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PERSONALITY TRAITS AND INVESTMENT BEHAVIOUR

Presentata da**: Marco Cecchini**

Coordinatore Dottorato   Relatore

Prof.ssa Rosa Grimaldi   **Prof. Emanuele Bajo**

Correlatori

Prof. Maurizio Sobrero

Prof. Paolo Maria Russo

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PERSONALITY TRAITS AND INVESTMENT BEHAVIOUR

Marco Cecchini
marco.cecchini10@unibo.it

Ph.D. Thesis in General Management
A collection of three papers:

1) Individual Differences in the Disposition Effect
2) Psychological Profile and Investment Style
3) Personality Finance

Abstract

Over the last decades, economists have gained a better understanding of financial stock-markets, uncovering and formalizing some relevant phenomena related to the individual trading behaviour. While these improvements led scholars to learn more about investment' patterns, a full comprehension of what drives these trading strategies and why subjects differ in applying them is still missing. Especially, through the availability of the first datasets on trading brokerage and investor characteristics, it becomes clear that the high heterogeneity in individual financial behaviour might be explained looking at the socio-psychological factors that depict each human being. However, the difficulty to find or create a proper and large sample is the main reason that prevented economists from this endeavour.

In this thesis I construct a unique dataset to test the role of individual characteristics in affecting the investor behaviour. In particular, I present two empirical research papers that investigate trading patterns unlikely to be driven by rational models, and a literature review in which are summarized the main findings within the new field of "personality finance". Using an experimental analysis that combine a trading simulation with a Big-Five personality questionnaire, Paper 1 and Paper 2 illustrate how personality affects the individual level of disposition effect and trading volume respectively. In detail, among a sample of 230 students, in the first paper I find strong heterogeneity in the level of disposition effect recorded. In explaining these differences and controlling for demographic variables, I show that the trait of extroversion is positively related with tendency to sell stocks at gain rather than at loss, while subjects with high conscientiousness and openness to experience are less biased. In a different sample of 176 students, from Paper 2, I demonstrate that emotionally stable investors are more likely to exhibit higher trading volume, while high-conscientiousness seems to weaker it. Demographics and risk-attitude measures moderate the individual investment choices. Finally, in the third paper I introduce a literature review on those works in which the personality of the investors is used to explain subjects trading performance and specific financial phenomena. I try to organize the main findings from this new field, named "personality finance", identifying the psychological sources that can predict the heterogeneity in the individual investment behaviour.

Ai miei cari genitori

Individual Differences in the Disposition Effect

Marco Cecchini, Emanuele Bajo, Paolo Maria Russo and Maurizio Sobrero[*]

Abstract

We investigate the role of personality traits in explaining the disposition effect. The experimental analysis combines NEO IP-R five-factor personality measures with individual financial data from a trading simulation. Among our sample of 230 students we find strong heterogeneity in the level of disposition effect recorded. In explaining these differences and controlling for demographic variables, we find that extroversion is positively related with tendency to sell stocks at gain rather than at loss, while subjects with high conscientiousness and openness to experience are less biased.

[*]Marco Cecchini is a PhD Student at the University of Bologna, Department of Management. Emanuele Bajo and Maurizio Sobrero are Full Professors at the University of Bologna, Department of Management. Paolo Maria Russo is an Associate Professor at the University of Bologna, Department of Specialistic, Diagnostic and Experimental Medicine. Corresponding author: marco.cecchini10@unibo.it.

1.   Introduction

The assumption of market efficiency has been widely challenged in recent years. The evidence of trading anomalies not explained by rational investor models led a stream of literature to address the question within different fields of analysis, especially by considering cognitive science studies.

In 1979, with their innovative experiment, psychologists Daniel Kahneman and Amos Tversky found inconsistency between individual risky choices and the basic principles of utility theory. Proposing an alternative value function, the authors introduce the bias of loss aversion and underweight of probabilities, contributing to create what will be called behavioural finance.

At the base of this research' field there is the belief that the financial markets reflect all the features of investors as human beings, with their emotional/cognitive response. Overconfidence (Fischoff, Slovic and Lichtenstein, 1977; Fischoff and Slovic, 1980; Barber and Odean, 2001; Gervais and Odean, 2001), mental accounting (Tversky and Kahneman, 1981) and herding (Huberman, 2001) are just few financial biases related with psychological factors.

In this paper, we investigate one of the most well-known phenomena in financial trading, the disposition effect. Despite the existing literature demonstrating the tendency to ride losses and realize gains in a market place (Shefrin and Statman, 1985; Weber and Camerer, 1998; Odean 1998; Shapira and Venezia, 2001; Dhar and Zhu, 2006; Frazzini, 2006), a missing explanation of the bias variation across subjects is found. Following the interdisciplinary studies that suggest a link between risky decision-making and psychological factors (Zuckerman, 1983; Dahlbäck, 1990; Kuhlman and Zuckerman, 2000; Lauriola and Levin, 2001), we propose a conceptual modelling of the role of personality traits in exploring the individual differences in the disposition bias.

The question is important as the traditional theories, based on information asymmetry or transaction costs (Odean, 1998) fail to give an interpretation of the phenomenon. In proposing a study at the individual level, we analyse investment heuristics for each different subject

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to detect and monitor data features that are no visible in trading aggregated records.

If we find that a specific psychological factor correlates with the disposition effect, potential implementations of behavioural models that capture anomalies in asset pricing could be addressed. Especially, the role of some personality traits in stimulating cognitive processes might motivate theorists to explain investors heterogeneity on financial phenomena like: insufficient or naive diversification (French and Poterba; 1991; Lewis, 1999; Baxter and Jermann, 1997; Grinblatt and Keloharju, 2001; Barberis and Shleifer, 2003; Barberis and Thaler, 2003), excessive trading (Odean, 1999; Barber and Odean; 2000; Barberis and Shleifer, 2003; Barberis and Thaler, 2003) and underreaction (overreaction) to the events (Daniel et al., 1997; Barberis et al, 1998; Frazzini, 2006).

The results of this study can also raise attention on the development of regulatory policies by financial institutions in educating investors of such bias and help them to make better investments.

We use an experimental analysis in a sample of 230 students from Economics and Engineering Faculties both at University of Bologna (Italy) and at University of Wuhan (China). Subjects were asked to participate in a trading competition based on Weber and Camerer (1998) experimental task and to fulfil a booklet of questionnaires in which demographic and Big Five personality traits are measured.

Our data indicates that extroversion is positively related with disposition effect, while subjects with high conscientiousness and openness to experience are less biased. In particular, in line with the psychological literature that demonstrates a link between extraversion and high sensitivity to reward (Smillie, 2013) we report that extroverts prefer short-term capital gains instead of delayed profits (Daly et al., 2009). Moreover, the fact that in our experiment open mind investors close negative positions faster than positive reinforces the theories (Costa and McCrae 1992; Lauriola and Levin, 2001; LePine, 2003) that suggest the facets

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of intellect, curiosity and exploration in reducing harm-avoidance behaviour through unconventional decision-making. Finally, we show how low impulsive investors base their trading activities on a non-immediate aim-achievement (Holt et al., 2003; Daly et al., 2009) that lead them to follow long-term strategies for the main goal of higher return.

The structure of the paper is the following. A review of the literature on disposition effect and personality traits is provided in Section 2. Section 3 is devoted to our experimental protocol, while we describe the results in Section 4. Discussion and conclusions are in Section 5.

2. Literature Review

2.1. Disposition Effect

The attitude to ride losses instead of gains has always drawn the attention of economists as one of the most challenging trading anomalies to define.

In fact, from the introduction in 1985 by Shefrin and Statman, the disposition effect has been widely investigated both in controlled environments and in market settings. After the empirical demonstration of its existence (Odean, 1998; Weber and Camerer 1998) and the evidence of a negative correlation with the investment return[1] (Odean, 1998; Grinblatt and Keloharju, 2000; Shapira and Venezia, 2001; Kaustia; 2004; Chen et al., 2007), the research moved on to the implication of the phenomenon in financial trading. Based on the Grinblatt and Han (2005) model, Frazzini (2006) shows how the disposition effect drives most of the stock-price underreaction to new information[2], while Goetzmann and Massa (2008) demonstrate how the bias is positively (negatively) associated with trading volume (volatility).

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[1]From Odean (1998), the annual return of investors affected by disposition effect is 4.4 per cent lower than that of subjects who sell immediately loser stocks instead of winners.

[2]For stocks with high-unrealized capital gains and losses, the author finds a slower price drift due respectively to a positive and negative announcement.

