was impossible to estimate the yield of return 10 years from now a railroad business or copper mines, let alone the an equity's value. Investors do not think that the current situations will change, but instead act as the current situation will continue. Keynes noted:

> A conventional valuation which is established as the outcome of the mass psychology of a large number of ignorant individuals is liable to change violently as he results of a sudden fluctuation of opinion due to factors which do not really make much different to the prospective yield… The market will be subject to waves of optimistic and pessimistic sentiment, which are reasoning, and yet in a sense legitimate where no solid basis exists for a reasonable calculation.[27]

While Keynes is not considered a "behaviorist" by today's standards, the change to a psychological view of the stock markets can be linked to his earlier work, as mentioned previously. Keynes wrote:

> We are merely reminding ourselves that human decisions affect the future, whether personal or political or economic, cannot depend on strict mathematical expectation, since the bases for making such calculations does not exist; and that it is our innate urge to activity which makes the wheels go around, our rational selves choosing between the alternatives as best we are able, calculating where we can, but often falling back for our motive on whim or sentiment or chance.[28]

[27] Cassidy, *How Markets Fail*, 169.

[28] Keynes, *The General Theory*, 66.

Surge of Behavior Economics:

> Behavioral finance explains why individuals do not always make the decisions they are expected to make and why markets do not reliably behave as they are expected to behave[29]
>
> – Amar Kumar Chaudhary

Important Contributors to Behavioral Economics:

Robert Shiller

Robert Shiller is the leading economist when it comes to writing in this field. Dr. Shiller is a Professor of Economics at Yale University and received his doctoral degree from M.I.T. in 1972. He's worked with the National Bureau of Economic Research, and was a member of the Federal Reserve Bank of New York Advisory Committee. He is most known for his bestselling book, *Irrational Exuberance*, which has been updated to a 3rd edition in 2015. The first two editions warned of the tech and housing bubbles, and predicted the irrational exuberance amongst investors before the financial crisis of 2008-2009. To this day, he continues to write on various topics in behavioral finance.

Richard Thaler

Richard Thaler is considered one of the father figures is the school of behavioral economics. He is a professor at the University of Chicago, where along with a collaboration with colleagues came the early foundations of behavioral Economics.[30]

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[29] Amar Kumar Chaudhary, "Impact of Behavioral Finance in Investment Decisions and Strategies: A Fresh Approach," *International Journal of Management Research and Business Strategy* 2, no. 2 (2013): 85.
[30] Munir Quddus, "Behavioral Economics: Acritical Analysis", *Proceedings of the Midwest Business Economics Association.* (2002), 143.

Thaler stated "that most people actually behave like…people. They are prone to error, irrationality and emotion, and act in ways inconsistent with maximizing their own financial well-being." Thaler argues that people often make decisions that don't have their own long-term interest in mind, and people act emotionally instead of instinctively.

Daniel Kahneman and Amos Tversky

Finally, Daniel Kahneman and the late Amos Tversky, while not necessarily behaviorists, have been extremely influential in the psychology and decision making. Kahneman was born in Tel Aviv, and grew up in France during World War II. He received his Bachelor of Science degree from the Hebrew University of Jerusalem in Psychology, and later received his PhD in Psychology from University of California, Berkley. Amos was born in what is now Israel, and received his undergraduate degree from the Hebrew University of Jerusalem, and his PhD from the University of Michigan.

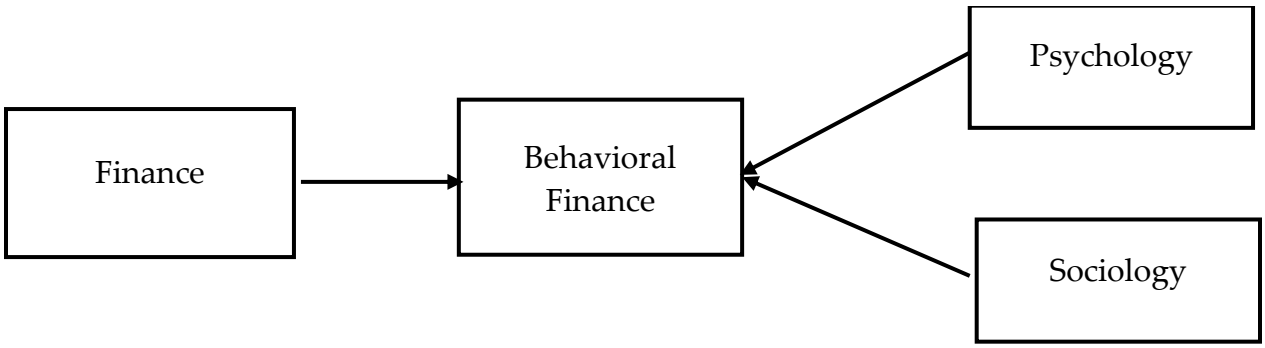
In the late 1970's Kahneman and Tversky started collaborating and published a series of articles on cognitive psychology. Some of their work will be discussed later in this paper. They are most known for their publication on their Prospect Theory, which will be discussed in the coming sections, but at its foundation "illustrated how investors systematically violate the utility theory"[31] They are also known for their contribution to heuristics and biases, such as availability and representativeness. Kahneman later received the Nobel Memorial Prize in Economic Sciences for his contributions to the study of rationality in Economics.

[31] Nathalie Abi Saleh Dargham, "The Implications of Behavioral Finance". *FGM*, Retrieved September 13, 2016, from http://www.fgm.usj.edu.lb/pdf/a102009.pdf.

Foundations of Behavioral Economics

"Behavioral finance is a relatively new field that seeks to combine behavioral and cognitive psychological theory with conventual economic and finance to provide explanations for why people make irrational financial decision (*Figure 2)*"[32]. Behavioral finance studies how the psychology and sociology affect financial players and ultimately the security market. Dr. Rohit Kishore, of the University of Western Sydney Australia states; "the field of 'behavioral finance' has evolved in order to attempt to better understand and explain how emotions and cognitive errors influence investors and the decision-making process"[33].

Figure 2: Foundations of Behavioral Finance



Source: Amar Kumar Chaunhary. "Impact of Behavioral Finance In Investment Decisions and Strategies: A Fresh Approach.". *International Journal of Management Research and Business Strategy* 2, no.2 , (2013), 86.

[32] Chaudhary, "Impact of Behavioral Finance, 86.
[33] Rohit Kishore, "Theory of Behavioral Finance and its Applications to Property Markety: A Change in Paradigm," paper presented at the Twelfth Annual Pacific Rim Real Estate Society Conference, Auckland, New Zealand, January 22-25,2006, 1.

As introduced earlier in this work, traditional economic models and theories assume investors act rationally all the time, and consider all available information before making a decision, whether it comes to buying/selling stocks, or making other economic decisions. Behavioral finance looks to show that this is far from the truth, and people tend to be reactionary when making decisions. Munir Quddus states “people often respond to skewed reasoning, self-indulgence, self-destructive behavior and a host of other human frailties and strengths”.[34]

[34] Quddus, “Behavioral Economics, 139.

Chapter Five: Fundamentals ideas of Behavioral Economics.

Major Theories of Behavioral Economics

Prospect Theory

Tversky and Kahnheman's most influential and lasting contribution to the field of behavioral economics is their work on the development of Prospect Theory, in regards to how people manage risk and uncertainty. They found that humans are not always risk-averse, rather they are risk-averse when it comes to gains, but risk-seekers when facing loses.[35] Prospect theory illustrates how people make choses between two alternatives that involve risk, where the probabilistic outcome of each result is known.

Prospect Theory counters the classical theory of utility maximization. Utility maximization assumes people act rationally, and "consumes in such a way as to obtain the most satisfaction out of the money and time spent".[36] This assumes that the consumer knows all information available, all potential outcomes, and will act without emotion, and select the option that gives them the most satisfaction. However, we know that people act impulsively and have a hard time correctly accessing probabilities. Komlos states that often times "there is not enough time to think about decisions carefully, and insufficient time to sort out the relevant information from background noise; we also have difficulty accessing the quality of information".[37] This is especially true when it comes to the stock market. Your average investor does not know where to go to get the most accurate

[35] Kishore, "Theory of Behavioral Finance", 4.
[36] John Komlos, *What Every Economics Student Needs to Know: And Doesn't Get in the Usual Principles Text* (Armonk, NY: M.E. Sharpe, 2014), 41.
[37] Ibid., 42.

information on the health of the market, and even a more difficult time sorting through all the information regarding a particular stock. By the time your average investor consumes all this information from cable news, the internet, the newspapers, co-workers and financial advisors, the price of the stock could have fluctuated so much, that the decision they make could ultimately be the wrong one.

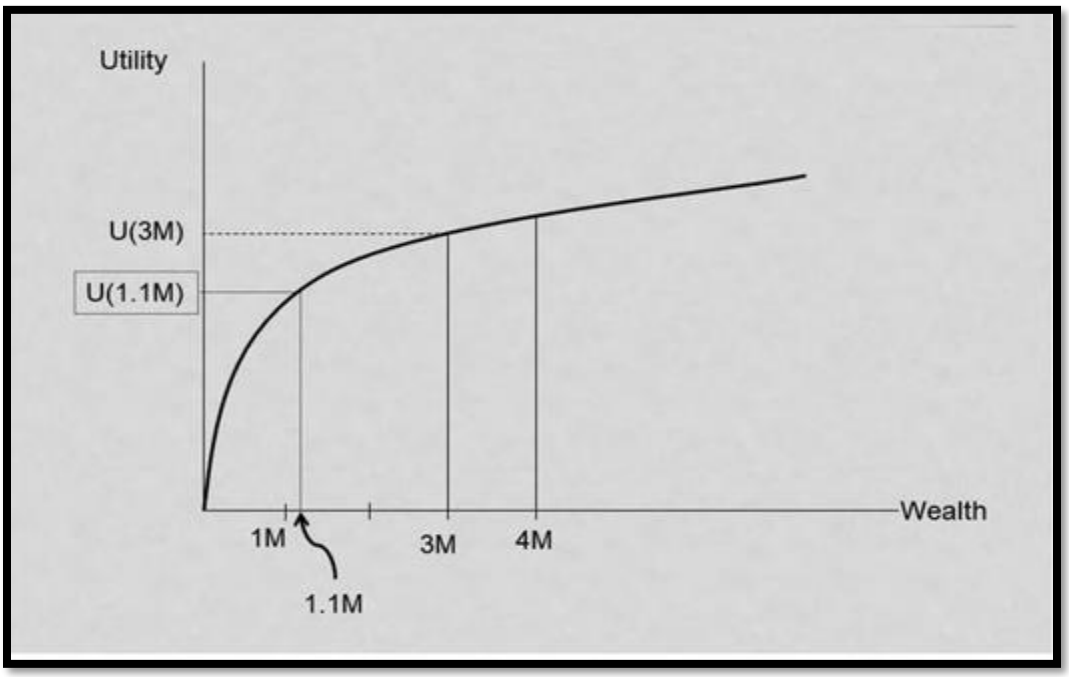
Through experiments, Kahneman and Tversky found that how we value an item is based on a "reference point" or value. Where utility maximization focuses more on the total magnitude of a person's wealth, status, or consumption. It is more difficult for humans to determine this level, than it is to understand the changes in these variables. In essence it is easier for us to evaluate the changes in levels, than it is to fully understand the levels themselves. Noticing this is where they concluded that the mind looks for a reference point when making decisions.

The reference point and better understanding of changes, rather than levels can be seen in the below example. Suppose Adam just logged on to his online stock brokerage account and sees the value of his portfolio drop from $4 million, to $3 million. At the same time, Brian checks his account and sees his net worth has increased from $1 to 1.1 million. According to the conventual approach. Adam should be happier than Brian because he is wealthier and has more utility, however this approach doesn't adequately reflect the emotional feelings of transitions from one state of wealth to another. [38] This can be seen in *Figure 3* below. While Adam lost $1 million, or 25% of his net worth,

[38] Ibid., 50-51.

he would still be happier in the conventual sense as he has more utility than Brian who gained $100,000 in wealth.

Figure 3: Utility at Various Levels of Wealth.



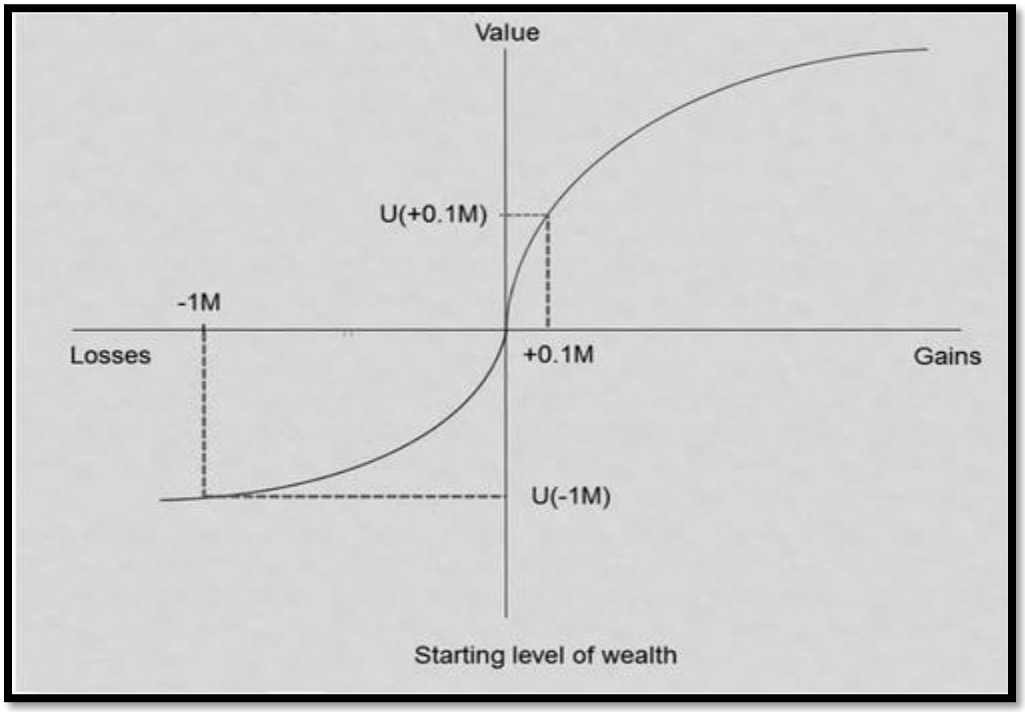
Source: John Komlos, *What Every Economics Student Needs to Know: And Doesn't Get in the Usual Principles Text*, New York: M.E. Sharpe, 2014, 52.

