

CAPITAL UNIVERSITY OF SCIENCE AND  
TECHNOLOGY, ISLAMABAD



**Impact of Neurotransmitters,  
Emotional Intelligence and  
Personality on Investor's  
Behavior and Investment  
Decisions**

by

Mumtaz Ahmad

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**Impact of Neurotransmitters, Emotional  
Intelligence and Personality on Investor's  
Behavior and Investment Decisions**

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*To my beloved mother, wife & kids;*

*To whom I owe my whole life.*

*To my respected mentor, teachers & supervisor, who made me able to conduct  
this research, helped me, and gave me courage and support.*

*To my friends & students, who care for me, helped me, and pray for me,*

*To all . . .*

*With millions of thanks and gratitude*



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This is to certify that the research work presented in the thesis, entitled “**Impact of Neurotransmitters, Emotional Intelligence and Personality on Investor's Behaviour and Investment Decisions**” was conducted under the supervision of **Dr. Muhammad Mazhar Iqbal**. No part of this thesis has been submitted anywhere else for any other degree. This thesis is submitted to the **Department of Management Sciences, Capital University of Science and Technology** in partial fulfillment of the requirements for the degree of Doctor in Philosophy in the field of **Management Sciences**. The open defence of the thesis was conducted on **June 24, 2019**.

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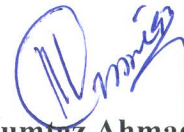
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## *List of Publications*

It is certified that following publication(s) has been made out of the research work that has been carried out for this thesis:-

1. Ahmad, M. (2018). Impact of Neurotransmitters, Emotional Intelligence and Personality on Investor's Behavior and Investment Decisions. *Pakistan Journal of Commerce and Social Sciences*, 12(1), 330-362, 2018.

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**“If you are grateful, I will give you more”**

Surah Ibrahim, V. 7

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## *Abstract*

Mainstream of the investors and investment advisory consultants both suggest and focus on standard finance models and do not take into account the neurological dimensions of finance as neurotransmitters and behavioral psychological dimensions of investors as Emotional Intelligence (EI) and Personality. When investors make investment in the stock market then these aspects of individual investors can cause of several mistakes which may lead to loss due to the unprofitable decisions, etc.

In the informed financial system and knowledge base economy, profitable investment program is not only imitative as of conventional and standard finance models or concepts but also use of neurology and behavioral psychology in finance. So, this study would be center of attention on shaping the impact of Neurotransmitters, Emotional Intelligence and Personality measures on Investor Behavior and its eventual rear-ender on investment decisions.

This study used the primary data; the data type is the cross sectional and collected with the help of questionnaire. Population of the study consists of investors in stock market of Pakistan. Sample size composed of 455 investors in the Pakistan Stock Exchanges. The data analysis performed with the help of partial least square base structural equation modeling (PL-SEM), especially hierarchical latent variable by using reflective-formative types model with the help of two stage approach as guided by (Becker et al., 2012).

The empirical evidence of the study reveals that personality dimensions especially openness and consciousness as well as emotional intelligence dimensions especially self emotions appraisal and regulation of emotions have significant relation with the behavioral features of investor especially investment horizon, personalization of loss and control level. Similarly, documented that neurotransmitter's dimension dopamine and epinephrine have significant relation with investment decisions of individual investors. In view of this, documented that emotional intelligence, neurotransmitters and personality have 13.2% impact on investor behavior and these dimensions have 4.1% impact on investment decisions of individual investor.

The empirical findings of study contribute in the theory that the fight-or-flight response theory and system of reward, theory of multiple intelligence and trait theory have superior grounds towards assessing the tendency of investor behavior and their investment decisions.

The study have wider pragmatic use for individual investors, academic researchers, consultants and investment managers of brokerage houses because it is significant for them to know the connection of behavioral and neurofinance concepts with investor behavior of individual and their investment decisions for their individual scheduling the economic decisions in the Pakistan Stock Exchange.

The empirical findings of the research open new horizon for advancement in field of neurofinance and behavioral finance. So, these avenues will provide supplemented inner view of investor's behavior and their decision's in the stock market of Pakistan and demand more and more effort to determine universal latent constructs for combine model of neurofinance and behavioral finance.

**Keywords: Neurofinance, Behavioral finance, Neurotransmitters, Emotional intelligence personality, Investor behavior and Investment decisions.**

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# Abbreviations

<b>AGFI</b>	Adjusted Goodness of Fit Index
<b>Agr</b>	Agreeableness
<b>AVE</b>	Average Variance Extracted
<b>CB-SEM</b>	Covariance Based Structural Equation Modeling
<b>CFA</b>	Conformatory Factor Analysis
<b>CFI</b>	Comparative Fit Index
<b>CR</b>	Composite Reliability
<b>CMIN/DF</b>	Chi-square Mean/Degree of Freedom
<b>Cons</b>	Conscientiousness
<b>Conf</b>	Confidence
<b>Cont</b>	Control
<b>D</b>	Dopamine
<b>E</b>	Epinephrine
<b>EFA</b>	Exploratory Factor Analysis
<b>EI</b>	Emotional Intelligence
<b>Ext</b>	Extraversion
<b>FTSE</b>	Financial Times Stock Exchange
<b>GFI</b>	Goodness of Fit Index
<b>HTMT</b>	Heterotrait-Monotrait Ratio
<b>IB</b>	Investor Behavior
<b>ID</b>	Investment Decisions
<b>IH</b>	Investment Horizon
<b>KMO</b>	Kaiser Meyer Olkin
<b>MSCI</b>	Morgan Stanley Capital Investment
<b>N</b>	Norepinephrine
<b>NFI</b>	Normed Fit Index

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<b>NNFI</b>	Non-normed Fit Index
<b>Neu</b>	Neuroticism
<b>NT</b>	Neurotransmitters
<b>OEA</b>	Other's Emotion Appraisal
<b>OPE</b>	Openness
<b>PGFI</b>	Parsimony Goodness of Fit Index
<b>PNFI</b>	Parsimony Normed Fit Index
<b>PL</b>	Personalization of Loss
<b>PLS-SEM</b>	Partial Least Square Structural Equation Modeling
<b>PR</b>	Personality
<b>PSX</b>	Pakistan Stock Exchange
<b>RA</b>	Risk Attitude
<b>RMR</b>	Root Mean Residual
<b>RMS</b>	Root Mean Square
<b>RMSEA</b>	Root Mean Square Error of Approximation
<b>RNI</b>	Relative Non-centrality Index
<b>ROE</b>	Regulation of Emotion
<b>S</b>	Serotonin
<b>SEA</b>	Self Appraisal of Emotions
<b>SMV</b>	Shared Maximum Variance
<b>SSND</b>	Symptom Scale Neurotransmitters Deficiency
<b>TLI</b>	Tucker Lewis Index
<b>UOE</b>	Use of Emotion
<b>USA</b>	United States of America
<b>VIF</b>	Variance Inflation Factor

# Chapter 1

## Introduction

### 1.1 Historical Background

The surroundings of the stock market are becoming very competitive in the world integrated economy, whereas the investors in Pakistan Stock Market are progressively more worried on the subject of humanizing their acts to meet up the modern challenges. However, according to Alam (2015) there are approximately 0.22 million individual investor at Pakistan Stock Exchange (PSX). As said by Associated Press of Pakistan (2016) PSX is paramount amongst the globally most excellent performing stock exchanges between the 2009 and 2015. PSX will be the front line for establishment of flaxen, well-organized, gung ho place as well as will turn into regional center for investors (Hijazi, 2016). PSX re-sorted as front line souk to growing souk while reviewing the semiannual index (Morgan, 2017). According to Akhtar (2016) on 28th May 2016, total capitalization of PSX was approximately \$98 billion and 400 centers to facilitate the trading on the floor of exchange.

In view of above mentioned information related to the Pakistan Stock Market, mainstream of the investors and investment advisory consultants both suggest and focus on standard finance models and do not take into account the neurological facets of finance and behavioral psychological aspects of investors. These aspects of individual investors can cause several mistakes while investing in stock market as to make unprofitable decisions etc.

Normal investors behavior takes part an indispensable job in sustainability, efficiency as well as prosperity of the investing environment in liberated financial system. Neurotransmitters as reward related signal or brain information movement, Emotional Intelligence (EI) and personality are being documented, at the same time as a system in support of scheming along with implementation of a self-regulated checking and remedial method, where feeling or sentiment or emotion as statistics or figures. This study would be center of attention on shaping the impact of neurotransmitters, EI and Personality measures on investor's behavior and its eventual rear-ender on investment decisions in stock market.

The transformation in the financial system as well as scenery of equity investment sector from investing to profit/loss concentrated actions has activated the worth of neurofinance concept as neurotransmitters. However, previously studies relevant to variables are as, neurotransmitters are chemical messenger in human brain which generates the signals from one neuron to another neuron (Lodish, 2000). In individuals neurotransmitters enter into a most important responsibility in daily life and working (Cherry, 2015). Neurotransmitters composed of dopamine, serotonin, epiphrine and norepiphirine which may have association with investor behavior of individuals. Harlow and Brown (1990) explored that dopamine, serotonin and norepinphrine as the neurotransmitters because these involve in signaling and have relation with investor's behavior.

Frydman (2012) studied that dopamine, serotonin; epinephrine and norepinphrine function as neurotransmitters in the central neural scheme of human being. These neurotransmitters act as neural circuit. Kuhnen and Knutson (2005) discussed the neurotransmitters as neural circuit. These neural circuits act as carrier of brain information. Shimokawa et al (2009) discussed the prediction of investor's behavior from the brain information. Neurotransmitters have a say toward the investors behavioral facets such as attitude of risk, optimism and overconfidence. Pompian (2006) explored that dopamine has contribution towards the investor's behavioral aspects for instance optimism, overconfidence and Loss aversion possibly will be a straight forward outcome of low level of serotonin. Individuals have different presences towards the risk as Preuschoff et al (2006) illustrated that

dopamine is associated with risk and reward. Kuhnen and Chiao (2009) studied and found that neurotransmitters dopamine and serotonin are important factors of risk taking in decisions of investment and these mentioned neurotransmitters have consequence towards the method a human being process the facts and figures related to the financial incentive as well as the loss avoidance.

Roe et al (2009) investigated that neurotransmitter as dopamine and serotonin are considered to be connected with risk attitude. Pompian (2006) explored that the most of individual investors earn profit in the stock market during the panic situations and during the fight or flight situations. Cohen and Hamrick (2003) explored that the neurotransmitters as norepinephrine and epinephrine give force to run away or probably keep him in a struggle. Kuhnen et al (2013) studied that in individuals presence of less serotonin indicates that less involvement in the equity investment and fewer line of credit.

In the informed financial system and knowledge base economy, profitable investment program is not only imitative as of conventional and standard finance models or concepts but also use of behavioral psychology in finance. Only standard finance models cannot give assurance of valuable scheme of business. Psychological variables in finance as Emotional Intelligence and investor's behavior are helpful in stock market operation.

Salovey and Mayer (1990) described that emotional intelligence as "a form of social intelligence that involves the ability to monitor one's own and others feelings and emotions, to discriminate among them, and to use this information to guide one's thinking and action". Mayer and Salovey (1997) explored the emotional intelligence like a four stem model that include the subsequent capabilities as perceiving emotion, using emotions to ease the thinking, understanding emotion and managing emotions.

Mayer, et al. (2000) describe the EI as sentiments are mind-set that someone have whereas cleverness as the capability of reasoning with something. Cherniss (2000) describes that emotional intelligence shows the approaches wherein one makes fastidious large support in the coming time period. Ameriks et al. (2009) studied and found the clue of significant associations between emotional intelligence and

investor's behavior in numerous, although not the entire areas which were investigated. Lerner et al (2004) investigated that Individual investors who can utilize the emotion intelligently formulate investment decisions as they have optimistic mental condition. Rubaltelli et al (2015) studied that emotional intelligence estimate the motivation for the investment as well as EI has a distinctive consequence on investor's behavior by manipulating the additional extent that was explored. Salovey (2006) described that emotional intelligence has relationship with behavioral features of investor as loss aversion, endowment effect and status quo bias. Lubis et al. (2015) studied that emotional intelligence; personality and defense mechanism have relationship with individual investor decisions.

If psychological variables in finance as personality and individual investor behavior are efficient and helpful in stock market operation, then it is impossible for the investors not be successful in information base world and integrated equity market system. As we know that personality is the concept which has been derived from the diverse theoretical corner as well as different phases of ideas (John, Hampson, & Goldberg, 1991). Every phase has special input to our sympathetic of human being contradiction of actions as well as know-how (John & Srivastava, 1999). One most important and repeatedly phase on which research work has done is personality trait (John & Gosling, 2000).

Collard (2009) studied the individual investor behavior and found that attitudes toward the hazard have relationship with the variety of things including demographics, personality and intensity of financial familiarity.

Individual investor's behavior has been recognized as a most important component in the stock market which acts as a conclusive mechanism for the investment program of individuals that give surprising economic wards. Similarly, Personality as a psychological dimension in behavioral finance is efficient and helpful in stock market operation because it has links with individual investor behavior as mentioned in the given literature. As, Bakker et al (2010) investigated the "a social network model of investment behavior in the stock market" and found that personality have association with investor's behavior in the stock market.

Similarly, Durand et al (2013) explored that personality traits have correlation with investor's overconfidence and overreaction while investing in the stock market. Mallick (2015) investigated that different personality traits have straight and unambiguous relation with different behavior aspects of individual investor. Rizvi and Fatima (2015) investigated and found that investor's personality traits such as extraversion, agreeableness, conscientiousness, neuroticism, and openness have relationship with the individual investor behavior.

Investor's behavior has been identified as a most key element in the capital market which acts as a decisive operator towards investment program that give astonishing economic benefits. Meanwhile, Wood & Zaichkowsky (2004) mentioned that behavior constructs of investors are as risk attitude, personalization of loss, investment horizon, confidence and control. Ghun & Ming (2009) performed the research in the Malaysian perspective and exposed that constructs of investor's behavior are overconfidence, anchoring, loss aversion and representativeness. Chin (2012) also studied the investor behavior in Malaysian stock market and mentioned in his work that regret, self-confidence, belief and snake and bite effect shapes the investor's behavior.

Thapa (2014) studied the individual investor behavior in the Stock Market of Nepal and said that Overconfidence, optimism, risk attitude and involvement are constructs which shapes the investors behaviors. Tedongap (2015) exposed that different investment horizon have different relation with cross sectional expected gain from stock. Alaoui et al (2015) performed investigation in the Islamic Dubai Financial Market index, regional Islamic indices such as GCC index, ASEAN index, Developing Countries index, Emerging Countries Index, and the Global Sukuk market and found that investment horizon have association with gain of stock.

Dangl et al. (2015) revealed that loss-averse investors come out to utilize a standard for assessment to estimate the profit and loss of investment of bunch of stock of different companies. Ang & Ismail (2015) explored that anchoring may has

constructive relationship with gain on the stock market and other which were investigated. Sheikh & Riaz (2012) found that overconfidence has association with stock market gain and other things as volatility and trading volume.

After discussing the historical background of study, it has been viewed that role of facets of neuro and behavioral finance towards the behavior of investors and their decisions of investment in the stock markets of developed world but the role of mentioned facets of study in PSX is untouched and demand more study due to which it is beneficial for indigenized as well as foreigner investor. So, every individual investor wants to avoid these neuro and behavioral mistakes by incorporating these dimensions of study in sense as, being a carefully conscious of neurotransmitter's consequence, attractive personality and Effective Emotional Intelligence focus the investor behavior so as to maximize the value of equity while leading toward the best interest of investors. Therefore, impact of neurotransmitters, emotional intelligence and personality on investment decisions in stock market need to be considered indirectly through investor behavior.

## 1.2 Identification of Research Gaps

This research highlights a spot that over and over again stay unnoticed in the field of neurofinance such as neurotransmitters and different dimensions behavioral finance in a combine way and the initial confirmed connection among neurotransmitters and investment decisions of individual, especially in Pakistan Stock market. Reason behind the combining of these dimensions of neurofinance and behavioral finance are the argument of Olsen (2007) about the decision making, he said that human decisions come simultaneously from two sides, one of them is biological side and other is behavioral side.

Further the investigation expands and pursues the upcoming direction related to research recommended by Ameriks et al. (2009) emotional intelligence and different psychological aspects of investor behavior. Kuhnen et al (2013) during the investigation of the different neurotransmitters and financial choice, found unclear relation and recommended that further studies of neural or hormonal influence on



the investment decisions of investors with large sample size. Mosher and Rudebeck (2015) while investigating “The amygdala accountant” recommended the further studies on reward related planning signals association with cognitive functions.

This research would not just confirm and prove with the help of facts which formerly unverified relationship but collectively may add to the lasting artistic work by evaluating initial structural sketch linking the measures of neurotransmitters, emotional intelligence, personality, investor behavior and investment decisions in stock market and will demonstrate that effective neurotransmitters, EI, personality measures direct to improve investor behavior and superior investment decisions in stock market. However, after review of extensive literature, it has been observed that previously in most of studies the measurement of neurofinance concept such as neurotransmitters was ambiguous but in this research, to avoid methodological issues author construct and validate the scale of neurotransmitter’s latent constructs such as dopamine, serotonin, epinephrine and norepinephrine.

### 1.3 Some Related Theories

This study is based on the number of supporting theories as Fight-or-flight response theory, Trait theory or dispositional theory, The theory of multiple intelligences, Decision theory, Prospect theory, Bounded rationality, Biosocial theory, Expected utility theory and the theory of security of market over and under reaction. However, description about the mentioned theories is given below.

Fight-or-flight response theory states that a physiological response that happen in reply to an apparent risky incident to the continued existence. This fight or flight response theory is due to neurotransmitter Epiphine (Cannon, 1929).

Decision theory phrase firstly used by (Lehmann, 1950) and then Hirshleifer (2009) defined as decision theory is analysis of the behavior of an individual facing non strategic uncertainty or if other individuals are involved, their behavior is treated as a statistical distribution known to the decision maker.

Prospect theory is a behavioral theory of finance for decision making which states that individual's decisions are supported by the possible worth of losses as well as gain than the ultimate result, furthermore that individual make assessment of these losses and gains by using sure psychological shortcuts to relieve the burden of mindful mental activities for decision making (Kahneman & Tversky, 1979).

Bounded rationality is the theory of decision-making under wisdom as is limited because of availability of incomplete information, limitations in the procedure of thinking, expertise as well as understanding mentality and the limited amount of time for decision making (Simon, 1983). Biosocial theory is theory in the behavioral and social sciences that help in personality disorder, mental problems to biologically determined personalities traits reacting to the environment (Cloninger, 1986).

Expected utility theory: states that how to select reasonably while not certain about the outcome which may be result of your proceeds. The fundamental motto is: select the proceeds along with the maximum anticipated usefulness (Mongin, 1997).

Theory of security of market over and under reaction based on the two psychological issues as overconfidence and self attribution which cause asymmetric move in investor's confidence as a function of investment outcome and correlation between future returns of stock and self attribution (Daniel et al, 1998).

Trait theory or dispositional theory deal with the study human personality which consist of routine behavioral outlines, thinking, as well as feelings (Kassin, 2003).

The theory of multiple intelligences was introduced by (Gardner, 1983), he revealed that normal concept of intelligence is completely unsuccessful to explicate abilities of cognition.

After completing the description of theories, now it has been revealed that theory of multiple intelligence deal with second order latest construct emotional intelligence (self-emotion appraisal, other's emotion appraisal, regulation of emotion and use of emotion). Similarly, system of reward theory and fight and flight theory has links with second order latent construct neurotransmitters (epinephrine,

norepinephrine, dopamine and serotonin). Whereas, trait theory or dispositional theory deal with second order latent construct personality (agreeableness, conscientiousness, extroversion, neuroticism and openness), similarly, biosocial theory to some extent also deal with personality.

Prospect theory link with behavioral aspect loss aversion of individual investor, however bounded rationality theory, and expected utility theory and theory of over and under reaction of security market also associated with behavioral features of individual investors, whereas decision theory deal with latent construct as investment decisions of individual.

On the base of literature and rational, this study try to link different theories as main latent constructs exist in the model of study. So, mainly theory of reward system, fight and flight theory, trait theory and theory of multiple intelligence are tried to connect with prospect theory, bounded rationality theory, expected utility theory, theory of over and under reaction of security and decision theory as described in the model.

## 1.4 Research Question

Neurofinance is inter-disciplinary field for probing which engage neurobiology with over and above financial market while behavioral finance involves behavioral psychology and financial market and their participant's activities.

Particularly the research would respond the following main query.

“How do Neurotransmitters, Emotional Intelligence and Personality have effects on the Investor Behavior and Investment Decisions in Stock market?”

This research is an effort to show the possible linkages of neurotransmitters, EI and personality with investor behavior and investment decisions in stock market so that individual investors by avoiding the feelings or sentiments or emotions intelligently with reasons that would mold the neurological, psychological issues in favor of profitable investment program.

## 1.5 Objectives of the Study

After taking comprehensive review of historical background, identification of research gap, discussion of related theories and after design of main research question of study the incremental/developmental objectives of the investigation to build up unique sculpt showing the relation between the neurotransmitters, emotional intelligence, personality, investor behavior and investment decisions in stock market with some latest constructs to amplify and inflate the association. Further, specifically the investigation would be effort to:

- i) Find out the relationship of neurotransmitters, emotional intelligence, personality, investor behavior and investment decisions in stock market,
- ii) Explore the impact of neurotransmitters, emotional intelligence and personality on investor behavior, and
- iii) Explore the impact of neurotransmitters, emotional intelligence and personality on investment decisions in stock market.

## 1.6 Scope of the Study

The current research is multidisciplinary and circumscribed to the field of neuro and behavioral finance with dimensions as neurotransmitters, emotional intelligence, personality, investor's behavior and their investment decisions. Similarly, this research focuses on the base of the number of supporting theories as fight-or-flight response theory, trait theory or dispositional theory, the theory of multiple intelligences, decision theory, prospect theory, bounded rationality and biosocial theory. However, this study emphasize and restricted to the Pakistani stock market which have total population approximately 0.22 million active investors and has outstanding performance in the duration of 2009-15 and is regional center for the investors.

The scope of this study focuses just to get actual practical a well as academic understanding related to neurotransmitters, emotional intelligence, personality,

investor's behavior and their investment decisions in Pakistani stock market. This will be for not only advancement in the current boundaries of academic knowledge, but this also have wider pragmatic use for both individual investors and investment managers of brokerage houses for their economic decisions. From methodological point of view, the study also includes the development and validation of neurotransmitters scale along with application of second generation technique for multivariate; specifically, hierarchical latent variable models in PLS-SEM using reflective-formative type model which are specific and suitable in contributory prognostic study in complicated circumstances.

## 1.7 Significance of the Domain

Neurofinance is a comparatively latest research area in order to make the struggle for recognizing the monetary verdicts as a result of joining the forthcoming as of neuroscience and psychology with financial hypothesis (Miendlarzewska, Kometer, & Preuschoff, 2017). These authors also said that neurofinance idea offer unconventional rationalization in support of the visible collapse of traditional hypothesis of finance. In the meantime, Kumar and Sireesha (2017) disclosed that neurofinance act as bridge among the human mind and decisions in the financial market. While studying "collaboration of psychology, neurology and investor behavior" Diacogiannis and Bratis (2013) revealed that neurofinance make addition to the traditional theory of finance with the help of neuroscience as well as psychology. Similarly, these authors also disclosed the advantages of the advancement in neurofinance as a substitute way of internal best judgment of the selection process while making investment decisions.

Purpose of neurofinance facets neurotransmitters is to achieve antagonistic, neurotic and practicable gain within an emerging and information base liberated financial system of economy. This competitive advantage may be expected if the neurotransmitters boost up the worth of security traded in stock market. Healthy signal of human brain show the way to confirm and recognize the decision related to the investment of individuals to facilitate the superior plan of outlay of funds

which may increase the efficiency of transactions and superior investment decisions. Krugel et al. (2009) disclosed the consequence of dopamine for behavior like thrill-seeking. Anderson, A., et al. (2015) studied 149 active investors in Sweden and explored that neurotransmitter namely dopamine and serotonin have relation with behavioral aspect of investment as loss aversion as well as financial risk taking.

Just making the investment with the help of standard finance theory, it would be impossible to gain maximum return in the stock market because it is matter-of-fact that behavioral finance investigates and recognizes mentioned variety of slip-up first and foremost in effective way and efficiently discovers, realize, as well as normalize sentiments of individuals and after that employ them to find out the solution of problem while making investment decisions. Behavioral psychological features in finance have major role in authentic monetary decisions related to the outlay of funds and behavior of investors in free market economy.

Observation indicate that simply earnings achievements as well as losses on investment are considered a regular component of the business activity, but due to the behavioral psychological features majority of patrons, shareholders, and financiers do not react in the same way to earning of profit as well as losses on investment in stock market.