While a considerable literature has been devoted to confirm these results and continue to explore the greatest paradoxes to the common financial advice "keep on the best and cut the worst", Kahneman and Tversky (1979 and 1992) put forward a relevant explanation of the phenomenon. Where the standard hypotheses failed to give an interpretation of the disposition effect (Odean, 1998), with their prospect theory the authors demonstrated how subjects take decisions based on a reference point and that this changes whether they are judging profits or losses[3]. The authors found that individuals exhibit risk-aversion towards gains while they seek risk when they are experiencing losses. Whereas the prospect theory seems to predict the disposition effect, Barberis and Xiong (2009) and Kaustia (2010) have discussed the difficulties in formalizing this statement. In particular, Barberis and Xiong (2009) demonstrated that, when a subject computes his own preferences on annual gains/losses rather than realized gains and losses, it is more likely to observe a positive relation between the prospect theory and the opposite of disposition effect. The idea of the authors was to highlight that the investment behaviour is better predicted by those models in which subjects derive utility not only from a total wealth experience (as annual gains/losses or on the entire portfolio) but from every investing episode. Formalizing their realization utility model (Barberis and Xiong, 2012)[4], the authors suggest that the investors (especially individual rather than institutional) have separated burst of utility for different single events (e.g. "I purchased a share of Ferrari at $40 and I sold at $60") instead of computing their wealth as the sum of several investments. Following Barberis and Xiong (2012), the width of utility that subjects experience is positively related with the size of the realized gains/losses

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[3]The way in which the reference point is evaluated is an on-going debate. Especially, the theories based on narrow framing often use different reference points for the evaluation of gains and losses (risk-free rate, zero return and size of gains/losses). Recently, in contributing to address this question, a new model from Hartzmark (2014) suggests to consider the portfolio composition as the key to explain differences in how investors evaluate the holding stocks. In particular, the author introduces the rank effect, showing the tendency of the subjects to take selling decisions comparing the trend of the stocks in their portfolio (e.g. closing extremely winning and losing positions).

[4]The idea of the realization utility is not totally new in behavioural finance. The theory of Barberis and Xiong (2012) relates indeed with the prospect theory (Kahneman and Tversky, 1979) in which the utility is formed for paper and gains too, and with the "mental accounting" assumption in Shefrin and Statman (1985).

on the assets they are trading. The higher is the distance between the purchase price and the price at which the stock is sold, the greater will be the burst of utility. The intuition behind the realization utility theory is simple. When we sell a stock at gain, we feel pleasant/good/successful because we create our own positive investment event. In contrast, by selling the security at loss, we face with a negative episode that produces unpleasant feelings. Whether the realization utility theory emerges as an alternative model able to predict disposition effect correctly[5], it also offers a promising framework in the study of the bias heterogeneity among investors (Frydman et al., 2014).

This point is relevant since the analysis of the phenomenon at an aggregate level masks considerable cross-section variation in the understanding of the trading behaviour (Odean, 1999). Surprisingly, very few attempts have been made to detect investor characteristics able to explain the interindividual differences in the disposition effect. In order to investigate such variability, Dhar and Zhu (2006) focused on financial wealth, professional occupation and educational background, to demonstrate that "high-income" and "professionals" investors display lower disposition effect. These results are also confirmed by Da Costa et al. (2013) who point to the subject's trading experience as a driver to reduce the disposition behaviour. The authors find that, although all the individuals are influenced by the disposition effect, the student sample is more affected compared to the professional sample.

With the existing literature mainly interested in the empirical demonstration of the disposition proxy at an aggregate level, a gap in the theory has been highlighted. In particular, from a psychological view, profiling a single investor who experiences the disposition effect leaves some questions to be addressed. For example, it should be asked what is the biological basis that leads subjects to respond more strongly to immediate rewards rather than to the immediate losses. Or, if there are some psychological dimensions that moderate the influence

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[5]Another model that could explain the disposition effect is the "mean-reversion" model. However, as Kaustia (2010) and Barberis and Xiong (2012) demonstrate, the irrationality assumption of the mean-reversion sometime fails to predict the disposition effect.

of experienced outcome on future decisions[6]. The personality traits framework seems to gain favour in answering these questions.

2.2.   *Personality Traits*

In a perfect standardized environment where all economics agents have the same information, experience and knowledge, the variation in decisions made by individuals reflects the differences in the way automatic mechanisms (often unconscious) drive various cognitive processes. Psychological literature (Fleeson, 2001; Pytlik et al., 2002) organizes this heterogeneity in stable patterns of affects, behaviours and cognitions that take the name of personality traits. Thoughts, emotions, actions are all elements of personality traits (Kassin, 2003).

Since the wide scientific area embraced by this notion, psychologists, from the seminal work of Allport on 1921, started a gold rush to better define and measure the basic traits of human personality.

A long stream of theories succeeded during the years, defining them as stables over time, different across subjects and able to influence people' behaviour. A long stream of scales has been developed during the years, to provide a better picture of human complexity.

Currently, the most popular approach in the analysis of personality traits is the one developed from Tupes and Christal (1961) in which a five-factor model is assumed to describe the psychological characteristics of individuals. In particular, after the works of Tupes and Christal (1961), Norman (1963), Borgatta (1964) and Goldberg (1981) psychologists focus on neuroticism, extraversion, conscientiousness, openness to experience and agreeableness as the main constituent traits of the Big-Five theory. The model has the greatest advantage to take into account, for each dimension, various qualities that are not overlapping each other. For example, sub-levels of neuroticism include the tendency to experience unpleasant emotions like anxiety, fear and anger. Table I provides a detailed description of lower dimensions

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[6]To this regard in the paragraph 2.3 we introduce some insights from the works of Fenton-O'Creevy et al. (2004), Grinblatt and Keloharju (2009) and Grinblatt et al. (2011).

for the five personality factors.

[Insert Table I here]

The accuracy of the Big-Five theory is widely accepted in psychological literature and the assessment of each trait takes place mainly through self-report questionnaire. Several studies established substantial evidence in using these personality measurements to explain heterogeneity across population. From the caffeine consumption to the learning process, social psychologists employed the questionnaire to analyse an endless list of subjects' behaviour, often combining various research fields (see Ozer and Benet-Martinez (2006) where the Big Five model predicts a variety of important outcomes as happiness and well-being, political attitudes and values and finally occupational choice and performance).

Since their role in the understanding of individual differences in subjects' cognitive, emotional and motivational processes, the traits result as the key to detect the differences across subjects in decision-making.

2.3. *Disposition Effect and Personality Traits*

Before introducing our model, we assume the realization utility as our reference behavioural theory from which construct our hypotheses[7]. In showing an attitude of the subjects to derive utility from realized gains and losses, rather than from their total final wealth, the theory of Barberis and Xiong (2012) proposes to consider the individual investment history as a set of different financial episodes with single and separates utility computations. With regard to the study of the disposition effect, Barberis and Xiong (2012) suggest that

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[7]Even if there is no unanimous consensus on what is the best behavioural model in predicting the disposition effect (prospect theory, mental accounting, mean-reversion and realization utility) the realization utility seems to offer a prominent framework in studying the individual investment behaviour. Especially, the advantage of this theory is to employ the basic ideas underlying other relevant models (as prospect theory and mental accounting) and to overcome the issues related to these models providing a more reliable and precise behavioural theory. In this term, the realization utility may be seen as a general theory that summarize and implement previous behavioural models.

each realized gains or losses correspond to a separate financial decisions made by the investors during their life. In this term, the realization utility theory offers a prominent starting point to investigate the heterogeneity of the bias among investors. Indeed, from an exhaustive cognitive literature on the effect of individual differences on decision-making, is more than reasonable to think to a role of some psychological factors in influencing the individual choice during specific financial tasks[8].

In order to offer a better and comprehensive intuition on how personality traits drive heterogeneity in the disposition effect, we pause on the work of Frydman et al (2014) in which the reliability and the implications of the realization utility on the disposition effect are tested[9]. In particular, in describing the cognitive process behind the realization utility, Frydman et al. (2014) state: *"If an investor derives pleasure from realizing capital gains and, moreover, is impatient, he will be keen to sell stocks at a gain. Conversely, if he finds it painful to sell stocks at a capital loss and also discounts future utility at a high rate, he will delay selling losing stocks for as long as possible."*

From the sentence above we can literally extrapolate several psychological constructs that might affect the individual investment behaviour. For example, let's focus on the rewarding and punishment sensitivity[10] [*"... investor derives pleasure from realizing capital gains. ... he finds it painful to sell stocks at a capital loss..."*] and consider a scenario where subject A and subject B have the same stock XYZ in their portfolio. If subject A is more sensitive to rewards than B and an increase in the price of XYZ from its purchase level occurs, subject A may ascribe more value to that capital gain than subject B would do. The distance in how the value is encoded could lead the two individuals to act differently. We should expect that in feeling satisfy easily than subject B, A will be more likely to sell stocks at gain faster

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[8]In finance there are few papers that analyse the effect of some personality traits on financial decision making. See for example Fenton-O'Creevey et al. (2004), Grinblatt and Keloharju (2009), Grinblatt et al. (2011) and Conlin et al. (2015). These papers will be also discussed later.

[9]In particular, the authors use neural data to demonstrate the implication of the realization utility on financial theories as the disposition effect.

[10]The reward and punishment sensitivity refers to the differences in the way subjects respond to positive and negative stimulus (Eysenck, 1967).

than B[11].

Again, the fact that in some cases rewards and punishments are considered reinforcers[12] could amplify their influence on the individual investment behaviour. In particular, a positive relation between reward and punishment sensitivity with the disposition effect is expected.