Kahneman and Tversky note that in the utility maximization theory depicted in *Figure 3*, there is no mention of a starting point, or reference point. From this they recreated the problem by looking at gains and losses and used that as the foundation for their prospect theory.

Figure 4 is drawn in terms of gains and losses, instead of an absolute value of wealth. The origin of the graph implies a neutrality of zero, where one has become

accustomed to their current level of consumption or wealth.[39] In this figure, zero does not mean zero wealth, but acts as a reference point, or how an individual currently views their state of wealth at time 0. Before Adam and Brian checked their stock portfolios they were positioned at the origin, as they were accustomed to that level of net worth. After they checked their portfolio, Adam moved to the left, to a loss of $1M, and Brian moved up and to the right for a gain of $0.1M and is therefore happier than Adam.

Figure 4: Prospect Theory in relation to Gains and Losses.



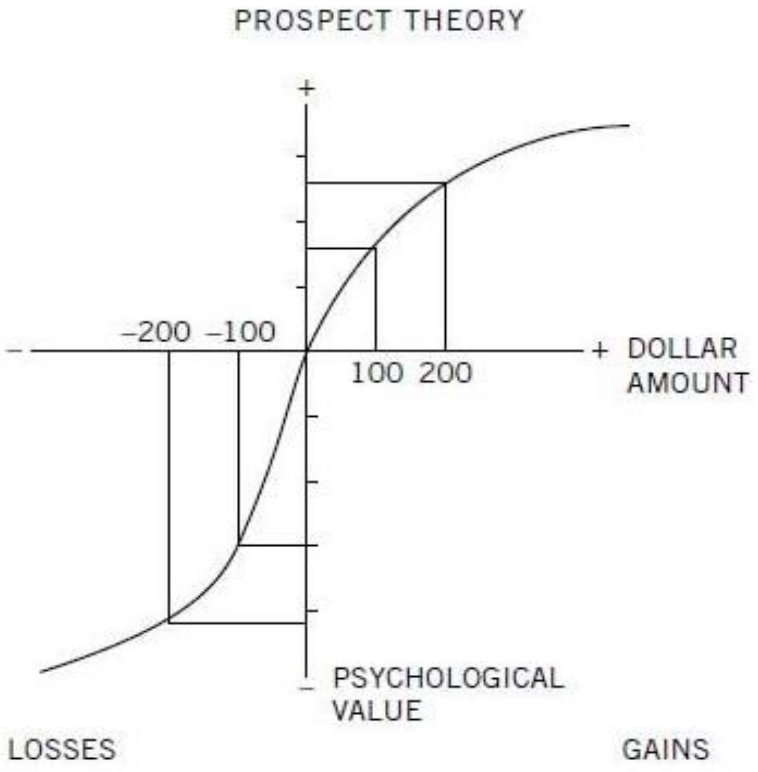
Source: "Prospect Theory is Calibrated in Terms of Gains and Losses, Not in Levels." John Komlos, *What Every Economics Student Needs to Know: And Doesn't Get in the Usual Principles Text*, New York: M.E. Sharpe, 2014, 53.

[39] Ibid., 52.

Kahneman relabels *Figure 4* by changing the Y Axis to “Psychological Value” in *Figure 5*. According to Kahneman;

> The graph has two distinct parts, to the right and to the left of a neutral reference point. A salient features is that it is S-shaped, which represents diminishing sensitivity for both gains and losses. Finally, the tow curves of the S are not symmetrical. The slope of the function changes abruptly at the reference point: the response to losses is strong than the response to corresponding gains.[40]

Figure 5: Prospect Theory according to Kahneman.



Source: Daniel Kahneman. *Thinking, Fast and Slow*, New York: Farrar, Straus and Giroux, 2013, 283.

[40] Daniel Kahneman, *Thinking, Fast and Slow* (New York: Farrar, Straus and Giroux, 2013), 282.

You can see that the slope of the graph is far greater, about twice what is in quadrant III then in quadrant I. Kahneman and Tversky noticed this through many experiments that losses decrease one's welfare more than gains increased.[41] This can be shown by people taking on risk, in order to reduce loses, or *loss aversion*.

Loss Aversion

Loss aversion is a strong phenomenon of behavioral economics. Traditional economic principles imply that people are often risk-averse, that investors will only take on risk for an acceptable return. Loss aversion implies that investors will increase their risk, to avoid the probability of loss because "investors suffer greater disutility from a wealth loss than the utility from an equivalent wealth gain".[42] In a famous experiment, Kahneman asked the following question:

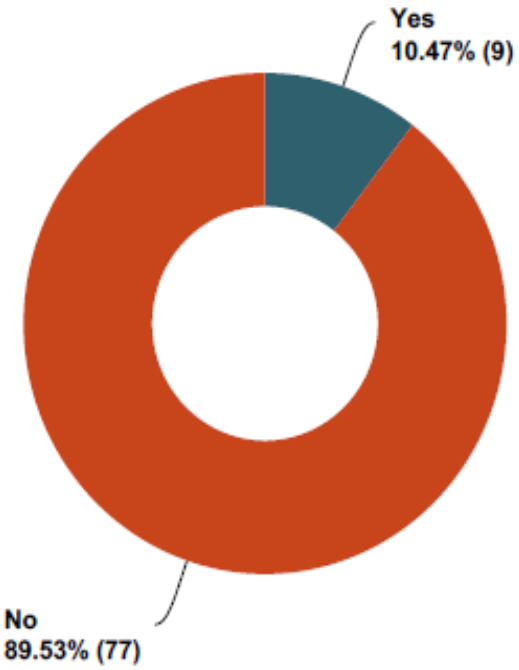
You are offered a gamble on the toss of a coin.
If the coin shows tails, you lose $100.
If the coin shows heads, you win $150.
Is this gamble attractive? Would you accept it?

To answer this question, you must decide not on the monetary gain, but the psychological gain from the end result. We know that flipping a coin results in a 50/50 result in landing heads, but is the result of gaining $150 enough to cancel out the same risk of losing $100? Kahneman found that for most people the fear of losing $100 was far greater than the joy they would have received from winning $150.

[41] Komlos, *What Every Economics Student*, 52.
[42] Dargham, "The Implications of Behavioral Finance", 11.

I asked this same question on my questionnaire to 86 colleagues and peers and the results overwhelming prove what Kahneman discovered. *Figure 6* shows that out of 86 responses, 77, or 89.53% would not take that gamble, while only 9 or 10.47% would.

Figure 6: Loss Aversion: Coin Toss.



Source: Justin Nagy. February, 2017.

The results show that even though the 50% gamble would result in a larger gain than the equivalent percentage chance of loss, the $50 “premium” to take on this risk was not enough. Kahenman asks, “what is the smallest gain that I need to balance an equal chance to lose $100?”. Meaning, in a game of chance, where two outcomes are

equally likely to occur, what potential gain must be available for one to risk losing $100. Kahenman found that people tend to answer $200 to his above question, meaning on average one needs a 2:1 odds in order to take on a 50/50 gamble. He did find professional investors are "more tolerant of losses, probably because they do not respond emotionally to every fluctuation" in the stock market.[43]

Loss aversion plays a huge role in the way average investors buy and sell stocks. Studies show that investors are quicker to sell a stock that has increased in value by *X,* then they are to sell a stock that has decreased by value *X.* The idea of a loss, is more painful, or outweighs the joy of the gains. Investors tend to hope that the fallen stock will bounce back to a break-even point, while investors who have seen a gain are worried about a "loss" if the stock falls back to the break-even point. On my questionnaire, I asked participants the following question:

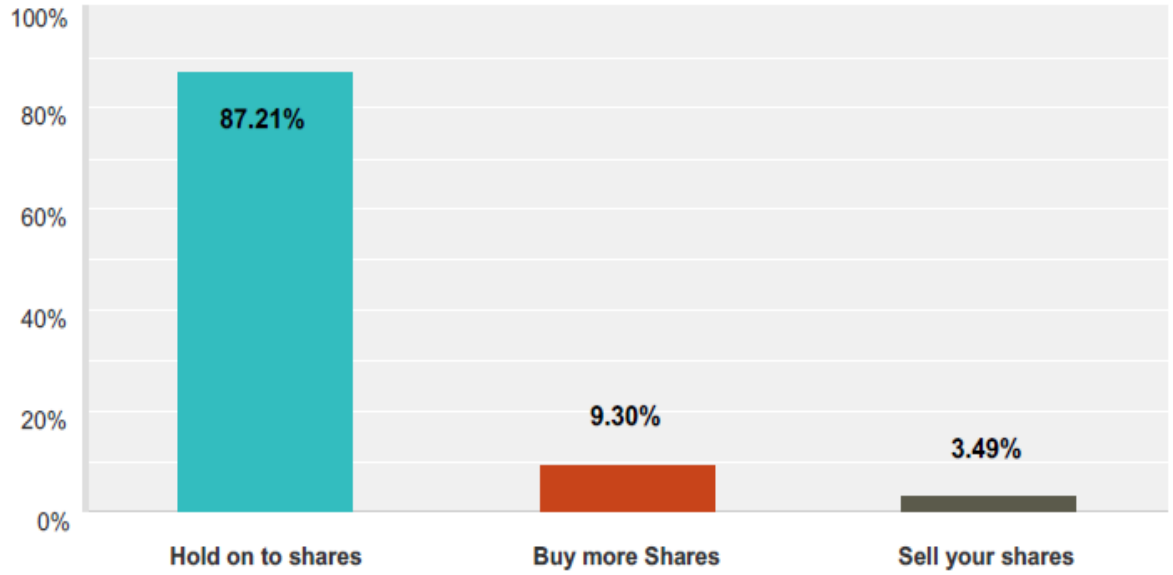
> **You purchased 100 shares of a well-known company stock a month ago, at $80 a share. The stock recently peaked at $95 a share, but today has plummeted to $75 a share. You look at the Yahoo Finance and see there is high volume of people selling their shares. You haven't heard any news today regarding the stock, and don't know why it's falling. What do you do?**

In *Figure 7*, the results confirm Kahneman's findings and shows that people are loss averse, and rather take the risk to get back to the break-even point. *

[43] Kahneman, *Thinking, Fast and Slow*, 284.

*Note: Respondents were not given the opportunity to sell their shares at $95 a share. If this was an option I would assume overwhelmingly respondents would have done so in order to secure gains. This will be discussed in a later section under Disposition Effect.

Figure 7: Loss Aversion: Stock Market.



Source: Justin Nagy. February, 2017.

Of the 86 responses, 87.21% of the participants would hold on to the shares, because they might go back up above the purchase price. 9.3% of respondents would buy more, and only 3.49% would sell their stock in order to take the $5 per share to avoid future loses. What's interesting here is that almost three times as many participants would rather buy more stocks, then sell. Not only does this reinforce that people are loss averse, but people would rather take the gamble that the price is going to increase to at least the breakeven point, then to realize a loss.

Selling a losing stock is unpleasant and painful, as it gives immediate feedback that you picked a "loser". People tend to make a mistake in "mental accounting" by only

looking at individual stocks, and not the stock market at their portfolio as a whole.[44] Finally, loss aversion can cause people to be reluctant to make timely decisions by focusing too much on what they could lose, and not what they could gain in the long-run, this referred to as the status quo bias or inertia.

Fear of Regret and Disposition Effect

Investors have a hard time admitting they were wrong when it turns out their stock pick declined. As previously mentioned, investors tend to hold on to losers too long, and sell winners too soon, which is known as the *disposition effect*. Disposition effect is the result of *mental accounting* or the process of separating one's money into separate accounts instead of a whole. A rational investor would focus on the overall return of their portfolio and not focus on one stock. However, Dr. Shlomo Benartzi found that "the typical investor treats the portfolio as a series of investing episodes".[45]

Tversky and Kahnmean tested this in an experiment when they asked participants the following question*: would you rather take a sure game of $500, or a 50/50 shot at winning $1000 (or $0) after already winning $1000*. They found overwhelmingly that the participants would rather take the sure $500 instead of the gamble, cashing out gains higher than what's already guaranteed.