Shefrin and Statman (1985); Barber and Odean (1999) explored that majority of time investor's show constructive stance by recognizing profits but on the other hand comparatively more pessimistic sentiment as of a recognized failure of the similar extent consequently few investors make early sale of their winner stocks at the same time as holding of their stock which belong to the loser's class.

## 1.8 Significance of Neurotransmitters

The capability of investors to carry on and nurture in the 21st century, awareness base market can be controlled, depending upon know-how of effective and efficient neurotransmitters to exploit financial assets of investors. As we know that the neurotransmitters in the nervous system push and slow up different activities

like temperament adjustment and fly away or fight situations in the stock market. Neurotransmitter's signals movement in human brain act as hammering force for the behavioral aspects (Harden and Klump, 2015). Shao, Zhang, & Lee (2015) documented that role of neural bases observed in individuals' investors when making decisions regarding the total sum of appreciated outlay of funds and percentage of required return.

The signals improve the behavioral aspect of investor which may utilize for highest worth oriented performance in the stock market.

Investigation related to the neurotransmitters measures are significant in support of attaining the worth making, efficient as well as effective for the reason that of each components, seeing that are insubstantial form as well as difficult to identify, seeing as instruments for the quantifying the measures of neurotransmitters are at emerging arena. Many investigations in the different region of the world prove the significance of neurotransmitters measures as Mosher and Rudebeck (2015) recognized that neurotransmitter scheme corridor passes the signals related to the investment plane with high value depending upon the investment horizon. The main basic measure of neurotransmitter is dopamine which has effect on the behavioral aspect of investor.

Mohr and Heekeren (2012) confirmed that dopamine have prominent function in risky behavior while making investment. Serotonin play major role in individual's behavioral decisions when based on hazard and worthwhile investment. Appropriate neurotransmitters believer squabble that some variation in dopamine, serotonin, amygdala and testosterone may get better investor behavior as well as benefits in stock market. When individual makes investment in the stock market different psychological situations arises in the mind then neurotransmitters play prominent role of adjustment in the memory due to which investor feel comforts. Dornelles (2007) studied and found that neurotransmitter namely epinephrine makes adjustment in the human remembrance process for the psychologically triggering situation. In recent times, Conway and Slavich (2017) revealed that neurotransmitters, dopamine and serotonin involve in different aspects of mood or behavior which are beneficial for individuals of society. For the time being, Efremidze et

al. (2017) observed that dopamine has various functions in the human mind as well as physical structure, along with inspiring concentration to latest news in the surroundings as long as the human being with a enjoyable know-how. They also revealed that dopamine activate the reward signals. Because in the past Baechler, G. (2016) also observed that dopanine transmit the majo signals of incentive sysytem. In the meantime, Chorvat (2016) disclosed that neurotransmitters as well be a factor in decisions of investment.

In view of the exceeding point of view neurotransmitters would be considered the same as a force for recital for individuals who make investment.

Administrator of investment firms, executives of wealth Management Company and supervisor of funds value the significance of effective and efficient human neurotransmitters measures in the accomplishment of open and emerging market economy.

## 1.9 Significance of Emotional Intelligence

The core use of EI is recognizing, realizing, administrating and exploiting the emotions which can set up successful plans and guidelines for the trade of equity and most excellent use of resources, which subsequently achieve better investment in equity market. Emotionally intelligent persons have better capabilities to deal with the drawbacks of emotions and in the situation having biases on the floor of stock market. Mayer et al. (2001) studied that individuals in the midst of superior emotional intelligence are best practiced to recognize their personal as well as outsiders sentiment in circumstances, utilize that data to direct their dealings, as well as oppose forces as compare to others.

In emotionally intelligence investor feeling and sentiments utilize as statistics which may be supportive to gain superior returns in capital market. Ameriks et al. (2009) reported that emotional intelligence takes up the person's glee, rage, or attitude on a specific moment and sensations like figures or statistics. People feel alert about surrounding when individuals make management of their emotions for the attainment of his objective but also be conscious that you are not employing people



to administer your sentiments to complete their aims which make assurance that you are wise investor who can understand the behavioral inaccuracies. Christie, Jordan, and Troth (2015) recommended that attentiveness of individuals about their, however do not have need of them to particularly appoint for administration of their personal or others sentiment to attain their targets. Pizzani (2017) revealed that emotional intelligence is your capability to identify and realize our emotion and exploit this understanding to administer yourself as well as your associations among others.

The above mentioned perspective, the idea in subjective way additionally makes possible for short term investor or bettors to keep away from fatalities due to the emotional mistakes during the time of investment decisions.

## **1.10 Significance of Personality in Stock Market**

The decisions of investor could be manipulated in equity market due to the most reasonable arrangement of the personality difference, in behavioral tendencies, such as extraversion, agreeableness, conscientiousness and neuroticism. The most prominent feature of personality as impulsiveness, due to which, in the stock market instantaneous reaction of investor for decision making related to security trading may boost up the benefits. The study of personality discrepancy may be help full for the dealers who make buying and selling with individuals investors because it has effects on selection of assets.

While making financial decisions related to the investment, personality of investor may have different psychological issues and may be tricky to get rid of these issues. Chao, Wu and Huang (2012) documented that individuals who fit in to the investors' categories have psychological issues in the diverse personality as well as their relatives' surroundings, among investors could not easily throw out psychological problems as of the awareness.

These personality features are considered leading strategic intangible benefit which can convert unprofitable investment program to valuable and profitable investment in equity market. Personality characteristics have considerable effects on different

administrative aspects of investment. Akhtar et al. (2015) documented that Investor making decisions, related to the tolerance of threat as well as the investing plans, is highly influenced by the personality features.

## 1.11 Significance of Investor Behavior in Stock Market

Psychological judgment, behavioral prediction, analysis and evaluation measures of investment related decisions may play decisive role in the aggressive situation of stock market. Behavioral aspect of investors may be supportive to relocate the effort in aggressive surroundings of capital market. Investor may stay away from sightless view of investment and avoid the typecast role of faith and may feel pride about the benefits from stocks. Understanding of apologetic feeling about the investment decision may show appropriate time scale, attitude toward risk. Behavioral construct of investors may involve in financially viable arrangement of guiding principle. This could able to take part in maintenance of investor's loyalty toward a reliable procedure to restructure the situation and keeping on a glowing way in the stock mark.

As we know that behavior of investors may vary for diverse classes of financial assets as Barber and Odean (2013) argue that investors, holding different kind of financial assets and trade regularly have different behavior on the stock market floor. Kaniel et al. (2012) mentioned that shares purchased by soaring thinking investors receive hefty profits during short period of investment. Barber et al. (2011) discussed that investors having brawny earlier period recital be paid sturdy profits. Barberis and Xiong (2012) argue that investor gets value as of recognize profits and give the name to this behavioral benefit. Baker and Ricciardi (2014) investigated and observed that investors show many behavioral issues which persuade their decision of investment. These researchers also suggested that investors should keep know how about the behavioral issues to diminish them for fair verdict podium on existing information.

Without knowing these behavioral aspects of investors, it will be difficult to make profitable equity portfolio in stock market.

## **1.12 Significance of Investment Decisions in Stock Market**

The basic purpose of investment decisions is wealth maximization. Beal et al. (2005) find that more than half sample of investors believe maximization of wealth to be the vital feature in an investment decision. Similarly, investment decisions are helpful for lowering the risk and may also increase earnings and cash flow growth. However, the investment decisions are influenced by the differences in rates of return on the investment (Pasewark & Riley, 2010).

Investment decisions determine a degree of safety, ability to meet the financial obligations. As we know that investment decisions are critical and tricky particularly in a stock market moreover these kinds of decisions require superior sympathetic and insight (Qureshi, 2012). Investment decisions may be outcomes of behavioral and psychological aspects of investors (Evans, 2006). Evidence indicates that behavioral facets of investors influence the investment decisions. Statistical figures advise that a wide array of behavioral features of investors influence the investment decision (Jeffrey, 2006).

# Chapter 2

## Literature Review

### 2.1 Prologue

The world give attention to neurofinance in 2005 when the first study related to the neurotransmitters role in financial decision making gives awareness to the individuals who keenly occupied positions in the field of business, especially stock market business. The label of initial research was “neural basis of financial risk taking” by the (Kuhnen and Knutson, 2005) in the Stanford University Stanford, USA. Emotional Intelligence and complementary psychosomatic attribute as personality has incredible relationship with different aspect of investor’s behavior. Due to the worth mentioning role in stock market for investors show the need of advancement in these neurofinance and behavioral finance aspects.

The uprising in information technology as well as other mediums for the exchange of information in the 21st century has changed the buying and selling practices. Operations in the stock markets effectively as well as efficiently along with competitive edge in the present time has become defy. The investors and consultants are required to make financial assessment within the few seconds to stay in the marketplace even as in front of pressure base environment and irregularity in information. As compare to normal operation and investment program in stock market whereas the majority of the focus and emphasize is on the standard finance base models, information base on the neural and behavioral features of investors in

financial system require to emphasize and invest in neural and behavioral aspect of investors while making profitable investment programs.

Both individual investor's behavior and investment decisions have consequences toward the profitable investment program in the stock market. As we know, Investment decisions made by investor in stock market have different strength for every investor. However, Chandra and Kumar (2008) stated that decision making related to investment is a complex course of action for selecting a supreme existing choice among the substitutes because this course of action is completed once deep assessment of all the new substitutes. Similarly, the argument by Akhter and Ahmed (2013) investor behavioral features are more supportive for profitability while investing in stock market. After that, Moueed et al. (2015) studied that investment decisions of individuals investors have role in the capital market while making making investment. Similarly, Baker and Nofsinger (2002) studied the link among the behavioral features of individual investors and common mistakes of investment in the stock market. Where as, Kahneman and Tversky (1979) documented the relation among the behavior of investor and profit.

The majority of the existing literature related to the neurotransmitters and behavioral aspects of investors appears in the developed world and proposed that connection stay alive among the amygdala and stock trading, dopamine, serotonin and buying as well selling of stocks and testosterone and trading behavior in stock market. No single study has ever tried to combine these four measures of neurotransmitters with investor behavior and investment decisions.

Just only single investigation try to explore the relationship between EI and investor behavior however to achieve the concluding remarks as of limited view of investor behavior (Ameriks et al., 2009).

This research would not just confirm and prove with the help of facts based on the observations which formerly unverified relationship of neurotransmitters measures, EI, psychological facets and behavior aspect of investor recommended by Ameriks et al. (2009); Mohr and Heekeren (2012); Kuhnen et al (2013); Mosher and Rudebeck (2015), but as well pursue the prospect work scheme of Lai and Wang

(2014) to verify the connection of investor behavior as well as the stock market benefits.

For the aim of exploring the related studies this part properly disseminated into four components. In first part, the pioneers scholarly work on investor behavior then the literature on neurotransmitters measures and behavioral aspects of investors whereas subsequent component discuss the studies on the EI and investor behavior. Then literature associated personality and behavioral features of investor and the ending component of this section is related to the previous work done by practitioners and academicians related to investor behavior and investment decisions in stock market.

## **2.2 Pioneer Studies on Investor Behavior**

Scholarly discussion about the investment behavior of individual openly started when Klein in 1951, wrote a section with the title of “studies in Investment Behavior” in the book of “Conference on Business Cycles” under the umbrella of National Bureau of Economic Research in Cambridge. Klein (1951) called it as investor behavior theory and financial circumstances that are scene to be occur. Other scholars as Jorgenson (1963); Eisner and Nadiri (1968); Schramm (1970); Feldstein and Flemming, (1971) also explored the investment behavior of individual and Jr (1983) called it as financial theory of investment behavior of individual. Arnsward (2001) performed the fundamental psychoanalysis of survey information and discussed the investment behavior of German equity fund managers.

There is a lack of consensus on accurate description of investment behavior of individual because different scholars in the different areas of world in the different time period define the investment behavior of individual as Slovic (1972) define as, how the individual investor makes judgment, forecast, examine as well as evaluate the measures for decision making that may consist of gathering of information, analysis and psychology of investment.

Wood and Zaichkowsky (2004) said that stock market investor’s behavior includes investment horizon, risk attitude, confidence, control and personalization of loss.

Chun and Ming (2009) discussed the investment behavior of Malaysian stock market investors that includes constructs as overconfidence, representativeness, loss aversion and anchoring. Chin (2012) investigated the investment behavior of Malaysian stock market investors that may includes their belief, decision making and psychological concepts as regret, self confidence. Thapa (2014) studied the investment behavior of individual investors in the stock market of Nepal and finalized the constructs as overconfidence, optimism, involvement and risk attitude.

### **2.3 Studies on Neurotransmitters Measures and Behavioral Aspects of Investor**

First time in scholarly studies few words were exchanged about the relation of neurotransmitters measures and investor behavior openly in scholarly investigation, by the Kuhnen and Knuston (2005) when got in print his manuscript in neuron academic periodical in the discipline of neuroscience, it is believed, at that time the earliest piece of writing on neurotransmitters measures and behavioral aspects of investor (Sahi, 2012). Lodish et al. (2000) documented that neurotransmitters are something like substance/material that makes possible communication with the help of impulses/signals in innermost anxious structure of body.

Barnea et al. (2010) collected data from Stockholm, Sweden then investigated and revealed that neurotransmitters dopamine regulates the financial benefits and attitude of risk taking in individuals. It is unveiled that the neural movement manipulates the financial decisions and behavioral features of individuals (Frydman & Camerer, 2016). While completing his doctoral desertation at the University of Toulouse, Baechler (2016) discussed the individual investor behavior, risk, neurofinance and revealed that neurotransmitter dopamine has association with financial incentive.

Neuro and behavioral finance scientists, Frydman et al. (2014) studied the theory of investor behavior and neural data and observed the association among the

neural information and mental prospects of investor behavior and found that investment results in shape of success or failure are due to the neural information. The scholars, Walsh and Yun (2016) revealed that the considerate of the dopamine and serotonin is very helpful for considerate of several attributes of individual's behavior. By understanding the importance of neuroscience measures in stock market as the game of chance for money, Singh et al. (2017) observed the role of neurotransmitters measures as dopamine, serotonin and norepinephrine in investors behavioral prospects as risk/reward and decision making.

Meanwhile, Efremidze et al. (2017) conclusively point out that neurotransmitters dopamine has numerous functions in the brain of participants of capital market. Mesly (2017) disclosed that behavior of investor in capital market depend upon the neural information. Similarly, Gonzalez (2017) confirmed that neurotransmitters measures show the existence in the individuals who bear the more financial risk to achieve the normal financial benefit.

The scientists have no harmony on the authentic recognition of neurotransmitters but many scholars agreed that serotonin, dopamine, norepinephrine and epinephrine recognized as neurotransmitters. The Peterson (2007a, b) investigated that the neurotransmitters specifically dopamine that is connected to investor's unbreakable sensation of needs to consist of something as well as serotonin that is connected to the sensation of someone to possess the consciousness. In human brain compensation and inspiration features are due to dopamine substance (Roxby et al., 2017).

Further, Halfmann et al. (2016) found the association among the dopamine signal and decision making function in the brain of human. Kusev et al. (2017) investigated and revealed relationship among the neurotransmitters measures and individual investor behavior as risky attitude.

Dopamine job is to regulate the behavioral control and decision making of participants of stock market (Kishida et al., 2016).

Meanwhile, Konovalov and Krajbich (2016); Frydman and Camerer (2016) explored the relationship of neurotransmitters measures and behavioral features of individual investor.



Young (2007) discussed the serotonin and its link with behavior and Berger et al (2009) also discussed the serotonin. Volkow (2009) investigated the dopamine link with investor behavior and Miller (2011) also discussed the dopamine as neurotransmitter system. Hamill et al. (2012) discussed norepinephrine as a neurotransmitter and Gardenhire (2013) also investigated norepinephrine as a main neurotransmitter in the nervous system. Chansky et al. (2013) recognized the epinephrine as neurotransmitters as well as hormone but the Bell (2009) identified its psychosomatic response in the situation of risky dealings or assail. Further, Nicole (2017) described that well known neurotransmitters dopamine regulate the unfair and investigative decision making and specifically, author revealed that dopamine, norepinephrine and serotonin have relationship with behavioral features of individuals.

The main contribution in neurofinance was the study of Kuhnen and Chiao (2009) who investigated and found that neurotransmitters measures namely serotonin and dopamine have role and impact on financial risk and reward system of human being. Cherry (2014) innovative psychologist explored that neurotransmitters become involved in shaping the behavior. Cicchetti, Rogosch, and Thibodeau (2012) found that neurotransmitters namely dopamine, serotonin and nor-epinephrine have relation with the routine contrary or risky behavior in individuals. Sharot et al. (2012) investigated that dopamine has connection along with impact on the behavioral facet of investor as investor optimism or self-assurance regarding the upcoming time or achievement of remarkable things.

Poppa and Bechara (2015) mentioned that these may result problematic financial decisions. Hum et al. (2005) investigated and found that nor-epinephrine has relation with the behavioral element of investor as predisposition to react significantly to the indication of return/compensation.

Recently, Conway and Slavich (2017) investigate and found the relationship between neurotransmitters (dopamine and serotonin) and behavioral characteristics of human. Further, Schiphof and Hettinga (2017) also indentified the relation among the neurotransmitters and individuals behaviors.

Andreou et al. (2015) studied that dopamine as a neurotransmitter system has effects on the components of overconfidence level of individual. Anwar et al. (2015) explored that neurotransmitters as serotonin, dopamine, nor-epinephrine and epinephrine have relation with behavioral element of human being odd feeling, bad condition of remembrance and concentration problem. Hennessy et al. (2015) explored that the valuable investment demands the elastic behavior due to the neurotransmitter as epinephrine otherwise may not receive the incentive, condition is that the atmosphere go on to changing faster as compared to behavior might be tailored.

## **2.4 Studies on the Emotional Intelligence and Investor Behavior**

EI has been studied scholarly in different intellectual mode of investigation but it got fame when, Goleman (1995) psychologist and press officer, wrote book on the subject of “Emotional Intelligence”. Meanwhile, different academicians, researchers and practitioners more or less define the EI as Goleman (1998) in the Harvard Business Review defined the EI as the collection of abilities as well as features to impel the administrative achievement. Petridis and Furnham (2001) give another definition of EI as it includes behavioral way of thinking or frame of mind along with personally invented capacities.

Mayer, Salovey, and Caruso (2004) defined the EI as the personnel capability to practice the emotional data and utilize it to downbeat the situation. Carolyn et al. (2014) describe that EI as a talent of recognizing the feelings, combine the feelings to assist thinking process, realize feelings as well as adjust feelings to support individuals strengthening.

In the prior history of research, connection among the EI as well as investor behavior has been extensively investigated and set the opinion that EI have important position in the behavioral aspect of investor as Salovey (2001) studied and found

that EI play a considerable role in the decision making activities in financial markets. In the same way, Charles Ellis, financial professional as well as writer of a number of text is also clear in his mind and admitted in several meeting and interviews that, because of sentiments or emotions or feelings, are out of control in the field of monetary managerial activities and clearly said that if individuals are emotionally intelligent may be superior investor.

Some scholarly work related to the management of emotions as well as behavioral constructs of investor discussed by the several experts as Kahneman and Tversky (1979) studied that even though achievement and fatalities may be the common ingredient in any financial period but the majority of individual investor does not react in the same way to profit and loss. Therefore, few individuals put up for sale their winning investment too early whereas holding losing investment (Barber and Odean, 1999). Few perform buying and selling surplus, but others, not enough (Barber and Odean, 2000). Psychology as well as economics experts show high level curiosity in emotion's role in financial behavior and decision making (Thaler, 2000; Loewenstein, 2000; Hopfensit and Wranik, 2008). Loewenstein et al (2001) investigated and said that sufficient confirmation indicates that emotion prominently manipulate managerial activities, particularly as the judgment connect to hazard as well as doubt.

The recent studies as Rubaltelli, Agnoli and Franchin (2015) in their scholarly work found the relationship between the emotional intelligence and investor behavior. Azouzi and Jarbouï (2014) suggested the relationship between the emotional intelligence and behavioral constructs of investor as overconfidence, loss aversion and optimism as well as advancement in the economic strategies as true financial decisions of investment as well as behavior. Sterrett (2014) also investigated the relation between the EI and overconfidence. Hessner, Camerer and Phelps (2013) studies that emotion management has link with loss aversion at some stage in the economic choice. Paniagua et al. (2015) investigated the scheme of executive activities in the equity market with the help of synthetic feeling. Pirayesh (2014) studied the consequence of heartwarming brainpower mechanism on investor's speculation behavior in Iranian equity markets and found optimistic as

well as considerable relation.

Recently different scholars in the different region of the world observed the relation among the emotional intelligence and behavioral facets of individual investors. As Chaarani (2016) collected data from 197 international investor through email then observed the relationship among the emotional intelligence and investor's behavioral facets. Meanwhile, Nofsinger (2016) disclosed the relation of emotions management and decision of individual investor regarding the investment. Mitroi (2016) also observed the link of emotional intelligence and behavioral contents of individual investors. Recently, Bouzguenda (2017) investigated in Tunisia and showed the impact of emotional intelligence on individual's financial decisions (investment and financing decisions).

Similarly, Buccioli and Zarri (2017) studied that objectionable as well as uncertainties in emotions have association with the investor's financial risk attitude in stock market. Salehi et al. (2017) collected data from 119 Iranian individuals and observed the associations among the emotional intelligence and their financial dealings. Altman (2017) discussed the human capital theory and disclosed that different human characteristics, emotional intelligence is one of them, have impact on individuals decisions making including financial decisions (investment and financing decisions). Cronqvist and Jiang (2017) studied the individual investors in the book of Bakar and revealed that reaction among the emotion management and conduct of individual investors. Bakar et al. (2017) describes that emotional elements of individuals manipulate the opinion as well as process of decision making including the financial decisions.

## **2.5 Studies on Personality and Investor Behavior**

Scholarly work of the personality gives a scientific description about the uniqueness of individuals. It also highlights the determinants of inner behavioral aspects as qualities, desires, intentions, and social facets of person's uniqueness (Storm, and

De-Vries, 2006). Allport and Allport (1921) investigation on personality features started then continue grow over and over.

As explored by the Allport (1961) that personality is a vibrant involvement, in the inner personality of the individual, of psychophysical configuration so as to make the individual's characteristic prototype of dealings, decisions and frame of mind. Different experts work done on it as Norman (1963), Eysenck (1970), Goldberg (1981), and McCrae and Jr (1997).

Academically different personality theories introduced but Big Five model, the personality features including the openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism (Goldberg, 1993). Warren (2004) conducted the investigation in United Kingdom and concluded that way of thinking about the investment hazard is influenced by the different factors one of them is personality.

Parashar (2010) studied that individual's personality characteristics may be helpful for experts of assets supervisors who can give better advice to their customers and these personality features may be source in favor of assembling the opinion regarding the psychology of investor, investment preferences, adventuresome even as making investment in stock market.

Sadi et al. (2011) performed the study in Iranian equity market and found that personality features as openness and extroversion have positive relation with the behavioral characteristics of investor as hindsight, neuroticism also have relation with overconfidence but negative relationship among the openness and availability. Kourtidis et al (2011) investigated and documented that personality characteristics have influence on the investor behavior as overconfidence as well as hazard forbearance.

In the modern research, personality and investment behavior of individuals shows the relation as Zaidi and Tauni (2012) performed the investigation in Lahore Stock Exchange and found that investor personality characteristics such as extroversion, agreeableness and conscientiousness have positive association with behavioral characteristic of investor as overconfidence but neuroticism negatively associated.

Nga and Yien (2013) studied that personality has influence on the behavioral facet of investor as decision making in money-making activities.

Durand et al. (2013) performed the meta analysis and found that personlaity features for example extraversion and conscientiousness have relation with behavioral aspect of investor as overconfidence. Sarojpant and Dumka (2014) explored that investor behavior has connection with psychosomatic surface of personal-ity. Akhtar, Thyagaraj and Das (2015) documented that personality may cause the inconsistency in the decision related to the investment. Gerransa, Faffb and Hartnettc (2015) explored that personality has relation with behavioral aspect of investor as patience related to financial risk. Lin and Lu (2015) investigated the relations between personality and vital element of investment activities as forbear-ance about the risk and other behavioral features of investor.

The latest litrature revealed the linkages between the different traits of personality and investor's behavioral features. As Tauni et al. (2017) collected data from 541 chinees individual investors then investigated and revealed the relation among the personality charcteristicis and behavior features of investor. They also found that individual who have openness and neuroticism qualities make investment more repeatedly at the same time as investors with extraverted and conscientious personality traits buy or sell shares with less concentration.

For the meantime, Bucciol et al. (2017) conducteed th servey on 7784 individuals in the university of Michigan and observed the considerable pessimistic associa-tion among the personality and behavioral features as financial risk attitude of individual investor.