However, the clear effect on the realization utility and consequently on the disposition effect, it is not an exclusive of the reward and punishment sensitivity. The same relationship can also be interpreted looking at another psychological construct, still highlighted in the sentence of Frydman et al (2014). Especially, the trait of impulsiveness[13] [*"...is impatient..."*] is underpinning a greater sensitivity to rewards (Eysenck, 1967; Carver and White, 1994; Torrubia et al., 2001) and it is easy to integrate what described above with the imagine of an impulsive individual who, acting with little or no concerns for future consequences, sell stocks as soon as a capital gain occurs.

Whether being impulsive it might drive differences in the gain' side of the disposition effect, in the realm of losses, the traits of anxiety, and more in general of neuroticism, is at the base of a negative relationship with the bias among the investors. Indeed, from Frydman et al. (2014) [*"...he finds it painful to sell stocks at a capital loss ..."*], in experiencing an increase reaction to negative signals (Eysenck, 1967; Torrubia et al., 2001), a neurotic might not sell quickly the stocks at loss waiting for possible price increases that could reduce their unpleasant feelings.

The list of psychological facets that may impact on the individual utility formation, and in turn on subjects' financial decisions, is long and straightforward. Reward/punishment sensitivity, impulsiveness and anxiety are just three constructs of broader dimensions that see systematic interactions among multiple factors (as extraversion, sensation seeking, conscientiousness, intellect and openness - Costa and McCrae, 1992; Holt et al., 2003). Therefore,

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[11]Vice-versa, if subject A is more sensitive to punishments than B, A will feel harder to close a negative position and to face with a loss. In this case, we should expect that A will sell slowly than B stocks at loss.

[12]When occur, the reinforcers increase the probability that the subject will repeat similar behaviour to obtain the same output.

[13]Impulsiveness is a construct that leads the subjects to act with little or no concerns for the future consequences (VandeBos G., 2007).

in analyzing the impact of the psychological variables on the disposition effect, we require a framework that proposes a complete and clear categorization of the personality profile. The Five-factor model (Tupes and Christal, 1961) perfectly answers to our needs.

In the next paragraph, we describe the intuition behind the relation among each of the five personality trait and different levels of disposition effect.

2.3.1. *Five Factor Theory and Disposition Effect*

As a specific behaviour in which subjects promptly sell stocks at capital gain rather than at loss, the disposition effect perfectly relates with the Big Five theory. The stimuli given by each trait in altering individual behaviour justifies this link.

From the seminal work of Depue and Collins (1999), extraversion has been increasingly linked to the human reward system (Smillie, 2013) showing how extroverts enjoy more intensely rewarding situations than other individuals (Costa and McCrae, 1992). This behaviour is mainly driven by the excitement in obtaining immediate rewards (even monetary) over delayed rewards (Daly et al., 2009; DeYoung, 2014), that in the case of disposition effect can be translated into the monetization of capital gains as soon as they appears[14].After a burst of utility in experiencing a reward, extroverts usually reinforce the positive value ascribed to an object/behaviour/status increasing the likelihood to repeat previous actions to reach similar appetitive goals (DeYoung et al., 2010). With respect to a raise in a stock price from its purchase level, the greater sensitivity to the capital gains might motivate extroverts to quickly sell the stock every time a potential short-term profit shows up. We hypothesize that the dependent trading pattern that results from this strategy could strengthen the probability for these investors to record higher disposition effect.

In the realm of losses, whereas psychological theories predict null or negative low correlation between extraversion and sensitivity to punishment, a positive high relation with neuroticism has been highlighted (Torrubia and Tobeña, 1984; Ball and Zuckerman; 1990; Zuckerman,

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[14]The excitement/sensation seeking is one of the main facets of the extraversion (Eysenk, 1967; Zuckerman, 1969; Aluja et al., 2003).

1991; Zuckerman et al., 1999; Torrubia et al., 2001; Boksema et al., 2006). In particular, Larsen and Ketelaar (1989) have shown how neurotic individuals exhibit an amplified reactivity to punishment-induced affects[15] and how the sub-trait of anxiety acts as the main dimension in pushing people to respond strongly to negative signals and to avoid harm behaviour.

Again, for our purpose, a decrease in the stock price could be considered as a non-reward experience that investors face during their trading session and that, according with the statements above, can lead instable individuals to not close rapidly loss positions. Indeed, these subjects might post-pone the monetization of their capital losses, gambling on potential price' increases that could reduce their hurtful feelings.

Finally, other considerations can be made for the traits of conscientiousness and openness to experience[16]. The conscientiousness is usually a good predictor of high individual job/academic performance (Higgins et al., 2007; Almlund et al., 2011; Roberts et al., 2012) since, according to Costa and McCrae (1992) is composed of different constructs that lead people to act dutifully and efficiently. In particular, conscious subjects tend to suppress impulsivity working for goals (even monetary) that are not immediate (Holt et al., 2003; Daly et al., 2009). From the analysis of this trait, we should thus expect that a non-impulsive investor might simply not sell stocks at the first gains, patiently waiting for higher cumulative returns even if it would mean to support some losses during the trading pattern. A negative correlation with the disposition proxy is suggested.

Moreover, as conscientiousness does, the openness to experience drives to better job performance but through different processes and higher intensity (Almlund et al., 2011). Indeed, the trait underlies the main sub-dimensions of intellect, curiosity, imagination and exploration, and it is possible to recognize how openness to experience uses different cognitive channels to affect successful decision-making. Although subjects who score high on this trait

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[15]The authors show how neurotics manifest higher reactivity just to negative signals and not to positive inductions.

[16]The trait of Agreeableness seems to be not strongly involved in the explanation of differences both in decision-making and in job performances (Barrick M. et al.; 2002).

do not always outperform the less open counterparts, they tend to exhibit attitudes to activate learning orientation toward higher long-term knowledge and skill acquisition (Rolfhus and Ackerman, 1999). Whether they are very interested in what surrounds them, high open individuals also enjoy trying different approaches of doing things (Costa and McCrae, 1992). In particular, from Costa and McCrae (1992), LePine (2003) and Homan et al (2008), the trait leads subjects to be less categorical in ideas and more willing to accept novelty. They are less locked into pre-conscious mechanisms that reduce their chance to repeat dependent and harm-avoidance behaviours and that give them the possibility to act differently every time something new occurs. When they engage in decision-task with actual reward, open persons have more sensitivity not to the reward itself but to the value of information that they can use to yield positive outcomes. In a trading perspective, whereas the facet of intellect guides to a general learning predisposition and superior investment performances (Grinblatt et al., 2011), we might expect a less biased strategy in subject who score high on openness experience. Especially, following the characterization of the trait in the gain and loss domains (Lauriola and Levin, 2001), we could observe a slower closing activities for positive positions rather than negative.

From above, a need for a formal model of the influence of psychological dimensions on disposition effect gains favor. In this paper we take up this task and we advance an analysis of the role of personality traits in explaining the tendency to sell stocks at gain than those at loss.

Research Question:*"Do personality traits explain disposition effect?"*

Our research question finds preliminary support from the stream of literature that combines psychological factors and risky decision-making. Between economists and psychologist, a large debate is what biological dimensions of human personality better predict decisions

under uncertainty. During the last years, scholars identified relevant correlations between personality dimensions and risky behaviour[17]. Unfortunately the results are limited to the parametrization of risk-taking level for specific domains (health, financial, career, social, safety and recreational risk)[18]. In particular, it is also hard to understand why the entity of the correlation between personality traits and risk-preferences differs using experimental design rather than self-report questionnaire. Although these limitations do not help in showing evidence of a stable pattern among personality traits and decision-making under uncertainty, in the last years some attempts have been made to detect which personality traits relate to real financial decisions. Especially, Conlin et al. (2015) demonstrated a positive relationship between the dimension of extraversion with the stock-market participation in term of the number of securities (debt and asset) held by the investors. Moreover, in a sample of 118 investment bankers, Fenton-O'Creevey et al. (2004) found that high openness to experience and both low extraversion and neuroticism significantly correlate with better trading performance. With the main goal to better investigate the role of openness to experience in driving higher rewards in stock-market, Grinblatt et al. (2011) use a Finnish dataset to match individual trading records with a measure of intelligence (IQ) for each subject[19]. Consistent with what found by Fenton-O'Creevey et al. (2004), the authors demonstrate that intelligence predicts lower disposition effect and high returns. In the opposite direction are the results from a previous work of Grinblatt and Keloharju (2009) in which it is studied the effect of

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[17]Nicholson et al. (2005), using NEO PI-R personality survey, found that the sensation seeking is highly correlated with an overall measure of various risk domains (health, financial, career, social, safety and recreational).

[18]Especially, people who play dangerous sports might prefer safe investments (Weber et al., 2002; Nicholson et al., 2005; Soane and Chmiel, 2005) and, as suggested by Lo et al. (2005) subjects might differ in gambling decisions taken on paper questionnaire from those in real markets (Slovic, 1964; MacCrimmon and Wehrung, 1990; Schoemaker and Hershey, 1992; Kirchler and Maciejovsky 2001; Kirchler and Maciejovsky 2002; Fellner and Maciejovsky, 2002). For the purpose of our paper, in the study of gambling preferences through psychological surveys, the traits of extraversion and openness to experience have been often significantly positive correlated with higher risk-taking, while conscientiousness and agreeableness with risk aversion (Lauriola and Levin, 2001; Nicholson et al., 2005; Mishra and Lalumiere, 2010 and 2011).