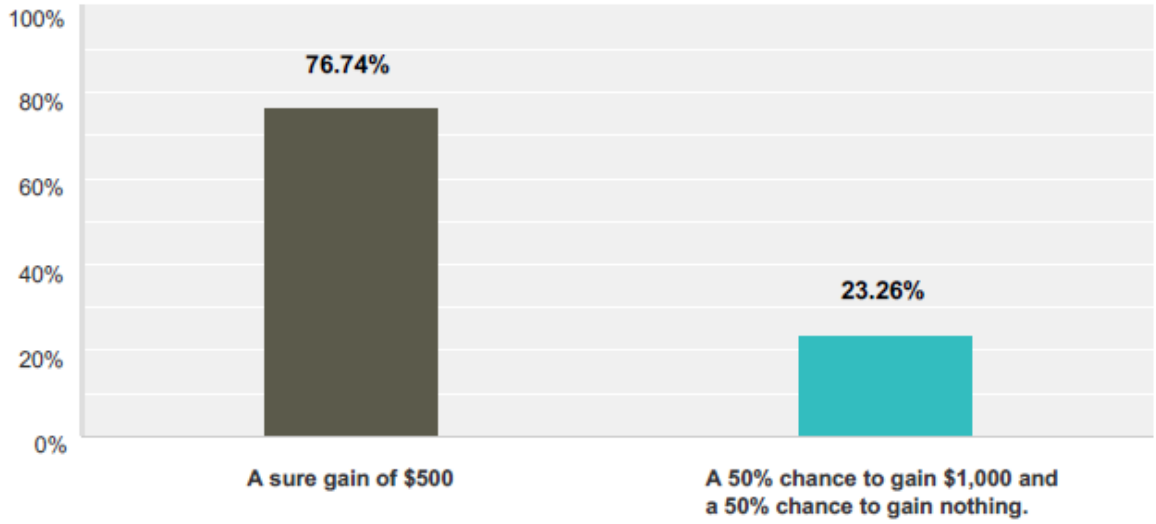
[44] Shlomo Benartzi, "Behavioral Finance in Action: Psychological Challenges in the Financial Advisor/Client Relationship, and Stategies to Solve Them," *Center for Behavioral Finance*, accessed from WWW.AllianzBeFi.Com on September, 28,2016, 5.
[45] Ibid., 13.

During my survey to my peer's I replicated their experiment and found results confirming their study. I asked 86 participants the following question and gave them two responses to choose from:

> **In addition to whatever you own, you have been given a gift of $1,000, free of charge. You are now asked to choose between the following:**
>
> **A) A sure gain of $500**
> **B) A 50% chance to gain $1000 and 50% chance to gain $0.**

The results (*Figure* 8) showed over 3 in 4 participants would rather take the sure smaller gain instead of taking a risk to gain a larger amount, even when there would be no further financial loss to them if they lose the game.

Figure 8: Disposition Effect and Chance.



Source: Justin Nagy. February, 2017.

Disposition effect also shows that people hold on to loses too long. This is seen in the same survey question asked previously:

> **You purchased 100 shares of a well-known company stock a month ago at $80 a share. The stock recently peaked at $95 a share, but today has plummeted to $75a share. You look at the Yahoo Finance and see there is high volume of people selling their shares. You haven't heard any news today regarding the stock, and don't know why it's falling. What do you do?**
>
> **A) Hold on to the shares**
> **B) Buy more shares**
> **C) Sell your shares**

The results from *Figure 7* were staggering, confirming Tversky and Kahneman's studies. Over 87% off the responders would rather hold on the "losing" stock then to sell it and realize a small loss.

By not realizing a loss, investors do not have to deal with regret and confirming the notion that they would have fared better making a different past decision, and instead can remain optimistic that in the long-run their choice of stock was correct. Sherfin and Statman found "investors ride losers to postpone regret, and sell winners' too quickly' because they want to hasten the felling of pride at having chosen correctly in the past".[46] One way professionals combat this is by setting up a "stop-loss" order, or a price below the purchased price of the stock that automatically sells the stock to limit the loss. Many professionals will set this window up at 10%-15% below the purchased price. This can

[46] Hersh M. Shefrin and Meir Statman, "The Disposition to Sell Winners Too Early and Ride Losers Too Long: Theory and Evidence," in *Advances in Behavioral Finance*, ed. Richard Thaler (New York: Russell Sage Foundation, 1993), 511.

be implemented by your average investor too help eliminate the emotional struggle of having regret for purchasing a losing stock.

Amar Kumar Chaunhary found that investors realize greater regret when they chose a bad stock in an unconventional way.[47] As will be discussed later in this work, investors also implement a herd mentality approach to limit regret when purchasing stocks. In this approach, an investor picks stocks that are popular at the time, or stocks that their friends are purchasing as it limits the research they need to make when investing, and "reduce emotional reactions of felling since a group of individual investors also lost money on the same bad investment".[48] Chaudhardy notes "the fear of regret can make investors either risk averse or motivate them to take greater risk" (90)

Herd Behavior and Groupthink

Herd behavior was introduced to economics over a hundred years ago. In fact, Thorstein Veblen argued that "consumption was governed mainly by social norms, habit, customer and such irrational motives as status seeking, or snobbism, and by the bandwagon effect, or herding behavior".[49] Herd behavior in the stock market is the propensity for individuals to follow the actions of other investors in the stock market, whether rationally or irrationally. Rational herding is based on information, where in which rational investors will adopt the same response to other investors who share the same stock strategies when receiving new information. Irrational herding focuses on investors who blindly follow other investors without adequate information or accessing the risk of

[47] Chaudhary, "Impact of Behavioral Finance, 90.
[48] Ibid.
[49] Komlos, *What Every Economics,* 67.

doing so. Irrational herding is "closely linked to such distinct phenomena as imperfect expectations, fickle changes without much new information, bubbles, fads, frenzies, and sun-spot equilibria.[50]

Groupthink

Herding can occur with or without the participates knowing they are partaking in the event, and can occur by individual investors as well as professional investors. Professional investors and fund managers often find the disvalue of following their own beliefs and, being incorrect (potentially leading to termination) outweighs the value of being correct while standing alone.[51] They found there tends to be a "bandwagon effect" amongst fund managers, as performance is measured on earnings compared to the market. If for example the competitors fund in a particular sector increased by 10% during a particular period, while their own fund following their own fundamental analysis increased by only 2%, they would be underperforming the competitors by 8%. When one would rather risk being wrong when compared to their peers, instead of being right while listening to their own instinct, and knowledge, that is known as *groupthink*. According to David N. Dreman;

> …the groupthink hypothesis, which states that highly cohesive groups will often develop dangerously incorrect homogeneity in their views. Shared illusions on the proper course of action are reaffirmed continually by outside experts and influential investment organizations with whom the decision maker is in constant communication…the apparent consensus, without the heavy buffeting of serious critical evaluation, can produce and encourage undue optimism and promote excessive risk taking in a rising

[50] Devenow and Welch, "Rational Herding in Financial Economics," 30.
[51] David S. Scharfstein and Jeremy C. Stein, "Herd Behavior and Investment," *The American Economic Review*, 80, no. 3 (1990): 466.

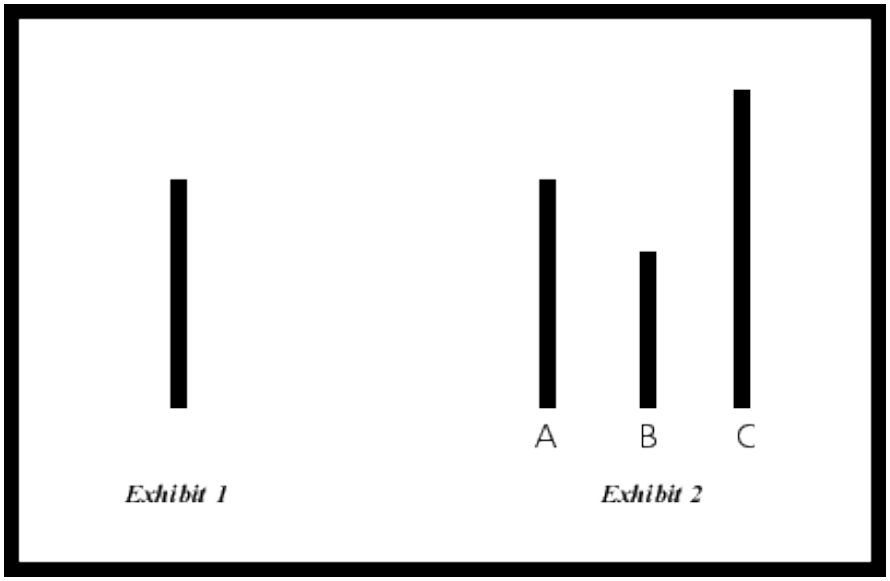
> market…Groupthink may account for a signification portion of all professional investment errors. It may also explain why professions have not outperformed the markets (consistently).[52]

In essence, fund managers will save their reputation even if the choice they made was an unprofitable decision, as they can "share-the-blame". This goes back to being risk-averse, as being potentially right doesn't offer enough premium to be wrong against the crowd.

This idea of Groupthink has been tested in and outside of the financial markets. One famous experiment was performed by Dr. Solomon Asch. In his experiment the subjects where shown two cards, with different vertical lines (see *figure 9*). This was done in a group setting with usually 7 or 8 participants. What the one participate didn't know is that all the other participants were told to deliberately give the wrong answer. The experiment was simple, looking at the two cards, (similar to *figure 9* below) which line on the right card was the same length as the line on the left card. One can clearly see that line A is the same length as the line in Exhibit 1, but the six participants in on the experiment were told to say another line was the same size, for example B. In these experiments the first six participants in on the test would say B was the same as the line on the left. In most cases the seventh, and unknowing participant would go with the group and agree that B was the same size as the line on the left. It was only when one or more participants dissented from the group that the unknowing participant would follow their gut and say line A.

[52] Dreman, *Psychology of the Stock Market*, 146-147.

Figure 9: Groupthink: Solomon Asch Conformity Experiment.



Source: *Age-of-the-Sage.org*,"Solomon Asch Conformity Experiments." http://www.age-of-the-sage.org/psychology/social/asch_conformity.html. Accessed: February 16, 2017.

Liquidity Trap

One Final problem with groupthink is that it can lead to a liquidity trap. The problem occurs due to herding and groupthink as fund managers and professional investors are buying the same stocks as other investment firms. Keynes warned of this in the 1930's when he said: "the fact that each individual investor flatters himself that his commitment is 'liquid' calms his nerves and makes him more willing run a risk".[53] As the firms purchase more of the same stock, they are driving up the prices, while at the same time increasing

[53] Keynes, 160.

the concentration of shares. This becomes a problem, as there are less likely suiters to purchase the stock if there is a panic. It may take time for a firm to accumulate substantial positions in a particular security, however, when they do and there is a bit of bad news the portfolio managers will try to sell the stocks to liquidate their positions. But because only a small number of firms own these shares there are not enough buyers to exit these positions, and at the same time with all these sellers they are creating serious impact to the security price.

Individual Herding

Institutional investors are not the only ones who herd in the stock markets, in fact with technology today, and the rush of news everywhere you look, you can see this more so in average traders every day. People often feel pressure to conform to their social environment, and people who interact with each other tend to think similarly over time.[54] Even more so, when people are seeing decisions made by large groups of people, example the price of AAPL stock increasing, people tend to believe that group of people must know something they don't know, as they all can't be wrong.

Information Cascade and Lemmings

Morton Deutsch and Harold Gerald, two psychologists from NYU studied human interactions in a group setting in the 1950s. They conducted studies like the Asch test and came to similar results. The noted:

> It is not surprising that the judgement of others would be taken as evidence to be weighed in coming to one's own judgements…From

[54] Dargham, "The Implications of Behavioral Finance", 21.

> birth on, we learn that the perceptions and judgements of others are frequently reliable sources of evidence about reality. Hence, it is to be expected that if the perceptions by two or more people of the same objective situation are discrepant, each will tend to re-examine his own view and that of the others to see if they can be reconciled.[55]

This observation is called information cascade. Information cascade occurs when you disregard your own private information and received signals, and follow the actions of others, as you perceive they must have more information that you currently have.

Lemmings Example

There is a popular saying that the average investor behaves like lemmings, or following blinding ignoring rational analysis.[56] The phrase "lemmings" comes from small rodents found near the Arctic and Scandinavian countries. These rodents are said to follow each other in a straight line in search of food, regardless of what is in front of them, or act like the blind leading the blind.