Similarly, Raheja and Dhiman (2017) collected data, from Ludhiana Stock Ex-change Securities limited in Punjab state of India, with sample of 500 individual investors and showed the association among the jeopardy tolerance behavior of invstors and personality features while making the investment decisions. Wong et al. (2017) collected data from 340 individual investors in Perak state of Malaysia and observed the association among the personality features and behavioral facet of investor as jeopardy tolerance. For the time being, Khan (2017) conducted the study in Pakistani context with help of 268 individual investors and showed

that personality in vague situation have extensive impact on pecuniary jeopardy avoidance behavior of investors.

Currently, Tauni et al. (2017) used 541 individual Chinese investors data and observed the association among the personality features and buying and selling behavior when they make investment decisions in stock market. Meanwhile, Mishra et al (2017) used the sample of 328 Canadian investors and revealed the relation between the thrill-seeking behavior and personality.

Parise and Peijnenburg (2017) collected data from 11855 individuals of Netherlands then performed the investigation then come to know the link between the personality and investor behavioral facet distress as well as risk attitude. Ahmad et al. (2017) used sample of 100 Malaysian individuals in investment industry and observed the association among the personality features and investors behavioral features as control and risk.

Some latest studies about the emotional intelligence, behavior features of individual investor and their investment decisions are given below.

## **2.6 Latest Studies on the Neurotransmitters and Investment Decisions**

Lazer et al. (2017) studied the Cloninger's model of personality with neuropsychological aspects with the help of 50 individuals and observed the association between the neurotransmitters and attitude of risk. They also revealed the relation between the personality dimensions and decision making while making the investment.

Similarly, Lang et al. (2017) used the data of 124 Czech Republic's individuals and examine the associations among the neurotransmitters and investment decisions. At the same time, Mamula and Blazanin (2017) collected data from 38 individuals in the Isralian then studied and examine the links among the signal of brain and

investment decisions. Singh et al. (2017) used the data of 2400 americans and observed the association of dopamine, serotonin and norepinephrine with investment decisions in stock market.

Similarly, Fineberg et al. (2017) studied with the help of 129 Turkish individual investors and observed the association among the neurotransmitters and decisions of investment. Wang et al. (2017) showed the role of dopamine in decision making regarding the expenditures and gain and concluded that the level of dopamine will decide the investment. Ty, Mitchell and Finger, (2017) used the data of Los Angeles residents and suggested that neurotransmitters support to financial decisions which gave benefit to society. Pertl et al. (2017) collected the data of 49 German resident in controlled environment and observed the relation of neurotransmitters and decisions related to the investment for saving purpose.

Casco et al. (2017) performed the research with the help of 50 Italian citizen and revealed the attachment of neurotransmitters and decision making related to the reward with role of age level of individuals. Nath, Majumder and Roy (2017) conducted a case study in india and point out the association of signals chemical messengers of brain and decision related to long and short run benefit. Joiner et al. (2017) conducted the research with collaboration of American National Science Foundation and National Institutes of health and observed that human brain's signals have involvement with the decisions making about the financial benefit. Makropoulos et al. (2017) studied with sample of 255 resident of Hellenic Republic and exposed the relation of neurotransmitters and pecuniary investment with propensity of risk taking. Lancu (2017) discussed the responsibility of human brain in decision making regarding the buying and selling behavior of individuals.

## **2.7 Latest Studies on Emotional Intelligence and Investment Decisions**

American Professors, Ingram et al. (2017) during the investigation used the data of 943 Americans with different socioeconomics background and point out the



relationship among the emotional intelligence measures and investment decision measure as return on investment.

Nakamura et al.(2017) collected the data from 48 (18 male and 28 female) Japanese investors and exposed the relation of investment decisions and facets of emotional intelligence. Vakola, Bourantas and Karli (2017) discussed the linkages among the long run investment decisions and measures of emotional intelligence. Wang et al. (2017) conducted the study with the help of 21 Chinese residents and revealed that emotions have considerable impacts on the pecuniary verdict regarding the gain on investment.

Lincoln Memorial University Professor, Reid (2017) during his research disclosed that non-natural intelligence of emotions can improve the decisions about the investment. Thompson (2017) conducted the survey in the 21 countries including Europe and Asia and got the data from 192 individuals and observed that emotional intelligence is human insightfulness and have association with decisions particularly continuing attitude of business investment. According to Corea (2017) emotional intelligence is wisdom and talent and this will explore the decisions concern to the investment. As said by Beadnell et al. (2017) emotional intelligence is effective when making decision about the long term financial benefit and these benefits are fruitful for chairty contributions.

Driver of strategic decisions making in finance. As stated by Pivac, Barac & Tadic (2017) emotional intelligence is one characteristic of human capital and this characteristic influence the financial benefit of stock investment. A study conducted by Tang et al. (2017) with the help of data collected from 300 investors at Shanghai stock exchange. They revealed that emotional intelligence is part of human good sense and this part has relation with decisions which leads toward the up and down of prices of stocks. According to Osieko, Maru and Bonuke (2017) EI is main.

## 2.8 Latest Studies on Personality and Investment Decisions

Personality characteristics influence the investment decisions (Pak & Mahmood, 2015; Dhochak & Sharma, 2016).

Chinese scholars, Tauni et al. (2015) collected the data of 333 investors from Chinese financial markets and apply structure equation modeling then unfolded the buying and selling behavior and financial resources distribution decisions are controlled by the personality characteristics of investors.

Iranian Professor, Ebrahimi, Dastgir and Latifi (2016) used the data of 120 Iranian stock market investors and study the process of investor's verdicts and their reaction to diverse situation in market of financial products as well as the effect of personality and investment decisions of individual.

Tapia, Tudela and Carrasco (2016) conducted the interview of 304 residents of Chile and point out the association among the personality characteristics and investment decisions. Schaufeli (2016) used the data of 1973 Dutch individuals and studied the importance and impact of personality for the investment by using the SEM.

Indian Professors, Raheja and Dhiman (2017) collected the data of 500 individual investors from Ludhiana Stock Exchange Securities Ltd in Indian Punjab and revealed the constructive connection among the personality and investment decisions. They recommended that investor must be vigilant about what, where, why, when and how to take decision of investment in diverse investment opportunities. Similarly, Kaur (2017) disclosed that personality characteristics have influence on behavioral aspect of investment decisions. Academician, Wong et al. (2017) used the data of 340 Malaysian investors and observed that individuals with most important personality features as neuroticism, openness, agreeableness, conscientiousness, extraversion get better the investment behavior.

Professors of Ohio State University, United States, Young, Greenbaum and Dormady (2017) used the data of 1155 individuals and revealed that there is no gender

discrimination among the investor personality and their investment decisions. Professionals, Mak and Ip (2017) used the sample size of 142496 investors from Hong Kong Stock Exchange and conducted the exploratory research work study and observed the relationship among the personality and investment decisions of individual investors. Professors, Migali and Zucchelli (2017) studied the data from 90000 students as investors from different educational institutes in America between 1994 and 1995 then applied the linear probability econometric model.

In view of above, all old or latest literature discussed in section of literature review belong to developed world and relationship among the independent and dependent latest constructs at first order to some extent has been proved in the different areas of world but scholar observed that this area of research in Pakistan stock market is untouched So, reasons of selection of topic and formation of hypotheses are different from developed. The reasons behind this may be due to the different psychological behavior, level of brain information and cultural background of investors of Pakistani markets as compare to the investors of rest of world countries. So, link between international and local dynamics is based on the above arguments due to which hypotheses are developed as given below.

## 2.9 Hypotheses Development

On the base of discussion of above given literature, the following hypotheses are developed to test the impact of neurotransmitters, emotional intelligence and personality on investor behavior and investment decisions in stock market:

<b>Hypothesis</b>	<b>Description</b>
H1	Neurotransmitters have influence on investor behavior
H2	Emotional Intelligence has influence on investor behavior
H3	Personality has influence on investor behavior
H4	Neurotransmitters have influence on investment decisions
H5	Emotional Intelligence has influence on investment decisions
H6	Personality has influence on investment decisions

On the base of above mentioned literature gap, the following research framework has developed.

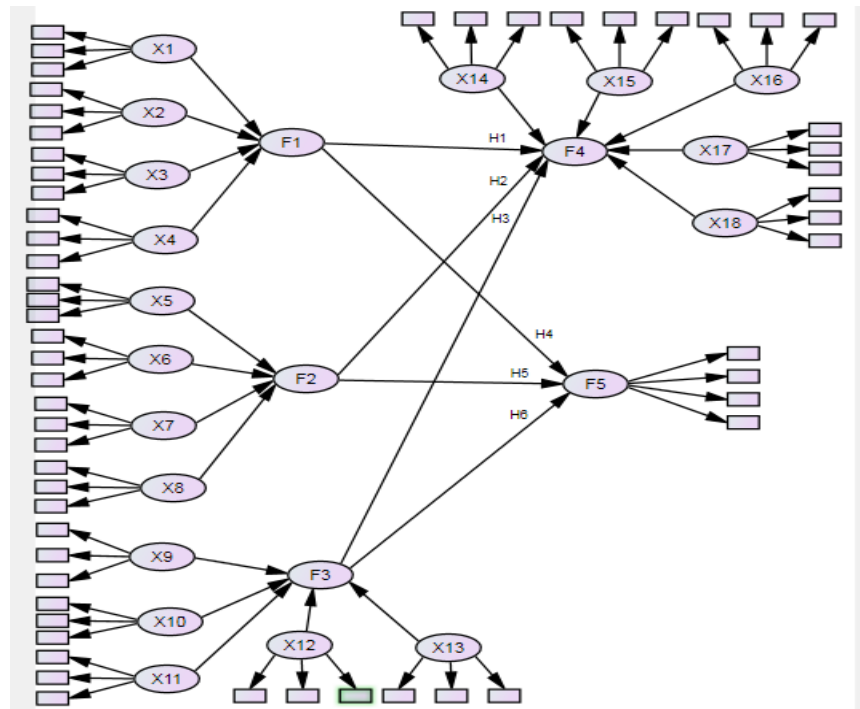


FIGURE 2.1: Conceptual framework of the study.

The main dimensions of the latent variables and their description is given below as

TABLE 2.1: Higher Order Latent constructs and their description.

Main Latent Variables	Description
F1	Neurotransmitters (NT)
F2	Emotional Intelligence (EI)
F3	Personality (PR)
F4	Investor Behavior (IB)
F5	Investment Decisions (ID)

Each of the latent will be measured with the help of set of questions. The main dimensions, their latent variables and their description given below as

TABLE 2.2: Higher Order Latent constructs with their Lower Order constructs and their description.

<b>Main Latent Variables</b>	<b>Sub-Latent Variable</b>	<b>Description</b>
Neurotransmitters (F1)	X1	Dopamine
	X2	Serotonin
	X3	Norepinephrine
	X4	Epinephrine
Emotional Intelligence (F2)	X5	Reading Emotion
	X6	Using Emotion
	X7	Understanding Emotion
	X8	Managing Emotion
Personality (F3)	X9	Extraversion
	X10	Agreeableness
	X11	Conscientiousness
	X12	Neuroticism
	X13	Openness
Investor Behavior (F4)	X14	Investment Horizon
	X15	Risk Attitudes
	X16	Control
	X17	Confidence
	X18	Personalization of loss
Investment Decision (F5)	X19	Investment decisions

# Chapter 3

## Methodology

### 3.1 Population

This study used the primary data from individual investors who trade at PSX as the unit of analysis of study is individual investor at PSX. According to Alam (2015) there are approximately 0.22 million individual investor at PSX. As said by Associated Press of Pakistan (2016) PSX is paramount amongst the globally most excellent performing stock exchanges between the 2009 and 2015. PSX will be the front line for establishment of flaxen, well-organized, gung ho place as well as will turn into regional center for investors (Hijazi, 2016).

PSX re-sorted as front line souk to growing souk while reviewing the semiannual index (Morgan, 2017). According to Akhtar (2016) on 28th May 2016, total capitalization of PSX was approximately \$98 billion and 400 centers to facilitate the trading on the floor of exchange.

### 3.2 Sampling Procedure and Sample Size

To accomplish the objective of investigation, carry out the convenience and purposive sampling techniques due to the following reasons as first, it is one of the cost and time effective, secondly, willingness and availability of respondents is compulsory for data collection, so for this, conduct a survey and collected data

from individual investors in Pakistani Stock Exchange (PSX) because the unit of analysis is individual investors who carry on buying and selling in stock market.

Keeping in view the population of study, for data collection, author visited 100 brokerage houses at PSX and gave them approximately 12 questionnaires to each and asked them to be filled up questionnaires from their clients (individual investors) if they visited. This way of data collection believed to be a suitable process for the reason that it is up to the readiness of subjects to respond the questions of survey.

The data collection process does not show as much of consequence of common attraction toward the answers because of the nonattendance of researcher (Duffy et al., 2005). That is why, 1200 questionnaire distributed in the brokerage houses then these questionnaires were forwarded to the individual investors by the brokerage houses. After few days, researcher again visited the brokerage houses and collected the 595 questionnaires and remaining did not returned by the respondents and 501 out of 595 were useful. So, the rejoinder rate was 49.58 percent.

According to Osborne and Costello (2004) there is no accurate rule to decide the size of sample in behavioral investigation. They observed that approximately 17 percent of scholars employed the proportion of 2:1 between the response and question moreover 20 percent of scholarly work used the proportion below the 5:1 between the response and question.

The size of sample 455 after detection of outlier (outlier detection will be in data screening and cleaning section) in this research is still superior as compared to the ratio of 5:1 between the respondent and question which is deem to be suitable to carry out the study. There are different rules of thumb for the requirement of sample size in SEM. As, Boomsma (1982, 1985) documented that minimum sample size of 100 or 200 will sufficient but Nunnally (1967) give different view about the sample size, he recommended that 10 cases for each variable will be appropriate. However, results of study of Wolf et al. (2013) discovered and suggested the range of 30 to 460 sample size will be appropriate for SEM to obtain the suitable results.

### 3.3 Measurements of Variables

Our research composed of main five dimensions of neurofinance and behavioral finance as neurotransmitters, emotional intelligence, personality and investor behavior of individuals and their investment decisions. The primary data collected from individual investors in the PSX with the help of questionnaire.

#### 3.3.1 Measurement of Neurotransmitters

Measurement of neurotransmitters activities can be done in the laboratories and as well as with the help of field survey or questionnaires and some psychological tests. Peterson (2014) studied and found that other than the labortroy setting, there are several method to measure the neurotransmitters that neurofinance researchers used as surveys, personality testing such as the NEO, and specific psychometric instruments or scales. Several experts measured the neurotransmitters with the help of questionnaires as Song et al. (2010) in their study measured the neurotransmitters with the help of symptom scale of neurotransmitter deficiency (SSND) questionnaire having 111 items including dopamine with 24 items. Similarly, Ge and Lui (2015) in their research used questionnaire with 111 items to measure the few facets of neurotransmitters as dopamine with the help of 24 items.

However, Cloninger (1987) used the scale with 28, 26 and 26 items to measure the three genetic dimensions of personality with their Neuromodulation, dopamine, serotonin and Norepiphrine in term of novelty seeking, harm avoidance, and reward dependence. Colbert (2012) practitioner measured of the neurotransmitters as dopamine with 34 items, serotonin with 20 item, and Norepiphrine with 20 items. Epinephrine proxy is Fight or Flight and measurement of this done by the practitioner Tessler (1997) with approximately 20 components on five point Likert Scale.



### 3.3.1.1 Scale Development for Neurotransmitters

After review of extensive literature as mentioned above we can observe that neurotransmitters measurement is possible with the help of questionnaire. In the view of Aupperle et al. (1985) we should develop a questionnaire or survey instrument to avoid some of methodological setback of earlier scholarly work because of the importance of the design and validation of survey instrument. As we know that Stone (1978) said that the questionnaire is the frequent way of data gathering in field research.

The satisfactory measurement of variables may be the supreme challenge for understanding of the individual's behavior and troubles of validity and reliability of constructs prolong the complexities in explaining the outcomes of questionnaire base study (Hinkin, 1998). Price and Mueller (1986) proposed that problem related to the measurement of construct because of not having an appropriate sketch for the direction of researcher through the different steps for the development of scale.

In this research the scale of neurotransmitters developed by following the seven steps procedure from item generation to replication of scale recommended by the (DeVellis, 1991; Hinkin, 1995; Hinkin et al. 1997; Hinkin, 1998; Kinicki et al. (2013) and Zheng, et al. (2015).

The following pages will explain the scale development for neurotransmitters.

**3.3.1.1.1 The Scale Development Process** Researchers in neurofinance use specific psychometric instruments in field other than the laboratory (Peterson, 2014).

In field study, most of time commonly used technique for data gathering is questionnaire (Stone, 1978). Unluckily, questionnaires repeatedly have faced the reliability and validity issue which may leads to complexities in interpretations of outcomes of research (Schriesheim, et al., 1993).

Valid scale development is a tricky as well as lengthy procedure (Schmitt & Klimoski, 1991).

The main purpose of development of questionnaire is to build up appropriate estimate of substance of measure (Clark & Watson, 1995). Schoenfeldt (1984) mentioned that instruments development may be the most significant section of every research.

In the past, various parameters have been considered for evaluating the credibility of instrument. As the American Psychological Association (1995) described that instrument must have the internal consistency, content and construct validity including criterion-related validity. Till now, as best of my knowledge, in neurofinance research measures of neurotransmitters, specially dopamine, serotonin, epinephrine, Norepinephrine, have not been fully developed or inadequate or unsuitable or unavailable scale because of lack of interest of neurofinance researchers.

A deep-rooted structure to lead the academic investigators with the help of different steps of scale construction in the field of neurofinance is required. To evade various procedural issues of prior work we have to prefer to develop the questionnaire undoubtedly (Aupperle, Carroll and Hatfield, 1985).

This valid and reliable scale construction is based on procedure provided by the Churchill (1979); Hinkin (1995); Hinkin, Tracey and Enz (1997); Hinkin (1998). Hinkin, Tracey and Enz (1997); Kinicki et al. (2013) and Zheng, et al. (2015). Hinkin (1998) discussed the process having different steps for development of questionnaire and analysis, to demonstrate the most suitable techniques to sketch the valid and reliable instrument. In the following pages different phases of development of scale will be discussed in detail.

**3.3.1.1.1.1 Phase 1: Item Generation** The process of development of scale starts through the items generation to evaluate an idea under assessment (Hinkin, Tracey and Enz, 1997). We should produce the items by use of inductive and deductive method of research according to the recommendation of (Hinkin, 1998). According to the Kinicki et al. (2013) deductive method will helpful for the start of procedure as previous measure may be supportive for the construct development and inductive method will be required for additional help of deductive view point of measure because of broad and invalid measure in past. Schwab (1980) said that

existence of some theories about the construct may guide for the generation of items while performing the process of scale development.

There is no precise policy regarding the exact number of items for scale however very few useful method be present. Thurstone (1947) explored that a construct may be internally reliable as well as closed-fisted, consist of the least numeral of statements that sufficiently evaluate the area of curiosity. Harvey, Billings and Nilan (1985) in their study found that satisfactory internal uniformity and trustworthiness of scale could be attained with the help of four or five statements for each construct.

However, Schmitt and Stults (1985) investigated and revealed that construct with minimum items is a successful way of reducing the biasness in responses of individuals reasoned by tediousness or tiredness. As per the Ghiselli, Campbell & Zedeck (1981) theory of domain sampling tells that, it is essential that the sample of statements or items used from inventory of prospective items sufficiently symbolizes the measure under assessment. For example, Song et al. (2010); Ge and Lui (2015) in their research used questionnaire with 111 items to measure the few facets of neurotransmitters.

However on the base of given literature, it is decided to choose, 94 items for four constructs of neurotransmitters as dopamine, serotonin, Norepinephrine and Epinephrine, from two American practitioners Colbert (2013) and Tessler (1997) because of existence of theory about the phenomenon is being study. These items have never been used by academicians for research and never gone through scale development process. For more confirmation about the 94 behavioral items of neurotransmitters, further these discussed, with one expert of content domain, about the unnecessary items, defectively worded, or not required to the domain of content. According to the Kinicki et al. (2013), this process is said to be the preliminary evaluation.

Once the items or statements in the questionnaire have been finalized then as per the procedure of development of questionnaire, it is moment of carry out a first round of test for the adequacy of contents of the statements of measures.

**3.3.1.1.1.2 Phase 2: Content Adequacy Assessment** Mostly researchers spent energy and time for data collection in damaged construct without confirming the adequacy of contents of items. In this study, items pretesting process will be helpful exercise for the validation of scale before ultimate survey instrument. Literature of research revealed the number of ways for the assessment of content adequacy (Nunnally, 1978). As Hinkin (1998) said that most frequently used technique is to classify or sort statement or substance or items on the base of similarity to definition of measures with the help of experts in content domain or respondents who can read and understand the statements or students of contents domain.

According to Nunally (1978) the assessment of contents adequacy could be carry out through the panel of jury having understanding about the contents area.

**Step 1:** The preliminarily judge analysis performed to evaluate the content adequacy of early 94 items. For this, questionnaire circulated among the group of 60 individuals, from which 18 were university faculty members with average age of 38 year, 25 were M.Phil level students and 17 were graduate level students. The average age of student was 25 year and 30 percent of the respondents were female. Questionnaires were circulated among the faculty members during the office timing and among the students in class time and detail discussion made and information given about the questionnaire and dimension of measures and then asked to complete the survey.

The request made to the respondent that they agree or not with the given statements and their relative dimension. Moreover it was confirmed the truthful fraction of agreement for each item and apply the 80 percent standard for harmony to hold items for further investigation. According to the Kinicki et al. (2013), while developing the scale used standard of 80% for agreement for each item. All the judges made consensus about the 86 items.

**Step 2:** A second judge analysis of the items performed with the help of 30 respondents including one practitioner cum faculty member two university faculty members and 27 M.Phil level students including 20% female. Author met to the respondent in their offices and classes, made detail discussion and provide detail

information about the statements and related dimensions then asked to complete the survey. The standard of 80% agreement was used and all the respondents in second judge analysis agreed about all of the items holding for further analysis. As said by Nunnally (1978), this procedure indicates one way for investigating the content validity.

According to Hinkin et al. (1997) and Hinkin (1998), no one of the mentioned method will assure the contents validity; however these techniques give indication of reasonable items for the measurement of the variable as well as minimize the requirement of amendment of succeeding instrument. Right now in the procedure, the investigator holds the statements for process that previously vigilantly developed as well as evaluated with the help of specialist.

**3.3.1.1.1.3 Phase 3: Questionnaire Administration** In this phase, the investigator will utilize the 86 statements or items that have been survived in the content validity assessment process discussed above for measurement of construct and how deeply these statements or items will prove the hope of psychometric features like discriminant, convergent and criterion-related validity, as discuss in subsequent parts.

**(i) Items Scaling**

Previously retained items are taken on five point Likert scale and asked to the respondent to allocate up to the five points because of minimization of desirability of respondents. Aupperle et al. (1985) recommended the methodology of force choice in questionnaire base study to limit the wishes of persons providing information. As suggested by Lissitz and Green (1975), five points Likert scale used to produce variance in order to examine the associations between statements, scales as well as to produce satisfactory level of internal consistency and coefficients of reliability. The huge and main stream of scholar while developing the questionnaires used the Likert scale for measurement (Schmitt & Klimoski, 1991).

**(ii) Sample Size**

There has been extensive discussion regarding the size of sample for suitable assessment of statistical importance. During this phase of construction of instrument,

the investigator confirmed the gathering of data through appropriate size of sample to perform the subsequent statistical tests. It has been shown; the specific number of items or variables selected for assessment will indicate about the size of sample. For factor analysis, suggested sample size depend upon the ratio of item and response that may vary from 1 to 4 and 1 to 10 (Rummel, 1970; Schwab, 1980).

In the pretest stage of content validity procedure, as suggested by the Schriesheim et al. (1993); Anderson and Gerbing (1991) sample of 65 will be suitable and then 2 sample of twenty for latter use may be appropriate. According to the Guadagnoli and Velicer (1988), to obtain the precise result in exploratory factor analysis 150 respondents will be appropriate. Hoelter (1983) recommended that, at least 200 observation for confirmatory factor analysis but later Bollen (1989) investigated and recommended that at least 100 observations will be appropriate for confirmatory factor analysis.