[19]Intelligence has been depicted as one of the main elements of openness to experience (Ashton et al., 2000; Harris, 2004).

sensation seeking[20] in altering the individual investment choices. In particular, Grinblatt and Keloharju (2009) show how sensation seeker investors, reporting higher trading activity, exhibit negative performances.

The findings here discussed clearly suggest a generic but partial guideline in profiling traders that might support our inference about the role of personality traits in explaining the disposition effect. However, whether the previous literature focuses mostly on the influence of single personality facets over individual investment performances, the analysis of what psychological factors drive financial irrational phenomena is still missing. In particular, we believe in the study of the individual differences in subjects who face biased trading behaviour as a prominent appointment for a future research agenda. This paper takes a first step in this direction.

3.   Methodology - Experimental Protocol

For this study we recruited graduate and undergraduate students from Engineering and Economics faculties both at the University of Bologna (Italy) and at the University of Wuhan (China). Building on the findings of individualism-collectivism cultural differences[21], we decided to focus on a cross-country dataset to increase the variation of personality traits in our observations. However, taking into account Chinese and Italian students we were able to build a homogeneous sample that is coherent with the cognitive literature[22]. This point is relevant because a heterogeneous reduced amount of subjects might not promptly catch the effect of personality sub-dimensions (Lo et al., 2005). Using personality inventory surveys as well as trading simulations, we construct measures of personality traits for each subject,

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[20]A person who scores high on sensation seeking exhibits preferences for adventure sports, drugs intake, illegal activities etc... The trait has been always attributed to impulsive and extraverted subjects (Eysenck, 1990; Zuckerman, 1969).

[21]For a summary of this literature see Triandis (2001).

[22]Despite the two countries are mostly individualistic (Italy) and collectivistic (China) (http://geert-hofstede.com/italy.html), they have some similarities that lead them to be more closed than other European and Asian countries. In particular, family integrity and social virtues are two main elements that approach the two nations.

and we correlate these measures with trading records. Volunteers were gathered through announcements during lessons and courses. The students were told that a trading contest would be conducted by the Department of Management at the University of Bologna (DiSA). According to the highest realized gain, a reward system was provided[23] The experiment was completely anonymous: all booking and informational communications were done through numerical codes as a unique identifier for each subject. Participants have filled in question-naires through a web site developed specifically for this research[24]. From an initial sample of 234 students, we exclude 4 participants to whom we were not able to calculate the disposition effect. At the start of the experiment, all participants were asked to complete the following two questionnaires:

1. **Demographic Characteristics**: From the existing literature on disposition effect we took into account some socio-demographic variables (age, gender, education, stock-market knowledge and experience).

2. **International Personality Item Pool (IPIP) NEO**[25]: This is the shorter (50-item) public-domain version of the McCrae and Costa (1996) NEO IP-R five-factor person-ality inventory instrument, which can typically be completed within 5–10 minutes. The questionnaire reports 10 items for each of the big five personality dimensions: (1) Extraversion; (2) Agreeableness; (3) Conscientiousness; (4) Emotional Stability; and (5) Openness to Experience. Participants describe themselves using a 5-point scale

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[23]The first classified received a total prize of euro 165. The second was entitled of euro 100, the third of euro 50 and the fourth of euro 15. A legitimate concern is about the structure of the rewarding system that could lead subjects with low performances to change their trading behaviour in the last periods of the simulation. Especially these participants might be encouraged to take more risk as a final chance to increase the returns and to win a prize without losing anything. We test this potential bias comparing the investment behaviour between subjects with low and high performances. In particular, we analyze whether these two subsamples differ in the trading activities performed at the ending of the simulation (last three periods) with respect to the investment style followed during all the simulation session. We did not find any statistical significant difference among the participants. During the last three periods of the simulation, the entire sample exhibits a tendency to reduce the number of stocks bought, while no differences are highlighted in the quantity of stocks sold and in the type of stocks traded. Low performance subjects keep their investment strategy stable over time.

[24]www.tradingamedisa.com

[25]Responses from over 20,000 individuals have been used to calibrate this questionnaire. See Goldberg (1999), International Personality Item Pool (2001), and the IPIP website http://ipip.ori.org/ for further details.

ranging to indicate disagreement (1 = very inaccurate) or complete agreement (5 = very accurate).

At the end of questionnaires, the subjects were expected to complete a trading simulation. We use software based on Weber and Camerer (1998) experiment, in which participants have the chance to trade 2000 euro in six risky assets, labelled from A to F[26], for 14 periods. Stock prices are randomly generated and not affected by the trading actions of subjects. From Weber and Camerer (1998), according to the changes of a price-increasing/decreasing, there are 5 types of stocks: the first (–) with likelihood to experience a rising in price about 35 per cent; the second (-) of 45 per cent; the third (0) about 50 per cent; the fourth (+) 55 per cent and of 65 per cent for the fifth (++). Participants knew the chances of all six assets to rise and fall, but they did not know which share (A-F) had which probability of rising. Finally, the price could rise or fall just by 1, 3 or 5 euro. To give an idea about stock trends, the software automatically generated the first 4 periods. Figure I illustrates an example of the stock prices evolution showed in the main screen of the simulation website.

[**Insert Figure I here**]

Once the trends have been auto-generated, students have the chance to trade 14 periods with two minutes for each interval. After the two minutes the software will automatically bring the subject to the next period. A short trial session of the simulation has been provided to allow participants to become familiar with the software.

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[26]Using general labelled-stocks we can avoid the potential effect of different asset classes on the disposition effect (Chang et al., 2014).

4.   Results

4.1.   Data Description

Our data contains the trading records from various experimental sessions began on May 2014 and completed on November 2014. As from Table II, we reached a final Sample of 230 subjects.

The basis voluntary of the participation in the trading competition let us to experience unbalanced observations in terms of gender (90 were females and 140 were males) and country origin (176 Italian and 54 Chinese). In documenting our results, we clearly take into account these differences.

[Insert Table II here]

4.2.   Data Summary Statistics: Demographic and Personality Traits

Table III provides summary statistics of demographics and personality traits for our entire sample. From Panel A, among the 230 subjects, the age varies from 19 to 31, with a mean value of 22. 112 participants were undergraduates, 111 graduates while 7 subjects had just earned their master diploma. In addition, we asked students to report their stock market knowledge and their trading experience on financial markets. In particular, in indicating the level of stock-market knowledge among 3 options, 119 participants denoted that "My field of education is not related to trading in investment instruments, neither I hold/held a job position in this field", 107 that "Only my education is related to trading in investment instruments" and just 4 subjects answered "In the last ten years I held/or I hold a job position in the financial sector". Finally, for trading experience we find that 193 subjects never invested before, 17 makes one trade each year, 11 make an average of one trade each quarter, while only 9 subjects trade every month.

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Panel B reveals the personality raw data for the five broad domains of IPIP NEO five-factor model. On average participants scores 33.57 on extraversion, 38.25 on conscientiousness, 31.14 on emotion stability, 35.38 on agreeableness and 37.21 on openness. We compare these findings with what reported by Goldberg (1992). The author uses the International Personality Item Pool (IPIP) to measure the personality scores for a large sample aged 13–60 (n=19719). His study includes 206 Italian and Chinese individuals in the age range 18-35. Their results are for extraversion 28.95, conscientiousness 32.27, emotion stability 22.52, agreeableness 37 and openness 40. Compared to the Goldberg (1992), our cohort scores higher on extraversion, conscientiousness and emotion stability and lower on openness and agreeableness.

In line with previous literature on gender differences among personality traits, we report that, within our sample, female scores higher on conscientiousness than male (p<0.01). Men and women seem to differ also on emotion stability, where females score lower than males (p<0.01).

[Insert Table III here]

No significant statistically differences in the personality traits raw score are found between Chinese and Italian.

These results lead us to consider our sample as quite homogeneous, even with respect to trading experience and knowledge.

