

# **DECISION MAKING UNDER UNCERTAINTY THE IMPACTS OF EMOTIONAL INTELLIGENCE AND BEHAVIORAL PATTERNS**

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## **ABSTRACT**

*This paper provides a review of factors influencing and enhancing the decision making process in financial assets. Market participants may strive at reducing the degree of volatility in their wealth as well as reaching a satisfactory return on investment. Given the state of uncertainty prevailing in the financial markets investors may aim for obtaining adequate reward, avoid losses and minimizing regret from their actions. This appears to be as a result of reflexive responses, feelings and emotions as well as reflective processes. In particular, understanding, managing and regulating emotions appear to help in the decision making process. That is, the findings in the modern portfolio theory, psychology of investing as well as discoveries in neuroscience can collectively help in improving the decision making process.*

## **INTRODUCTION**

Since the early 2000s an exciting school of thought has emerged in exploring the role of emotional intelligence in the investment management process as a result of the interaction between neuroscience and financial economics. Emotions are unconsciously experienced as outcomes are guessed or imagined by an investment manager when faced with information disadvantage or partial ignorance in a highly dynamic and competitive investment environment. It is shown that indicators and ranking criteria for evaluating the degrees of emotional intelligence (for example, Mayor, Salovey and Caruso, 2002), generally reveal that investors with the ability to analyze and evaluate their emotional states as well as regulating and managing their emotional intelligence tend to make better decisions and appear to learn much from their mistakes especially when faced with an uncertain environment in which exact calculations are not possible (Ameriks, Wranik and Salovey, 2009).

This is further reinforced in findings by Coricelli, Critchley, Joffily, O'Doherty and Sirigu (2005) who show a strong relationship between emotions and signals encoded in the brain in that emotions such as regret or excitement appear to be tied to reward prediction errors that are processed in the regions of the brain similar to a mathematical risk prediction error function. Blackman (2014) states that "great strategies seem to draw on emotional and intuitive parts of the brain..." shown by neuroimaging. And that "A good strategic thinker would pay attention to emotion and social thinking, social temperature... and neuro-feedback for training the brain in learning endeavors." Loewenstein (2000) stresses that emotions were included as a part of utility analysis in 1789 by Jeremy Bentham in the decision making process. Maximization of the utility of the final wealth, for example, has been the prevalent rule in investment decisions since the 1950s with the development of the mean-variance analysis leading to the capital asset pricing model in portfolio theory.

Modern theories of finance are however based on the notion of rational behavior in the decision making process and on restrictive assumptions including the existence of complete

information regarding the payoff structure of financial assets. This implies that the average return and the likely fluctuations around it are known in advance. Furthermore, investors are assumed to be risk averse and thus would be willing to invest as long as the average payoff is expected to exceed the cost of the asset. An investor who is risk averse is expected to take a risky venture when the rise in wealth is expected to be greater than the fall in wealth. While the pleasure of gaining a dollar, on average, is less than the suffering from losing a dollar, investments are made as long as there is a net premium or reward for taking the risk involved.

Investors however may possess a loss aversion behavior and aim for avoiding the decline in wealth. Empirical evidence during the past three decades shows that investors appear to sell financial assets that have risen in price too quickly while keeping the loss producing ones for a long time. That is, investors react differently to gains and losses as they feel positive emotion from a gain in price but a much stronger negative emotion from an equal amount of loss. This behavioral financial pattern is, in part, due to cognitive heuristics and biases. In the mind of an investor a dollar gained in the retirement account does not cancel a dollar lost in the personal account. Furthermore, investors view a dollar received in dividend income differently from a dollar gained in capital gain even in the absence of differential taxes and transactions costs as they appear to consume the dividend while saving the capital gain. The feeling is that earning the capital gain had required more effort—taking more risk—as compared with the receiving the predictable stream of dividend income (Kahneman and Tversky, 1979; Thaler, 2000 and Statman, 2010). This view is different from those in the neoclassical finance as for example in Modigliani and Miller's (1958) irrelevance of the dividend policy of the firm as the dividend income and the capital gains are assumed to have the same value for the investor in the absence of differential taxes and transactions costs.