However, researcher used a traditional way regarding the size of sample in the study and decides to use 200 observations for further analysis. After completing the task of data collection, it is necessary to assess the validity of instrument with the help of factor analysis

**3.3.1.1.1.4 Phase 4: Factor Analysis** Psychometric features of scale are assessed with the help of consistency and trustworthiness as well as construction of factors. As suggested by Schriesheim et al. (1993) assessment of adequacy of contents of items quantitatively can be done with the help of factor analytical techniques because of limitation of judgmental injustice of human. Researcher performed the construction of factors with the help of two stage procedure. In first stage, as Ford et al. (1986) said, judge analysis on the base of two grounds, economical and convenient length of scale

In second stage, According to the Gerbing and Hamilton (1996), scale developers perform exploratory factor analysis before the confirmatory factor analysis. As we know that EFA is used for reduction of items as well as CFA is used to check

the worth of instrument. As Fabrigar et al. (1999) said, exploratory factor analysis is applied by the investigators while constructing an instrument and provides identification of unobserved variables.

According to the Yong and Pearce (2013), exploratory factor analysis is applied to recognize unobserved variables or dynamics and is generally employed to shrink the constructs to a lesser part due to the two reasons, one is time saving and other is easy explanation. This is also said by the Williams et al. (2010) as exploratory factor analysis is a main procedure, which is used in construction, fine-tuning and assessment of questionnaire. Harrington (2009) disclosed that scale developer employ the confirmatory factor analysis for the purpose of psychometric assessment and validity of measures.

### **(i) Exploratory Factor Analysis**

Researcher collected the data with help of questionnaire having 86 items previously confirmed in the two steps judge analysis, from 250 university students having knowledge of content domain then found 51 questionnaires incomplete and 199 questionnaires appropriate for further analysis.

Researcher do not asked to respondents to provide the demographics to maintain the secrecy of respondents as Roch and McNall (2007) suggested that lack of profile of respondents improve correctness of outcome.

Before exploratory factor analysis author performed the items analysis with the help of inter items correlation matrix and found more than 0.20 value of coefficients of 67 items out of 86 and remaining deleted and later on these 67 items confirmed in EFA because Churchill (1979) disclosed that lower value of correlation coefficient shows that items not belong to suitable domain due to which chances of inaccuracy and unreliability increases. The reliability statistics through Cronbach's Alpha 0.91 for 86 items calculated.

As Kim and Mueller, (1978) recommended, before factor analysis inter items correlation should be performed to check that either or not items fit in to content domain.

As, Piedmont (2014) mentioned that inter-item correlation is an important ingredient, in carry out an analysis of items in scale development, having value more than 0.20 for each item which indicate that items are representative of content domain. According to Cronbach (1951), scale reliability or internal consistency problem can be clarify through the inter-item correlations because it tell us how better scale is quantifying the construct.

After deleting of items having less than 0.20 values of correlation coefficient then Cronbach's alpha improve from 0.91 to 0.93. Then reliability statistics through Cronbach's alpha for each construct as 0.798, 0.908, 0.943 and 0.947 respectively for Dopamine, Serotonin, Epiphine and Norepiphine.

Exploratory factor analysis performed by using the five steps guidelines of (Williams et al., 2010). First, with the help of Kaiser-Meyer-Olkin Measure of Sampling Adequacy 0.787 confirmed that data is suitable for exploratory factor analysis, as the Kaiser (1974) recommended that range of value should be as 0.00 to 0.49 unacceptable, 0.50 to 0.59 wretched, 0.60 to 0.69 just adequate, 0.70 to 0.79 adequate, 0.80 to 0.89 admirable and 0.90 to 1.00 excellent and Comrey and Lee (2009) indicated that 200 sample size as reasonable.

Second, factors extracted with the help of the Principal Component Analysis method and third, orthogonal varimax rotation to wish for four factor solution by researcher because Pett et al. (2003) also recommended the PCA and Osborne and Costello (2005) suggested the orthogonal varimax method for rotation when factors are uncorrelated and also said that no single criteria for extraction of factors.

Subsequently, four factors are confirmed with 43.4% value of Cumulative Percentage of Variance and Eigen value more than 1. Finally, author retained 67 items by employing value 0.30 as lowest point for each statement or item for factor loading and 19 items deleted because of lack of support. As Kinicki et al. (2013) said minimum 0.30 weight is appropriate for items loading.

Similarly, the robust of results of inter item correlation matrix checked through the EFA. These 67 items retained for confirmatory factor analysis to check the significance of scale.



## (ii) Confirmatory Factor Analysis

One of the primary limitations of exploratory factor analysis is the failure to compute the goodness of fit of the resultant factors (Long, 1983). The indicators that fulfill the criteria of an exploratory factor analysis may not have fit in measurement model because of not having external consistency (Gerbing and Anderson, 1988). Most of time CFA is used for validation of constructs (Levine, 2016). Confirmatory factor analysis is just affirmation about the previous examination because as MacKenzie, Podsakoff, and Fetter (1991) suggested that, at this time approximately 30 goodness-of-fit indices used to evaluate confirmatory factor analysis outcome.

Author performed the CFA with the help AMOS.20 and 67 items stay alive in EFA and got four possible models with four possible factors (dopamine, serotonin, Epiphrine and Norepiphrine) solution. In CFA 16 items retained by correlating the different items and remaining 51 deleted and model fitness criteria assessed with the help of absolute measure fit (GFI, RMR, RMSEA and CMIN/DF) and incremental measure fit (TLI, CFI, NFI, AGFI and IFI) and parsimony adjusted measure (PGFI and PNFI) see Table.1.

Medsker, Williams, and Holahan (1994) advised that the chi-square statistic, Comparative Fit Index (CFI) and the Relative Non-centrality Index (RNI) can be suitable to verify the superiority of fit with different situation in the data. Generally fitness of model was assessed with the help of two indices of fit as the comparative fit index (CFI; Bentler, 1990) and the non-normed fit index (NNFI; Bentler & Bonnett, 1980). Along with these indices of fit, the root mean square error of approximation (RMSEA) evaluated the fitness of model, if the value of RMSEA is 0.05 or smaller show strong fit, among .05 and .08 show logical fit, as well as figures between .08 and .10 show ordinary fit (Browne & Cudeck, 1992).

Hu and Bentler (1999) recommended in support of model fit as RMR values close to .09, RMSEA values close to .06 or below, CFI and TLI values close to .95 or greater and along with  $GFI \geq 0.90$ . The cutoff values for  $\chi^2/df$  (CMIN/DF) is recommended 1 as lower limit and 2 to 3 or 5 as upper limit,  $AGFI \geq 0.80$ ,  $IFI \geq 0.90$ ,  $NFI \geq 0.90$ , PGFI and PNFI values 0 to 1. (Gulla & Purohit, 2013).

Commonly a CMIN/DF statistic lower than 5 is believed satisfactory, as lesser values consider better (Thomson et al., 2005).

Additionally, five models observed the loading as of 18 items on appropriate 4 factors in model-1, as 4 items loaded on dopamine, 4 items loaded on serotonin, 6 items loaded on Norepinephrine 4 items loaded on Epinephrine and detail can be seen in table-2. Furthermore model-2 to 5 showed the loading of 16 items on appropriate 4 factors as 4 items loaded on dopamine, 4 items loaded on serotonin, 4 items loaded on Norepinephrine 4 items loaded on Epinephrine and detail can also be seen in Table 3.2.

Till now all these five models fulfill the criteria of goodness of fit and show appropriate loading of items on appropriate expected factors but which one model is best suitable will be decided later on after completion of further analysis.

TABLE 3.1: Summary of model fit indices

Types of measure fit	Model-1	Model-2	Model-3	Model-4	Model-5	Level of acceptable fit
<b>Absolute measure fit</b>						
GFI	0.931	0.932	0.932	0.927	0.919	$\geq 0.90$
RMSEA	0.030	0.039	0.037			$< 0.050$
$\chi^2/df$ (CMIN/DF)	1.183	1.296	1.276	1.355	1.476	$< 5$
RMR	0.076	0.09	0.087	0.89	0.92	$< 0.90$
<b>Incremental fit measures</b>						
TLI	0.983	0.969	0.971	0.963	0.950	$\geq 0.95$
AGFI	0.902	0.901	0.904	0.897	0.887	$\geq 0.80$
CFI	0.987	0.976	0.977	0.970	0.959	$\geq .95$
IFI	0.987	0.976	0.977	0.971	0.960	$\geq 0.95$
NFI	0.920	0.904	0.903	0.896	0.886	$\geq 0.90$
<b>Parsimonious fit measures</b>						
PGFI	0.653	0.644	0.658	0.661	0.662	0-1
PNFI	0.722	0.708	0.723	0.725	0.724	0-1

TABLE 3.2: 18 Items Loaded on 4 Constructs (Model-1) and 16 Items Loaded on 4 Constructs (Model: 2 to 5).

Factors	Items	Loading-1	Items	Loading-2	Loading-3	Loading-4	Loading-5
Serotonin	S5	0.618	S7	0.702	0.851	0.85	0.445
	S6	0.606	S8	0.662	0.796	0.797	0.555
	S10	0.666	S10	0.654	0.526	0.527	0.797
	S14	0.551	S11	0.521	0.408	0.408	0.834
Dopamine	D20	0.569	D20	0.574	0.574	0.574	0.574
	D19	0.667	D18	0.834	0.831	0.831	0.831
	D17	0.555	D16	0.558	0.559	0.56	0.56
	D15	0.578	D15	0.654	0.658	0.658	0.658
Epiphrine	E8	0.801	E8	0.707	0.629	0.629	0.629
	E7	0.773	E6	0.769	0.799	0.798	0.798
	E6	0.693	E4	0.885	0.839	0.84	0.84
	E5	0.746	E1	0.57	0.604	0.604	0.604
Norepiphrine	N8	0.794	N6	0.772	0.797	0.813	0.705
	N9	0.881	N7	0.726	0.847	0.814	0.836
	N10	0.817	N8	0.847	0.819	0.836	0.814
	N11	0.806	N12	0.743	0.75	0.705	0.813
	N12	0.805					
	N14	0.764					

**3.3.1.1.1.5 Phase 5: Internal Consistency Assessment** Internal consistency is a gauge of reliability and indicates the intensity of items in the construct about the different facet of the similar trait (Revicki, 2014). Internal consistency assesses the steadiness contained by the scale as well as items how fine a depository of statements quantifies a specific attribute (Drost, 2011). Reliability is said to be the degree where a construct cedes the equal value all time when it is governed, all else unchanged (Hays and Revicki, 2005). Most common satisfactory gauge in survey investigation for evaluating internal consistency of scale is Cronbach's alpha with the help of which it is notify that how good the statements assess the similar measure (Price& Mueller, 986).

Cronbach alpha is the coefficient 0 to 1 commonly used to estimate the reliability of instruments based on internal consistency. As Hinkin (1997) said, internal consistency should be assessed after EFA and CFA. After exploratory and confirmatory factor analysis, it was determined internal consistency with help of Cronbach's alpha twice: first, scale with 18 items having Cronbach alpha 0.833 for 4 constructs as values of alpha 0.7, 0.73, 0.92 and 0.88 respectively for dopamine with 4 items, serotonin with 4 items, Norepinephrine with 6 items and Epinephrine with 4 items. Second, scale with 16 items having Cronbach's alpha 0.796 for 4 constructs as values of Cronbach's alpha 0.75, 0.76, 0.87 and 0.80 respectively for dopamine with 4 items, serotonin with 4 items, Norepinephrine with 4 items and Epinephrine with 4 items.

Obviously, the value of coefficient alpha is one of the very significant as well as persistent statistics in investigation concerning scale development (Cronbach's, 1951). According to the Cortina (1993), an instrument having more than 14 statements or items with alpha value 0.7 is satisfactory for freshly constructed scale. Next step is to confirm the validation of scale.

**3.3.1.1.1.6 Phase 6: Construct Validation** In the previous phases, content validity and internal consistency of the newly constructed instrument has been confirmed, these two shows the proof of validity of construct.

Moreover proof of validity of construct can be provided with the help of convergent, discriminant and criterion-related validity.

**(i) Convergent Validity**

Confirmatory factor analysis applied to evaluate validity of construct (Joreskog, 1969). But according to Campbell and Fiske (1959), construct validity assessment has two sides, one is said to be the convergent validity as self-assurance level about the feature which tell us how good construct is assessed by the mentioned observed variables and second, discriminant validity as the extent to which variables of diverse characteristics are dissimilar. Fornell and Larcker (1981) standard usually applied to evaluate the extent of communal variance among the underlying constructs.

In accordance with standard, the convergent validity evaluate with the help of Average Variance Extracted (AVE) and Composite Reliability (CR), whereas the value of AVE 0.5 and value of CR 0.7 are acceptable. But according to Hair et al., (2006) Composite Reliability (CR) value between 0.6 and 0.7 is acceptable. Similarly, Kotcharin et al. (2012); Gulla and Purohit (2013) suggested that AVE value 0.48 is also acceptable.

TABLE 3.3: Convergent Validity of Constructs.

(A)					(C)				
	Measures	Items	AVE	CR		Measures	Items	AVE	CR
<b>Model-1</b>	Dopamine	4	0.4	0.6	<b>Model-2</b>	Dopamine	4	0.4	0.6
	Serotonin	4	0.4	0.6		Serotonin	4	0.4	0.6
	Epinephrine	4	0.6	0.6		Epinephrine	4	0.5	0.7
	Norepinephrine	4	0.7	0.9		Norepinephrine	4	0.6	0.8
(B)					(D)				
	Measures	Items	AVE	CR		Measures	Items	AVE	CR
<b>Model-3</b>	Dopamine	4	0.5	0.6	<b>Model-4</b>	Dopamine	4	0.4	0.6
	Serotonin	4	0.5	0.6		Serotonin	4	0.5	0.6
	Epinephrine	4	0.5	0.7		Epinephrine	4	0.5	0.7
	Norepinephrine	4	0.6	0.8		Norepinephrine	4	0.6	0.8
(E)									
	Measures	Items	AVE	CR					
<b>Model-5</b>	Dopamine	4	0.5	0.6					
	Serotonin	4	0.5	0.7					
	Epinephrine	4	0.6	0.8					
	Norepinephrine	4	0.5	0.7					

On the base of methodological recommendation of literature related to convergent validity for five appropriate models of CFA, author calculated the values of average variance extracted (AVE), composite reliability (CR) for dopamine, serotonin, epinephrine and Norepinephrine.

The values of AVE and CR of five different models can be seen in table-3

Table 3.3 results indicate that model three and five show better and acceptable values of average variance extracted and composite reliability which indicates that observed variables converge to the latent variables appropriately.

### **(ii) Discriminant Validity**

Evaluation of discriminant validity becomes precondition for exploring associations among hidden constructs (Henseler et al. 2015). According to Fornell and Larcker (1981), discriminant validity assessment can be achieved by comparing the AVE of latent variable and maximum.

Share variance or squared correlation of constructs. As said by this standard, for each construct the values of AVE must be greater than maximum share variance or squared correlation of other constructs.

For this we use the above mentioned five models from confirmatory factor analysis and determined the square of correlation or maximum shared variance (MSV) of latent variables in each model. For assessment of discriminant validity, we compared the values of square of correlation and AVE. Then it is checked that values of AVE are greater than the values of square of correlation of each construct which indicates that dopamine, serotonin, Epinephrine and Norepinephrine discriminate with each other appropriately.

The values of square of correlation of dopamine, serotonin, epinephrine and norepinephrine in five different models can be seen in table-4. From the results of table-4 can be seen that values of AVE are greater than the values of MSV for dopamine, serotonin, epinephrine and norepinephrine in all five different models.



TABLE 3.4: Discriminant validity of Constructs.

	Correlation <sup>2</sup> or Maximum Share Variance (MSV)				
	Model-1	Model-2	Model-3	Model-4	Model-5
Dopamine ↔ Serotonin	0.001296	0.003364	0.001024	0.001024	0.001369
Dopamine ↔ Epinephrine	0.002401	0.000009	0.000400	0.000400	0.001600
Dopamine ↔ Norepinephrine	0.006084	0.001156	0.000900	0.001600	0.000400
Serotonin ↔ Epinephrine	0.355216	0.272484	0.207936	0.207936	0.229441
Serotonin ↔ Norepinephrine	0.253009	0.251001	0.226576	0.231361	0.212521
Epinephrine ↔ Norepinephrine	0.180625	0.193600	0.212521	0.207025	0.207025

Till now, the results mentioned in the above tables, indicates that values of average variance extracted, composite reliability and maximum share variance are appropriate and acceptable for convergent and discriminant validity.

### (iii) Criterion-related Validity

For the assessment of criterion-related validity, investigator must observe the associations among the fresh construct as well as theorized measure to build up the idea of attention in the research (Cronbach & Meehl, 1955). According to Hinkin (1998), associations among the new measure as well as theorized variables must be supported with the help of theory as well as by observing the correlation analysis and this association must be statistically significant for the confirmation of criterion-related validity. For this, author accumulated the data of five related resulting measures of dopamine, serotonin, epinephrine and Norepinephrine.

As per opinion of Pompian (2006) some behavioral aspects of investors are results of neurotransmitters as dopamine, serotonin and epinephrine. These five resulting variables as investment horizon, risk attitude, Personalization of Loss, confidence and control are evaluated by using the 21 items scale on 5 pint Likert scale (Wood & Zaichkowsky, 2004). The result of correlation analysis between neurotransmitters and behavioral outcome of investor reveals that some of variables are significant at the 0.01 level and some are significant at 0.05 levels. The final phase in development of questionnaire procedure is replication. The concluding items of questionnaire can be seen in the Appendix A.

**3.3.1.1.7 Phase 7: Replication** In replication phase, it is possibly squabbled that, due to the false variance caused by the measurement technique (Podsakoff, MacKenzie, & Podsakoff, 2003) and prospective complexities due to the common variance method, it is unsuitable to employ the identical set of data for scale construction as well as for the assessment of psychometric features of a newly developed construct (Campbell, 1976). The use of independent data set will generalize the newly constructed variable (Stone, 1978). For this, Anderson & Gerbing (1991) suggested the administration of one more self-sufficient set of data.

For these reasons, researcher collected another independent set of data of 199 sample size from the individuals who have suitable knowledge of content domain. Newly administered scale have 16 items of neurotransmitters as dopamine, serotonin, Epinephrine and Norepinephrine, survived in previous phases of scale development process. Then performed the confirmatory factor analysis, assessment of internal consistency reliability, and convergent, discriminant, and criterion-related validity for evaluation of psychometric features of scale.

Confirmatory factor analysis of previously survived 16 items of dopamine, serotonin, epinephrine and Norepinephrine shows the appropriate loading as seen in table 3.1, RMR values is .09, RMSEA values is .04, CFI, TLI, IFI, NFI, PNFI and PIFI values are 0.98, 0.97, 0.98, 0.91, 0.72 and 0.77 along with GFI, AGFI and PGFI value 0.93, 0.90 and 0.65. The value for  $\chi^2/df$  (CMIN/DF) is 1.30. These results of CFA indicates that model is fit as per the standard describes in literature. So, the table-3.5 indicates that values are acceptable.

Correlation coefficient indicates that an association among the new measure as well as theorized variables is supported and this association is statistically significant for the confirmation of criterion-related validity.

TABLE 3.5: 16 Items Loaded on 4 Constructs, internal consistency reliability and convergent validity.

Factors	Items	Loading	Cronbach's alpha	AVE	CR
Serotonin	S7	0.51	0.823	0.515	0.709
	S8	0.64			
	S10	0.78			
	S11	0.88			
Dopamine	D20	0.58	0.814	0.511	0.703
	D18	0.58			
	D16	0.83			
	D15	0.82			
Epiphrine	E8	.80	0.737	0.50	0.66
	E6	0.77			
	E4	0.72			
	E1	0.40			
Norepinephrine	N6	0.71	0.784	0.51	0.708
	N7	0.84			
	N8	0.63			
	N12	0.66			

TABLE 3.6: Discriminant validity of Constructs.

	MSV
Dopamine ↔ Serotonin	0.082
Dopamine ↔ Norepinephrine	0.082
Dopamine ↔ Epinephrine	0.074
Serotonin ↔ Norepinephrine	0.042
Serotonin ↔ Epinephrine	0.053
Norepinephrine ↔ Epinephrine	0.046

TABLE 3.7: Criterion-related validity.

<b>Correlations</b>									
	<b>IH</b>	<b>RA</b>	<b>PL</b>	<b>Confi</b>	<b>Control</b>	<b>D</b>	<b>S</b>	<b>N</b>	<b>E</b>
IH	1								
RA	.354**	1							
PL	.298**	.518**	1						
Confi	.542**	.600**	.449**	1					
Control	.382**	.622**	.724**	.480**	1				
D	.208**	.210**	.071	.172*	.180*	1			
S	.647**	.462**	.385**	.645**	.455**	.169*	1		
N	.499**	.690**	.495**	.611**	.631**	.188**	.511**	1	
E	.446**	.458**	.392**	.525**	.466**	.199**	.554**	.550**	1
**. Correlation is significant at the 0.01 level (2-tailed).									
*. Correlation is significant at the 0.05 level (2-tailed).									
IH = Investment Horizon, RA = Risk Attitude, PL = Personalization of Loss, Confi = Confidence									
Control = Control, D = Dopamine, S = Serotonin, E = Epinephrine, N = Norepinephrine									

**3.3.1.1.1.7 Conclusion of Scale Development Process** Superior investigation initiates with superior scale. Due to this; we have visited the literature directed seven steps procedure for construction and validation of scale of neurotransmitters and finalized four latent constructs that are dopamine, serotonin, epinephrine and norepinephrine with 16 items. This study was with anticipation that neurofinance investigators will use this logical advancement to measure the level of dopamine, serotonin, epinephrine and norepinephrine of stock market investor. Above mentioned process of questionnaire development found that constructs which come out will be glowing psychometrically (Mackenzie et al., 1991). This investigation will give the hope that the corroborated scale is reliable as well as valid and will be appropriate to utilize in upcoming studies of neurofinance. So, after completion of all necessary steps (items generation, Content Adequacy Assessment, administration of questionnaire, exploratory factor analysis, confirmatory factor analysis, assessment of internal consistency, convergent, discriminant, criterion related validity and finally replication of all steps) this valid and reliable scale of neurotransmitters, author of the study will use it for data collection procedure of this research to avoid some methodological issues.

## **3.4 Measurement of Emotional Intelligence**

The emotional intelligence measured with help of four constructs as Self-emotion appraisal (SEA), Others' emotion appraisal (OEA), Use of emotion (UOE) and Regulation of emotion (ROE). This emotional intelligence questionnaire contain 16 items 4 items for each construct and developed by the experts as (Wong & Law, 2002). As detail of questionnaire is mention in the Appendix A.

## **3.5 Measurement of Personality**

Personality was measured with the help of five constructs as openness, extraversion, agreeableness; conscientiousness and neuroticism with opposite positions having 44 items and these 44 items were developed by the (John & Srivastava,1999).

As detail of questionnaire is mention in the Appendix A.

### **3.6 Measurement of Investor Behavior**

Different scholars in different area of the world measured the investor behavior by and large similarly as Ghun and Ming (2009) measured the investor's behavior with the help of four constructs having fifteen items on the five point Likert scale. Thapa (2014) developed the five point Likert scale questionnaire having 4 behavioral constructs to measure the investor's behavior with 14 items. But in this study researcher used the questionnaire of Wood and Zaichkowsky (2004) to measure the behavior of individual investors. This questionnaire was developed on five point likert scale to measure the behavior of individual investors who are engaged in stock trading. The questionnaire has five behavioral constructs as control, confidence, personalization of loss, and investment horizon and risk attitude of investors. These constructs have 18 items, as the detail of questionnaire is mention in the Appendix A.

### **3.7 Measurement of Investment Decisions**

In this study, the construct investment decision measured by the (Pasewark & Riley, 2010). These experts developed the questionnaire on the five point likert scale with the help of 14 items to measure the individual's investment decisions. Further, validation and reliability of this scale is checked by the Qureshi (2012) on the five point likert scale. The detail of this questionnaire is given in the Appendix A.

### **3.8 Developing the Structural Equations**

As a final point, research model of this dissertation is to be build up by generating structural equations that make connections among the neurotransmitters, EI and personality on investor's behavior and investment decisions.