Small investors tend to have less capital available for investments, so any price change in a stock can severely impact their net worth. Because of their limited available capital, small investors set up price boundaries above and below the current market price in order to minimize losses and acquire some gains.[57] As you can see in the below diagram *Figure 10*, stock XYZ has an intrinsic value of $25, with all information made available. At time 0, the price is at $25, but for some reason some shares are sold by smaller investors. Even though there are only a few small investors choosing to sell, but

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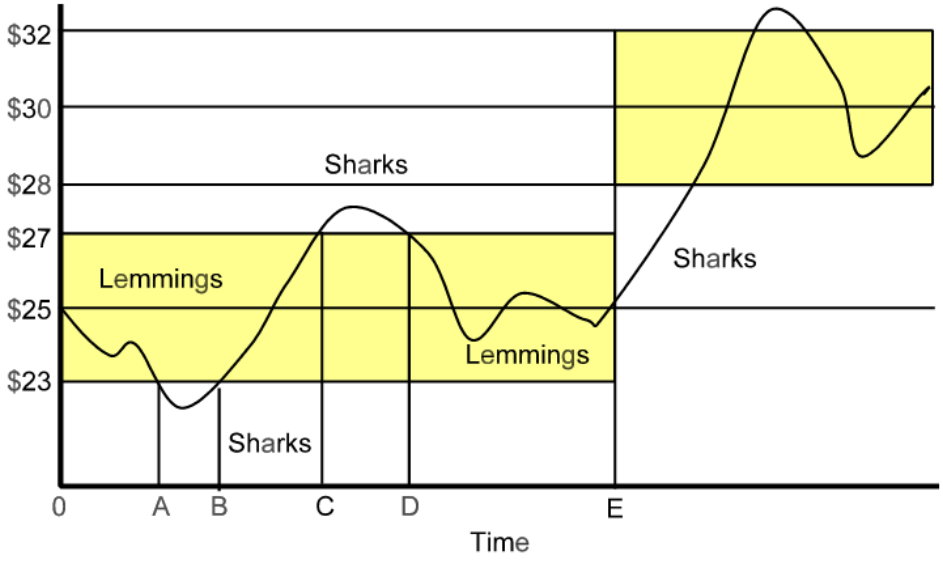
[55] Cassidy, *How Markets Fail,* 189.
[56] Devenow and Welch, "Rational Herding in Financial Economics," 604.
[57] Dallas Brozik, "Sharks and Lemmings: How the Stock Market Really Works,", Submitted to Marshall University, n.p.

several sell orders cause the price to drop slightly, which creates more sell orders from other small investors afraid that their potential profits are decreasing. This creates a panic, as the price of stock will drop even further.

At time A, the price of the stock has reached the lower boundary set up by the investors, so the remaining small investors sell their shares, dropping the price even further. Now that the price of the stock is under $23, “sharks” or professional investors purchase these shares because they are undervalued, and can become profitable if sold later. At price B, the stock has started to level off, and the major selling is over. Here, small investors start buying the stock, creating more demand forcing the stock price up to C. Small investors notice the upswing in price, and decide to follow the herd and move in on this stock as well moving the price above the upper boundary of the early investors. As this occurs, those small investors, and some professionals see this price above their upper value, and above the intrinsic value and sell their shares to earn a profit, causing more sales of the stock, starting the roller-coaster process all over again.

Figure 10: Herding: Sharks vs Lemmings in the Stock Market.



Source: Dallas Brozik, "Sharks and Lemmings: How the Stock Market REALLY Works," *Marshall University.*

Bubbles

Herd mentality has played a role in creating stock market bubbles throughout history, whether it's the *Tulipmania* of the 1600s, or the market bubble and crash in 1987, the dot-com bubble, and the financial crisis in 2008. A speculative bubble occurs when stock prices deviate considerably from their intrinsic value over a period of time until it reaches a bursting point.[58] Bubbles can occur rationally, but the negative effects from a bubble are typically caused by irrational behavior. Prices cannot rise forever, and therefore bubbles are not sustainable forever. As demand continues to rise, prices rise

[58] John A. Sondey, "Random Walks, Lemmings, and Behaviorism: The Search for a Market Lodestar," (Economic Staff papers, South Dakota State University, 2001), 10.

with it, but at some point, the demand no longer rises, in fact it reverses course generating a downward feedback pattern.[59]

Tulipmania

One of the earliest known bubbles did not involve the stock market, or housing, but involved Tulips. In the mid-1600s Tulips were imported from what is now Turkey, to Holland. Tulips were considered very rare, and prestigious. By the turn of the century the Dutch became the main suppliers of Tulip bulbs, and at the same time fashion had spread throughout Europe.[60] By 1620 tulips demand was starting to grow, but limited to collectors and horticulturists, but shortly after the general public started to buy them as well. As the demand swelled, so did the prices. At one point houses in Holland sold for the price of three tulip bulbs.[61] In fact, according to Dreman, tulip bulbs were selling at more than their weight in gold. The demand was so high, that sellers sold bulbs they did not own to buyers who pledged money they did yet own (derivatives).[62]

The tulip market finally crashed in 1637, when bulbs could not be sold. Along with the large issues of credit and less demand for the high price, sellers panicked looking for sellers, but there were none. Because prices dropped so significantly, those buyers who promised to pay at higher prices reneged on their commitments, causing huge issues of credit. There was no intrinsic value to the tulip bulb that should have skyrocketed its price to nearly $10,000 a bulb. While demand was high, it was in hopes to resell it immediately

[59] Robert J. Shiller, "Bubbles, Human Judgement, and Expert Opinion," *Financial Analysts Journal* 58, no. 3 (2002), 19.
[60] Dreman, *Psychology of the Stock Market*, 49
[61] Ibid.
[62] Ibid., 51.

to someone less rational they themselves, or *greater fool theory.* Greater fool theory implies “any price, no matter how out of line with historical values, can be justified if you believe that there is another buyer who will take the stock… off your hands for an even greater price” (64). As Dreman puts it; “the human animal is apparently heavily influenced by the whims of the moment, rather than the wisdom of the past.[63]

The Market Crash of October 1987

The stock market crash of 1987 is still widely debated among economists. On Monday, October 19, 1987 the stock market prices would tumble sending out panic across the globe. The markets of Hong Kong were first effected and then those in Europe, and would fall over 20% that day in New York City.[64] The previous Friday the markets closed down roughly 5%. The plummet of the stock market on the 19th started due to nothing more than the fact that news that the markets were down already. There was no big national or global news story that day. No wars, no embargos, no new laws, no political assassinations, nothing out of the ordinary. Thaler notes that the day after the attack on Pearl Harbor the U.S. markets only dropped by 4.4% for the day.[65]

On Tuesday, the markets would jump by 5.3%, and 9.1% on Wednesday, and yet fall again drastically by 8.3% on the following Monday. If the markets were truly efficient and the players were rational, the markets would only change with respect to news, and there was no news that week other than the fact the markets prices were volatile. Thaler

[63] Ibid., 52.
[64] Thaler, *Misbehaving,* 232
[65] Ibid.

argues that EMH cannot hold true do to the fact the market dropped 25% from Tuesday, October 15th and the close on Monday, October 19th given the absence of news.[66]

Dot-Com Bubble

The herd also drove the dot.com bubble of the late 1990s, though it can be considered rational. During this time, the internet was taking off, and new internet companies were entering the stock market almost every day it seemed. While some of this was driven by irrational investors purchasing stocks in companies they knew little about (like Pets.com), much of this bubble was caused by rational herding of brokerage accounts and fund managers. As discussed under groupthink, fund managers were not only being compared to the overall return in the stock markets but also to their peers. As many funds were heavily invested in internet stocks, in order to keep pace with their peers they would need to invest in them as well, as there weren't' many other opportunities that provided the same type of outrageous returns. Brian E. Stack, a fund manager of MFS New Discover Fund told Business week in February of 1999; "if they want to beat their benchmarks this year…we'll either have to own investment stocks or be very proficient in picking other stocks".[67] A study done by MIT found that young fund managers who deviated from their peers were more likely to lose their jobs, than if they followed suit.[68].

During this time, many fund managers believed they were in an internet bubble, but they had to ride the bubble, not fight it.[69] Even chief investment officer at Soros Fund

[66] Ibid.
[67] Cassidy, *How Markets Fail,* 179.
[68] Ibid., 178
[69] Ibid., 181.

Management Stanley Druckenmiller believed this were the case. In the eyes of Keynes "beauty contest" they were busy predicting what their peers would do next, instead of researching the stocks they were investing in. The goal was to ride the bubble as long as they could, and get out before it burst. Many hedge funds did start to adjust their portfolio before the collapse of the bubble from internet stocks to technology stocks, such as Amazon.com and EBay. It was at this point though, that irrational individual investors started to enter the markets.

Feedback Theory

Shiller calls this process the feedback theory, where the "feedback that propelled the bubble carries the seeds of its own destruction, and so the end of the bubble may be unrelated to news stories about fundamentals"[70]. In his book, *Memoires of Extraordinary Popular Delusions*, Charles Mackay described the feedback theory in regards to the tulipmania previously discussed:

> Many individuals grew suddenly rich. A golden bait hung temptingly out before the people, and one after another, they rushed to the tulip marts, like Flies around a honey-pot.... At last, however, the more prudent began to see that this folly could not last forever. Rich people no longer bought the flowers to keep them in their gardens, but to sell them again at cent per cent profit. It was seen that somebody must lose fearfully in the end. As this conviction spread, prices fell, and never rose again.[71]

[70] Robert J. Shiller, "Efficient Markets Theory to Behavioral Finance," *The Journal of Economic Perspectives* 17, no. 1 (2003), 91-92

[71] Ibid., 92.

Cognitive Biases and Heuristics

One other way behavioral economics is contributing to the field of economics is through the study of cognitive biases. Cognitive biases occur when a person thinks and acts in a certain way that would take them away from them acting rationally. The most common way this occurs is through the use of *heuristics*, or "rules of thumb". These heuristics simplify decision making by using mental shortcuts in order to answer difficult questions more quickly. The use of heuristics often make people act irrationally, and ignore base rate information associated with similar past occurrences. This counters the statistical theory known as Bayes' theorem which uses all known information when assessing the probability of an event happening.

Bayes' Theorem

Little is known about Thomas Bayes, an Englishman born in the early 18th century, but his name is linked to one of statistics most famous theorems. Bayes' theorem deals with conditional probability, or the probability that a hypothesis is true given some recent event occurred. Bayes' theorem looks at the probability of an occurrence happening based on the base rates, or prior known probabilities of an event occurring, plus the probability of new found information. As new information or evidence is acquired, one must update the probability of an event. Bayes' theorem is made up of three parts: the base rate, the true positive, and the posterior probability.

Bayes' theorem is stated mathematically as the following equation:

$$P(A|B) = \frac{P(B|A)P(A)}{P(B)}$$

Where A and B are events and P(B) ≠ 0.

P(A) and P(B) are the probabilities of observing A and B without regard to each other.

P(A | B), a conditional probability, is the probability of observing event A given that B is true.

P(B | A) is the probability of observing event B given that A is true.

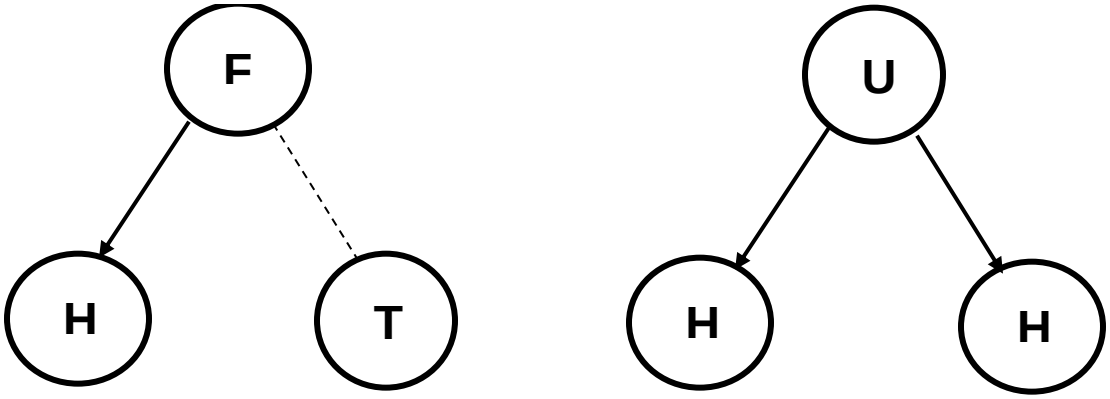
We can view this theorem in simplistic forms. Let's use an example of tossing two coins, one fair (1 head and 1 tail) and one unfair or double-sided coin (two heads). If you were to grab one of the coins, flip it and it lands on heads, what is the probability you flipped the fair coin? In order to answer this, you need to look at the probability of the events occurring. The first event has two possible outcomes, picking the fair coin (F) or the unfair coin (U). In the next event, we flip the coin. If we flipped the fair coin we know that we have equally likely chances of flipping a head or a tail. While if we had flipped the unfair coin, the results still have two outcomes, however, in this case the results would both be heads. This can be seen in the decision tree below in *Figure 11*. If the second event lands on heads (H) we know that Tails did not occur, we do not include the tails

outcome into our probability since it landed on heads. Since we know heads did occur, we know the probability that he picked the fair outcome can be seen as:

$$P\left(Fair\,|Heads\right) = \frac{1}{3}$$

1 heads result could from the fair coin, divided by three possible outcomes resulting in heads. If this test was performed again, we have a result of 1/5 probability that he flipped the fair coin. As we continue to flip the coins our confidence will approach 100% that it's the unfair coin being flipped, but we will never reach 100% certainty.

Figure 11: Conditional probability with Bayes' Theorem.