The notion of loss aversion, among other factors, brought about the development of behavioral finance in the 1980s by explaining the role of psychology and social psychology in the investment management process. Wood (2010) notes that the reaction of investors in the market is a combination of psychology, social psychology and the functioning of the brain in their decision making process. It is further likely that people may not process the available information in a comprehensive way. Instead, they reduce and simplify the existing information by using psychological shortcuts and rules of thumb (Dreman, 1995).

Ameriks, Wranik and Salovey (2009) examine the role of emotions in the investment decision making process. They study the degree to which investors identify, understand, interpret and effectively use their emotions. Emotional intelligence will add value in decisions with uncertain outcome. The authors measured the degree of emotional intelligence for investors in a retirement account and found that those with a higher level of emotional intelligence appear to manage a reasonable degree of allocation to equity or common stock and were thereby able to manage the portfolio risk. Such investors did not pursue a highly active trading strategy and were more conservative. In effect they utilized both reflexive as well as reflective planning in managing their investment portfolios. Furthermore, highly anxious and emotionally charged investors were less likely to make extreme asset allocation and tend to seek more information.

Mayew and Venkatachalam (2012) note and review that emotions conveyed by voice and its valence can transmit useful information to investors in the market. They study the conference calls data maintained by Thomas Reuters StreetEvents database for evaluating the positive and negative signals emitted by the tone of voice and its relationship with the firm's future earnings report as well as its stock performance. They find that investors perceive both positive and negative information conveyed by the tone of the voice, but security analysts appear to account

for only the positive one. In this manner, Mayew and Venkatachalam show that emotions reflected in voice provide a signal regarding the thinking processes by the respondents which can help in revealing possible private information. This is in line with Frijda (1988) who explains that emotions are the results of the evaluation of important events which are influencing the individual's concerns that are in part tied to the individual's line of thinking. Frijda (1993) further notes that "Emotion refers to a feeling that occurs in response to events, while affect is viewed as a valence of an emotional state."

Sapra and Zak (2010) note that when individuals are faced with risk, their reflexive part of the brain will influence a fast response for immediate safety in the short run at the same time that they will be using their reflective part of the brain looking for signals in a Bayesian revision process in the longer span of time with a delayed response. This will cause sharp changes in asset prices in the short run away from the equilibrium level.

## **EMOTIONS AND INFORMATION THEORY**

The notion of uncertainty in financial economics is often viewed as risk and measured as variance, standard deviation or covariance. Variance or standard deviations are indications of movements around an average value in the past. Covariance denotes the degree to which two assets are performing in relation to each other. That is, the manner in which their performance may converge over time. The variance-covariance analysis is further extended into beta which allows performance of an asset in relation to the market portfolio. Some problems associated with these notions of risk include the reliance of past data, the assumption of a normally distributed return and the extension of past observation into the future. Alternatively, one may use a forecast of such a probability distribution. However, as Sargent (2014) notes we do not know how an individual or the market may arrive at such a probability distribution and the states of nature. In addition the assumption that all market participants may think in the same manner is questionable.

Uncertainty however relates to cases of error in estimate, the inability to predict the outcome, the presence of noise in the market, or a case of novelty in which no prior information is available. In addition, there may be a dispersion of beliefs among the participants in the market as in Hirshleifer (1973). The role of lack of information or the state of ignorance in construction of a probability distribution in asset prices is studied by Sargent (2014) noting that numerous models are built on the basis of the likely future outcome and their associated probabilities. This assumed probability distribution however appears to be based on the convergence of opinions of market participants all of whom might have some degree of ignorance regarding the market. Further that such a rule of large numbers and the notion of complete market fail in the face of occurrence of some infrequent trades with large impacts and incomplete information.