### 3.8.1 Measurement Model

In Figure 2.1 all indicators (shown in squares) build and influence their respective main and sub- latent constructs (shown in circles). These main and sub-latent constructs can be measured in mathematical terms as:

$$F1 = \lambda1X1 + \lambda2X2 + \lambda3X3 + \lambda4X4 + \varepsilon$$

$$F2 = \lambda5X5 + \lambda6X6 + \lambda7X7 + \lambda8X8 + \varepsilon$$

$$F3 = \lambda9X9 + \lambda10X10 + \lambda11X11 + \lambda12X12 + \lambda13X13 + \varepsilon$$

$$F4 = \lambda14X14 + \lambda15X15 + \lambda16X16 + \lambda17X17 + \lambda18X18 + \varepsilon$$

$$F5 = \gamma1Y1 + \gamma2Y2 + \gamma3Y3 + \gamma4Y4 + \gamma5Y5 + \gamma6Y6 + \varepsilon$$

### 3.8.2 Structural Model

The first hypothesis (H1), impact of latent exogenous variable, neurotransmitters measures (F1) on latent endogenous variables, investor's behavior (F4) would be measured through:

$$F4 = \beta1F1 + \varepsilon$$

While second hypothesis (H2), impact of latent exogenous variable, EI measures (F2) on latent endogenous variables, investor's behavior (F4) would be measured through:

$$F4 = \beta2F2 + \varepsilon$$

In this way, third hypothesis (H3) impact of latent exogenous variable, personality (F3) on latent endogenous variables, investor's behavior (F4) would be measured through:

$$F4 = \beta3F3 + \varepsilon$$

In this way, fourth hypothesis (H4) impact of latent exogenous variable, neurotransmitters measures (F1) on latent endogenous variables, investment decisions (F5) would be measured through:

$$F5 = \beta1F1 + \varepsilon$$

In this way, fifth hypothesis (H5), impact of latent exogenous variable, EI measures (F2) on latent endogenous variables, investment decisions (F5) would be measured through:

$$F5 = \beta2F2 + \varepsilon$$

In this way, sixth hypothesis (H6) impact of latent exogenous variable, personality (F3) on latent endogenous variables, investment decisions (F5) would be measured through:

$$F5 = \beta3F3 + \varepsilon$$

While the impact of neurotransmitters, EI and personality on investor's behavior and investment decisions would be calculated through:

$$F4 = \beta1F1 + \beta2F2 + \beta3F3\varepsilon$$

$$F5 = \beta1F1 + \beta2F2 + \beta3F3\varepsilon$$



Detail of proxies for exogenous and endogenous variables is given in the Table (2.1 and 2.2). However, Greek letters  $\lambda$ ,  $\gamma$  and  $\beta$  are coefficients of main and sub-latent constructs while Greek letters  $\varepsilon$  indicates an error term.

So, on the base of literature and nature of conceptual framework of study, author will use the PLS-SEM with the help of hierarchical latent variable by using reflective-formative type model with all of its ingredients and necessary conditions. Further detail of data analysis techniques is given on the following sections.

### **3.9 Partial Least Squares Base Structural Equation Modeling (PLS-SEM)**

This research employed the most flourishing statistical method of multivariate analysis known as Partial Least Squares Structural Equation Modeling (PLS-SEM) because according to the Becker et al. (2012) in modern days charm of partial least squares structural equation modeling (PLS-SEM) is growing. In addition to this, Henseler et al. (2009) said that PLS-SEM is best method for data which did not meet the condition of normality.

Primarily, structural equation modeling (SEM) has two types; one is based on the covariance called CB-SEM and other is based on the variance called PLS-SEM. So, the CB-SEM is most appropriate where studies core is based on confirmatory factor analysis. Whereas, SEM-PLS is most appropriate method for the analysis of multiple regression models of exploratory studies. Because, according to Hair et al. (2012b) PLS-SEM method of analysis concentrate on the enlightenment of the variance of reliant construct in intricate model of research. Similarly, Iacobucci (2010) said that CB-SEM focus on measurement model but PLS-SEM focus on the structural model or prediction of dependent variable in best way. So, the more distinctions among the CB-SEM and PLS-SEM are given as:

TABLE 3.8: Distinctions among CB-SEM and PLS-SEM.

Scope	CB-SEM	PLS-SEM
<b>Implications</b>	Emphasize on covariance of all indicators in the anticipated model, on the base of indices of goodness of fitness and chi-square statistic.	Emphasize on the variances of constructs defined by the investigator and also said to be a foretelling method.
<b>Appropriate</b>	CB-SEM uses complete information and is commonly appropriate for confirmatory studies.	PLS-SEM does not need complete information as well as is beneficial for exploratory research and is appropriate on the base of incomplete information. When the purpose of study is incremental research and to construct new structural paths or new measures.
<b>Sample Size</b>	CB-SEM need comparatively big sample of data Normally more than 200.	PLS-SEM need comparatively small sample of data with 100 to 200 along with complicated models.
<b>Reflective and Formative Constructs</b>	CB-SEM has some constraints for analyzing the reflective variable only.	PLS-SEM can be useful for both categories of models either reflective or formative variable.
<b>Normality of data</b>	The CB-SEM technique similar to other multivariate statistical technique needed multivariate constraints must be for data.	PLS-SEM does not harshly need normality of data.
<b>Causality related aspects</b>	The appropriateness of the whole measurement model and the potency along with worth of the relation is essential among the independent as well as dependent constructs.	PLS-SEM can hut beam on the hypothetical causality of relations among unobserved as well as observed constructs. It up to investigators to make a decision of acceptance or rejection of a specific theorized relation.

**Source:** adapted from (Chin & W, 2010) and (Hair et al., 2014a)

### **3.9.1 Hierarchical Latent Variable Model in PLS-SEM using Reflective-Formative Type Model With the Help of Two Stage Approach**

In this study, author applied the hierarchical latent variable model in PLS-SEM using reflective-formative type model as per the guideline of (Becker et al., 2012). Because this research have four higher order latent formative constructs and nineteen lower order reflective constructs and these lower order reflective constructs consist of their respective items. In modern days, according to Becker et al. (2012) hierarchical latent variable models in PLS-SEM using reflective-formative type model are most preferable. Previously, Chin (1998b) said that the component model or hierarchical or higher-order latent variable models are clear demonstration of multi aspect variables that are present at a superior stage of concept.

For hierarchical latent variable model in PLS-SEM reflective-formative type model three choices are available in the previous studies: the repeated indicators method (Lohmoller, 1989), the chronological latent construct score approach, or two step method (Ringle et al., 2012) and the mix method (Wilson and Henseler, 2007). However on the base of a higher order hierarchical latent variable model, Ringle et al. (2012) differentiate four categories of models. According to Becker et al. (2012) names of models are reflective-reflective type I, reflective-formative type II, formative-reflective type III and formative-formative type IV.

So, in this dissertation author used reflective-formative type II model in hierarchical latent variable model using PLS-SEM because According to Chin (1998b) first or subordinated or lower order variable should be quantify reflectively that form the concept of construct. As per the Edwarad (2001) items working as reflective clearly form their measurement error. However, Lee and Cadogan (2012) said that reflective-reflective types I model in hierarchical latent variable model are most awful, confusing, as well as at superlative worthless level. Literature indicates that 52% studies used the reflective-formative type II model and 24% studies used the reflective-reflective type I model (Ringle et al., 2012).

In this study author applied the two stage approach because of nature of hypothesis of study. Because, Becker et al. (2012) said that two stage method is most appropriate as compare to repeated indicator or hybrid approach when researcher are interested mainly in higher order latent constructs.

He also said that two stage methods are more practical when guessing a advance practical type of model on the second order level of study. Lee and Cadogan (2012) proposed the two stage approach when higher order latent constructs have formative nature. For two stage approach there is need to calculate the latent score of lower order latent variables in first stage (Tenenhaus et al., 2005) and then these latent score calculated in first stage are used as indicator of higher order latent variable in second stage (Agarwal and Karahanna, 2000; Wilson and Henseler, 2007; Wetzels et al., 2009).

### **3.9.2 Formative Verses Reflective Indicators**

Mainly, construct's items or indicators have two directions when use PLS-SEM: arrow toward latent constructs (formative) or arrow from latent constructs (reflective). As, Chin (1998) recommended four assumptions while making decision of reflective or formative indicator of latent construct as:

- i. If the latent variable is delineate with the help of its items.
- ii. If the latent variable items are not exchangeable among themselves.
- iii. If items of the latent construct are not co-vary with any other items.
- iv. If the items are not supposed to have not similar surroundings.

If all of above conditions met by any latent construct's indicators that is called formative otherwise reflective. The decision of formative or reflective is extremely essential as slip-up come to mind while selecting the item's arrow direction this may direct to the errors in measurement model.

Construct's items with formative nature do not required to test the construct's indicator loadings, internal consistency, convergent and discriminant validity (Cenfetelli & Bassellier, 2009). Similarly, construct's items with reflective nature required to test the construct's indicator loadings, internal consistency, convergent and discriminant validity (Hair et al., 2012; Hair et al., 2012).

Hierarchical latent variable in PLS-SEM using reflective-formative type model has two categories of models: measurement and structural models. Diverse statistical measures are necessary for test of these models.

Internal consistency and validating techniques are needed for the external models in measurement models of the study. Subsequent to accomplish the least necessary principles for measurement model after that move towards the internal model of research that is called structural model (Hair et al., 2014a). This dissertation has both reflective and formative kinds of variables.

### **3.9.3 Evaluation of Reflective Measurement Models**

Reflective variables required to be evaluated by the measurement model. Therefore, investigator evaluates the measurement models by concentrating on construct reliability, indicator reliability, convergent and discriminant validity in PLS-SEM one by one with all the rules of thumb. Construct reliability is measurement model is calculated with the help of Cronbach's Alpha. Cronbach (1951) recommended that the value of coefficient alpha is one of the very significant as well as persistent statistics in research. However, Cortina (1993) proposed that alpha value 0.7 as a satisfactory.

Indicator reliability is assessed with the help of outer loading of a construct because the relationship of items is detained through the external loading of a variable. The least outer loading 0.70 or superior is important. The reason at the back of this superior outer loading may be identified in the situation of the square of items external loading which is called as communality of indicators. However, according

to the Hulland (1999) external loading can be feeble in freshly constructed questionnaire in the research of social sciences. Although, Hair et al. (2013) suggested that the acceptable level cross loading more than 0.4 in exploratory research.

Convergent validity indicates that indicators of any variables how much come together or put on maximum share of its variance. According to Campbell and Fiske (1959), construct validity assessment has two sides, one is said to be the convergent validity as self-assurance level about the feature which tell us how good construct is assessed by the mentioned observed variables. In accordance with standard, the convergent validity evaluate with the help of Average Variance Extracted (AVE) and Composite Reliability (CR), whereas the value of AVE 0.5 and value of CR 0.7 are acceptable.

However, Hair et al. (2013) suggested that AVE values less than 0.5 means that error in indicators that may failed to explain the variance of construct. But according to Hair et al., (2006) Composite Reliability (CR) value between 0.6 and 0.7 is acceptable. Similarly, Kotcharin et al. (2012); Gulla and Purohit (2013) suggested that AVE value 0.48 is also acceptable.

Discriminant validity reveals that how significantly and accurately any variable differ or dissimilar as of other variables of the research. It is the representation that the variable is distinctive gauge and not amplifies the similar things like other variable of the research currently. However, according to Campbell and Fiske (1959), construct validity assessment has two sides, one is said to be the convergent validity and other is discriminant validity as the extent to which variables of diverse characteristics are dissimilar. For reflective nature of variables mainly two gauges are used to see the discriminant validity of the variable as recommended: firstly, each indicators/variables cross-loading should be more as compare to their cross-loadings. Secondly Fornell-Lacker (1981) standard usually applied to evaluate the discriminant validity of underlying constructs.

Although, Henseler et al. (2015) recommended one more gauge to evaluate the discriminant validity which is on the base of Multitrait-Multimethod Matrix called as Heterotrait-Monotrait Ratio (HTMT) of correlation. The standardized value

for correlation of HTMT ratio should be less than 0.90, it concludes that latent constructs discriminant validity exist.

### **3.9.4 Evaluation of Formative Measurement Models**

Measurement model for formative variable may not be evaluated statistically like reflective variable. Higher level of association among items of formative variable is known as the problem of multicollinearity. This indicates that more than single items reveal the one and the same observable fact. Along with higher intensity of multicollinearity problem mislead external weights and also significance level of formative indicators.

The single most fundamental criteria for the assessment of measurement model of formative variables are to judge the importance with the help of its external weight. As Hair et al. (2013) reveals that the significance of external weights of the formative items of variable is judged with help of their t-value.

Similarly, Fornell-Lacker (1981); Chin (1998); (Cenfetelli & Bassellier, 2009); (Hair et al. (2012); Hair et al. (2012) said that there is no need to test the convergent and discriminant validity measures for formative variables and items but their outer weight, level of significance with the help of t-values, p-values and should assess the parameters of multicollinearity.

### **3.9.5 Evaluation of Structural Models**

Once the evaluation of measurement model has completed, the subsequently step is to make the assessment of the structural model of the research. Evaluation of structural model determines the prognostic knack along with the relationship of the variable of the research. According to the Hair et al. (2011) five most important measures are essential for the evaluation of structural model of every research. These measures are presented below separately along with their cut off point.

### 3.9.5.1 Multicollinearity Problem in Structural Model

The procedure of quantifying the multicollinearity in the structural model is the same as is exercise in formative type of measurement model which is the acceptance level of VIF value. In structural model VIF values for every variable must be authenticate one by one.

Kutner et al. (2004) said that VIF values more than 10 can create the problem of multicollinearity between the variable of research. On the other hand, Hair et al. (2013) recommended that VIF values less than or equal to 2 is acceptable but more than or equal to 5 can create the problem of multicollinearity between the variable of research.

### 3.9.5.2 Path Coefficients in Structural Model

Path coefficient of the research indicates the relationship between the variables. According to Dodge (2003) the word path coefficient was derive from the work of Wright (1921) where, in multivariate analysis a specific technique on the base of graphical interface was utilize to study the associations among the constructs. in view of Hair et al. (2013) the values of path coefficient with positive 1 stand for the considerable affirmative association of the variable as well as the value of 0 or less indicates that the feeble or no association among the variable.

Values for two tail test are as 1.65 at 90% significance level, 1.96 at 95% significance level and 2.57 at 99% significance level.

### 3.9.5.3 Coefficient of Determination ( $R^2$ Value)

Most of the time R-square is deemed to be the most important statistic for the evaluation of structural model. The coefficient of determination gauges the prognostic correctness of the model. The value of R-square indicates the amount of variance the independent latent constructs explicate the dependent latent constructs. According to Nagelkerke (1992) R-square is the fraction of the variation explicate in the model. Similarly, as per the StatTrek (2017) R-square is the fraction of the variance in the reliant latent constructs due to the independent latent



constructs. For R-square, there is no cut off point as it is completely based on the complexity of model as well as the nature of research. Hair et al. (2013) reveals that if the value of R-square is greater than 0.20, it is assumed encouraging in the behavior science studies. Selection of model on the base of R-square is assumed not superior.

#### **3.9.5.4 Effect Size $f^2$ Value of Structural Model**

The effect size  $f^2$  value facilitates to assess the influence of the variable in describing the chosen reliant variable of research. More specifically effect size value makes apparent to forecaster variable input toward the R-square. In view of Kelley and Preacher (2012) assessment of the strength of any phenomenon can be quantified with the help of the value of  $f^2$ . However, as per the Ellis (2010) the  $f^2$  value makes clear the importance of outcomes of the study. According to Hair et al. (2013) the standardized values for  $f^2$  are 0.02 for small, 0.15 for medium and .35 for large.

#### **3.9.5.5 Predictive Relevance $Q^2$**

According to the Geisser (1974); Stone (1974) once the assessment of the R-square has completed then it is compulsory the inspection of  $Q^2$  for the evaluation of structural model otherwise it is incomplete. Prognostic importance of the model can be assessed with the help of analysis of  $Q^2$ . Because Hair et al. (2013) suggested that  $Q^2$  value act as a precise gauge of model for endogenous variable not appropriate for variable with one item. According to the Chin (1998) the  $Q^2$  values more than zero deemed to be prognostic significance of variable. The standardized values for  $Q^2$  are 0.02 for small, 0.15 for medium and .35 for large.

# Chapter 4

## Results and Analysis

Prior to the application of the statistical technique to answer of research questions of this study, numerous pre analysis are conducted to see about the normality of data, outliers and demographics of respondents and adequacy of sample data, EFA for validation and trustworthiness of bunch of items of latent constructs. For this, firstly data screening and cleaning of the research is presented. Subsequently, demographics of respondent are presented and after that adequacy of sample and trustworthiness of bunch of items of latent constructs is checked with the help of EFA.

Therefore, to analyze the model, structural equation modeling approach (SEM) has been used with help of Partial Least Square (PLS) with hierarchical latent constructs by using the guide line of (Becker et al., 2012). As said by Chin et al. (2010) PLS-SEM outcomes may be communicated into two most important steps, talking about the conditions of measurement and structural models, separately. Author use the latest version of SmartPLS for the evaluation of the models of this research. The detail of these sections is given below.

### 4.1 Data Screening and Cleaning

Rejoinders supplied by uninterested partakers in a casual, disorganized, or haphazard way can intimidate the fundamental nature of data in management studies

(Huang et al., 2012). After the completion of data entry process, then data must be screen along with cleaning process prior to pursue the steps of data analysis (Rourke, 2000). Screening is the checking of faults in data and eliminate the erros for the purpose of to limit the din along with capitalize on the actual indication. According to Broeck et al. (2005) data screening and cleaning referred to deal with omitted as well as lower and upper extreme values in the data.

Omitted values in data of social sciences miss guide the researchers (Little & Rubin, 1989).

Omitted values are problems and generate prejudiced and unfair results, vague predictions and void conclusion (Acock, 2005). During this research, while punching data 41 respondents omitted the necessary responses and 12 respondents who gone unfilled their few replies therefore researcher make a decision of rejection of these questionnaires absolutely.

According to Hand, Ader and Mellenbergh (2008) ooccasionally some values omitted due to the researchers during the punching of data. For this, author manually visited from case to case with extensive care to check the any omitted value in the excel data file.

The existence of extreme values in the data may channelise the overstated inaccuracy and considerable misrepresentation of results (Zimmerman, 1994; 1995 and 1998). According to Tran, Shively and Preckel (2010) outliers are extreme values in data set which have substantial control on effectiveness of outcome. As said by Zimek, Schubert and Kriegel (2012) different techniques are available for the identification of exterme values in data set. Some of them are ghraphical and box plot is one of them which is mix technique. In this research, extreme values in data were detected by using the box plot and found that 41 respondents provided the data with extreme values. So, researcher makes the decision of complete rejection of these responses of these 41 respondents because according to the Stenstrom and Iyer (2009) there are vaious ways to deal with the extreme values in the data but deletion of complete response is one them.

Hodge and Austin (2004) proposed the mahalanobis distance for the detection of outlier in the data. Researcher used the statistical method mahalanobis distance

on the base of values of chi-square at critical alpha 0.001 as a standard for outlier detection. The existence of critical alpha 0.001 is warning of outliers in the data. After applying the statistical gauge mahalanobis distance, author found that 56 extreme values in the data then these values deleted from data set and remaining data set of 455 sample size used for further analysis.

Once, the screening process of omitted and extreme observations has completed then checked the normality of data with the help of kurtosis because, according to Folk and Ward (1957) kurtosis is main technique to check the normality of data with range from 3 to 8. But, Harlow (1985) suggested that kurtosis values should be -1 to +8 with sample size 200 to 400. However, Tanaka (1984) recommended that kurtosis value should be up to 7 with average value of 5, if sample size is 100, 500 and 1500. In the meantime, Browne (1984) said that if sample size is 500 the value of kurtosis should be up to the 6. So, on the base of guideline of literature author calculated the values of kurtosis of all unobserved constructs and revealed that these values are within the range.

Therefore, it is concluded that data of all unobserved constructs is normally distributed.

## **4.2 Demographics of Respondents**

### **4.2.1 Respondent's Genders by Age Group**

The participants have different exceptionality regarding the age, education, gender and marital status. The particulars of 455 individuals are analyzed in the following tables. Average age of participants is 39 years and Table 4.1 shows the different age group with respect to their gender as 12.31% individuals belong to the 20 to 30 years of age group having no female among this age group.

TABLE 4.1: Respondent's Genders by Age Group.

Variable	Category	Gender				Total	
		Male		Female			
		Freq	%	Freq	%	Freq	%
Age Group	20-30	56	12.31	0	0.0	56	12.31
	30-40	84	18.46	15	3.3	116	21.76
	40-50	161	35.38	9	2.2	185	37.58
	50-60	99	21.76	1	0.0	108	21.76
	60 and Above	30	6.6	0	0.0	32	6.6
<b>Total</b>		430	94.5	25	5.5	455	100.0

But age group of 30 to 40 year's individuals has 3.3% female and 18.46% male individuals. Similarly, 37.58% individuals belong to the 40 to 50 year age group in which 35.38% individuals are male and 2.2% are female. However, age group of people of 50 to 60 year has 21.76% male individuals. On the other hand, 6.6% individuals are 60 years old and in this age group, there is no female. Table 4.1 indicated that total 94.5% individuals belong to the male category and 5.5% are female.

#### 4.2.2 Respondent's Genders by Education

Table 4.2 indicates the educational level of respondents with respect to their gender accordingly; we can see that 2.4% participants are qualified up to the matriculation in which no feminine individual.

However, 16.9% male and 0.1% female individuals have qualification up to the intermediate level and 48.4% male as well as 2.9% female individuals have 14 years of education. On the other hand, 21.1% male along with 2.2% female participants has 16 years of education and 5.7% male as well as 0.1% female individuals has MS/M.Phil degrees. However, in our sample 0.1% male individuals have PhD degree.

TABLE 4.2: Respondent's Genders by Education.

Variable	Category	Gender				Total	
		Male		Female			
		Freq	%	Freq	%	Freq	%
Education	Matriculation/O-Level	11	2.4	0	0.0	11	2.4
	Intermediate/A-Level	77	16.9	1	0.1	78	17.0
	14 Year of Education	220	48.4	13	2.9	233	51.2
	16 Year of Education	95	21.1	10	2.2	105	23.1
	18 Year of Education	26	5.7	1	0.1	27	6.0
	PhD	1	0.1	0	0.0	1	0.2
<b>Total</b>		430	94.6	25	5.6	455	100.0

### 4.2.3 Respondent's Genders by Marital Status

Table 4.3 indicates that among the sample of 455, the 84.2% male as well as 5.4% female participants are married along with 10.1 male as well as 0.1 individuals belong to single category. It means that 383 male along with 25 female participants are married and 47 male along with 2 female individuals belong to the bachelors group.

TABLE 4.3: Respondent's Genders by Marital Status.

Variable	Category	Gender				Total	
		Male		Female			
		Freq	%	Freq	%	Freq	%
Marital Status	Married	383	84.2	23	5.4	406	89.6
	Single	47	10.3	2	0.1	49	10.4
<b>Total</b>		430	94.5	25	5.5	455	100.0

### 4.2.4 Respondent's Education by Age Group

Table 4.4 shows the education of respondent by age group. Investigation exposed that among the age group of 20 to 30 years individuals, 1.7% has education up to intermediate level as well as 1.7% has 14 year of education but 4.4% has 16 year of education along with 4.6% are MS/M.Phil degrees holders.

TABLE 4.4: Respondent's Education by Age Group.

Variable	Category	Education					
		Matric/O'Level		Intermediate/A'Level		14 Year of Education	
		Freq	%	Freq	%	Freq	%
Age Group	20-30	0	0.0	8	1.7	8	1.7
	30-40	1	0.2	7	1.5	52	11.4
	40-50	1	0.2	22	4.8	110	24.2
	50-60	4	0.9	28	6.1	52	11.4
	60 and Above	5	1.1	13	2.8	11	2.4
<b>Total</b>		11	2.4	78	17	233	51.2

Variable	Category	Education						Total	
		16 Year of Education		18 Year of Education		PhD			
		Freq	%	Freq	%	Freq	%	Freq	%
Age Group	20-30	17	3.7	21	4.6	0	0.0	54	11.8
	30-40	34	7.5	4	0.9	1	0.2	99	21.7
	40-50	34	7.5	2	0.4	0	0.0	169	37.1
	50-60	18	4	0	0.0	0	0.0	102	22.4
	60 and Above	2	0.4	0	0.0	0	0.0	31	7.0
<b>Total</b>		105	23.2	27	6.0	1.0	0.2	455	100.0

Among the participants between the age group of 30-40 year, 0.2% has matriculation degree along with 1.5% individuals who has intermediate level of education. However, 11.4% individuals have 14 years of schooling but 7.5% participants have 16 years of education as well as 0.9% has MS/M.Phil degrees and 0.2% has PhD degrees.

Among the individuals belong to age group of 40 to 50 years, 0.2% has matriculation degrees but 4.8% participants have education up to the intermediate level. However, 24.2% has 14 years of education and 7.7% participants have 16 year of schooling and 0.4% are MS/M.Phil qualified. Between the age group of 50 to 60 years individuals 1.1% has matriculation degrees but 6.4% are intermediate qualification, 11.4% has 14 year of education, 4% has master degrees. Among the age group of 60 year and above participants, 1.1% has qualification up to the matriculation, 2.8% individuals have qualification up to the intermediate, 2.4% participants have 14 years of education and 0.4% individuals have qualification up to the 16 years of schooling.