4.3. Disposition Effect

The main goal of this study is to demonstrate a relation between personality traits and disposition effect. In order to do that, we correlate the five psychological measures with the financial records obtained from the trading simulation. In particular, from the activities of the subjects we are able to compute, for each individual, the level of disposition effect as in

Odean (1998):

$$DE = PGR - PLR \tag{1}$$

$$-1 \leq DE \leq 1$$

$$PGR = \frac{RealizedGains}{RealizedGains + PaperGains} \quad PGR = \frac{RealizedGains}{RealizedGains + PaperGains}$$

According to Odean (1998) the disposition effect is given by the difference between the Proportion of Gains Realized (PGR) and the Proportion of Losses Realized (PLR). PGR (PLR) is a ratio of realized gains (losses) over the sum of paper and realized gains (losses). For paper gains or losses, the author refers to the number of securities in the portfolio not sold. Whether there will be a paper gain or loss is determined by comparing the high and low price for that day/period with the purchase price. If PGR ratio is greater than PLR the investor is selling winners too soon and/or holding losers too long. The disposition proxy is a bounded variable with a minimum of -1 and a maximum of 1. Exhibiting a disposition effect value greater than 0 the investor is closing quickly positions at capital gains instead to monetize short-term losses. Table IV contains summary statistics for the disposition effect levels of the 230 subjects. From Panel A we observe that the mean of PGR, PLR and DE are 0.36, 0.34 and 0.02 respectively. The small positive disposition effect is given by the 45 per cent of the students who show the opposite of the disposition effect. As noted by Dhar and Zhu (2006), an individual level of analysis captures all the idiosyncratic differences in PGR and PLR for each subject. We do not find a significant difference between our measure of the disposition effect and the one recorded at an aggregate level, where PGR, PLR and DE are 0.32, 0,28 and 0,04 respectively. The reduce time on which we could observe the trading behaviour of subjects, comparing both to the work of Weber and Camerer (1998) and to the years horizon of the previous empirical researches, might be a potential explanation for our smaller disposition effect. However, despite our short-term financial records observations, we believe that a specific less biased trading behaviour among the students emerges.

[Insert Table IV here]

Panel B partially confirms this assumption reporting high frequency in the trading activities performed by the participants. The mean of the capital not invested during the simulation is indeed just 576,51 euro and the average of the number of trades executed by the subjects is 26 (around 2 operations for each period). In preferring higher trading frequency, on average the students monetize capital gains when they face with a 3 per cent return and they usually close negative positions with a 2.2 per cent of loss.

Among the sample, we do not find gender, age and cross-country differences in the level of disposition effect recorded. However, whether the net effect on DE is the same, Chinese students sell more losers and winners than their colleagues in the Italian cohort (PLRChina=0.46; PGRChina=0.48; PLRItaly=0.30; PGRItaly=0.32; p<0.001). This result is in line with what found by Statman (2008) on his study of cultural differences in the approach to investing. In particular, the author conducts a survey over 22 countries with more than 4000 subjects to analyse how different religious, social and ethic belief/values affect the individual risk-preferences in a financial setting. Statman (2008) demonstrates that people from more individualistic countries (Italy, Israel, United States, UK, Germany, Norway and Switzerland) are more risk-averse than those from collectivistic regions as China, India, Vietnam, Taiwan but also France and Holland. Moreover, in the same paper the author investigates the propensity for regret among the sample. Consistent with his results on risk-preferences, Statman (2008) finds that Italians and Chinese score respectively the highest and the lowest on the propensity for regret. In explaining his insights, the author relates to the "cushion hypothesis" introduced by Hsee and Weber (1999). In their theory Hsee and Weber (1999) state that the higher risk propensity in collectivistic societies is driven by a strong group-cohesion that lead individuals to feel protected (safe cushion) in case of failure and that might motivate their higher trading activity.

4.4. Bayesian Optimal Trading Strategy

We now characterize the optimal trading strategy for a risk-neutral Bayesian investor whose objective is to maximize the expected value of his earnings. According to Weber and Camerer (1998):"*The optimal Bayesian method corresponds to a simple heuristic way to judge which of the six stocks has which trend: count the number of times a share rose in price. The share with the most price increases is the most likely to have the trend ++; the share with the second highest number of price increases is most likely to have the trend +, etc*".

Therefore, an investor who uses a Bayesian optimal strategy will count at period 4 the number of times each share rose in price and then he will select the stock (or the stocks) with the highest number. For each period after the fourth, the investor will update his count and, based on that, he will adjust his portfolio composition.

For example, if at period 4 (at the beginning of the experiment) we observe that stocks "A" and "B" rose in price 3 times, "C" and "D" only 1 time while "E" and "F" did not rise, we could assume that stock "A" and "B" are more likely to have a ++ trend. Building his investment strategy on this heuristic, the expected-value subject will invest his money only in stock "A" and "B".

At period 5 "A" has a price increase while B exhibit a decrease in price. Now stock "A" has the highest number of price increases (4 while "B" still has 3) and is more likely to have the trend ++. At period 5 the Bayesian trader will close the position in "B" and he will buy more shares of "A". The investor will repeat the same computation in each next period.

The optimal strategy involves therefore selling winners rarely and losing stocks more often, generating the opposite of the disposition effect. In particular, according to the sequence of prices in our experiment design, the difference between PGR and PLR for a Bayesian investor is -0.84. An expected-value trader will manifest high propensity to sell quickly stocks at loss than at gains.

Across our sample we find that the measure of PGR and PLR are 0.36 and 0.34 respectively.

This implies a disposition effect value of 0.02, which, even if not significantly different from 0, is positive and significantly greater than the benchmark expected value of -0.84 (p<0.001).

[**Insert Table V here**]

In particular, from Table V, we show that in contrast with the optimal trading strategy that a Bayesian investor could follow, the subjects in our experiment exhibit a tendency to buy the stock with the trend "0" and to sell the stock with the trend "-".

4.5. *Personality Traits and the Disposition Effect*

From our preliminary results and from the fact that there are no chances to take advantages from taxes, transactions costs and information asymmetry (Constantinides, 1984; Odean, 1998), the heterogeneity in the elaboration of a strategy to realize losses and gains seems to be driven by the effect of some inter-individual differences on various decision processes. To test this hypothesis, we perform a regression analysis specified as follows:

$$DE = \alpha + \beta PT + \gamma X + \delta TF + \epsilon \qquad (2)$$

where the dependent variable is the level of disposition effect (DE) as defined in the equation (1). The PT matrix is composed of individual raw scores for each of the five personality dimensions: extraversion, conscientiousness, emotion stability, agreeableness and openness to experience. The X matrix contains demographic variables for each subject as the dummies gender and country of origin and it also includes continuous variables for education, stock-market knowledge and trading experience. Finally, we take into account a variable for trading frequency (TF) "not invested capital" that reflects the budget that participants did not use during the simulation.

Table VI reports the results of a set of Tobit regressions on disposition effect. In the base model in Column (6), the coefficient of extraversion is positive and highly significant. Extroverts seem to be more likely to express a positive disposition effect than other individuals.

[Insert Table VI here]

In supporting this finding, Column (1) shows the output of a Tobit regression on disposition effect when among the personality variables just the extraversion is taken into account. Colum (1) exhibits similar results to those in Column (6). This result is in line with Mayfield et al. (2008) who use the Big Five taxonomy to understand students' preferences on short-term/long-term investment intentions. The authors exhibit a positive correlation between the trait of extraversion and the attitude to engage (avoid) short-term (long-term) investments.

Again, from Column (6) the traits of Conscientiousness and Openness to Experience are significantly negative correlated with the disposition effect, demonstrating that, the behaviours based on a long-term goal achievement, low impulsivity and learning/explorative mechanisms seem to reduce the bias. Columns (2) and (5) confirm these relations. Whereas psychology literature links the Openness to Experience to the intellectual curiosity and intelligence (Brand, 1994; Block and Kremen, 1996; Furnham, 1996; Austin et al., 1997; Farkas, 1997; Harris et al., 1999 and Harris, 2004), our results find consistency in Grinblatt et al (2011), in which a negative correlation between disposition effect and IQ measures is proved on a sample of more than eighty thousand Finnish household investors.

Surprisingly we do not find any significant role played by the trait of emotion stability, and especially of its sub-dimension anxiety, on the explanation of different levels of disposition effect.

Table VI shows also a negative relation between the coefficient for "not invested capital" and

the bias here analysed, confirming the findings in Dhar and Zhu (2006) where the *"trading frequency helps investors become more willing to sell losers, in turn reducing their DE"*. Demographic characteristics, such as gender, country of origin, education, stock-market knowledge and trading experience, have no effect on disposition effect. Interaction variables between personality traits and dummy country do not reveal any significant effect on DE. In testing the robustness of our insights, we also run the regression in the equation (2) for the Italian and Chinese sub-samples separately. Even if there is a change in the statistical predicting significance among the independent variables (mainly due by the fact that the sample is substantially reduced), in both the cohorts almost all the five personality traits maintain the same direction in explaining the heterogeneity in disposition effect.

Finally our results hold both when we use alternative measures of disposition effect, as the one used in Dhar and Zhu (2006)[29], and when we employ different regression models as Probit and OLS.

4.6.   *Personality Traits and the Proportion of Gains and Losses realized*

In order to better analyzed the role of personality traits in altering the individual investment behaviour, in this paragraph we propose to disentangle the disposition effect focusing on the attitude to ride loser and winners separately. Especially we are interested in observing whether the role of personality traits differs in explaining the financial decision-making in the domain of gain and loss. To do this, from the Odean's formula (1), we use the Proportion of Gains realized (PGR) and the Proportion of Losses realized (PLR) as our new dependent variables. To take into account how personality traits influence investment portfolio choices for positive and negative stock-trends, in Table VII we run the same regression specified in the equation (2) using PGR and PLR as dependent variables. Since, the PGR and PLR are computed as ratios, a Tobit model is employed.

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[29]The authors define the DE as (RG/RL) - (PG/PL), where RG and RL are the number of sales of winners and losers, respectively and PG and PL are the number of paper gains and losses. This measure avoids the potential scaling bias in the computation defined by Odean (1998).