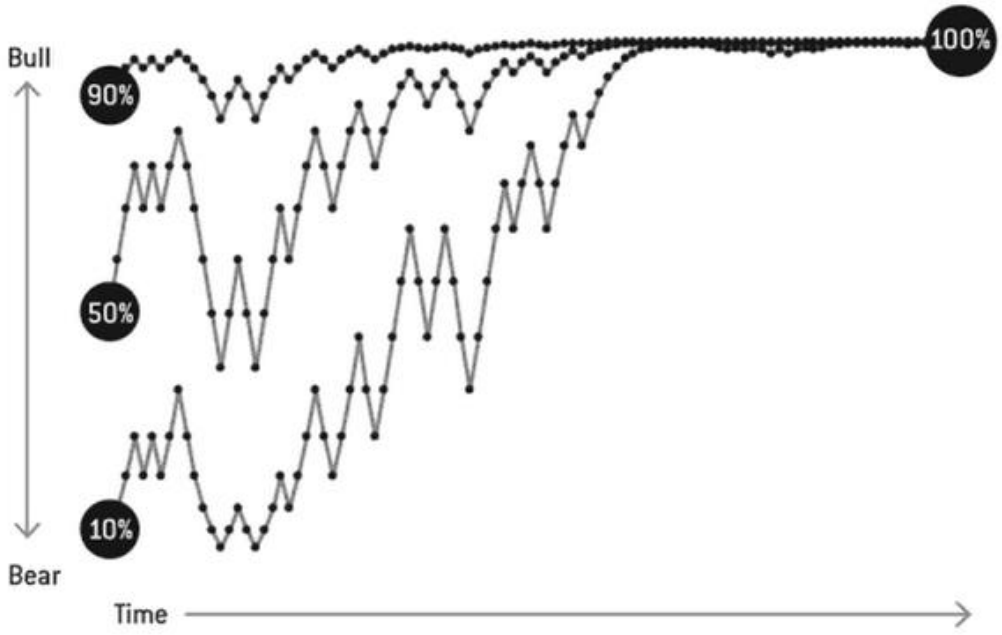


In fact, one property of Bayes' theorem is that our beliefs should all coverage towards the truth.[72] Nate silver provides an example in where he asks three investors

[72] Nate Silver, *The Signal and the Noise* (New York: Penguin Books, 2015),259.

whether they feel we are in a bull or bear market. One believed there was a 90% chance we were in a bull market, one believed it was a 50% chance, while the other believed there was only a 10% chance we were in a bull market. He set up a simulation where the market increased day over day 60% of the time.[73] As depicted in *figure 12*, while there were ups- and downs in the market, the three investors views on whether they were in a bull market converged to near 100% near the end of the experiments.

Figure 12: Bayesian Convergence in Market Predictions.



Source: Nate Silver, *The Signal and the Noise*" *Marshall University*. New York: Penguin Books, 2015, 259.

Bayes' theorem can be useful tool if used correctly and all the time. What we will find later in this section is that people alter their probability estimates too drastically when

[73] Ibid., 260.

they are given new information, or sometimes neglect new information all-together. We will see this when we discuss the representative heuristic, where individuals give too much weight to the evidence and thus too little weight to their prior beliefs".[74] People also tend to take new information and overreact to it as well as become overconfident in their predictions as they are swayed to heavily on the newest information.

Anchoring

EMH states that people should always act rationally when making economic decisions, but we have already seen that is not always the case. Anchoring is one example where people act irrational, even if it's against their best interest to do so. Anchoring involves attaching thoughts to a reference point or some piece of information more that we should when making a decision. Once a person "anchors" to a particular reference point they adjust their decisions insufficiently to reach some conclusion.[75]

In one classic study of anchoring, Tversky and Kahneman asked a group of participants to estimate the percentage of African countries that are members of the United Nations. Before the question was asked, Tversky and Kahman would spin a roulette wheel with numbers ranging from 1-100 on it. When the wheel stopped, they would ask the participants if they percentage was higher or lower than the number the wheel landed on. They found this has a huge effect on the answer given, even though

[74] De Bondt, Werner F.M. and Richard Thaler, "Financial Decision-Making in Markets and Firms: A Behavioral Perspective."*Handbooks in Operations Research and Management Science*, 1995, no. 9, 390.
[75] Kishore, "Theory of Behavioral Finance", 6.

the number on the wheel gave no valid information to answer the question. They found that if the wheel stopped on the number *ten*, the average percentage given was 25. If the wheel stopped on the number sixty-five, the average percentage given was 45.

We can see anchoring occur within financial markets as well. Vanguard investment professionals have found that when funds on the FTSE 100 Index have round numbers, say 5,000 points for example, there is disproportionate interest in those funds, despite their recent moves.[76] Robert J. Shiller has found that investors tend to anchor level of stock prices to the most recently remembered stock price.[77] Prices also tend to be anchored to prominent index funds, like the DOW and NASDAQ when they indexes are nearing round number levels. You can see that as the DOW approaches a whole thousand, it may actually take a few days before breaking that barrier, as it's a psychological indicator.

Shiller also notes that changes in individual stock prices tend to be anchored to the price changes in similar stocks. He explains: "this kind of anchoring may help to explain why individual stock prices move together as much as they do, and thus, ultimately why stock prices indices are as volatile as they are … why the averaging across stocks that is inherent in the constructions of the index doesn't more solidly dampen its volatility".[78]

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[76] Alistair Byrne, "Understanding How the Mind Can Help or Hinder Investment Success," *Behavioural Finance,* Vanguard, https://www.vanguard.co.uk/documents/portal/literature/behavourial-finance-guide.pdf. , 18.
[77] Shiller, *Irrational Exuberance*, 167.
[78] Ibid.

Overconfidence

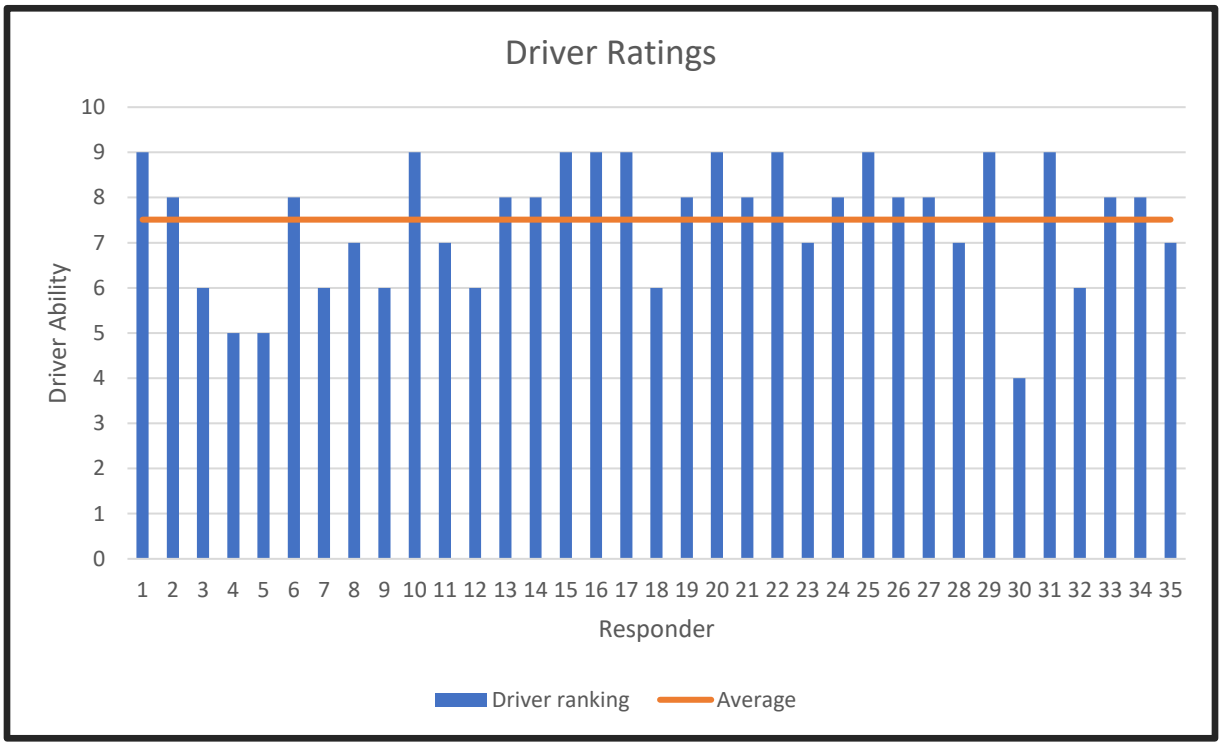
> The state of long-term expectation, upon which our decisions are based does not solely depend on the most probably forecast we can make. It also depends on the confidence with which we make this forecast – or how highly we rate the likelihood of our best forecast turning out quite wrong. – John Maynard Keynes, 1936

One area closely associated with Anchoring is the overconfidence bias, in which one has excessive confidence in one's own abilities. This is similar to the confirmation bias where one tends to focus and remember information that reinstates their own beliefs and preconceptions. A Texas study showed that 90% of drives questioned believed they have above average driving skills, and over 80% ranked themselves in the top one third of the population.[79]

In a quick in person survey of random individuals I asked 35 peers to rank their driving on scale of 1 to 9, 1 being a "bad driver", 4 and 5 being an "average driver" and 9 being "excellent driver". The average of the 35 individuals questioned was 7.51, or in the top 84%. As the *Figure 13* clearly shows below, that everyone but one participate rated themselves above average, and 21 out of 35 responded that they were in the top 20% in driver ability.

[79] Kevin Bracker, "Introducing Behavioral Finance: A Student Quiz," *Journal of Financial Education* 39, no ¾ (2013): 75.

Figure 13: Overconfidence and Driving Skills.



Source: Justin L. Nagy, February,2017

People tend to forget past failures, yet can easily recollect the positive outcomes of the past. One major issue with overconfident investors is it leads them to believe they can outperform the market. John A Sondey notes:

> If the investor becomes increasingly confident in his ability to ferret out important data, assimilate and evaluate it, generating "private information" he will underestimate his own forecasting errors while overvaluing his abilities as a stock-picker. Moreover, the informed, overconfident investor will overreact to his self-generated private information and underreact to public signals (stock split announcement, dividend change, insider buying or selling) which may counter or corroborate his personal perspective on a stock

> Moreover, when public information supports investors private signals, confidence levels rise significantly. However, when public information contradicts private signals, confidence levels fall only modestly as investors attribute (investment) failure to external events – beyond their control.[80]

Overconfident investors also tend to conduct more trades then others as they believe they are better at choosing the right stocks at the right time, thus causing these investors to "under-react to new information" leading to lower yields than the market.[81] Barber and Odean, two behavioral theorists, conducted a study of nearly 80,000 professional investors. They broke these investors into five groups, based on how actively they traded individual stocks and they showed for those that traded most frequently, they had an annual return of about 6% less, after transaction costs compared to those who traded the least.[82] The highest trader's turnover their portfolios more than twice a year, while the average investor turned over 75% of their portfolio.[83] Barber and Odean determined this can be explained by excessive trading due to overconfidence bias. Several studies have also shown that when there has been a huge price change without any substantial news or information, the anomalous price change reversed course the following month.[84]

Robert J Shiller offers some final thoughts on overconfidence in regards to speculative trading:

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[80] Sondey, "Random Walks", 8.
[81] Chaudhary, "Impact of Behavioral Finance, 88.
[82] Dargham, "The Implications of Behavioral Finance", 17.
[83] Benartzi, "Behavioral Finance in Action", 12.
[84] Kishore, "Theory of Behavioral Finance", 7.

> Overconfidence, however generated, appears to be a fundamental factor promoting the high value of trade we observe in speculative markets. Without such overconfidence, one would think that there would be little trading in financial markets. If people were completely rations, then, roughly speaking, half the investors should think that they are below average in their trading ability and should therefore be unwilling to do speculative trades with the other half, who they think will probably dominate them in trading. Thus, the above -average half would have no one to trade with, and there should ideally be no trading for speculative reasons.[85]

Availability Bias

Studies have shown that our decisions are strongly impacted by recent events and observations. People tend to measure the probability and frequency of an event occurring by the readily available instances of similar events in their recent memory.[86] Events that are traumatic, and evokes strong emotions will have a longer lasting effect than normal, routine events. An example would be buying flood insurance after you've seen stories of damaging flooding in nearby states. While the probably of a flood occurring in your area hasn't changed with this news, the traumatic video of seeing homes and cities destroyed arouses emotions that can make people become irrational.

This can occur in the stock market too, especially with IPOs. One example is the Pets.com IPO during the internet boom of the 1990s. While there are many other factors that lead to the internet bubble busting, Pets.com can attribute much of their stock price success due to their advertising. Pets.com spent millions on Super Bowl commercials and their ad campaigns were unforgettable, with their mascot sock puppet stating "pets

[85] Shiller, *Irrational Exuberance*, 172.

[86] Max H. Bazerman and Don Moore, *Judgement in Managerial Decision Making* 7th ed. (New York: Wiley, 2009), 7.

can't drive". With very little sales, and high shipping costs, the company raised $82 million dollars during the initial offering. The stock went from a high of $14 at launch in February 2000, down to $0.19 a share by November of that year. People bought shares of Pets.com because of the familiarity of the commercials, and because of the hype surrounding the launch of the IPO. Peter Lynch, a former fund manager for Fidelity Investments believes in "buying stock in firms that are unavailable in the minds of most investors (blandness); the more available the stock is… the more overvalued it will be".[87]

Framing

The framing heuristic deals with the way an individual perceives a problem. In traditional finance people use frame independence when making decisions, that is, only the information presented matters, not the order or way it is presented.[88] Kahneman and Tversky found that people make decisions based on frame dependence, meaning how the question is asked, not just the information presented before them. A classic example is when stating the chance of death. If the World Health Organization said that out of 100 people, 90 will survive or 10 out of 100 people will die, people will focus on the later, because people tend to focus on death.