#### **4.2.5 Respondent's Education by Marital Status**

Analysis of Table 4.5 shows that 2.2% respondents are married and 0.2% belong to the bachelors group and these have qualification up to the matriculation. However, 15.8% belong to married group and 1.3% respondents are single but these individuals have qualification up to the intermediate level. In contrast to these, 48.8% respondents are married as well as 2.4% are bachelors having qualification up to the 14 years of schooling. Although, 20% individuals are married and 3.1% are single but these have 16 years of education. At the same time as, 2.6% respondents belong to matrimonial whereas 3.3% individuals are unmarried but; qualification of these respondents is 18 years of schooling however; 0.2% individuals are married and has qualification of doctorate level.



TABLE 4.5: Respondent's Education by Marital Status.

Variable	Category	Marital Status				Total	
		Married		Single			
		Freq	%	Freq	%	Freq	%
Education	Matriculation/O-Level	10	2.2	1	0.2	11	2.4
	Intermediate/A-Level	72	15.8	6	1.3	78	17
	14 Year of Education	222	48.8	11	2.4	233	51.2
	16 Year of Education	91	20.0	14	3.1	105	23.2
	18 Year of Education	12	2.6	15	3.3	27	6.0
	PhD	1	0.2	0	0.0	1	0.2
<b>Total</b>		408	89.6	47	10.3	455	100

### 4.3 Exploratory Factor Analysis

Here, purpose of exploratory factor analysis is to validate the group of questions which gauge the variable(s) for which they are planned to design (Field, 2009). The main use of exploratory factor analysis is approval of underlying variable(s) as well as evaluation of their trustworthiness and assessment of items toward the latent constructs (Pett, Lackey, & Sullivan, 2003; Bruce, 2004). For these reasons, author performed five step exploratory factor analysis guided by (Williams et al., 2010).

First, with the help of Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy 0.74 confirmed that data is suitable for exploratory factor analysis, as the Kaiser (1974) recommended that range of value should be as 0.00 to 0.49 unacceptable, 0.50 to 0.59 wretched, 0.60 to 0.69 just adequate, 0.70 to 0.79 adequate, 0.80 to 0.89 admirable and 0.90 to 1.00 excellent and Comrey and Lee (2009) indicated that 200 sample size as reasonable.

Extraction of factor is based on principal component analysis and rotation is based on the orthogonal varimax rotation method because according to Darbyshire, (2016) in the science of business uses the principal component analysis for extraction of factor.

Commonly, there are several techniques for rotation but orthogonal varimax is used by the most of investigators where factor are uncorrelated (Bruce, 2004) as in this study.

At the start, 114 items for 19 latent constructs are included in exploratory factor analysis. Here, 45 items are causing trouble for these 19 latent constructs. So, these 45 indicators are deleted for commencing the further investigation as these 45 indicators didn't loaded on appropriate factor.

Exploratory factor analysis performed for a second time and now all the indicators loaded on 19 different latent constructs appropriately.

As first, neurotransmitters with 4 latent constructs having 15 items, second, emotional intelligence with 4 latent constructs having 13 items. Third, personality with 5 latent constructs having 20 items, fourth variable is investor behavior with 5 latent constructs having 15 items and fifth variable is investment decisions with 6 items.

Total variance explain is 85.37% on the base of more than 1 eigenvalue for 19 latent constructs. Hair et al suggested that total variance explain in natural science could be 95% but in humanities and social science total variance explain should be between 40% to 60%. For 19 latent constructs all 69 items are loaded accurately and significantly because according to Osborne and Costello (2005) for significance the loading of factor should be more than 0.30 as Table 4.6 is shows the outcome of exploratory factor analysis.

TABLE 4.6: Items Loading in Exploratory Factor Analysis.

Items	Factors																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
D4	.93																		
D3	.92																		
D2	.89																		
D1	.47																		
S3		.98																	
S2		.97																	
S4		.97																	
S1		.89																	
E2			.98																
E3			.98																
E1			.97																
E4			.95																
N2				.95															
N1				.91															
N3				.81															

Items	Factors																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Sea3					.85														
Sea2					.84														
Sea1					.78														
Sea4					.75														
Oea1						.92													
Oea2						.91													
Uoe2							.94												
Uoe1							.88												
Uoe3							.81												
Roe2								.92											
Roe3								.92											
Roe1								.81											
Roe4								.73											
Ope3									.94										
Ope2									.93										
Ope4									.87										

Items	Factors																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Ope1									.75										
Ext2										.97									
Ext1										.97									
Ext3										.97									
Ext4										.89									
Agr1											.97								
Agr3											.94								
Agr2											.92								
Cons2												.95							
Cons3												.95							
Cons1												.93							
Cons4												.84							
Nue1													.96						
Nue2													.95						
Nue3													.95						
Nue4													.93						

Items	Factors																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Nue5													.74						
IH3														.94					
IH4														.93					
IH2														.92					
IH1														.78					
RA1															.99				
RA2															.99				
PL2																.95			
PL1																.93			
Conf2																	.95		
Conf1																	.92		
Conf3																	.89		
Cont2																		.97	
Cont3																		.96	
Cont1																		.93	
Cont4																		.90	

Items	Factors																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
ID3																				.93
ID4																				.93
ID5																				.87
ID2																				.84
ID6																				.84
ID1																				.75

## 4.4 PLS-SEM Analysis

PLS-SEM is used for hierarchical latent variable in reflective-formative type model for the analysis of the research with the help of most recent edition of SmartPLS 3.2.7 with two stage approach as the guideline provided by (Becker et al., 2012). In first stage, measurement of thirteen independent latent constructs of neurotransmitters (dopamine, serotonin, epinephrine and norepinephrine), emotional intelligence (self appraisal of emotions, other's emotion appraisal, use of emotion and regulation of emotion) and personality (openness, extraversion, agreeableness; conscientiousness and neuroticism) and five dependent latent constructs of investor behavior (control, confidence, personalization of loss, investment horizon and risk attitude) as reflective at lower order.

In second stage, measurement of three independent latent constructs as neurotransmitters, emotional intelligence, personality and one dependent latent constructs which is investor behavior as formative and one another dependent latent constructs that is investment decisions as reflective at higher order. These reflective and formative latent constructs at lower and higher order fulfill all the condition mentioned in the literature.

Evaluation of results of hierarchical latent variable in reflective-formative type model with the help of PLS-SEM has completed mainly in two phases. Initially, the evaluation of measurement model and structural model one by one for every category of variable because reflective as well as formative latent constructs has their own set of conditions which already communicated previously in the section of methodology of this dissertation.

### 4.4.1 First Stage: Evaluation of Reflective Measurement Model at Lower Order

In the first stage of hierarchical latent variable model, there are thirteen independent latent constructs and five dependent latent constructs at lower order, author



will discuss the evaluation of reflective measurement model with the help the statistical measures which are as: the reliability of construct, with the help of outer loading, composite reliability (CR), Cronbach's alpha ( $\alpha$ ), convergent validity of construct with the help of (AVE) and discriminant validity of Construct with the help of Fornell-Lacker Criterion, cross loading of indicators and Heterotrait-Monotrait Ratio (HTMT). Along with these measures latent score of lower order variables determines which will be used as indicators for higher order latent constructs in second stage on the recommendation of (Agarwal and Karahanna, 2000; Wilson and Henseler, 2007; Wetzels et al., 2009). Figure 4.1 shows the evaluation of reflective measurement model at lower order in first stage.

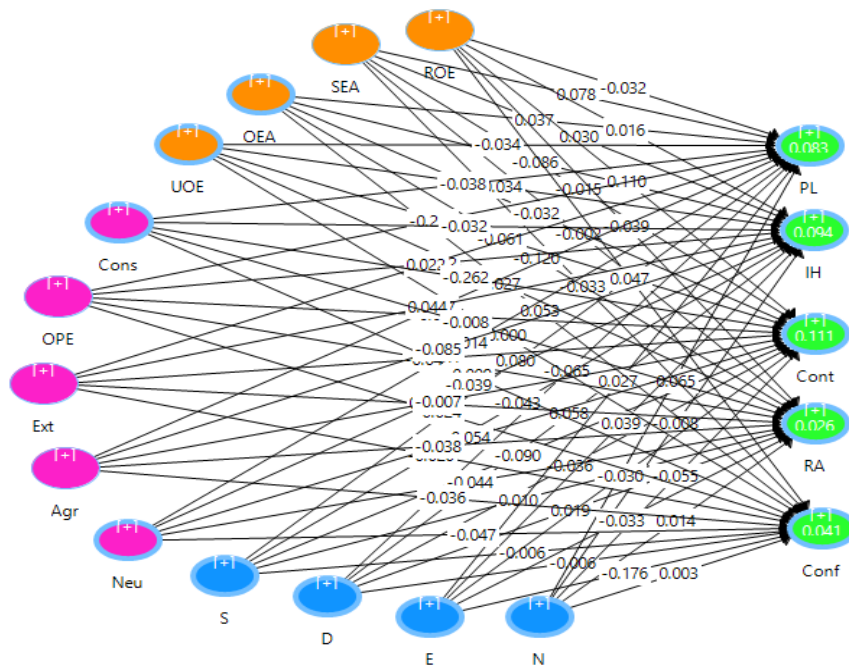


FIGURE 4.1: Reflective Measurement Model at Lower Order in First Stage.

Table 4.7 indicates the outer loading, Cronbach's alpha, average variance extracted (AVE) and composite reliability (CR) of lower order latent constructs of investor behavior (IB) such as investment horizon, confidence, control, personalization of loss and risk attitude with their respective items which are adopted from the work of (Wood & Zaichkowsky, 2004) as well as latent construct investment decisions from the work of (Pasewark & Riley, 2010). In this study, author removed those items which do not fulfill the criteria of reliability, convergent validity of constructs of reflective nature because Hair et al. (2014b) suggested the range of values

of Cronbach's alpha from 0.60 to 0.70 and proposed the deletion of every item having loading less as compare to the recommended standard which is 0.40 because deletion of items will improve the average variance extracted (AVE).

Table 4.7 indicates the outer loading, Cronbach's alpha, AVE and (CR) of lower order latent constructs of neurotransmitters (NT) such as dopamine, serotonin, epinephrine and norepinephrine with their respective items which are developed in the previous section of this dissertation and lower order latent constructs of EI such as self appraisal of emotions, regulation of emotion, use of emotion and other's emotion appraisal from the work of (Wong & Law, 2002).

TABLE 4.7: Assessment of Reflective Measurement Model at Lower Order.

<b>Constructs</b>	<b>Items</b>	<b>Loading</b>	<b>Cronbach's Alpha</b>	<b>CR</b>	<b>AVE</b>
Investment Horizon (IH)	IH1	0.82	0.93	0.95	0.82
	IH2	0.94			
	IH3	0.93			
	IH4	0.93			
Confidence (Conf)	Conf1	0.90	0.92	0.95	0.86
	Conf2	0.96			
	Conf3	0.93			
Control (Cont)	Cont1	0.94	0.97	0.98	0.91
	Cont2	0.98			
	Cont3	0.97			
	Cont4	0.92			
Personalization of Loss (PL)	PL1	0.97	0.94	0.97	0.94
	PL2	0.97			
Risk Attitude (RA)	RA1	0.92	0.88	0.91	0.89
	RA2	0.91			
Investment Decisions (ID)	ID1	0.97	0.93	0.93	0.68
	ID2	0.92			
	ID3	0.91			
	ID4	0.49			
	ID5	0.63			
	ID6	0.93			

Constructs	Items	Loading	Cronbach's Alpha	CR	AVE
Dopamine	D1	0.74	0.84	0.88	0.64
	D2	0.81			
	D3	0.82			
	D4	0.83			
Serotonin	S1	0.98	0.97	0.98	0.93
	S2	0.97			
	S3	0.92			
	S4	0.98			
Norepinephrine	N1	0.83	0.90	0.93	0.83
	N2	0.92			
	N3	0.97			
Epinephrine	E1	0.98	0.99	0.99	0.96
	E2	0.99			
	E3	0.99			
	E4	0.96			
Self Appraisal of Emotions (SEA)	SEA1	0.76	0.83	0.88	0.65
	SEA2	0.91			
	SEA3	0.81			
	SEA4	0.74			
Regulation Of Emotion (ROE)	ROE1	0.96	0.89	0.88	0.66
	ROE2	0.93			
	ROE3	0.78			
	ROE4	0.49			
Use Of Emotion (UOE)	UOE1	0.98	0.87	0.88	0.71
	UOE2	0.93			
	UOE3	0.55			
Others Emotion Appraisal (OEA)	OEA1	0.95	0.88	0.95	0.90
	OEA2	0.95			

<b>Constructs</b>	<b>Items</b>	<b>Loading</b>	<b>Cronbach's Alpha</b>	<b>CR</b>	<b>AVE</b>
Openness (OPE)	OPE1	0.74	0.91	0.94	0.79
	OPE2	0.94			
	OPE3	0.96			
	OPE4	0.90			
Neuroticism (Neu)	Neu1	0.96	0.95	0.96	0.83
	Neu2	0.95			
	Neu3	0.95			
	Neu4	0.93			
	Neu5	0.76			
Extraversion (Ext)	Ext1	0.98	0.97	0.98	0.91
	Ext2	0.98			
	Ext3	0.97			
	Ext4	0.89			
Conscientiousness (Cons)	Cons1	0.95	0.95	0.97	0.88
	Cons2	0.97			
	Cons3	0.97			
	Cons4	0.85			
Agreeableness (Agr)	Agr1	0.98	0.95	0.97	0.91
	Agr2	0.94			
	Agr3	0.95			

In this study, researcher removed those items which do not fulfill the threshold level of reliability, convergent validity of constructs of reflective nature because Hair et al. (2014b) suggested the range of values of Cronbach's alpha from 0.60 to 0.70 and proposed the deletion of every item having loading less as compare to the recommended standard which is 0.40 because deletion of items will improve the average variance extracted (AVE).

Table 4.7 indicates the outer loading, Cronbach's alpha, AVE and (CR) of lower order latent constructs of personality (PR) such as openness, neuroticism, extroversion, conscientiousness and agreeableness with their respective items which are

adopted from the work of (John & Srivastava, 1999). In this research thesis, researcher removed those items which do not fulfill the threshold level of reliability, convergent validity of constructs of reflective nature because Hair et al. (2014b) suggested the range of values of Cronbach's alpha from 0.60 to 0.70 and proposed the deletion of every item having loading less as compare to the recommended standard which is 0.40 because deletion of items will improve the average variance extracted (AVE). There are three techniques to assess the discriminant validity of latent constructs such as Fornell-Larcker Criterion. Because, Fornell and Larcker (1981) standard usually applied to evaluate the extent of communal variance among the underlying constructs.

TABLE 4.8: Fornell-Larcker Criterion.

	<b>Agr</b>	<b>Conf</b>	<b>Cons</b>	<b>Cont</b>	<b>D</b>	<b>E</b>	<b>Ext</b>	<b>IH</b>	<b>N</b>
Agr	<b>0.955</b>								
Conf	0.001	<b>0.929</b>							
Cons	-0.005	-0.013	<b>0.937</b>						
Cont	-0.009	0.094	-0.276	<b>0.955</b>					
D	0.067	0.003	0.047	-0.040	<b>0.801</b>				
E	-0.171	-0.174	0.000	-0.020	-0.055	<b>0.980</b>			
Ext	0.000	-0.018	0.045	-0.062	0.003	-0.025	<b>0.955</b>		
IH	-0.109	-0.030	-0.039	0.068	0.060	0.040	0.045	<b>0.906</b>	
N	0.008	0.003	-0.178	-0.041	0.002	-0.029	0.031	-0.012	<b>0.910</b>

	<b>Neu</b>	<b>OEA</b>	<b>OPE</b>	<b>PL</b>	<b>RA</b>	<b>ROE</b>	<b>S</b>	<b>SEA</b>	<b>UOE</b>
Neu	<b>0.914</b>								
OEA	-0.018	<b>0.947</b>							
OPE	0.007	-0.072	<b>0.889</b>						
PL	0.017	0.031	-0.230	<b>0.970</b>					
RA	-0.042	-0.116	-0.015	0.056	<b>0.999</b>				
ROE	-0.070	-0.007	-0.058	0.007	-0.043	<b>0.811</b>			
S	0.004	-0.282	0.046	0.050	0.037	0.063	<b>0.964</b>		
SEA	-0.019	0.008	-0.007	0.069	-0.005	0.026	-0.173	<b>0.807</b>	
UOE	0.059	0.233	-0.055	-0.032	-0.007	-0.024	-0.164	-0.122	<b>0.845</b>

Cross loading and Multitrait-Multimethod Matrix which is called as Heterotrait-Monotrait ratio (HTMT).

Table 4.8 indicate the Fornell-Larcker Criterion for the assessment of discriminant validity of latent constructs. For reflective nature of variables mainly two gauges are used to Table 4.8 (a) and (b) indicate the Fornell-Larcker Criterion for the assessment of discriminant validity of latent constructs. For reflective nature of variables mainly two gauges are used to Assess the discriminant validity of the variable as recommended; one of them is Fornell-Lacker (1981) standard which is usually applied to evaluate the discriminant validity of underlying constructs.

TABLE 4.9: Cross Loading of items/indicators.

	<b>Agr</b>	<b>Conf</b>	<b>Cons</b>	<b>Cont</b>	<b>D</b>	<b>E</b>	<b>Ext</b>	<b>IH</b>	<b>N</b>
Agr1	<b>0.977</b>	-0.012	0.013	-0.012	0.066	-0.166	-0.017	-0.098	0.011
Agr2	<b>0.941</b>	0.019	0.008	0.012	0.055	-0.161	0.007	-0.105	-0.007
Agr3	<b>0.948</b>	-0.009	-0.039	-0.029	0.074	-0.164	0.011	-0.108	0.020
Conf1	0.023	<b>0.904</b>	0.012	0.111	-0.004	-0.139	0.010	-0.067	-0.012
Conf2	0.000	<b>0.956</b>	-0.013	0.100	0.019	-0.156	-0.006	-0.033	0.008
Conf3	-0.014	<b>0.926</b>	-0.027	0.061	-0.008	-0.183	-0.045	0.003	0.009
Cons1	0.002	-0.025	<b>0.952</b>	-0.255	0.050	0.009	0.029	-0.010	-0.244
Cons2	-0.013	-0.034	<b>0.971</b>	-0.249	0.033	0.013	0.026	-0.025	-0.229
Cons3	-0.014	-0.018	<b>0.973</b>	-0.278	0.042	0.011	0.030	-0.034	-0.203
Cons4	0.008	0.028	<b>0.846</b>	-0.248	0.050	-0.033	0.085	-0.075	0.010
Cont1	0.003	0.075	-0.261	<b>0.940</b>	-0.043	-0.004	-0.033	0.042	-0.024
Cont2	-0.025	0.087	-0.266	<b>0.984</b>	-0.036	-0.022	-0.071	0.074	-0.033
Cont3	-0.013	0.110	-0.271	<b>0.975</b>	-0.030	-0.022	-0.066	0.077	-0.033
Cont4	0.003	0.085	-0.255	<b>0.920</b>	-0.045	-0.028	-0.068	0.064	-0.068
D1	0.048	0.005	0.059	-0.026	<b>0.743</b>	-0.052	-0.005	0.086	-0.009
D2	0.051	-0.016	0.009	-0.048	<b>0.811</b>	-0.010	-0.028	0.005	0.004
D3	0.063	-0.013	0.050	-0.048	<b>0.817</b>	-0.017	0.014	0.023	0.026
D4	0.056	0.016	0.013	-0.021	<b>0.829</b>	-0.065	0.021	0.032	0.000
E1	-0.148	-0.167	0.008	-0.022	-0.067	<b>0.980</b>	-0.019	0.034	-0.032

	<b>Agr</b>	<b>Conf</b>	<b>Cons</b>	<b>Cont</b>	<b>D</b>	<b>E</b>	<b>Ext</b>	<b>IH</b>	<b>N</b>
E2	-0.151	-0.169	0.002	-0.027	-0.060	<b>0.988</b>	-0.016	0.028	-0.034
E3	-0.174	-0.172	-0.008	-0.014	-0.045	<b>0.989</b>	-0.034	0.044	-0.027
E4	-0.195	-0.175	-0.003	-0.016	-0.045	<b>0.963</b>	-0.030	0.051	-0.019
Ext1	0.005	-0.002	0.017	-0.052	-0.004	-0.039	<b>0.976</b>	0.055	0.045
Ext2	-0.006	-0.012	0.015	-0.054	-0.006	-0.036	<b>0.978</b>	0.058	0.044
Ext3	0.017	-0.025	0.053	-0.049	0.011	-0.013	<b>0.974</b>	0.046	0.040
Ext4	-0.016	-0.034	0.098	-0.088	0.014	-0.005	<b>0.891</b>	0.009	-0.017
IH1	-0.099	-0.003	-0.039	0.083	0.063	0.068	0.004	<b>0.819</b>	-0.062
IH2	-0.102	-0.026	-0.060	0.087	0.055	0.049	0.017	<b>0.940</b>	-0.011
IH3	-0.094	-0.041	-0.017	0.036	0.050	0.010	0.075	<b>0.931</b>	0.015
IH4	-0.096	-0.040	-0.021	0.035	0.049	0.015	0.072	<b>0.929</b>	0.018
N1	0.012	-0.039	-0.239	-0.002	-0.050	-0.005	-0.050	0.011	<b>0.826</b>
N2	0.005	0.037	-0.088	-0.050	0.029	-0.038	0.053	-0.038	<b>0.923</b>
N3	0.007	-0.004	-0.190	-0.045	0.003	-0.027	0.045	-0.001	<b>0.974</b>

	<b>Neu</b>	<b>OEA</b>	<b>OPE</b>	<b>PL</b>	<b>RA</b>	<b>ROE</b>	<b>S</b>	<b>SEA</b>	<b>UOE</b>	<b>ID</b>
Neu1	<b>0.962</b>	-0.011	0.015	0.019	-0.011	-0.159	0.008	-0.030	0.073	0.066
Neu2	<b>0.954</b>	-0.029	-0.014	0.007	-0.054	-0.133	-0.005	0.001	0.077	0.055
Neu3	<b>0.948</b>	-0.001	0.032	0.017	-0.001	-0.163	-0.005	-0.039	0.061	0.074
Neu4	<b>0.927</b>	-0.009	0.021	0.041	0.007	-0.103	-0.007	-0.024	0.065	-0.004
Neu5	<b>0.762</b>	-0.029	-0.018	-0.001	-0.112	0.195	0.020	0.001	0.002	0.019
OEA1	-0.041	<b>0.947</b>	-0.076	0.046	-0.102	0.000	-0.264	0.114	0.129	-0.008
OEA2	0.007	<b>0.947</b>	-0.060	0.013	-0.118	-0.013	-0.270	-0.099	0.314	0.050
OPE1	0.012	-0.085	<b>0.736</b>	-0.171	0.017	-0.012	0.036	-0.013	-0.057	0.033
OPE2	-0.026	-0.048	<b>0.941</b>	-0.209	-0.011	-0.050	0.057	-0.006	-0.064	0.042
OPE3	0.004	-0.078	<b>0.960</b>	-0.220	-0.041	-0.056	0.056	-0.018	-0.055	0.050
OPE4	0.033	-0.053	<b>0.902</b>	-0.214	-0.010	-0.075	0.017	0.009	-0.026	-0.043
PL1	0.017	0.018	-0.214	<b>0.973</b>	0.045	0.001	0.065	0.083	-0.034	-0.036
PL2	0.017	0.045	-0.234	<b>0.966</b>	0.065	0.014	0.029	0.048	-0.026	-0.030
RA1	-0.040	-0.117	-0.017	0.054	0.92	-0.044	0.038	-0.005	-0.007	-0.045
RA2	-0.043	-0.115	-0.014	0.057	0.91	-0.041	0.036	-0.005	-0.007	-0.012
ROE1	-0.017	-0.012	-0.045	0.011	-0.061	<b>0.964</b>	0.045	0.017	-0.016	-0.007
ROE2	-0.132	0.002	-0.072	0.004	-0.012	<b>0.925</b>	0.082	0.033	-0.035	-0.027

	Neu	OEA	OPE	PL	RA	ROE	S	SEA	UOE	ID
ROE3	-0.150	0.008	-0.058	-0.014	0.011	<b>0.778</b>	0.057	0.040	-0.010	-0.068
ROE4	-0.161	0.025	-0.107	0.003	0.069	<b>0.493</b>	0.015	0.029	0.015	-0.037
S1	-0.014	-0.269	0.041	0.038	0.047	0.057	<b>0.982</b>	-0.168	-0.171	0.021
S2	-0.017	-0.255	0.052	0.040	0.033	0.058	<b>0.973</b>	-0.150	-0.169	0.020
S3	0.047	-0.293	0.047	0.053	0.032	0.072	<b>0.920</b>	-0.165	-0.128	0.040
S4	-0.013	-0.264	0.037	0.057	0.032	0.053	<b>0.981</b>	-0.181	-0.168	0.061
SEA1	-0.016	0.006	0.031	0.021	-0.012	0.037	-0.066	<b>0.756</b>	-0.120	0.057
SEA2	0.029	-0.039	-0.009	0.086	-0.014	0.014	-0.162	<b>0.913</b>	-0.072	0.052
SEA3	-0.066	-0.054	-0.014	0.045	0.009	0.018	-0.108	<b>0.808</b>	-0.121	0.017
SEA4	-0.067	0.161	-0.028	0.041	0.013	0.026	-0.212	<b>0.740</b>	-0.129	0.014
UOE1	0.062	0.260	-0.056	-0.029	-0.004	-0.031	-0.170	-0.099	<b>0.982</b>	0.036
UOE2	0.064	0.113	-0.045	-0.025	-0.008	-0.004	-0.086	-0.166	<b>0.935</b>	0.025
UOE3	0.114	-0.191	-0.013	0.024	0.015	0.026	0.205	-0.168	<b>0.552</b>	0.021
ID1	0.081	0.022	0.100	-0.081	-0.011	-0.015	-0.009	-0.056	0.009	<b>0.966</b>
ID2	0.039	-0.008	0.091	-0.058	-0.022	0.018	0.008	-0.021	0.012	<b>0.918</b>
ID3	-0.001	-0.005	0.062	-0.033	0.048	-0.013	0.045	0.052	0.005	<b>0.910</b>
ID4	-0.032	-0.029	-0.017	-0.081	0.036	0.074	-0.064	-0.055	-0.024	<b>0.492</b>
ID5	-0.010	-0.028	-0.046	-0.048	0.025	0.109	-0.015	-0.038	0.012	<b>0.629</b>
ID6	0.066	0.039	-0.154	0.008	0.052	0.011	0.039	-0.008	-0.142	<b>0.929</b>

Table 4.9 indicate the cross loading of items/indicator for the assessment of discriminant validity. According to Hair et al. (2014b) outer loading of items of related latent constructs must be more than the outer loading of other latent constructs. So, all the item in Table 4.9 are as per the threshold.