While Bayesian revision estimates may be used in the decision making processes, Sargent notes the Ellsberg Paradox in which decision makers did not appear to apply it due to an ambiguity or uncertainty regarding the initial probability distribution. In such a case, Sargent notes that the decision maker would likely pursue the mini-max regret as we tend to maximize our welfare in the face of perception that the market may be minimizing our gain. In line with this, ambiguity is measured by entropy as a measure of divergence between the expected and observed distributions (Hansen and Sargent, 2008). In Addition, Hansen and Sargent (2010) further note that changes in the degree of ambiguity and incomplete information tend to lead to market fragility in which decision makers would pursue the mini-max regret behavior in dealing

with uncertainty. Such a behavior could potentially cause large swings in the market especially on the down side. This model of investor behavior is noted to appear to be in line with Black and Littlerman (1992) stating doubts in the mind of decision makers regarding the estimated average returns while showing agreement on the estimated covariance.

In this line of thinking, Shackle (1972) reviews the notion of uncertainty resulting from economic decisions and explains the nature of the feelings that result from the outcome. In each decision one is limited to a single action. In some circumstances the decision maker might have taken such actions before, for example, trading a type of bond or common stock. However the rules underlying such decisions are based on past information, the likely reactions of others in the market, the evolving nature of information disseminated to the market as well as the change in the nature of the market. Shackle compares the observed results of an action with the expected or anticipated outcome. The occurrence of an event which was expected should cause no surprise to the decision maker. The divergence of the outcome and what was expected causes a surprise. That is, Shackle defines surprise as a notion of uncertainty as one's state of feelings regarding the degree of divergence between the observed result and the expected outcome. The greatest surprise is associated with the occurrence of an event which was not expected. Uncertainty is thus measured as the degrees of surprise in line with an entropic design in the context of information theory.

In doing so, an individual may not necessarily pursue the pure optimization process and instead would take into account the resulting emotions from any decision. In effect investors would be pursuing a satisfying approach to decision making as in Simon (1955). While the cognitive aspects and magnitude of risk may remain unchanged, emotional notions and degrees of risk vary and may intensify rapidly. Loewenstein indicates that the intensity of emotions resulting from an event leads to a change in the degree of risk aversion. In line with this behavioral pattern, in order to see how winners, for example, tend to make more bets and losers would stay away from taking more risk one can consider the asymmetric interdependence of actions and outcomes as shown by Perez and Tondel (1965) in which the dependence of  $x$  on  $y$  may differ from the dependence of  $y$  on  $x$  as the interdependence may be path dependent. If informational dependence of  $x$  on  $y$  is denoted as  $I\left(\frac{x}{y}\right)$ , information contained in an action or event  $x$  is denoted as  $I(x)$  and the information contained in an action or event  $y$  is denoted as  $I(y)$  and the joint information contained in both  $x$  and  $y$  is denoted as  $II(x, y)$  then informational dependence of  $x$  on  $y$  is denoted  $I\left(\frac{x}{y}\right) = \frac{II(x,y)}{H(x)}$  and informational dependence of  $y$  on  $x$  is denoted as  $I\left(\frac{y}{x}\right) = \frac{II(x,y)}{H(y)}$  where the numerical values of  $I\left(\frac{x}{y}\right)$  or  $I\left(\frac{y}{x}\right)$  are in between zero and one.

This entropic view of correlation shows the amount of information that may be needed to make a decision based on an observation and thereby the state of ignorance or uncertainty in the system. At the same time, it shows how each outcome can influence the decision maker in later actions. Information denotes an increase in knowledge while entropy refers to the amount of information that is needed to remove the uncertainty in the decision making process as a measure of divergence or discrepancy between  $I\left(\frac{x}{y}\right)$  and  $I\left(\frac{y}{x}\right)$ . One may consider an action ( $x$ ) to be reflexive in nature while as for action ( $y$ ) due to the reflective decision making processes.

## EMOTIONS AND INVESTMENT DECISIONS

Emotional intelligence complements the theories formed in behavioral finance. Ackert, Bryan and Deaves (2003) show the role of emotional responses in enhancing decision making without contaminating judgment. Emotional intelligence in effect provides guidance for optimal decisions under uncertainty (Schwarz, 1990). In an interview-structured research design, Tuckett and Taffler (2012) analyzed statements of professional investment managers and found it to be a case of decision making with incomplete information in both the amount and quality of the available knowledge in regards to the state of the financial markets.