Framing can play an irrational role investment management as well. People make subconscious framing decisions because of the way stocks are presented to them. Andrei Shleifer notes; "investors allocate more of their weight to stocks rather than bonds when they see a very impressive history of long-term stock returns relative to those on bonds,

[87] Ibid., 8.
[88] Bracker, "Introducing Behavioral Finance", 80.

than if they see the volatile short-term stock returns".[89] Alistair Byrne also found that investors focus on the results of individual securities and funds in their portfolio instead at an aggregate level. Because of this "narrow" frame, investors worry over poor performances of a single stock, while those who look at their whole portfolio are not as concerned about small changes of individual stocks in the short -term. Finance theory argues that we focus on our total wealth when it comes do financial decision making. Behavioral economists would argue that investors should look at loses or wins as small movements, not one large shift. Instead of seeing a stock valued at $90 today, when 6 months ago it was valued at $100, look at a smaller time frame to see how the movements are trending. By narrowing your framework, you can eliminate the framing bias.

Representativeness

One final heuristic is representativeness bias which occurs when individuals see something for "what it looks like" rather than evaluating the scenario. Andrei Shleifer explains representativeness as "the tendency of experimental subjects to view events as typical or representative of some specific class and to ignore the laws of probability in the process ".[90] In one widely cited study, Kahnmean and Tversy asked a group to pick a subject's fields (student) based on some characteristics of the subject. In the 1970s they posed the following question:

> *Tom W. is of high intelligence, although lacking in true creativity. He has a need for order and clarity, and for neat and tidy systems in which every detail finds its appropriate place. His writing is rather dull and mechanical, occasionally enlivened by somewhat corny puns and by flashes of imagination of the sci-fi type. He has a strong drive for competence. He*

[89] Shleifer, *Inefficient Markets,* 11.
[90] Ibid., 113.

seems to feel little sympathy for other people and does not enjoy interacting with others. Self-centered, he nonetheless has a deep moral sense.

The rankings from the study are shown below. The top field of study predicted was computer science, likely due to the "nerdiness" attributes, followed by engineering due to the mechanical and dull characters.[91]

1. *computer science*
2. *engineering*
3. *business administration*
4. *physical and life sciences*
5. *library science*
6. *law*
7. *medicine*
8. *humanities and education*
9. *social science and social work*

The results show that people forget to look at the probability of events occurring when making predictions. If this test was done today, it might be more likely for Tom to be in the field of computer science, but still not as likely due to the probability of these jobs being available. By ignoring probability, you are ignoring the base rates of the various fields. If you were not given any information on Tom, just that he was a student, based on likelihood of fields of study alone humanities and education and social science and social work would be near the top as there are a larger portion of students as a whole in those fields.

Quite possibly Tversky's and Kahenemans most famous study had to deal with a fictional subject named Linda. They wanted to test representativeness with relation to the

[91] Kahneman, *Thinking, Fast and Slow*, 148.

probability of conjunction. The probably of conjunction notes that the probability of A and B cannot be greater than the individual probability of A and B.

$$P(A+B) \nsucc P(A)+P(B)$$

Tverksky and Kahneman found that subjects tend to find the conjunctive to be more likely "if it is more representative of how they characterize an event or individual".[92] The pitfall arrives when "a detailed description of an individual's personality matches up well with the subject's experiences with people of a particular profession, the subject (then) tends to significantly overestimate the actual probability that the given individual belongs to that profession.[93] In the case study of "Linda" they asked the below question:

> *Linda is thirty-one years old, single, outspoken, and very bright. She majored in philosophy. As a student, she was deeply concerned with issues of discrimination and social justice, and also participated in antinuclear demonstrations. Thinking of Linda, what alternative is more probable?*
>
> *Which alternative is more probable?*
>
> *A) Linda is a bank teller*
> *B) Linda is a bank teller and is active in the feminist movement*

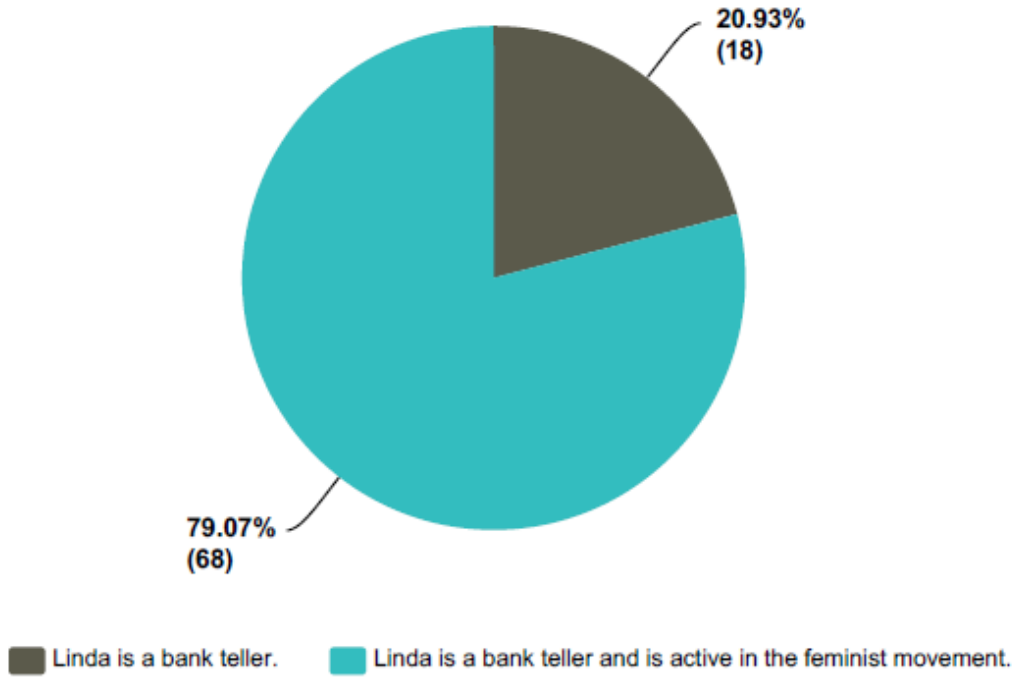
They found between 85-90% of undergraduates at several major universities chose option B, contrary to the probability logic mentioned above.

To test this experiment, I asked 86 participates the same question, and received nearly identical results. As shown in *Figure* 14, of the 86 participants, 68 responded with

[92] Bracker, "Introducing Behavioral Finance", 74.
[93] Shliefer, "Inefficient Markets", 129.

choice B, or 79.07%, well within the standard deviation of Tversky and Kahneman's results.

Figure 14: Representativeness: The "Linda" Experiment.



Source: Justin L. Nagy, February, 2017

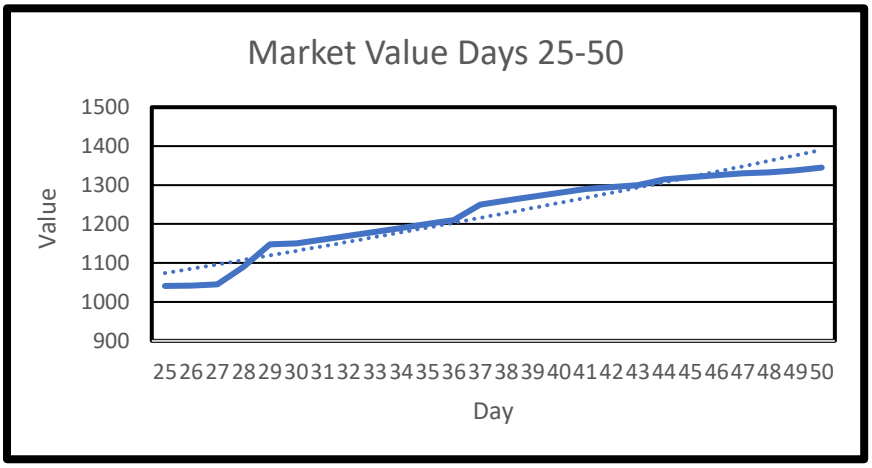
Robert Shiller describes representativeness as "judgements in uncertain situations by looking for familiar patterns and assuming that future patterns will resemble past ones, often without sufficient consideration of the reasons for the pattern or the probability of the pattern repeating itself" [94] Everyday investors make this mistake when assuming that shares in a well-known company automatically leads to a good investment. In this case,

[94] Shiller, *Rational Ixuberance,* 171.

other factors need to be looked at. Many long-lasting firms do not have consistent returns, and are not investing much in R&D, and are more focused on maintaining revenue. If this company does not offer a dividend, you may not see much in the growth in the stock price as this company is focused on longevity, not development. Investors forget that the share price may already reflect the overall quality of the company and thus may only produce modest returns. Investors often conclude that past history *represents* future projections, as a company who has several years of consistent growth will continue that way in the future.

One final note on representative heuristic is that it tends to tempt individuals to give too much credit to recent evidence, and small sample and too little weight to larger picture and prior odds. It is important to look at the whole picture when evaluating stocks. If we were to look at *Figure 15* below you would see a consistent up trek in value. If an investor were too look at this alone, they would assume this stock is headed in the right direction, and could signal a good buy.

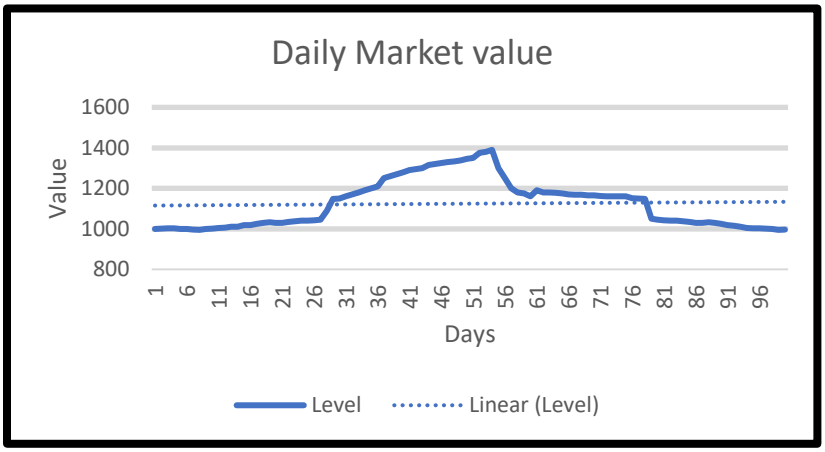
Figure 15: Representativeness and Daily Market Value over Small Sample Size.



Source: Justin L. Nagy, February,2017

However, if we pan-out and look at a longer period of time, in this case 100 days, we can see that during this time the we can see over the average value is roughly 1100, and in fact dips back down to the starting price by day 100.

Figure 16: Daily Market Value over 100 Days.



Source: Justin L. Nagy, February,2017

Chapter Six: Empirical Evidence

Overreaction in the Stock Market: Representativeness and Bayes' Theorem

New Zealand Stock Exchange Study

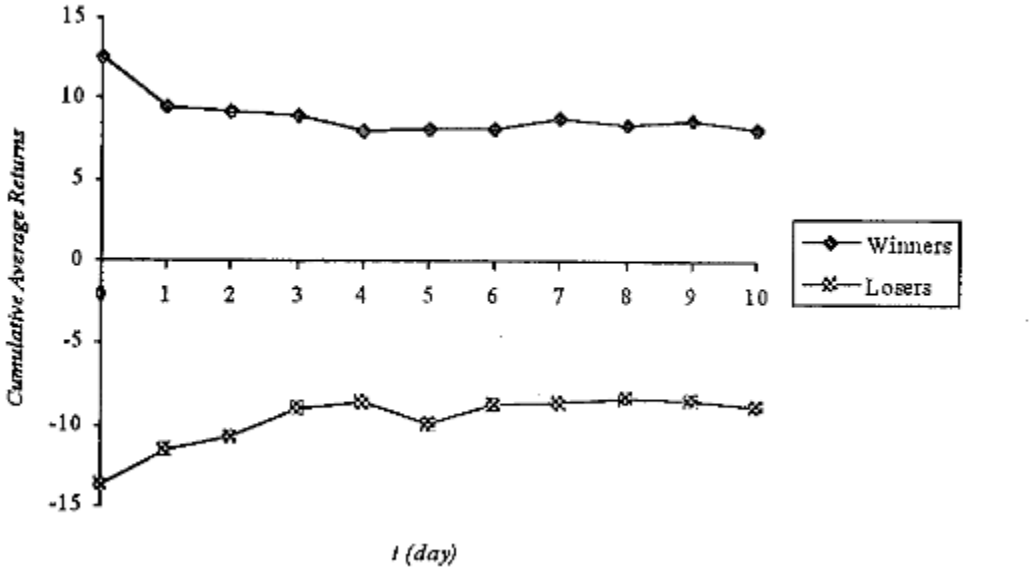
One study by Simon Swallow and Mark Fox of Lincoln University tested whether or not investors overreact to new information in the stock market. This would of course go against Bayes' theorem of weighing all information equally. They proposed: "if shares exhibit an initial significant return (positive or negative) that is followed by a subsequent return reversal, then this would confirm the 'overreaction' hypothesis".[95] If the prices reversed course back to their true economic price, an overreaction occurred, while if there was no significant reversal, investors where using a "Bayesian" approach when making decisions regarding stock purchases.

Swallow and Fox looked at all New Zealand Stock Exchange (NZSE) companies over a one year period from April 1994 through March 1995. They selected the top three and bottom three performers on 50 random days to help ensure validity in their experiment. The six companies over these 50 random days were analyzed for the subsequent 10 days to see if there were any price reversals. There was a total of 11 days observed where t=0, was the day of the first major price change, or day of any "news", t=1 is the first day after the first price movement and t=10 is the tenth day or last day of observation. Their results can be found in the Appendix, but are also graphed in *Figure*

[95] Swallow, Simon and Mark Fox, "Investor Psychology in New Zealand," Lincoln University.