As correctly stated when we formulated our hypotheses on the influence of each personality traits on disposition effect, we find a precise pattern among the traits of extraversion, conscientiousness and openness in altering the individual investment behaviour. Especially, whether we find that extraversion and conscientiousness have a role only in increasing and decreasing the number of capital gains realized during the simulation, we observe that subjects who score high on openness to experience keep winners in their portfolio longer than losers.

[**Insert Table VII here**]

These results are consistent with the idea of: 1) a greater sensitivity of the rewarding system that motivate extroverts to quickly sell the stock at gain in order to receive a burst of utility; 2) a tendency for conscious subjects to suppress impulsivity not selling the security as soon as it experiences an increase in the price while patiently waiting for higher cumulative returns; 3) an ability for people who score high on openness to experience to work efficiently ascribing more value to the new information that they can use to obtain better outcomes. Consistently with what already discussed in the descriptive statistics, Chinese close more positive and negative positions than Italians. As posit before, this result is in line with the theory of cultural differences (individualism and collectivism) in affecting individual risk-preferences.

Finally, the amount of cash not invested in assets positively relates with the PGR and PLR. In particular, in selling a stock with a positive return the participant increase significantly the budget available to operate in the market, while when a subject closes negative positions the increase in the capital not invested is less strong.

Other individual demographic characteristics, such as gender, education, stock-market knowledge and trading experience seem to not affect the tendency to ride losers and winners (we find a small effect of gender only for the loss domain, $p<0.1$).

As for Table VII, interaction variables between personality traits and dummy country do not reveal any significant effect both on PLR and PGR. The results hold also employing OLS and Probit models.

5.   Conclusions

This paper studies the role of personality traits in the explanation of disposition effect through an experimental analysis carried out on a cohort of university students. Despite the existing literature demonstrates a wide tendency of investors to sell quickly stock at gains rather than at losses, our results document that almost half of the sample exhibits a non-positive disposition effect. We investigate the drivers of this high heterogeneity in an individual psychological perspective.

At odds to the folk usual picture of successful investors who trade aggressively and impulsively, we find that personality traits, like extraversion and conscientiousness, are respectively positive and negative related with the biased financial behaviour. In particular, we prove that outgoing and energetic (extraversion) subjects have more chances than other individuals to ride losers instead of winners. Subject who scores high in conscientiousness are less likely to be affected by disposition effect instead. In line with Fenton-O'Creevey et al. (2004) and Grinblatt et al. (2011) we find that a more rational trader tends to be open to new experiences and less locked into pre-mechanism processes that lead him to repeat the same action over time.

These findings seem to suggest a specific "personality profile" less affected by disposition effect that is coherent with the previous experimental studies on emotional responses and successful trading (Lo et al., 2005)[30]. On the trait of extraversion, our results are also consistent with the evidence that extroverts, in responding strongly to immediate rather than

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[30]The authors found a positive correlation between financial performance and emotion stability in a sample of day-traders.

postponed rewards, have more sensitivity to rewarding system than other individuals[31].

The fact that personality traits can explain part of the disposition effect variation among a population suggests an implementation of the models that describe anomalies in asset pricing as naïve diversification and excessive trading. Providing a clear picture of each investor as human being might also motivate brokerage firms to make subjects aware of such bias and help them to obtain better performances.

However, a number of open research questions remain to be addressed. The specific interaction between personality traits and disposition effect deserves further investigations, particularly the role of the traits domains in influencing the main psychological basis of the phenomenon (realization utility theory). The lack of studies that attempt to investigate financial irregularities through a combined personality and social psychology framework, begs for additional data.

Finally, a detailed neuro-imaging analysis on a profiled sample during risky decisions trials may provide stronger support to our results.

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[31]See DeYoung (2013 and 2014).

References

1. Allport F. and Allport G. (1921) "Personality traits: their classification and measurement", Journal of Abnormal and Social Psychology, vol. 16;

2. Almlund M., Duckworth A., Heckman J. and Kautz T. (2001) "Personality psychology and economics", Handbook of the Economics of Education;

3. Aluja, A., Garcıa, O. and Garcıa L. (2003) "Relationship among extraversion, openness to experience, and sensation seeking", Personality and Individual Differences, vol. 35;

4. Austin E., Deary I. and Gibson J. (1997) "Relationship between ability and personality: Three hypotheses tested", Intelligence, vol. 25;

5. Ball S. and Zuckerman M. (1990) "Sensation seeking, Eysenck's personality dimensions and reinforcement sensitivity in concept formation", Personality and Individual Differences, vol. 11;

6. Barber B. M. and Odean T. (2000) "Trading is Hazardous to your Wealth: The Common Stock Investment Performance of Individual investors", Journal of Finance, n. 22;

7. Barber B. M. and Odean T. (2001) "Boys Will Be Boys: Gender, Overconfidence, and Common Stock Investment", Quarterly Journal of Economics, vol. 116, n. 1;

8. Barberis N. and Shleifer A. (2003) "Style investing", Journal of Financial Economics, n. 68;

9. Barberis N. and Thaler R. (2003) "A survey of behavioural finance", Handbook of the Economics of Finance, vol. 1, Part B;

10. Barberis N., Shleifer A and Thaler R. (1978) "A model of investor sentiment", Journal of Financial Economics; vol. 49, n. 3;

11. Barberis N. and Xiong W. (2009) "What Drives the Disposition Effect? An Analysis of a Long-Standing Preference-Based Explanation", The Journal of Finance, vol. 64, n. 2;

12. Barberis N. and Xiong W. (2012) "Realization utility", The Journal of Financial Eco-

nomics, vol. 104;

13. Bargh A., Chaiken S., Raymond P. and Hymes C. (1996) "The Automatic Evaluation Effect: Unconditional Automatic Attitude Activation with a Pronunciation Task", Journal of Experimental Social Psychology, vol. 32, n. 1;

14. Bargh A. and Chartrand T. (1999) "The Unbearable Automaticity of Being", American Psychologist, vol. 54, n. 7;

15. Barrick M., Mount M. and Li N. (2002) "The Theory of Purposeful Work Behaviour: The Role of Personality, Job Characteristics, and Experienced Meaningfulness", Academy of Management Journal, vol. 38;

16. Baxter M. and Jermann U. (1977) "The international diversification puzzle is worse than you think", The American Economic Review, vol. 87, n. 1;

17. Block J. and Kremen A. (1996) "IQ and ego-resiliency: conceptual and empirical connections and separateness", Journal of personality and social psychology, vol. 70, n. 2;

18. Bokesem M., Tops M. and Wester A. (2006) "Error-related ERP components and individual differences in punishment and reward sensitivity", Brain Research, vol.92;

19. Borgatta E. (1964) "The structure of personality characteristics", Behavioural Science, vol. 9;

20. Brand C. (1994) "Open to experience—closed to intelligence: Why the Big Five are really the Comprehensive Six", European Journal of Personality, vol. 8, n. 4;

21. Camerer C. and Hogarth R. (1999) "The Effects of Financial Incentives in Experiments: A Review and Capital-Labor-Production Framework", Journal of Risk and Uncertainty, vol. 19;

22. Carver C. and White T. (1994) "Behavioural inhibition, behavioural activation and affective responses to impeding rewards and punishments: the BIS/BAS scales", Journal of Personality and Social Psychology, vol. 67;

23. Chang T., Solomon D. and Westerfield M. (2014) "Looking for someone to blame:

delegation, cognitive dissonance, and the disposition effect", forthcoming on Journal of Finance;

24. Chen G., Kim K., Nofsinger J. R. and Rui O. M. (2007) "Trading Performance, Disposition Effect, Overconfidence, Representativeness Bias, and Experience of Emerging Market Investors", Journal of Behavioural Decision Making, n. 20;

25. Conlin A., Kyrolainen P., Kaakinen M., Järvelin M., Perttunen J. and Svento R. (2015) "Personality traits and stock-market participation", Journal of Empirical Finance, vol. 33;

26. Constantinides G. (1984) "Optimal stock trading with personal taxes: implications for prices and abnormal January returns", Journal of Financial Economics, vol. 13;

27. Costa P. and McCrae R. (1992) "NEO PI-R professional manual", Odessa, FL: Psychological Assessment Resources, Inc.;

28. Coursey D., Hovis J. and Schulze W. (1987) "The disparity between willingness to accept and willingness to pay measures of value", The Quarterly Journal of Economics, vol. 102, n. 3;

29. Da Costa Jr. N., Goulart M., Cupertino C., Maced Jr. J. and Da Silva S. (2013) "The disposition effect and investor experience", Journal of Banking and Finance, n. 37;

30. Dahlbäck O. (1990) "The social value of risk-taking", European Journal of Social Psychology, vol. 20, n. 6;

31. Daly M., Harmon C. and Delaney L. (2009) "Psychological and biological foundations of time preference", Journal of the European Economic Association, vol. 7;

32. Daniel K., Grinblatt M., Titman S. and Wermers R. (1997) "Measuring mutual fund performance with characteristic-based benchmarks", The Journal of Finance, vol. 52, n. 3;