Tuckett and Taffler (2012) study the role of emotions and feelings in investment portfolio management and trading processes when decisions are made in a rapidly changing environment and in which every decision must be highly convincing. They strive at appraising the role of cognitive as well as emotions in the decision making process. While investors are speculated to act on the basis of fear, greed and hope, Tuckett and Taffler perceive the process to be the case of excitement, anxiety and denial. They note that this may be due to “cognitive biases” and “affect heuristic” as the outcome of decisions cannot be known in the presence of ambiguity in the market.

Emotions, intuition, and gut feeling appears to be an integral part of thinking and decision making and tend to raise the capacity and in the speed of actions by combining the reflective and reflexive parts of the brain. In a market characterized by conflicting signals money managers may form an opinion based on the likely actions of others by increasing the state of knowledge and gaining information advantage by the merits of signals transmitted by business enterprises. In this process Tuckett and Taffler believe that money managers form an emotional relationship with their investments tantamount to love and hate depending on the outcome.

Tuckett and Taffler further indicate that this ambivalent relationship causes feelings of pleasure and anxiety at the same time. Money managers may avoid or repress the negative thought or their state of ignorance and make actions with no doubt. This may be strengthened by group thinking. That is a divided state of mind may be formed which is a case of excitement and anxiety as a pervasive neurophysiological emotional state which is unconscious with powerful impact on investment decisions. On the contrary an integrated state of mind may prevail among the money managers in which uncertainty is recognized and the occurrence of possible outcomes are explained which appears to be in line with Shackle (1972) and Simon (1955).

Decisions based on feeling could be either more risk averse or less risk averse depending on personality characteristics. Past negative experiences in the market often cause fear of losing thereby making trading decisions in a highly cautious manner. On the contrary, an investor may have a hope to benefiting from a constantly developing investment opportunities and thereby making fast and frequent trading decisions. Fenton-O’Creery, Soane, Nicholson and William (2011) find that traders who control and regulate their emotional responses have a better performance. As an indicator of superior performance the authors used the subsequent rise in pay in major investment banks. The traders noted that their own emotions appear to be a useful source of information regarding the likely state of the market.

Hirshleifer (2001) notes that misevaluation and risk are tied to expected return on assets. While an investor’s mind uses heuristics and rules of thumb that are similar among the participants causing systematic biases as in Kahneman and Tversky, investors are subject to emotions that can influence cognitive processes. Investors are further influenced by regret aversion when making decisions. Simon (1955) explains a bounded rational behavior leading to a

satisfying goal in the decision making process due to limited time and cognitive power when faced with a complex environment.

Tuckett and Taffler (2012) note that the notion of risk to money managers is asymmetric as losses from their actions have negative consequences while outperforming the market does not appear to be rewarded. Thereby, they tend to stay close to their perception of the average market asset allocation. Meanwhile, the risk of shortfall and the pressure to outperform the market causes anxiety and fear. Faced with this emotional conflict, money managers strive at finding a connection between the observed information, its implications and probable outcome in order to reduce uncertainty enabling them to make a decision. The lack of complete information, or when faced with partial ignorance, combined with the varying degrees of interpretation of financial events were found to lead to a state of anxiety among these investors. Tuckett and Taffler found that their selected professional investors viewed each decision in an isolated environment in which the outcomes were guessed or imagined but not known which stimulated emotions.

Zweig (2010) states that emotion may override cognitive and analytical reasons in the decision making process and is contagious in the market. Emotional reactions of losing money for example is based on the function of amygdala in the brain as the risk perceived by the reflexive part of the brain, which will lead to a fast response in deciding to sell. As many people appear to share the same information, the intensity of selling will rise and lead to a sharp decline in price. Ricciardi (2010) notes ambiguity as an important source of risk which includes cognitive as well as emotional dimensions. In particular MacGregor, Slovic, Berry and Evensky (1999) estimate that worry, volatility and knowledge explain 98 percent of perceived risk.