17 below. You can see that at t=1 there is a major correction on days with good news and bad news. Swallow and Fox concluded that in the short-run it appears investors overreact and invest with a representative heuristic and ignore the Bayesian ideology.

Figure 17: The Cumulative Average Returns for Winner and Loser Shares on the NZSE.



Source: Simon Swallow and Mark Fox, "Investor Psychology in New Zealand," *Lincoln University.*

They found that of the "losers", the 3 corrective days after the initial price movement totaled around 35 percent of the total movement on t=0. When looking at the winners, the first day saw an average correction of nearly 25 percent, from 12.57% return, to a -3.09% return on t=1. They concluded that investors overreact to both good and bad news, behave less rationally and overreact more to negative news. They found that there is also a longer correction period after bad news confirming the representative heuristic.

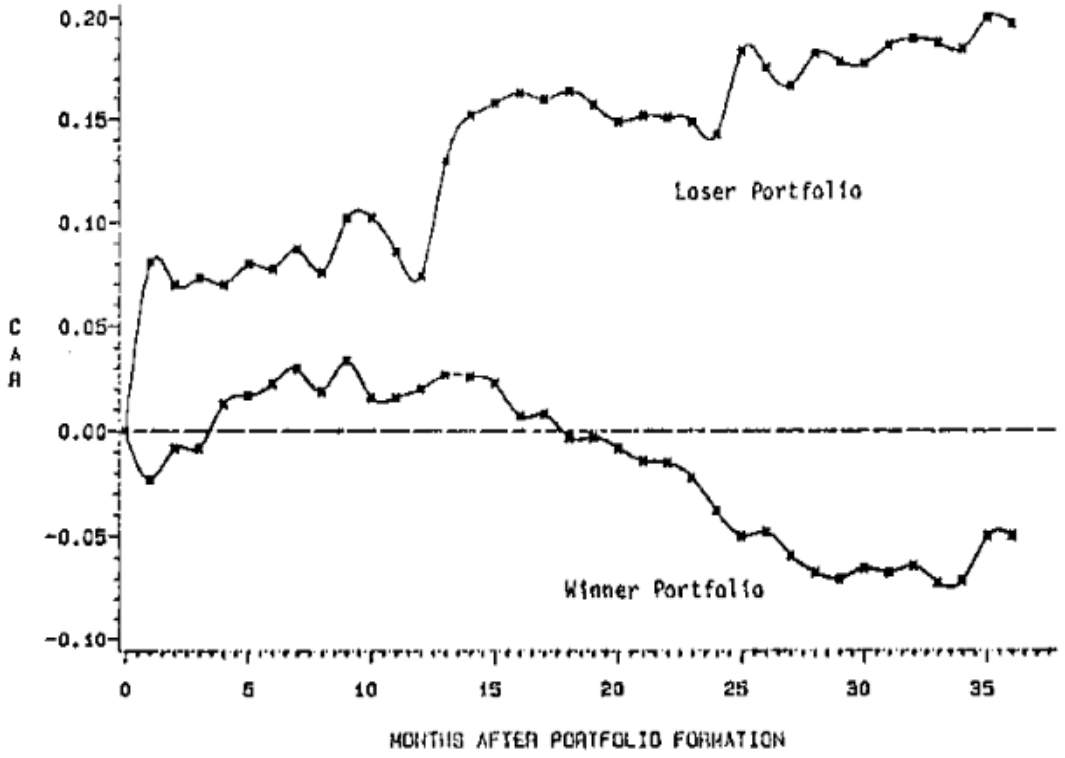
De Bondt and Thaler Study

Werner De Bondt and Richard Thaler also tested if investors overreact and violate Bayes' Law. In their study discussed in their paper, "Does the Stock Market Overreact," they examined returns in the New York Stock Exchange (NYSE) over a 36- month period. After examining the results, they separated the top 35 performing stocks into the "winner's portfolio" and the 35 worst performing stocks into the "loser's portfolio". The results showed that the winner's portfolio consistently underperformed compared to the market index. On the other hand, the loser's portfolio beat the market index by a wide margin.

Figure 18 shows the results for each portfolio over the 3-year period of observation. They found that over the last half-century (1930-1980) the 35 stocks in the loser portfolio outperformed the market by an average of 19.6%, 36 months after the formation of the portfolio.[96] During the same time period the winner's portfolio actually did around 5% worse compared to the market index.

[96] [96] De Bondt, Werner F.M. and Richard Thaler, "Does the Stock Market Overreact," *The Journal of Finance, XL*, no. 3, 799.

Figure 18: Average of 16 3-year test periods.



Source: De Bondt, Werner F.M. and Richard Thaler, "Does the Stock Markety Overreact?" *The Journal of Finance,* XL, no. 3, 800.

They had three man conclusions from their study:

1. There is asymmetry when it comes to overreaction to news in the stock market. The adjustment is much greater for the losers than it is for the winners long-term.
2. There seems to be a seasonal effect to the large adjustment in gains, specifically in January. This is often referred to as the January Effect. The main theory behind this is in December, as the year ends investors will sell "losing" stocks as those will provide tax-benefits due to the loses. Then, in

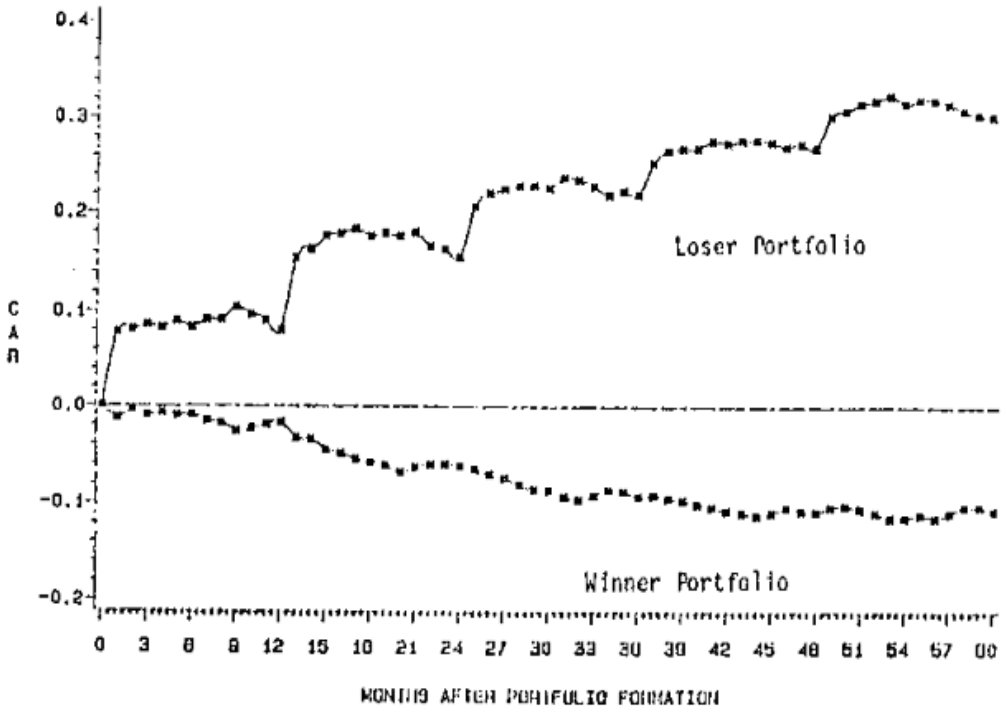
January when the stocks are thought to be undervalued, they are repurchased back to their portfolio.

3. Lastly, they found that the overreaction mostly occurred in the second and third year following the start of the test period.[97] The differences between the winning portfolio and losing portfolio is roughly 5.4% after year one. By the end of year two, it's roughly 20%.

Lastly, they found further evidence to the January Effect when looking at returns over five-month periods. They formed winners and loser's portfolios based on the residual returns over the previous five years. The residual return is equal to the excess return, minus the benchmark excess return times its beta. *Figure 19* represents what an investor could expect if they were aware of the "overreaction phenomenon".[98] Even after five years, the January Effect is still observable. Between October and December of each given year, there is a sharp decline in value in relations to the market. This reinforces the tax-loss savings benefit previously mentioned. When comparing the winner's portfolio to the losers we see the opposite occur, but to a lesser degree. During the last couple months of a year the average returns increase, but take a dip in January of the next year.[99]

[97] Ibid., 799.
[98] Ibid., 802.
[99] Ibid.

Figure 19: Average of 46 Yearly Replications Starting Every January from 1933 to 1978.



Source: De Bondt, Werner F.M. and Richard Thaler, "Does the Stock Markety Overreact?" *The Journal of Finance,* XL, no. 3, 803.

Herding in the Swedish Markets

Per Ohlson from Jonkoping University studied herd behavior in the Swedish Market from 1998 through 2009 and found that herding does exist, especially in the bullish markets of 2005 and 2007. He used several methods to test this, one of which was the Dummy Method developed by William G. Christie and Roger D. Huang. This method is "market focused, which means that it measures investors'' tendency to follow the mean

of the entire market".[100] When this occurs investors ignore their own opinions and knowledge, and instead favor the market, which "causes returns to cluster closer around the market returns".[101] Christie and Hauge found that during stable market conditions investors tend to act rational, but act irrational during large stock movements.

To measure how individual stock returns, compare to the market returns we use a cross sectional standard deviation (CCSD) or dispersion approach. This will test how the return of an individual stock compares to the mean of that portfolio. If there is complete herd behavior we would see a dispersion of zero.[102]

$$CSSD_t = \sqrt{\frac{\sum_{i=1}^{N} (R_{i,t} - R_{m,t})^2}{N-1}}$$

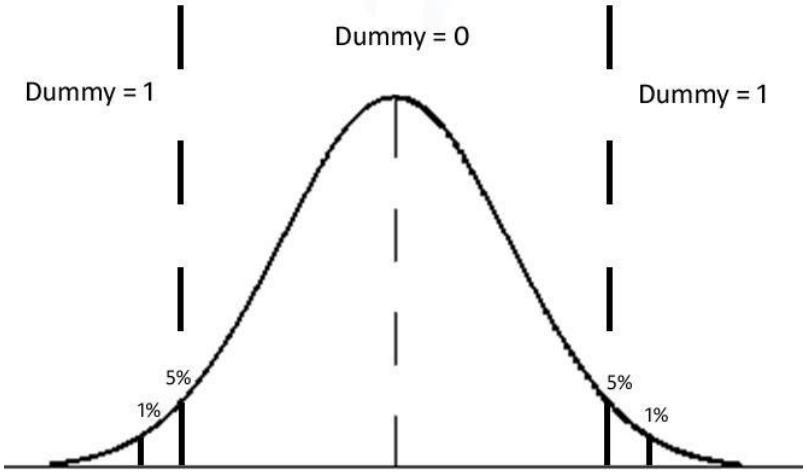
Where R is the observed stock return of firm I, at time t and N is the number of stocks in the portfolio. To determine if there was herding in the market, Christie and Huang added a dummy variable. In order to capture differences in herding during severe up-markets and down markets dummy variables are used. The CSSD returns are then regressed against two dummy variables along with the constant.[103] In the below formula D^L and D^U represent dummy variables during extreme phases of market returns. The formula is:

[100] Ohlson, Per, "Herd Behavior on the Swedish Stock Exchange,", *Jonkoping International Business School*, May 2010, 15.
[101] Ibid.
[102] Ibid.
[103] Ibid.

$$CSSD_t = a + b_1 D_t^L + b_2 D_t^U + e_t$$

If CSSD values are lower during these phases CSSD and Rm,t move in opposite direction indicated by a negative value of the coefficient. For example, if b1 or b2 has a negative relation to the CSSD estimate, herd behavior is implied to be present. In that case, it means that in the most extreme market days the CSSD measure actually decreases.[104]

Figure 20: Construction of the dummy variables.



Source: Ohlson, Per, "Herd Behavior on the Swedish Stock Exchange" *Jonkoping International Business School,* 2010, p17.

Ohlson also used a linearity method. The reason for this is due to the fact it doesn't only assume herding in the most volatile periods, and can detect herding in small movements.[105]

[104] Ibid., 16.
[105] Ibid.

$$CSAD_t = a + \gamma_1 \left| R_{m,t} \right| + \gamma_2 R_{m,t}^2 + \varepsilon_t$$

where Rm,t stand for market return. A significantly negative γ2 coefficient implies evidence of herd behavior.

Results

The results of using Chrisite's and Huants Dummy Method indicated no herding in the markets, since B_1 and B_2 were both positive. Their results concluded as follows:

> …t-values are significant. The 1% respectively the 5% criterion refers to test with 1% or 5% of the Rm,t distribution marked as extreme market phases, thus with "1" as a dummy variable. The α parameter represents the rest of the population, the normal phases of the stock market, hence marked with the dummy variable "0" in the test. The adjusted R square value is used to ex-plain the models' goodness of fit. That is, the percentage of variance in the dependent variable that is explained collectively by the independent variables. It is useful as a quality indicator, especially in comparison to the other models since two of the models use the same dependent variables. Not surprisingly the higher value of adjusted R square is found with the 5% criterion model since it contains additional dummy variables marked with "1". That is, the 5% criterion model explains the dependent variables variance to a higher degree than test with the 1% criterion.[106]

[106] Ibid., 23.