33. Depue R. and Collins P. (1999) "Neurobiology of the structure of personality: dopamine, facilitation of incentive motivation, and extraversion", Behavioural and Brain Sciences, vol. 22, n. 3;

34. DeYoung C. (2014) "Cybernetic Big Five Theory", Journal of Research in Personality, forthcoming;

35. DeYoung C., Hirsh J., Shane M., Papademetris X., Rajeevan N. and Gray J. (2010) "Testing Predictions from Personality Neuroscience: Brain Structure and the Big Five", Psychological Science, vol. 21, n. 6;

36. DeYoung C., Peterson J. and Higgins D. (2005) "Sources of Openness/Intellect: Cognitive and Neuropsychological Correlates of the Fifth Factor of Personality", Journal of Personality, vol. 73, n. 4;

37. DeYoung C., Quilty L. and Peterson J. (2007) "Between facets and domains: 10 aspects of the Big Five", Journal of Research in Personality, forthcoming;

38. Dhar R. and Zhu N. (2006) "Up close and personal: investor sophistication and the disposition effect", Management Science, vol. 52, n. 5;

39. Eysenck H.J. (1967) "Biological dimensions of personality", Handbook of personality: theory and Research, New York: Guilford;

40. Fellner G. and Maciejovsky B. (2002) "Risk Attitude and Market Behaviour: Evidence from Experimental Asset Markets", Strategic Interaction, vol. 34;

41. Farkas D (1997) "Investigating the relationship between intelligence and the personality domain openness to experience", Senior Honours thesis, The University of Western Ontario, London, Canada;

42. Feingold A. (1994) "Gender differences in personality", Psychological Bulletin, vol. 116;

43. Fenton-O'Creevey M., Nicholson N., Soane E. and Willman P. (2004) "Traders: Risks, decisions, and management in financial markets", UK: Oxford University Press.

44. Fischhoff B. and Slovic P. (1980). "A little learning...: Confidence in multicue judgment tasks" In R. Nickerson (Ed.), Attention and performance VIII, Hillsdale N.J;

45. Fleeson W. (2001) "Toward a structure-and process-integrated view of personality: traits as density distributions of states", Journal of Personality and Social Psychology,

vol. 80, n. 6;

46. Frazzini A. (2006) "The disposition effect and underreaction to news", Journal of Finance, vol. 111, n. 4;

47. French K. and Poterba J. (1991) "Investor diversification and international equity markets", American Economic Review, vol. 81, n. 2;

48. Furnham A. (1996) "The big five versus the big four: the relationship between the Myers-Briggs Type Indicator (MBTI) and NEO-PI five factor model of personality", Personality and Individual Differences, vol. 21, n. 2;

49. Gervais S. and Odean T. (2001) "Learning to be overconfident", The Review of Financial Studies, vol. 14, n. 1;

50. Gilaie-Dotan S., Agnieszka T., Cooper N., Kable J., Glimcher P. and Levy I. (2014) "Neuroanatomy Predicts Individual Risk Attitudes", The Journal of Neuroscience, vol. 34;

51. Goetzmann W. N. and Massa M. (2008) "Disposition Matters: Volume, Volatility, and Price Impact of a Behavioural Bias", Journal of Portfolio Management, vol. 34, n. 2;

52. Goldberg L. (1981) "Language and individual differences: the search for universals in personality lexicons", Review of Personality and Social Psychology, vol. 2;

53. Goldberg L. (1992) "The development of markers for the Big-Five factor structure", Psychological Assessment, 26;

54. Goldberg L. (1999) "A Broad-Bandwidth, Public-Domain, Personality Inventory Measuring the Lower-Level Facets of Several Five-Factor Models", Personality Psychology in Europe, vol. 7;

55. Grinblatt M. and Han B. (2005) "Prospect theory, mental accounting and momentum", Journal of Financial Economics, vol. 78;

56. Grinblatt M. and Keloharju M. (2000) "The Investment Behaviour and Performance of Various Investor Types: A Study of Finland Unique Data Set", Journal of Financial Economics, vol. 55;

57. Grinblatt M. and Keloharju M. (2001) "How Distance, Language and Culture Influence Stockholdings and Trade", The Journal of Finance, vol. 56;

58. Grinblatt M., Keloharju M. and Linnainmaa J. (2011) "IQ, Trading Behaviour, and Performance", Journal of Financial Economics, vol. 102;

59. Harris J. (2004) "Measured intelligence, achievement, openness to experience, and creativity", Personality and Individual Differences, vol. 36, n. 4;

60. Harris J., Vernon P., Jang K. (1999) "Intelligence and personality characteristics associated with accuracy in rating a co-twin's personality", Personality and Individual Differences, vol. 26;

61. Hartzmar S. (2014) "The worst, the best, ignoring all the rest: the rank effect and trading behaviour", Review of Financial studies, forthcoming;

62. Higgins D, Peterson B., Lee A., Pihl O. (2007) "Prefrontal cognitive ability, intelligence, Big Five personality, and the prediction of advanced academic and workplace performance", Journal of Personality and Social Psychology, vol. 93, n. 2;

63. Holt R. and Barfield M. and Gonzalez A. (2003) "Impacts of environment variability in open populations and communities: "inflation" in sink environments", Theoretical Population Biology, n. 64;

64. Homman A, Hollembeck J., Humphrey S., Van Knippenberg D., Ilgen D. and Van Kleef G. (2008) "Facing differences with an open mind: openness to experience, salience of intragroup differences, and performance of diverse work groups", Academy of Management Journal, vol. 51, n. 6;

65. Hsee C. K. and Weber U.E. (1999) "Cross-National Differences in Risk Preferences and Lay Predictions", Journal of Behavioural Decision Making, vol. 12, n. 2;

66. Huberman G. (2001) "Familiarity breeds investment ", Review of Financial Studies, vol. 14, n. 3;

67. John O. and Srivastava S. (1999) "The Big-Five trait taxonomy: History, measurement, and theoretical perspectives" in L. A. Pervin and O. P. John (Eds.), Handbook of

personality: Theory and research, vol. 2, New York: Guilford Press;

68. Kahneman D. and Tversky A. (1979) "Prospect Theory: An Analysis of Decision under Risk", Econometrica, vol. 47, n. 2;

69. Kassin S. (2003) "Psychology", Prentice-Hall fourth edition;

70. Kaustia M. (2004) "Market-wide impact of the disposition effect: evidence from IPO trading volume", Journal of Financial Markets, vol. 7;

71. Kirchler E. and Maciejovsky B. (2001) "Tax compliance within the context of gain and loss situations, expected and current asset position, and profession", Journal of Economic Psychology, vol. 22, n. 2;

72. Kirchler E. and Maciejovsky B. (2002) "Simultaneous Over-and Underconfidence: Evidence from Experimental Aseet Markets", Journal of Risk and Uncertainty, vol. 25, n. 1;

73. Knetsch J. and Sniden J. (1984) "Willingness to pay and compensation demanded: experimental evidence of an unexpected disparity in measures of value", Quarterly Journal of Economics, vol. 55;

74. Knez P., Smith V and Williams W. (1985) "Individual rationality, market rationality, and value estimation", American Economic Review, vol. 75, n. 2;

75. Kuhnen C. and Knutson B. (2005) "The neural basis of financial risk taking", Neuron, n. 47;

76. Larsen R. and Ketelaar T. (1989) "Extraversion, neuroticism and susceptibility to positive and negative mood induction procedures", Personality and Individual Differences, vol. 10;

77. Lauriola M and Levin I. (2001) "Personality traits and risky decision-making in a controlled experimental task: an explanatory study", Personality and Individual Differences, vol. 31;

78. LePine J. (2003) "Team adaptation and postchange performance: effects of team composition in terms of members' cognitive ability and personality", Journal of Applied

Psychology, vol. 88, n. 1;

79. Levy I., Snell J., Nelson A., Rustichini A. and Glimcher P. (2010) "Neural representation of subjective value under risk and ambiguity". Journal of Neurophysiology, vol. 103, n. 2;

80. Lewis K. (1999) "Trying to explain home bias in equities and consumption", Journal of Economic Literature, vol. 37, n. 2;

81. Lo A., Repin D. and Steenbarger B. (2005) "Fear and greed in financial markets: a clinical study of day-traders", American Economic Association, vol. 95;

82. MacCrimmon K. and Wehrung D. (1990) "Characteristics of risk taking executives", Management Science, vol. 36, n. 4;

83. Martin L and Potts G (2004) "Reward sensitivity in impulsivity", Neuroreport, vol. 15, n. 9;

84. Mayfield C., Perdue G. and Wooten K. (2008) "Investment management and personality type", Journal of Financial Services Review, vol. 17;

85. McCrae R. and Costa P. (1987) "Validation of the five-factor model of personality across instruments and observers", Journal of Personality and Social Psychology, n. 52;

86. McCrae R. and Costa P. (1996) "Toward a new generation of personality theories: Theoretical contexts for the five-factor model", In J. S. Wiggins (Ed.), The five-factor model of personality: Theoretical perspectives (pp. 51-87). New York: Guilford;

87. Mishra S. and Lalumière M. L. (2010) "You can't always get what you want: The motivational effect of need on risk-sensitive decision-making", Journal of Experimental Social Psychology, vol. 46;