## **CONCLUSION**

The capital markets may be viewed as a noisy channel transmitting large amount of data in a sporadic manner and often contradictory to investors expectations. Various techniques are used to recognize probable patterns and information for enhancing the quality of the investment decisions. Yet the ambiguous nature of the markets creates an uncertain environment causing anxiety and fear when faced with negative outcomes. In the presence of anxiety and the lack of ability to make a sound judgment, an investor may perhaps follow a path of minimizing regret, as opposed to maximizing gain. In effect, decisions may be based on maintaining a desired level of satisfaction as a result of the interactions between the emotional and reflective responses. In this paper the various views regarding the notion of uncertainty are explained and noted that the investment environment is highly observed and thereby it is imperative for the investor to perceive, identify, understand, use and manage their emotions to maintain an acceptable level of performance.

Measures of risk such as variance, covariance, entropy and informational dependencies of events in the market are useful tools and a guide to action. In addition, the market participants are noted to be further influenced by their reflexive and emotional responses as an additional source of information in the decision making process. That is, a psychologically attuned and emotionally intelligent investor should be able to add value, perhaps by balancing the reflexive and reflective forces. It is noted that knowledge gained from the findings in behavioral science and neuroscience help in increasing our knowledge regarding the decision making process in the capital markets. This, in part, helps in reducing the emotional conflicts caused by errors in judgment.

While investors may pursue a risk averse or loss averse behavior, they may further aim for minimizing the maximum regret not just for the present but for the probable later state of

their feelings. This may result in quick responses to events in the market causing much short term fluctuations in asset prices while their reflective judgment as a group would tend to bring such market conditions to an equilibrium level. Emotional intelligence appears to help investment managers and traders in the capital markets to form an opinion regarding the likely actions of others and thereby reducing the degree of ambiguity in the market.

## REFERENCES

- Ackert, Lucy F., Bryan K. Church and Richard Deaves (2003). Emotion and Financial Markets. *Economic Review*, Federal Reserve Bank of Atlanta, Second Quarter, 33-41.
- Ameriks, John, Tanja Wranik, and Peter Salovey (2009). *Emotional Intelligence and Investor Behavior*. Charlottesville, VA: The Research Foundation of CFA Institute.
- Baker, H. Kent and John R. Nofsinger, (eds.), (2010). *Behavioral Finance: Investors, Corporations, and Markets*, Hoboken, NJ: John Wiley & Sons.
- Black, Fischer and Robert Litterman (1992). Global Portfolio Optimization. *Financial Analysts Journal*, 48(5), September/October, 28-43.
- Blackman, Andrew (2014), Inside the Executive Brain. *The Wall Street Journal*, Monday, April 28, R1-R2.
- Cornell, Bradford and Richard Roll (2005). A Delegated-Agent Asset Pricing Model, *Financial Analysts Journal*, January/February, 57-69.
- Coricelli, G., H.D. Critchley, M. Joffily, J.P. O'Doherty, and A. Sirigu (2005). Regret and its Avoidance: A Neuroimaging Study of Choice Behavior. *National Neuroscience*, 8, 1255-1262.
- David Dreman (1995). Out Psyching the Market – 1995 Money Guide. *Forbes*, June 19, 162-168.
- Dreman, David (1984). *Contrarian Investment Strategy*. New York, Random House.
- Fenton-O'Creevy, Emma Soane, Nigel Nicholson and Paul William (2011). Thinking, Feeling and Deciding: The Influence of Emotion on the Decisions Making and Performance of Traders. *Journal of Organizational Behavior*, 32,1044-1061.
- Frijda, Nico H., (1988). The Laws of Emotion, *American Psychologist*, 43, 349-358.
- Frijda, Nico, (1993). Mood, Emotion Episodes and Emotions, in M. Lewis and J. Haviland, eds.: *Handbook of Emotions*, NY: Guilford Press.
- Hansen, Lars P. and Thomas J. Sargent (2008). *Robustness*, Princeton, NJ: Princeton University Press.
- Hansen, Lars P. and Thomas J. Sargent (2010). Fragile Beliefs and the Price of Uncertainty. *Quantitative Economics*, 1(1), August, 129-162.
- Hirshleifer, J. (1973). Where Are We in The Theory of Information? *American Economic Review*, Papers and Procedures, May, 31-39.
- Hirshleifer, David (2001). Investor Psychology and Asset Pricing. *The Journal of Finance*, LVI(4), August, 1533-1597.
- Janis, I. L. and L. Mann (1977). *Decision Making: A Psychological Analysis of Conflict, Choice, and Commitment*. New York: The Free Press.