Table 4.10 indicate the discriminant validity of latent constructs with the help of correlations of Heterotrait-Monotrait Ratio (HTMT) of indicators across constructs. Henseler et al. (2015) recommended one more gauge to evaluate the discriminant validity which is on the base of Multitrait-Multimethod Matrix which is called as Heterotrait-Monotrait Ratio (HTMT) of correlation. Less than 0.90 are standardized values for Heterotrait-Monotrait Ratio (HTMT).



TABLE 4.10: Heterotrait-Monotrait Ratio (HTMT).

	<b>Agr</b>	<b>Conf</b>	<b>Cons</b>	<b>Cont</b>	<b>D</b>	<b>E</b>	<b>Ext</b>	<b>IH</b>	<b>N</b>
Agr									
Conf	0.025								
Cons	0.022	0.031							
Cont	0.020	0.103	0.287						
D	0.075	0.019	0.048	0.049					
E	0.176	0.180	0.018	0.021	0.048				
Ext	0.017	0.027	0.052	0.065	0.026	0.026			
IH	0.115	0.047	0.041	0.070	0.051	0.042	0.050		
N	0.017	0.036	0.230	0.043	0.043	0.027	0.058	0.036	

	<b>Neu</b>	<b>OEA</b>	<b>OPE</b>	<b>PL</b>	<b>RA</b>	<b>ROE</b>	<b>S</b>	<b>SEA</b>	<b>UOE</b>
Neu									
OEA	0.030								
OPE	0.031	0.083							
PL	0.020	0.035	0.249						
RA	0.042	0.124	0.023	0.058					
ROE	0.201	0.027	0.090	0.013	0.047				
S	0.026	0.302	0.050	0.050	0.038	0.061			
SEA	0.062	0.154	0.032	0.066	0.016	0.047	0.186		
UOE	0.101	0.242	0.056	0.033	0.011	0.036	0.187	0.210	

#### 4.4.2 Second Stage: Evaluation of Formative Measurement Model at Higher Order

Measurement model for formative variable at higher order not be evaluated statistically like reflective variable at lower order. Higher level of association among items of formative variable is known as the problem of multicollinearity. This indicates that more than single items reveal the one and the same observable fact. Along with higher intensity of multicollinearity problem mislead external weights and also significance level of formative indicators.

The single most fundamental criteria for the assessment of measurement model of formative variables are to judge with the help of its outer weight with the significance level. As Hair et al. (2013) reveals that the significance of external weights of the formative items of variables is judged with help of their t-value. Similarly, Fornell-Lacker (1981); Chin (1998); Agarwal and Karahanna, (2000); Wilson and Henseler, (2007); (Cenfetelli & Bassellier, 2009); (Hair et al. (2012); Hair et al. (2012) said that there is no need to test the convergent and discriminant validity measures for formative variables and items but their outer weight, level of significance with the help of t-values, p-values and should assess the multicollinearity.

Table 4.11 shows the values of outer weights of all the items of higher order construct which are latent constructs at lower order at first stage. Here, in Table 4.11, the values of outer weight of items of neurotransmitters such as dopamine, serotonin, epinephrine and norepinephrine. Here, only dopamine's outer weight is significant which can be seen with the help of t-value and p-value and rest of the items are insignificant but their VIF values are less than 5 which are indications of no multicollinearity. Similarly, emotional intelligence's items self emotions appraisal, regulation of emotions, other's emotion appraisal and use of emotion have VIF values within limit. Outer weights of self emotions appraisal and regulation of emotions are significant at 95% confidence level because their t-values are 1.96, 2.41 and p-values are 0.05 and 0.016 respectively and outer weight of rest of the items of emotional intelligence are insignificant. So, the VIF values of all the items of mentioned construct are less than 5.00 indicates no problems of multicollinearity. However, outer weight of items of personality such as openness is significant at 100% confidence level but other items are insignificant but VIF of all items within the range.

Similarly, outer weight of indicators of investor's behavior such as investment horizon and personalization of loss are significant at 99% and 95% confidence level and rest of items are insignificant but VIF of all items are as per the threshold.

However, some of the items in formative measurement model at higher order are insignificant such as serotonin, norepinephrine of neurotransmitters whereas, other's emotion appraisal, use of emotion of emotional intelligence, similarly, neuroticism,

extraversion, conscientiousness, agreeableness, of personality, whereas, confidence, control, risk attitude facets of investor behavior respectively. There are different reasons of insignificance of these items; one of them is the different personality and behavioral features, mood, attitude and different mental approach of investors of PSX. Second, indigenization of research, specially emerging markets participants as investors in PSX. Third, most of the participants of emerging markets as investors in PSX focus standard finance model not the neurological and behavioral facets for investment.

TABLE 4.11: Assessment of Formative Measurement Model at Higher Order.

Constructs	Items	VIF	Weight	t-value	P Values
Neurotransmitters (NT)	D	1.004	0.916	3.496	0.000
	S	1.011	-0.071	0.361	0.718
	E	1.014	0.455	1.833	0.067
	N	1.001	0.075	0.361	0.718
Emotional Intelligence (EI)	SEA	1.017	0.564	1.957	0.050
	ROE	1.001	0.645	2.412	0.016
	OEA	1.059	-0.229	1.011	0.312
	UOE	1.076	-0.325	1.365	0.172
Personality (PR)	OPE	1.005	0.874	3.731	0.000
	EXT	1.003	-0.056	0.484	0.629
	NEU	1.004	-0.021	0.187	0.852
	CONS	1.005	0.443	1.711	0.087
	AGR	1.006	0.061	0.514	0.607
Investor Behavior (IB)	IH	1.013	0.636	2.991	0.003
	CONT	1.033	0.444	1.630	0.103
	CONF	1.017	0.090	0.714	0.475
	PL	1.031	0.488	2.474	0.013
	RA	1.009	0.014	0.134	0.893

### 4.4.3 Second Stage: Evaluation of Structural Model at Higher Order

Subsequent to the evaluation of measurement model in the first and second stage of hierarchical latent variable in reflective and formative type model by using the PLS-SEM outcomes of second stage at higher order level of constructs can be observed on the base of structural mode which can be seen in Figure 4.2. Initially, universal gauge for the assessment of the structural model in PLS-SEM is identified as R-square or  $R^2$  which is known as coefficient of determinants. So, according to Hair Jr et al. (2013) it is very complicated to build up typical value of R-square or  $R^2$  because it is fully based on the temperament of model as well as on the discipline of research.

Figure 4.2 indicates the values of R-square or  $R^2$  for the impact of neurotransmitters (NT), emotional intelligence (EI) and personality (PR) on investment behavior (IB) which is 0.132 however, impact of neurotransmitters (NT), emotional intelligence (EI) and personality (PR) on investment decisions which is 0.041. So, the values of R-square or  $R^2$  for the impact of neurotransmitters (NT), emotional intelligence (EI) and personality (PR) on investment behavior (IB) is acceptable because Falk and Miller (1992) recommended that lowest value for R-square or  $R^2$  should be 0.10. Although, the value of R-square or  $R^2$  for impact of neurotransmitters (NT), emotional intelligence (EI) and personality (PR) on investment decisions is less than the minimum value. There may be several reasons as first reason; this may be due to the different background of investors, related to the behavior, mood, attitude and mental approach, of Pakistan as compare to the individual investors of other countries. Second reason is that, in this study insignificant role of different personality and emotional intelligence facets like neuroticism, extraversion, conscientiousness, agreeableness, use of emotion and other's emotion appraisal respectively. However, the values of R-square or  $R^2$  of structural model can be seen in Figure 4.3.

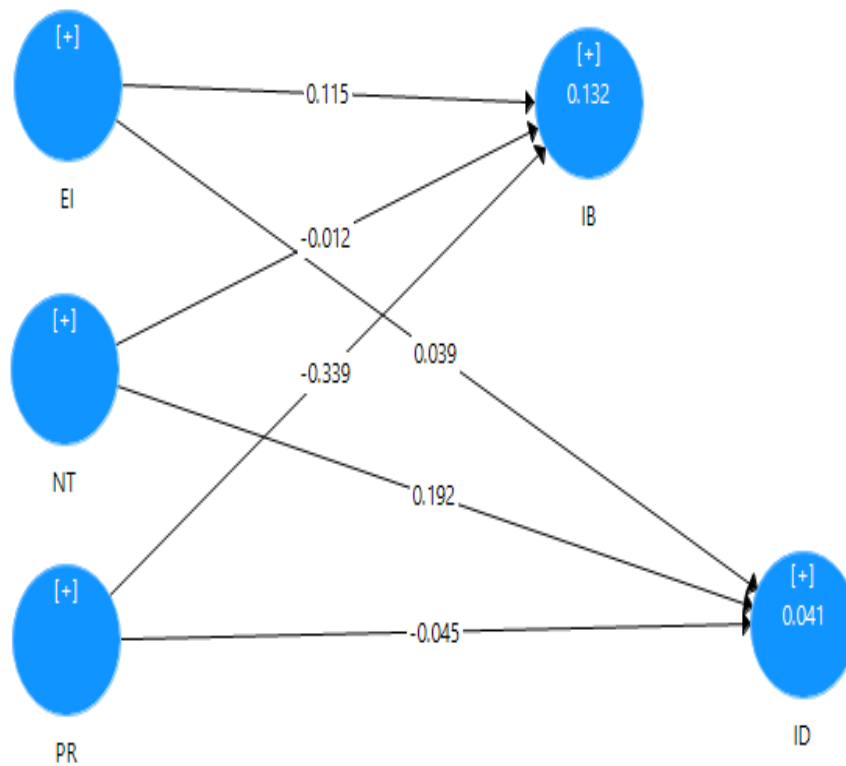
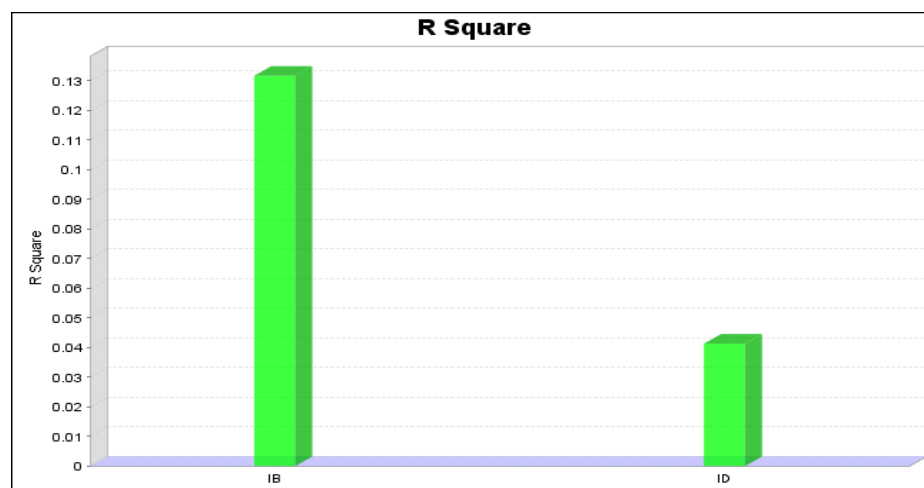


FIGURE 4.2: Structural Model Results in PLS-SEM.

Once, the decision of structural model on the base of values R-Square or  $R^2$  has taken then researcher move toward the path coefficients which are deem to be considered for the assessment of structural model of the research. In structural model, the level of significance of path coefficient has indicates the association among the exogenous as well as endogenous constructs related to the study.

FIGURE 4.3:  $R^2$  of Structural Model in PLS-SEM.

The Bootstrapping method is used in PLS-SEM to check the significance level of the values of path coefficients in every category of structural model because; Hair et al. (2013) recommended this technique with sample of 500 to 5000. Here, author employed 5000 as sample size for bootstrapping to engender the outcomes which is pertinent to the real information. Particularly, during bootstrapping significance of path coefficients is gauged through significance level with the help of P-values at 90%, 95% and 99% and an concrete values with of t-statistics with two-tailed test are  $\pm 1.64$ ,  $\pm 1.96$  and  $\pm 2.56$  respectively.

Table 4.12 and Figure 4.4 indicates that neurotransmitters as independent latent construct at higher order does not explain the investor behavior in this study because investors of Pakistan have different characteristics as compare to investors belongs to the rest of world. However, Figure 4.7 shows that when author checked the relationship of neurotransmitters with investor behavior found it significant which is as per the previous studies because Frydman and Camerer (2016) explored and found relationship of neurotransmitters measures and behavioral features of individual investor. In this disertation neurotransmitters as a latent construct at higher order explain the investment decisions at lower order with 95% level of significance; this is according to the literature.

The emotional intelligence as an independent latent construct explain the investor behavior as a latent construct at higher order with 95% level of significance. This is as recommended by previous studies as mentioned chapter of literature review. But Figure 4.8 indicates that path coefficient among the emotional intelligence and investment decisions are significant when author study the relation between them separately, which is according the previous studies. Similarly, Rubaltelli, Agnoli and Franchin (2015) in their scholarly work establish the relationship among the emotiomal itelligence and investor behavior.

The path coefficient between personality and investor behavior is negatively significant 95% level of significance. This result is literature consistent as Sadi at al. (2011) performed the study in Iranian equity market and fond that personality features positive relation but some situation negative relation with the behavioral characteristics of investor Kourtidis et al (2011) investigated and documented that

personality characteristics have influence on the investor behavior. Similarly, Zaidi and Tauni (2012) performed the investigation in Lahore Stock Exchange and found positive relation among the personality characteristics and behavioral characteristic of investor but in some situation also have negative relation.

The path coefficient between personality and investment decisions is insignificant; this may be due to the different background of investors of Pakistan as compare to the investors of other countries. But when author perform the analysis separately, between personality and investment decisions, found the results as per the previous studies which can be seen in Figure 4.9. Figure 4.4 indicates the values of path coefficients of neurotransmitters is positive significant with investment decisions and negative insignificant with investor behavior, emotional intelligence's path coefficient with investor behavior positive significant and insignificant with investment decisions. However, path coefficients of among the personality and investor behavior is positive significant but between investment decisions is insignificant in this research.

Figure 4.5 indicates that path coefficients 0.56 and 0.65 of latent constructs, self emotion appraisal and regulation of emotion, of latent construct of emotional intelligence (EI) are significant at 95% confidence level whereas path coefficients of latent constructs, use of emotion and other emotions appraisal are insignificant.

The path coefficients 0.92 and 0.46 of latent constructs, dopamine and epinephrine, of latent construct of neurotransmitters (NT) are significant at 95% and 90% confidence level whereas path coefficients of latent constructs, serotonin and norepinephrine are insignificant.

Table 4.12 indicates the evaluation of structural model by using the path coefficients with their p and t-values and  $f^2$  and comments related to the effect size which is small for each construct.

Figure 4.5 indicates the path coefficients 0.87 and 0.44 of latent constructs openness and consciousness, of latent construct of personality (PR) are significant at 95% and 90% confidence level whereas path coefficients of latent constructs, agreeableness, neuroticism and extroversion are insignificant. The path coefficients 0.64,

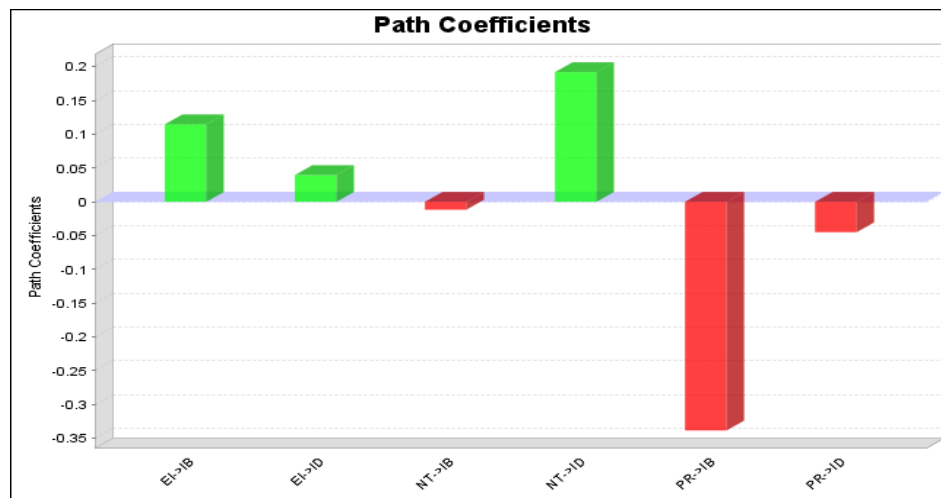


FIGURE 4.4: Path Coefficients of the structural Model.

TABLE 4.12: Evaluation of Structural Model.

	Path Coefficients	t-Values	P Values	$f^2$	Effect Size
EI → IB	0.115	1.9279	0.05	0.02	Small
NT → IB	-0.012	0.206	0.84	0.02	Small
PR → IB	-0.339	7.683	0.000	0.041	Small
EI → ID	0.039	0.704	0.48	0.012	Small
NT → ID	0.192	2.957	0.003	0.024	Small
PR → ID	-0.045	0.970	0.33	0.01	Small

0.49 and 0.44 of latent constructs, investment horizon, personalization of loss and control, of latent construct of investment behavior (IB) are significant at 95% and 90% confidence level whereas path coefficients of latent constructs, confidence and risk attitude are insignificant. Figure 4.5 shows the weight of latent constructs whereas, Figure 4.6 shows the result of bootstrapping.

Figure 4.6 indicates the results of structural model in second stage after bootstrapping. These bootstrapped results show the significance level of path coefficients among the independents and dependents latent constructs and significance level of outer weights of formative latent constructs.

In PLS-SEM, the validity of structural model validity is evaluated with the help



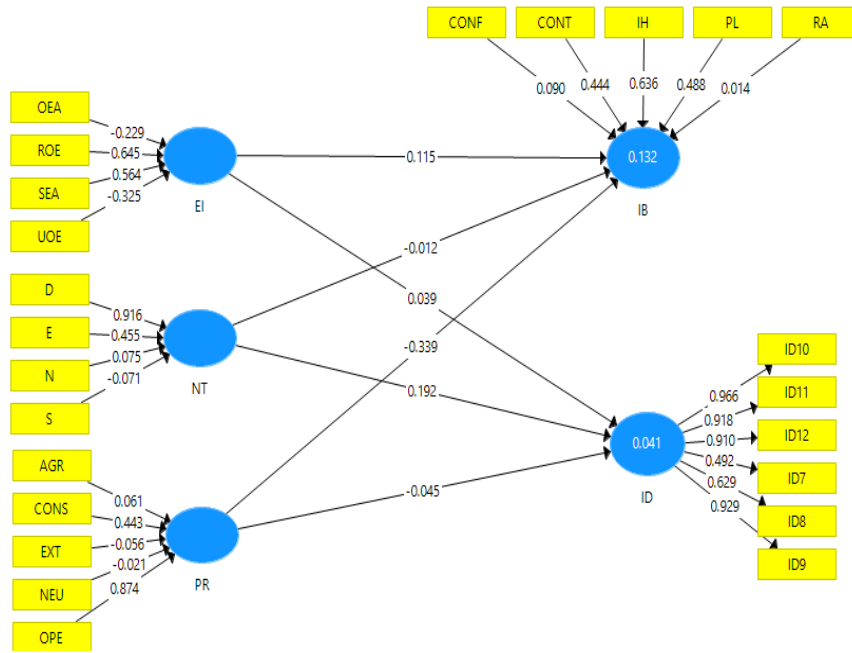


FIGURE 4.5: PLS-SEM Results of Structural Model (Second Stage).

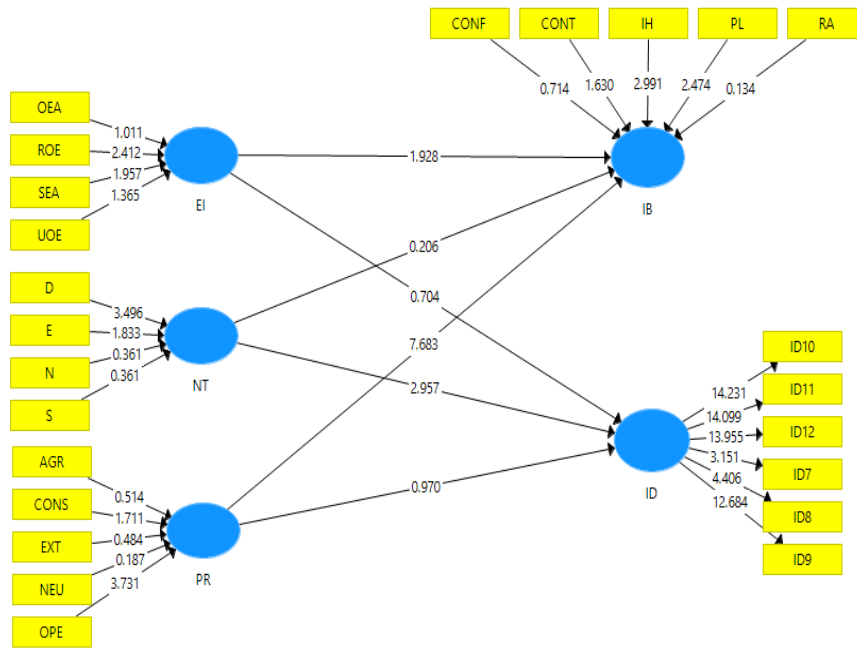


FIGURE 4.6: PLS-SEM Results of Bootstrapping of Structural Model (Second Stage).

of predictive relevance ( $Q^2$ ). Normally, values of  $Q^2$  should be more than zero for independent latent constructs in the structural model of PLS-SEM. Besides this, it is bickered that more the  $Q^2$  values higher the prognostic relevance of the structural model otherwise vice versa. On the base of procedure recommended by

TABLE 4.13: Overall Statistics of Structural Model.

	$R^2$	$Q^2$
<b>NT, EI and PR on IB</b>	0.132	0.013
<b>NT, EI and PR on ID</b>	0.041	0.013

Hair et al. (2013), the investigator depend on a blindfolding technique to get the cross-validated redundancy as a gauge to authenticate the predictive relevance of research model. Above given Table 4.13 indicate the values of  $Q^2$  which are as per the threshold. It is the assurance of the model fitness in this research. Table 4.13 also indicates the overall statistics of structural model of study.