Figure 21: The Dummy Models covering 1998 to 2009.

	The Dummy Model $CSSD_t = a + b_1D_t^L + b_2D^U{}_2 + e_t$		The Modified Dummy Model $CSAD_t = a + b_1D_t^L + b_2D^U{}_2 + e_t$	
	1 % criterion	5 % criterion	1 % criterion	5 % criterion
α	0,033***	0,031***	0,020***	0,019***
	(120,654)	(115,862)	(163,828)	(165,184)
B_1 (L)	0,016***	0,010***	0,013***	0,009***
	(6,143)	(8,298)	(10,409)	(17,425)
B_2 (U)	0,027***	0,021***	0,021***	0,015***
	(10,301)	(18,121)	(17,802)	(29,488)
Adj.R^2	0,045	0,0114	0,0124	0,274

Note: ***,**, and * equals significance on the 1%, 5%, and the 10% level in the t-table
CSSD = Cross sectional standard deviation, CSAD= Cross sectional absolute deviation

Source: Ohlson, Per, "Herd Behavior on the Swedish Stock Exchange" *Jonkiping International Business School*, 2010, p23.

The results using the more scientific Linearity Model did show signs of herding in the market overall in *Figure 22*. The Y2- coefficient is negative in this case and t-value is significant. The results also show strong evidence of herding in bull market days by the Y2 coefficient, and some evidence of herding in bear markets but not as strong. Since the dummy variable method only allows herding to be present on days with the extreme market movements, the linearity method should be preferred for testing.[107]

[107] Ibid., 22.

Figure 22: The Linearity Model Covering 1998 to 2009.

	All Days	Bull- days	Bear- days
	$CSAD_t=a+Y_1\|R_{m,t}\|$ $+Y_2R_{m,t}^2+e_t$	$CSAD_t=a+Y_1^{UP}\|R_{m,t}\|^{UP}$ $+Y_2^{UP}(R_{m,t}^2)^{UP}+e_t$	$CSAD_t=a+Y_1^{DOWN}\|R_{m,t}\|^{DOWN}$ $+Y_2^{DOWN}(R_{m,t}^2)^{DOWN}+e_t$
	2971 observations	1656 observations	1315 observations
α	0,016***	0,015***	0,017***
	(91,843)	(66,219)	(65,767)
Y_1	0,539***	0,715***	0,371***
	(23,287)	(23,326)	(11,019)
Y_2	**-1,688*** **	**-2,441*** **	-0,694
	(-3,460)	(-3,837)	(-0,966)
Adj.R^2	0,36	0,468	0,262

Note: ***,**, and * equals significance on the 1%, 5%, and the 10% level in the t-table
CSAD= Cross sectional absolute deviation

Source: Ohlson, Per, "Herd Behavior on the Swedish Stock Exchange" *Jonkiping International Business School*, 2010, p24.

Finally, Ohlson also performed a linearity model to test evidence of herding between large and small cap stocks. In *Figure 23* we see a negative Y2 coefficient which according to the hypothesis shows signs of herding. Next, we look at the adjusted R square value to determine the fit of the results. The low adjusted R square value on the large cap stocks does not present enough evidence to confirm the results of herding, however the higher R square value on the small cap test suggests goodness of fit. Ohlsen also concluded that there is a difference when comparing large and small cap stocks, and that is the presence of institutional investors, and they are more prone to herd in extreme market conditions.

Figure 23: The Linearity Model Covering Large & Small Cap Stocks During 1998 to 2009.

$CSAD_t = a + Y_1 |R_{m,t}| + Y_2 R_{m,t}^2 + e_t$

	Large Cap	Small Cap
α	(2,599***	0,019***
	(26,379)	(78,638)
Y_1	0,067***	0,656***
	(2,690)	(21,323)
Y_2	**-0,076***	**-1,879***
	(-2,915)	(-3,055)
Adj. R^2	0,003	0,356

Note: ***,**, and * equals significance on the 1%, 5%, and the 10% level in the t-table
CSSD = Cross sectional standard deviation, CSAD= Cross sectional absolute deviation

Source: Ohlson, Per, "Herd Behavior on the Swedish Stock Exchange" *Jonkiping International Business School*, 2010, p28.

Chapter Seven: Conclusions

Concluding remarks:

The idea that psychological factors cause people to be irrational in decision making dates back Adam Smith. In his book *The Theory of Moral Sentiments*, he argued that passions, such as sex, and emotions such as Fear and anger, drove people's desires and decisions.[108] He wrote about loss-aversion in regards to pain being a more powerful sensation than joy, when he stated: "the pleasure which we are to enjoy ten years hence, interests us so little in comparison with that which we may enjoy today".[109] Smith also wrote in depth about overconfidence, fairness, self-control and altruism, all psychological factors that cannot be measured through fundamental economics.

Nearly two-hundred years later Keynes compared the stock market to a *beauty contest* where one is not trying to decide the most beautiful contestant, but is trying to decide what the other contestants feel is the most beautiful contestant. In buying and selling stocks investors are trying to sell stocks not by what we know, but by what other investors know and feel. Keynes also argued that it was impossible to estimate the value a railroad business 10 years from not, let alone an equity's value.

By the mid-1970s the EMH was the widely-accepted theory on the stock markets, but by the 1980s, a small group of economists were looking to not only challenge the EMH, but to understand how our own mental limitations effect markets. Psychologists

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[108] Nava Ashraf, Coling F. Camerer and George Lowenstein, "Adam Smith, Behavioral Economist," *Journal of Economic Perspectives* 19, no. 3 (2005): 131.
[109] Ibid., 133.

Tversky and Kahneman did ample research in their fields that showed the limitations in decision making. Their contribution to the Prospect Theory showed that individuals violate the theory of utility maximization due to the lack of a reference point. Investors make decisions based on gains and losses, rather than the end level of wealth. They found that investors tend to sell winners too soon, and hold on to losers too long. The fear of regret, and pain associated with loses outweighs the joy of the gains. People do not want to admit they made a mistake in purchasing a poor stock.

Tversky and Kahneman also studied cognitive biases and heuristics. They found that people “anchor” their view to a particular reference point, and adjust their decisions around this point. For example, if Apple’s stock price was $125 last month, but has been trending at $110 the last week, investors will anchor to the $125 price as the price Apple Inc. was, and “should be”. They will use this as a guide price if they should sell, or buy more shares.

Investors also tend to be overconfident in their own abilities. As my survey showed earlier, 60% off all those surveyed believed they were in the top 20% when it came to their driving abilities. Overconfidence also influences investors to trade more often, as they believe they are better at choosing the right stocks at the right time, as well as it causes investors to under-react to new information.

Investors also tend to take part in groupthink and herd mentality. We have seen that investors follow the herd for multiple reasons. Average investors may follow because they believe a large group of people cannot be wrong, and a group individuals should be smarter than one. In the famous Asch experiment participants answered incorrectly which lines were equal, even though they knew the answer they were given was incorrect. We

found professional investors herd due to social pressures, and fear of losing their jobs. It is better to be wrong along with everyone else, than to be wrong by yourself. Herd behavior has led to several bubbles and crashes, including the *tulipmania* in the Netherlands, the stock market crash in 1987, the dot.com bubble of the late 1990s and the most recent financial crisis. All of these created due to fads, following the herds, and irrational exuberance.

Finally, we looked at the representativeness heuristic, and found that individuals evaluate something for what it looks like, rather than evaluating the entire scenario. We tend to ignore the laws of probability, and instead focus on one or two specific scenarios or examples when making decisions. This was seen in the famous “Linda” experiment, where participants were looking at what they think her personality represented, instead of looking at the laws of probability, that the probability of A and B happening cannot be greater than the individual probability of A and B. Representativeness heuristic tends to tempt individuals to credit recent history, more than the larger picture. If you only look at a 10-day window of a stock price movement, or only look at the one piece of fundamental information on a firm’s balance sheet, you may be missing some other key factors in deciphering the true value of the stock.

Behavioral finance has significantly contributed to better understanding the stock market in terms of price movements, and investor’s behavior over the last 30 years. With the advancement of behavioral finance, we may be able to predict investor’s behavior in the future and improve market efficiency. Through challenging economic theories of utility maximization and the EMH, further discussions and studies will take place allowing us to

further explore decision making in equity markets. Continued advancement will help investors to understand their own limitations, and become more rational in the long-term.

Appendix

Data Results: Online Survey.

In addition to whatever you own, you have been given a gift of $1,000, free of charge. You are now asked to choose between the following:		
Answer Options	**Response Percent**	**Response Count**
A sure gain of $500	76.7%	66
A 50% chance to gain $1,000 and a 50% chance to gain nothing.	23.3%	20
	answered question	86

Linda is thirty-one years old, single, outspoken, and very bright. She majored in philosophy. As a student, she was deeply concerned with issues of discrimination and social justice, and also participated in antinuclear demonstrations. Thinking of Linda, what alternative is more probable?		
Answer Options	**Response Percent**	**Response Count**
Linda is a bank teller.	20.9%	18
Linda is a bank teller and is active in the feminist movement.	79.1%	68
	answered question	86

You purchased 100 shares of a well-known company stock a month ago at $80 a share. The stock recently peaked at $95 a share, but today has plummeted to $75a share. You look at the Yahoo Finance and see there is high volume of people selling their shares. You haven't heard any news today regarding the stock, and don't know why it's falling. What do you do?		
Answer Options	**Response Percent**	**Response Count**
Hold on to the shares, because they might go back up above your purchase price.	87.2%	75
Buy more shares because the price might go back up.	9.3%	8
Sell your shares at today's $75 value and and lose $5 per share from your purchase price as you don't know if the price will continue to fall.	3.5%	3
	answered question	86

You are offered a gamble on the toss of a coin. If the coin shows tails, you lose $100.If the coin shows heads, you win $150 . Is this gamble attractive? Would you accept it?		
Answer Options	**Response Percent**	**Response Count**
Yes	10.5%	9
No	89.5%	77
	answered question	**86**

Data Results: In person Survey for Driving Abilities.

Male/Female	Driver ranking	Average
M	9	7.51
F	8	7.51
M	6	7.51
F	5	7.51
M	5	7.51
F	8	7.51
M	6	7.51
F	7	7.51
M	6	7.51
M	9	7.51
M	7	7.51
F	6	7.51
F	8	7.51
F	8	7.51
M	9	7.51
M	9	7.51
F	9	7.51
M	6	7.51
M	8	7.51
M	9	7.51
F	8	7.51
F	9	7.51
F	7	7.51
M	8	7.51
F	9	7.51
M	8	7.51

M	8	7.51
F	7	7.51
F	9	7.51
F	4	7.51
M	9	7.51
M	6	7.51
F	8	7.51
F	8	7.51
F	7	7.51
Average	7.51	7.51

100 Day Daily Market Value Data.

1	1000	**36**	1210	**71**	1162
2	1001	**37**	1250	**72**	1160
3	1003	**38**	1260	**73**	1161
4	1002	**39**	1270	**74**	1161
5	999	**40**	1280	**75**	1160
6	999	**41**	1290	**76**	1151
7	996	**42**	1295	**77**	1149
8	995	**43**	1300	**78**	1148
9	1000	**44**	1315	**79**	1050
10	1001	**45**	1320	**80**	1045
11	1005	**46**	1325	**81**	1042
12	1006	**47**	1330	**82**	1041
13	1010	**48**	1333	**83**	1040
14	1011	**49**	1338	**84**	1038
15	1018	**50**	1345	**85**	1035
16	1019	**51**	1350	**86**	1029
17	1025	**52**	1375	**87**	1030
18	1030	**53**	1380	**88**	1033
19	1033	**54**	1390	**89**	1030
20	1030	**55**	1300	**90**	1025
21	1029	**56**	1250	**91**	1019
22	1035	**57**	1200	**92**	1015
23	1038	**58**	1180	**93**	1011
24	1040	**59**	1175	**94**	1005
25	1041	**60**	1160	**95**	1003
26	1042	**61**	1190	**96**	1002
27	1045	**62**	1180	**97**	1001
28	1090	**63**	1179	**98**	1000
29	1148	**64**	1178	**99**	995
30	1150	**65**	1175	**100**	996

31	1160	**66**	1170		
32	1170	**67**	1169		
33	1180	**68**	1168		
34	1190	**69**	1165		
35	1200	**70**	1165		

Data Results from Swallow and Fox Study:

Table 1: Abnormal returns in the New Zealand Stock Exchange for "Winner" and "Loser" Share Portfolios

Day (t)	Winning Stocks i.e., Large Positive Returns (150 observations)		Losing Stocks i.e.,Large Negative Returns (150 observations)	
	Abnormal return (%)	***t*-value**	**Abnormal return (%)**	***t*-value**
0	12.57	75.86**	-13.64	-85.86**
1	-3.09	-25.67**	2.15	20.21**
2	-0.24	-1.60	0.81	4.93**
3	-0.30	1.78	1.65	12.30**
4	-0.86	-4.56**	0.46	2.96
5	0.12	0.80	-1.33	-8.73**
6	0.03	0.12	1.25	7.97**
7	0.58	3.13*	0.14	0.90
8	-0.40	-2.50*	0.23	1.60
9	0.33	2.03	-0.22	-1.47
10	-0.58	-3.15	-0.34	-1.92

Note: * represents significance at the 0.10 level;
** represents significance at the 0.05 level.
Abnormal returns are those returns which occur following a market adjustment (refer Note 2).

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