- Kahneman, D. and A. Tversky (1982). Prospect Theory: An Analysis of Decision Under Risk, *Econometrica*, 47, 263-291.
- Loewenstein, George (2000). Emotions in Economic Theory and Economic Behavior, *American Economic Review*, 90(2), May, 426-432.
- MacGregor, Donald G., Paul Slovic, Michael Berry and Harold R. Evensky (1999). Perception and Financial Risk : A Survey of Advisors and Planners, *Journal of Financial Planning*, 12(8), 68-86.
- Mayer, J. D., P. Salovey and D.R. Caruso (2002). *Mayer-Salovey-Caruso Emotional Intelligence Test (MSCEIT) User's Manual*. Toronto: MHS Publishers.
- Mayew, William J. and Mohan Venkatachalam (2012). The Power of Voice: Managerial Affective States and Future Firm Performance. *The Journal of Finance* , LXVII(1), February, 1-43.
- Modigliani, Franco, and Merton Miller (1958). The Cost of Capital, Corporation Finance and The Theory of Investment, *American Economic Review*, 48(3), June, 261-297.
- Perez and Tondel (1965). *Information and Prediction in Science*, 15-37 in Dockx, S. and Bernays (eds.). Academic Press.
- Ricciardi, Victor (2010). The Psychology of Risk, in Baker and Nofsinger (eds.), *Behavioral Finance: Investors, Corporations, and Markets*, Hoboken, NJ: John Wiley & Sons., 131-149.
- Sapra, Steven G. and Paul Eak (2010). Eight Lessons from Neuro-economics in Money Management, in Wood (ed.), *Behavioral Finance and Investment Management*. Charlottesville, VA: Research Foundation of CFA.
- Sargent, Thomas J. (2014). Rational Expectations and Ambiguity. *Financial Analysts Journal*, 70(2), 14-19.
- Schwarz, N. (1990). Feeling as Information: Informational and Motivational Functions of Affective States. In *Handbook of Motivation and Cognition*, E.T. Higgins and R.M. Sorrentino, (eds.) New York, NY: Guilford Publishing.
- Shackle, G.L.S. (1972). *Uncertainty and Expectations in Economics*. Cambridge University Press.
- Simon, Herbert. A., (1955). A Behavioral Model of Rational Choice, *Quarterly Journal of Economics*, 69, 99-118.
- Statman, Meir, What is Behavioral Finance, in Wood, (ed.) (2010). *Behavioral Finance and Investment Management*. Charlottesville, VA: Research Foundation of CFA Institute, 1-12.
- Taffler, R.J. and D. Tuckett (2010). Emotional Finance: The Role of the Unconscious in Financial Decisions. In Baker and Nofsinger (eds.), *Behavioral Finance: Investors, Corporations, and Markets*, Hoboken, NJ; John Wiley & Sons.
- Thaler, R. H. (2000). From Homo Economicus to Homo Sapiens. *Journal of Economic Perspective*, 14(1), 133-141.
- Tuckett, D. (2011). *Minding the Markets: An Emotional Finance View of Financial Instability*. Basingstock, U.K.: Palgrave Macmillan.
- Tuckett, David and Richard J. Taffler (2012). *Fund Management: An Emotional Finance Perspective*. Charlottesville, VA.
- Wood, Arnold S., (ed.) (2010). *Behavioral Finance and Investment Management*. Charlottesville, VA: Research Foundation of CFA Institute.
- Zweig, Jason, Fear, in Wood, (ed.) (2010). *Behavioral Finance and Investment Management*. Charlottesville, VA: Research Foundation of CFA Institute, 24-46.