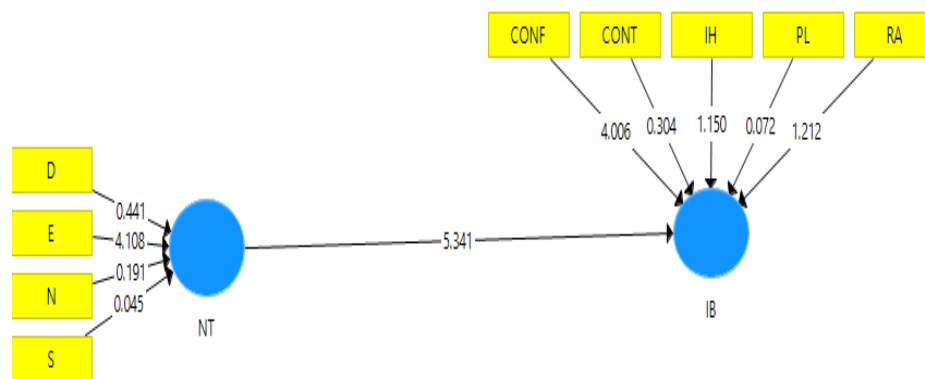


FIGURE 4.7: Bootstrapped PLS-SEM Results of Structural Model at higher order between neurotransmitters and investor behavior (second stage).

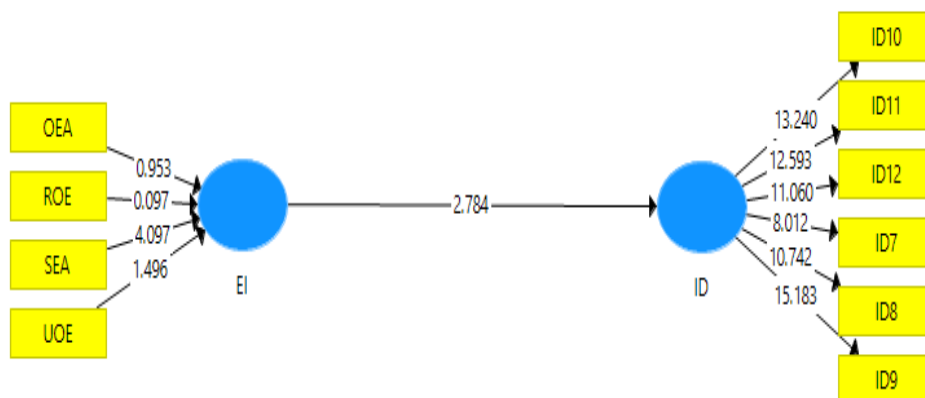


FIGURE 4.8: Bootstrapped PLS-SEM Results of Structural Model at higher order between emotional intelligence and investment decisions (second stage).

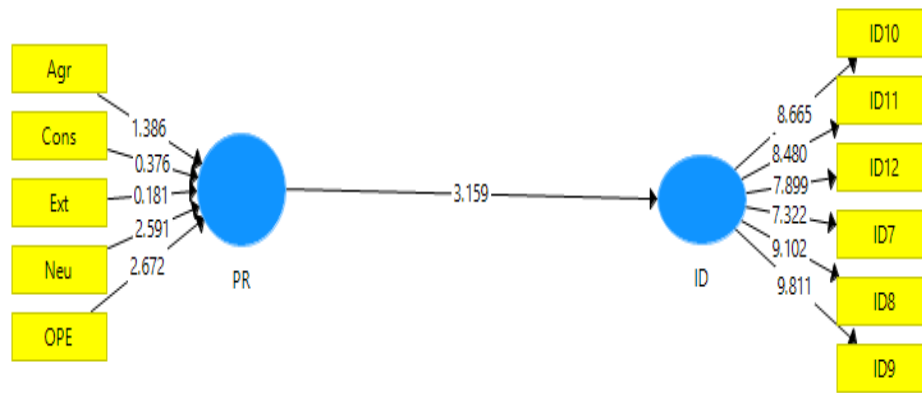


FIGURE 4.9: Bootstrapped PLS-SEM Results of Structural Model at higher order between personality and investment decisions (second stage).

Hypothesis developed in this dissertation are evaluated on the basis of path coefficients through hierarchical latent construct in PLS-SEM by using reflective-formative type model with help of the sequential latent variable score technique on the recommendation of (Becker et al., 2012). An study is conducted on the base of path coefficient for the approval and refusal of anticipated hypotheses. So, the hypothesis H3, H4 and H5 are accepted and H1, H2 and H6 are rejected on the base of recommendation of literature.

## 4.5 Summary of Results

Summary of results composed of main six parts as first, screening and cleaning of data, so detail of which is given in Section 4.1. However, second part includes the demographics of respondents, the detail of which is given in Tables 4.1 to 4.5, whereas third part include the exploratory factor analysis, the detail of which is given in Section 4.3 and Table 4.6. Similarly, main and fourth part of results is PLS-SEM which consists of the three sub components as first component is first stage that is composed of evaluation of reflective measurement model at lower order where author confirmed the reliability of construct with the help of outer loading, composite reliability and cronbach's alpha. Similarly, convergent validity of construct with the help of average variance extracted and discriminant validity of construct with the help of Fornell-Lacker Criterion cross loading of indicators and

HTMT. So, values of all these measures are according to the standard and within the range, the detail is given in sub-section 4.4.1 and Tables 4.7 to 4.10. Along with these measures latent score of lower order variables determines which will be used as indicators for higher order latent constructs in second stage. Similarly, second component of PLS-SEM is second stage that is composed of evaluation of formative measurement model at higher order, where author checked the multicollinearity with the help of VIF and significance level with the help of t-values and p-values which are according to the standard and within the range so, detail is given in sub-section 4.4.2 and Table 4.11. Likewise, third component of PLS-SEM is composed of evaluation of structural model at higher order with the help of path coefficients along their t-values and p-values, effect size with the help of f-square and overall statistics of structural model with help of R-square and Q-square, however, values of all these measures are according to the standard and within the range, so, detail of which is given in sub-section 4.4.3 and Tables 4.12 and 4.13.

# Chapter 5

## Conclusion and Recommendation

### 5.1 Conclusion

In previous studies the impact of each dimension of neurotransmitters, emotional intelligence and personality on investor behavior were observed separately. However, literature related to impact of neurotransmitters, emotional intelligence and personality on investor behavior as latent constructs did not present a precise narrative that is why in this dissertation re-examine and establish the H1, H2, H3, H4, H5 and H6. So, hypothesis 2 (H2) foresee the impact of emotional intelligence (IE) on investor behavior (IB) in PSX and observed this significant and positive. The result of hypothesis 2 to some extent is consistent with the studies of (Chaarani, 2016; Mitroi, 2016).

The hypothesis 3 (H3) foresee the impact of personality (PR) on investor behavior (IB) in PSX and observed this significant and negative. Generally, the result of H3 is different from literature of developed world but, Sadi at al. (2011) performed the research in Iranian equity market and found negative relationship among the personality features and behavioral characteristics of investor. Similarly, Zaidi and Tauni (2012) performed the research in Lahore Stock Exchange and observed the negative relation between personality characteristics and behavioral characteristics of investor.

The hypothesis 4 (H4) observe the impact of neurotransmitters (NT) on investor behavior (IB) in PSX and observed this significant and positive. As author mentioned earlier most of studies in the developed world used dimensions of neurotransmitters as a latent construct but no single study found where neurotransmitters collectively used as latent construct collectively. However, Singh et al. (2017) and Lang et al. (2017) in their studies found that some facets of neurotransmitters have connection with investment decisions facets.

The hypothesis 1 (H1) predict the impact of neurotransmitters (NT) on investment decisions (ID) in PSX and observed this relation as a insignificant and positive. Generally, literature reveals that neurotransmitters have significant relation with facet of investment decisions. Similarly, when author test H1 separate from the model of study found it significant at 100% confidence level as per recommendation of literature as can seen in figure 4.7.

The hypothesis 5 (H5) foresee the impact of emotional intelligence (EI) on investment decisions (ID) in PSX and observed this insignificant and positive. Normally, earlier studies point out that emotional intelligence (EI) has significant relation with latent constructs of investment decisions. Similarly, when author test H1 separate from the model of study found it significant at 100% confidence level as per recommendation of literature as can seen in figure 4.8.

The hypothesis 5 (H5) foresee the impact of emotional intelligence (EI) on investment decisions (ID) in PSX and observed this insignificant and positive. Usually, previous studies indicate that emotional intelligence (EI) has significant relation with latent constructs of investment decisions. Similarly, when author test H1 separate from the model of study found it significant at 100% confidence level which can seen in figure 4.8. Similarly, Beadnell et al. (2017) reveals that emotional intelligence is effective when making decision about the long term financial benefit. Similarly, a research conducted by Tang et al. (2017) with the help of data collected from 300 investors at Shanghai Stock Exchange and revealed that emotional intelligence is part of human good sense and this part has relation with decisions which leads toward the ups and downs of prices of stocks.

The hypothesis 6 (H6) predict the impact of personality (PR) on investment decisions (ID) in PSX and viewed this insignificant and positive. Generally, prior studies show that personality (PR) has significant relation with investment decisions. Earlier research reveals that personality characteristics persuade investment decisions of individuals (Crysel et al., 2013). According to Pak & Mahmood (2015; Dhochak & Sharma (2016) personality dimensions have influence on investment decisions. Similarly, when relationship between personality and investment decision is tested separately as compare to the model of study, it is found significant at 100% confidence level which can seen in figure 4.8.

Model of study describe that impact of neurotransmitters, emotional intelligence and personality on investor behavior is 13.2%. However, the impact of neurotransmitters, emotional intelligence and personality on investment decisions is 4.1%, so these are indication of correctness of model. Similarly, the value of Q2 is more than zero which confirm the primitive relevancy of model.

According to Olsen (2007), primitive side of human decisions is able deal with more complicated verdicts to achieve just ballpark correct answer of puzzle. Similarly, most of researchers has shown that “*financial decision making has important roots in emotional process and cannot be understood fully as the expression of cognitive limitations*” (Sjobreg and Engelberg, 2006, p. 21). So, on the base of theses guideline, proposed combine model of neurofinance and behavioral finance in this dissertation is an achievement. Similarly, these sentences act as a brainwave to discover a suitable neurofinance and behavioral finance model which is residue to discover what is correct within this black box.

After this, author learn lot of things from this research, first, the impact of neurotransmitters on investment decisions and the impact of emotional intelligence, personality on investor behavior in PSX and observed this is significant.

Second, the impact of neurotransmitters, emotional intelligence and personality on investor behavior is 13.2%. However, the impact of neurotransmitters, emotional intelligence and personality on investment decisions is 4.1%.

Third, it is significant for individual investors and investment managers of brokerage houses to know the connection of behavioral and neurofinance concepts with

investor behavior of people and their investment decisions for their individual scheduling the economic decisions. On the base of this, that is to say neurotransmitters, emotional intelligence and personality features having links and impact on investor's behavior to understand the investment mistakes and to achieve superior investment decisions in stock market.

Fourth, author learned about the theoretical contribution of study and practical implication of the study with their limitation and future directions, so, the detail of which is given in Sections 5.3 to 5.6.

## **5.2 Contribution of the Study**

The empirical findings and concluding remarks offer in this dissertation confirm that emotional intelligence particularly self emotion appraisal and regulation of emotion, personality particularly openness are extensively linked with the investor behavior. On the other side, neurotransmitters particularly dopamine have extensive and epinephrine to some extent have connection with investment decisions of individuals participating in the PSX. Whereas the other constructs of model did not revealed association with investor behavior and investment decisions of individual. So, these are not only advancement in the current boundaries of academic knowledge, but this also have wider pragmatic use for both individual investors and investment managers of brokerage houses because it is significant for them to know the connection of behavioral and neurofinance concepts with investor behavior of people and their investment decisions for their individual scheduling the economic decisions.

This research presents the initial ever experiential confirmation of connection among neurotransmitters and investment decisions of individual, especially in Pakistan Stock market, in view of this; it would be possible a superior base for point of reference for neurofinance and behavioral finance pollster in upcoming. This research applied the second generation technique for multivariate; specifically, hierarchical latent variable models in PLS-SEM using reflective-formative type model which are specific and suitable in contributory prognostic study in complicated



circumstances previously which has not been used in the field of neurofinance and behavioral finance.

This research proves the authenticity of earlier research on association among the neurotransmitters, emotional intelligence, personality, individual's investor behavior and their investment decisions and put some considerable part in the scholarly work. Initially, it confirms that emotionally intelligent individual have impact on their investment behavior. Subsequent to this, it recognizes some personality and emotional intelligent features which put considerable brunt to manage behavior of individual investor of stock market. Similarly, it confirms that neurotransmitters of individual investor have impact on their investment decisions.

Third, this scholarly work test the argument of Olsen (2007) and organize and test the upcoming research guidelines of Ameriks et al. (2009); Kuhnen et al (2013); Mosher and Rudebeck (2015).

Previously, in most of scholarly work while investigating the neurotransmitters, emotional intelligence; personality and investor behavior; researchers pay attention and test the first order latent constructs of these concepts and ignore these second order latent constructs. But in this dissertation this problem has been addressed. Similarly, previously in most of studies the measurement of neurotransmitters was ambiguous but in this research, to avoid methodological issues author construct and validate the scale of neurotransmitter's latent constructs such as dopamine, serotonin, epinephrine and norepinephrine.

This research highlights a spot that over and over again stay unnoticed in the emerging field of neurofinance and behavioral finance; that is to say neurotransmitters, emotional intelligence and personality features having links and impact on investor's behavior to understand the investment mistakes and to achieve superior investment decisions in stock market.

### **5.3 Theoretical Contribution of the Study**

The empirical findings of study contribute in the theory that the fight-or-flight response theory and system of reward are trait theory because this research recommends that neurotransmitters especially, dopamine and epinephrine are the best descriptive concepts which are use for assessing the tendency in investment decisions. Similarly, the theory of multiple intelligence is the most excellent for latent explanatory idea of emotional intelligence particularly, self emotions appraisal and regulation of emotions are use for assessing the advancement in investor behavior. Correspondingly, the trait theory is the prominent and well-built base for latent explanatory concept of personality especially openness is use for assessment of the trends in investor behavior after conducting complete research in the environment of PSX.

### **5.4 Implication of the Study**

The empirical findings of this combine research in neurofinance and behavioral finance would be advantageous in the subsequent ways: First, recognize the function of personality feature openness and consciousness in the improvement of behavioral features, such as investment horizon, personalization of loss and control level, of individual investor. Second, identify the role of emotional intelligence's mechanism such as self emotions appraisal and regulation of emotions in the development of behavioral aspects such as investment horizon, personalization of loss and control level of individual investor. So, on the base these two arguments, it concluded that investors with carefully, attentiveness and openness to experience will choose the appropriate time span for investment and when there will loss on investment, they will not feel more and become more curious about loss. Likewise, investors after evaluation and regulation of their emotions will be able to manage and control the loss of investment by choosing the appropriate time span in stock market.

These are not only advancement in the current boundaries of academic knowledge, but this also have wider pragmatic use for both individual investors and investment managers of brokerage houses because it is significant for them to know the connection of behavioral and neurofinance concepts with investor behavior of individual and their investment decisions for their individual scheduling the economic decisions.

Similarly, after understanding the role of neural pleasure system and fight or flight situations in the presence of behavioral facets in the PSX, it will be supportive for financial managers to design the strategies by highlighting investment consideration of individual investor. So, individual investor will make financial decision for their economic interests by understanding the relation of the neurotransmitters and investment decisions.

This empirical research has numerous implications in favor of individual investors and academic researchers along with this, open latest prospects to investigate the dynamics of latent concepts of neurofinance and behavioral finance in Pakistan's stock Market. This research informs through an excellent written empirical finding that individual investors are prone to investment horizon and personalization of loss while making investment in Pakistan's stock Market. The results of this research give a latest viewpoint in current body of knowledge as of collectively practical a well as academic angle.

## **5.5 Limitation of the Study**

This research is documented on the base of investors of PSX. Investors of other markets of various countries in the different region of the world have diverse demographics and investment culture related to the behavioral feature of individuals such as investment horizon, risk attitude and level of confidence and their investment decisions. So, these dissimilarities can influence the domino effect of this combine neuro and behavioral finance model in the rest of markets of world.

Another limitation of study is that it does not analyze the performance evaluation of the current model beyond the current sample size for stock market of other

region of the world because it is outside the range of this research. Criticism on reliability and validity of this research can be on the base of different dimensions of latent constructs of study because most of researchers in the different region of world use different personality dimensions. Similarly, researcher used different numbers of neurotransmitters of emotionally intelligent individual investors with different behavioral dimensions for investment and their decisions.

However, credibility of this research is outstanding and on the base of participants symbolizing the more than 0.22 million investors of PSX classified as secondary merging market by the Morgan Stanley Capital Investment (MSCI) and Financial Times Stock Exchange (FTSE). Similarly, data collected for this study is limited and on the base empirical findings limitation is that findings may not be generalized for other participants of stock markets of world.

## **5.6 Directions for Future Research**

The empirically concluding remarks of research open new horizon for advancement in field of neurofinance and behavioral finance. Further, personality and behavioral latent constructs of investor for instance multidimensional personality traits and optimism with anchoring. Similarly, more research about neurofinance such as prefrontal cortex and anterior cingulate to make better investment decisions. So, these avenues will provide supplemented inner view of investor's behavior and their decision's in the stock market of Pakistan and demand more and more effort to determine universal latent constructs for combine model of neurofinance and behavioral finance.

The most prominent and main defy for researchers of neurofinance is the measurement of neurotransmitters latent constructs specifically dopamine, serotonin, epinephrine, norepinephrine and other proxies which has been done in this study. So, there is need to test the validity and reliability of neurotransmitter's measures in the setting of other stock markets of region.

Upcoming inquiries about this study may increases the size of sample by focusing on all aspects of neurotransmitters components of neurofinance and investor's

behavior aspects of finance in the equity market of Pakistan. Further studies in growing as well as developed financial markets of the world are desired to wind up this model for quantifying structural impact of neurotransmitters, emotional intelligence and personality on investor behavior and investment decisions to enhance the natural authenticity of empirical findings.

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# Appendix A

## Research Questionnaire

**Dear Respondent,**

I am PhD Scholar at Capital University of Science and Technology, wishing to conduct research on Impact of Neurotransmitters, Emotional Intelligence and Personality on Investors Behavior and Investment Decisions for the completion of my research thesis. In this regard, I have prepared following questionnaire, please note down that your identity as respondent is concealed. You can freely express whatever the ground realities you see and face. It will take few minutes only; any information obtained for this research will only be used for academic purpose. For more queries please email [mumtazkanjuiub@hotmail.com](mailto:mumtazkanjuiub@hotmail.com). I really appreciate your time for filling up this questionnaire.

Regards

Mumtaz Ahmad

## Emotional Intelligence Questionnaire

### Self-emotion appraisal (SEA)

1. I have a good sense of why I have certain feelings most of the time.
2. I have good understanding of my own emotions.
3. I really understand what I feel.
4. I always know whether or not I am happy.



### **Others' Emotion Appraisal (OEA)**

5. I always know my friends' emotions from their behavior.
6. I am a good observer of others' emotions.
7. I am sensitive to the feelings and emotions of others.
8. I have good understanding of the emotions of people around me.

### **Use of Emotion (UOE)**

9. I always set goals for myself and then try my best to achieve them.
10. I always tell myself I am a competent person.
11. I am a self-motivated person.
12. I would always encourage myself to try my best.

### **Regulation of Emotion (ROE)**

13. I am able to control my temper and handle difficulties rationally.
14. I am quite capable of controlling my own emotions.
15. I can always calm down quickly when I am very angry.
16. I have good control of my own emotions.

### **Questionnaire of Personality**

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

## Extraversion vs. Introversion

I see myself as someone who ...

- |                                    |   |   |   |   |   |
|------------------------------------|---|---|---|---|---|
| 1. Is talkative                    | 1 | 2 | 3 | 4 | 5 |
| 2. Is full of energy               | 1 | 2 | 3 | 4 | 5 |
| 3. Generates a lot of enthusiasm   | 1 | 2 | 3 | 4 | 5 |
| 4. Has an assertive personality    | 1 | 2 | 3 | 4 | 5 |
| 5. Is outgoing, sociable           | 1 | 2 | 3 | 4 | 5 |
| 6. Is reserved (R)                 | 1 | 2 | 3 | 4 | 5 |
| 7. Is sometimes shy, inhibited (R) | 1 | 2 | 3 | 4 | 5 |

## Agreeableness vs. Antagonism

I see myself as someone who ...

1. Is helpful and unselfish with others
2. Has a forgiving nature
3. Is generally trusting
4. Likes to cooperate with others
5. Is considerate and kind to almost everyone
6. Starts quarrels with others (R)
7. Tends to find fault with others (R)
8. Can be cold and aloof (R)
9. Is sometimes rude to others (R)

## Conscientiousness vs. Lack of Direction

I see myself as someone who ...

1. Does a thorough job
2. Is a reliable worker

3. Perseveres until the task is finished
4. Does things efficiently
5. Makes plans and follows through with them
6. Can be somewhat careless (R)
7. Tends to be disorganized (R)
8. Tends to be lazy (R)
9. Is easily distracted (R)

### **Neuroticism vs. Emotional Stability**

I see myself as someone who . . .

1. Is depressed, blue
2. Can be tense
3. Worries a lot
4. Can be moody
5. Gets nervous easily
6. Is relaxed, handles stress well (R)
7. Is emotionally stable, not easily upset (R)
8. Remains calm in tense situations (R)

### **Openness vs. Closeness to Experience**

I see myself as someone who . . .

1. Is original, comes up with new ideas
2. Is curious about many different things
3. Is ingenious, a deep thinker
4. Has an active imagination

5. Is inventive
6. Values artistic, aesthetic experiences
7. Likes to reflect, play with ideas
8. Is sophisticated in art, music, or literature
9. Prefers work that is routine (R)
10. Has few artistic interests (R)

## Questionnaire of Investor Behavior

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

### Investment Horizon

1. Fluctuations in the stock market DO NOT concern me.
2. The constant media reporting of stock market fluctuations does NOT bother me.
3. If one of my investments dropped 20% over six months, and this drop coincided with a stock market crash, I would keep that investment in hopes that it would recover.
4. I am investing to supplement my income (reverse-coded).

### Risk Attitude

1. I am prepared to take greater risks (possibility of initial losses) in order to earn greater future returns.
2. I feel more comfortable taking risks (possibility of initial losses) when my investments are performing well.

## **Personalization of Loss**

1. When one of my investments performs poorly, I feel unlucky.
2. My investment losses are felt more than my gains.

## **Confidence**

1. I am an experienced investor.
2. I feel that on average my investments perform better than the stock market.
3. When I purchase a winning investment, I feel that my actions and knowledge affected the result.
4. I expect my investments to perform better than the stock market.
5. I feel more confident in my own investment opinions over opinions of financial analysts and advisors.
6. I feel more confident in my own investment opinions over opinions of friends and colleagues.
7. I am likely to purchase investments that have been recommended by friends or colleagues (reverse-coded).

## **Control**

1. I feel more confident in the validity of information that I collect myself.
2. The more information I collect on my investments, the more confident I feel.
3. I spend considerable effort researching my investments.
4. I check the performance of my investments very frequently.
5. After I have spent a long time researching an investment, I am more likely to act on this information (buy or sell).
6. I feel more confident when I have immediate access to my investments.

## Questionnaire of Investment Decisions

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

1. Investment has a high degree of safety.
2. Investment has the ability to meet interest payments.
3. Investment is likely to repay the principal at maturity.
4. Investment has recently reported results that were significantly better than expected.
5. Investment has lower risk compared to the market in general.
6. Investment is suitable for conservative investors.
7. Investment has demonstrated increased revenue growth in the past 5-10 years.
8. Investment has higher than average revenue projections for the next several years.
9. Investment has demonstrated high rates of cash flow growth in the past 5-10 years.
10. Investment has higher than average cash flow projections for the next several years.
11. Investment has demonstrated high rates of earnings growth in the past 5-10 years.
12. Investment has higher than average earnings projections for the next several years.
13. Investment proceeds will be used in a way that benefits society.
14. Investment proceeds will be used in a way that I find productive.

## **Neurotransmitters (Dopamine, Serotonin, Epinephrine and Norepinephrine) Questionnaire**

### **Dopamine**

1. I have episodes of low blood sugar with light-headedness, irritability, extreme hunger, and cloudy thinking.
2. I get excessive amounts of sleep and still awaken tired.
3. I am easily angered, irritated, or frustrated.
4. I need medication to cope with or forget my problems.

### **Serotonin**

1. I eat when I am not hungry.
2. I eat massive quantities of food at one time.
3. I eat unconsciously and wonder why after that.
4. I eat such large quantities of food that I get nauseated.

### **Epinephrine**

1. I feel difficulties or problems with stress, mental clarity, maintaining my focus, organizing my thoughts, making decisions, and feeling out of control.
2. I find it difficult to concentrate on my job or projects.
3. I feel eye fatigue that affects my job, work or reading enjoyment.
4. I feel difficulty while starting work/job/projects.

### **Norepinephrine**

1. I feel out of control, especially with my hunger.

2. I think about food most of the time.
3. I have strong desire of breads or pastas rather than sweets or junk food.
4. I feel down, depressed, or unexciting.