88. Mishra S. and Lalumière M.L. (2011) "Individual differences in risk-propensity: Associations between personality and behavioural measures of risk", Personality and individual differences, n. 50;

89. Nicholson N., Soane E., Fenton-O'Creevy and Willman P. (2005) "Personality and

domain-specific risk taking", Journal of Risk Research, vol. 8, n. 2;

90. Norman W. (1963) "Toward an adequate taxonomy of personality attributes: Replicated factor structure in peer nomination personality ratings", Journal of Abnormal and Social Psychology, vol. 66;

91. Odean T. (1998) "Are Investors Reluctant to Realize Their Losses?", Journal of Finance, vol. 53, n. 5;

92. Odean T. (1999) "Do Investors trade too much?", The American Economic Review, vol. 89, n. 5;

93. Ozer D. and Benet-Martinez V. (2006) "Personality and prediction of consequential outcomes", American Review of Psychology, vol. 57;

94. Pytlik Zillig L. M., Hemenover S. H. and Dienstbier R. A. (2002) "What do we assess when we assess a Big 5 trait? A content analysis of the affective, behavioural, and cognitive processes represented in Big 5 personality inventories", Personality and Social Psychology Bulletin, vol. 28;

95. Roberts B., Lejuez C., Krueger R., Richards J., Hill P. "What is conscientiousness and how can it be assessed?", Developmental Psychology, vol. 50, n. 5;

96. Rolfhus E. and Ackerman P. (1999) "Assessing individual differences in knowledge: Knowledge structure and traits", Journal of Education Psychology, vol. 91;

97. Schneider W. and Shiffrin R. (1977) "Controlled and Automatic Human Information Processing: I. Detection, Search and Attention", Psychological Review, vol. 84, n.1;

98. Schoemaker P. and Hershey J. (1992) "Utility measurement: signal, noise, and bias." Organizational behaviour and human decision processes, vol. 52;

99. Shapira Z. and Venezia I. (2001) "Patterns of behaviour of professionally managed and inde- pendent investors", Journal of Banking and Finance, vol. 25, n. 8;

100. Shefrin H. and Statman M. (1985) "The disposition to sell winners too early and ride losers too long: theory and evidence", The Journal of Finance, vol.40, n. 3;

101. Slovic P. (1964) "Assessment of risky behaviour", Psychological bulletin, vol. 61, n.3;

102. Smillie L. (2013) "Why does it feel good to act like an extravert?", Social and Personality Psychology Compass, vol. 7, n.12;

103. Soane E. and Chmiel N. (2005) "Are Risk Preferences Consistent? The Influence of Decision, Domain and Personality", Personality and Individual differences, vol. 38, n.8;

104. Statman M. (2008) "Countries and culture in behavioural finance", Institute Conference Proceedings Quarterly;

105. Torrubia R., Avila C., Molto J. and Caseras X. (2001) "The Sensitivity to Punishment and Sensitivity to Reward Questionnaire as a measure of Grayos anxiety and impulsivity dimensions", Personality and Individual Differences, vol. 31;

106. Torrubia R. and Tobena A. (1984) "A scale for the assessment of susceptibility to punishment as a measure of anxiety: preliminary results", Personality and Individual Differences, vol. 5;

107. Triandis H.C. (2001) "Individualism-Collectivism and Personality", Journal of Personality, vol. 69;

108. Tupes E. and Christal R. (1961) "Recurrent personality factors based on trait ratings", Technical Report, USAF, Lackland Air Force Base, TX;

109. Tversky A. and Kahneman D. (1981) "The framing of decisions and the psychology of choice", Science, vol. 211, n. 4481;

110. Tversky A. and Kahneman D. (1992) "Advances in prospect theory: cumulative representation of uncertainty", Journal of Risk and Uncertainty, n. 5;

111. VandenBos G. (2007) "APA Dictionary of psychology", American psychological association;

112. Weber E., Blais A. and Betz N. (2002). "A domain-specific risk-attitude scale: Measuring risk perceptions and risk behaviours", Journal of Behavioural Decision Making, vol. 15, n. 4;

113. Weber M. and Camerer C. (1998) "The disposition effect in securities trading: an

experimental analysis", Journal of Economic Behaviour and Organization, vol. 33;

114. Weber M. and Welfens F. (2007) "An Individual Level Analysis of the Disposition Effect: Empirical and Experimental Evidence", Working paper, University of Mannheim;

115. Zuckerman M. (1969) "Theorical formulations", Appleton-Century-Crofts.

116. Zuckerman M. (1983) "Biological Bases of Sensation Seeking, Impulsivity and Anxiety", Hillsdale, NJ: Erlbaum;

117. Zuckerman M. (1991) "Psychobiology of personality", New York: Cambridge University Press;

118. Zuckerman M., Joireman J., Kraft M. and Kuhlman D. (1999) "Where do motivational and mood traits fit within three factor models of personality", Personality and Individual Differences, n. 26;

119. Zuckerman M. and Kuhlman D. (2000) "Personality and risk-taking: common biosocial factors", Journal of Personality. Special Issue: Personality Perspectives on Problem Behaviour, vol. 68, n.6.

Figure I below illustrates the time series chart of stock prices. As from the chart below, the trading software automatically generates the first 4 periods to give an idea about the stocks trend.

Figure I Chart Price x Period

Table I Big Five Personality Traits

This table presents all the facets within each of the five personality traits of the Five Factor Model. The adjectives are recreated from McCrae and Costa (1996) and from John and Srivastava (1999)

Five Personality Traits	Constituent Traits (adjectives)
Extraversion	Outgoing, energetic, sociable, friendly, talkative, assertive, enthusiastic, gregarious.
Conscientiousness	Efficient, organized, prepared, dependable, self-disciplined, not careless, respectful of duties.
Neuroticism	Anxious, irritable, shy, moody, not self confident, depressed, tense, stressed out.
Agreeableness	Modest, not demanding, warm, altruistic, generous, not stubborn, likeable, enjoyable.
Openness to Experience	Inventive, curious, unconventional, excitable.

Table II Sample Description

This table reports the number of observations controlled for gender and country.

	Obs	Italian	Chinese
Sample	230	176	54
Male	140	121	19
Female	90	55	35

Table III Summary Statistics - Socio-demographic and Personality

Table III describes demographics (Panel A) and personality traits (Panel B) variables for the entire sample. Age is the age of the participant. Education is a categorical variable taking the following values if the participant: 1 is undergraduate; 2 is graduate; 3 hold a PhD. Stock market knowledge is a variable taking values of 1 whether participant has not knowledge on financial markets, 2 if he has a background education in finance or related areas and 3 if he works/worked for stock-market services. Finally, trading experience takes the following values of: 1 if the participant has never invested; 2 if he invested just one time; 3 whether she/he invested for maximum one year; 4 for maximum three years; 5 if he invested for more than three years.

	Obs	Mean	Median	Std. Deviation	Minimum	Maximum
Panel A						
Age	229	22,48	22	1,95	19	31
Education	230	1,54	2	0,55	1	3
Stock-Market Knowledge	230	1,5	1	0,54	1	3
Trading Experience	230	1,32	1	0,84	1	5
Panel B						
Extraversion	230	33,57	34,2	5,5	18	47,5
Conscientiousness	230	38,25	38,7	5,43	20	50
Emotion Stability	230	31,14	30,8	7,22	13	48,3
Agreeableness	230	35,38	35,8	5,37	17,5	48,2
Openness	230	37,21	37,5	5,41	24	49,2

Table VI Summary Statistics - Trading Records 1/2

The first panel (Panel A) reports the main variables of disposition effect. Number of stocks sold at gain (Realized Gains) at loss (Realized Losses), number of stocks hold at gain/loss but not sold (Paper Gains/Losses) and the ratio of the number of stocks sold over those sold and not sold for both gain and losses (PGR = Proportion of gains realized = Realized Gains/ Realized Gains + Paper Gains; PLR = Proportion of losses realized = Realized Gains/ Realized Losses + Paper Losses). Finally, from the difference between PGR and PLR a measure of disposition effect is shown (DE = PGR-PLR). In the second panel (Panel B) some financial records of the trading simulation are reported. Number of operations is the total number of stocks traded by the participant during the simulation, while number of operations – buy(sell) refer to the number of stocks bought (sold) by the participant during the simulation. Return from winner selling describes the return that participant obtain when he sells stocks at gain, in contrast Loss from loser selling is the loss the subject experiences when he sells stocks at price lower than the purchase price. Capital Not Invested reflects the available budget that the participant does not use during the simulation.

	Obs	Mean	Median	Std. Deviation	Minimum	Maximum
			Panel A			
Paper Gains	230	50,37	37,5	42,97	0	194
Paper Losses	230	39,54	31	35,01	0	181
Realized Gains	230	23,33	17	24,16	0	162
Realized Losses	230	15,41	12	13,43	0	70
PGR	230	0,36	0,27	0,27	0	1
PLR	230	0,34	0,28	0,27	0	1
DE	230	0,02	0	0,36	-0,89	1
			Panel B			
Number of operations buy	230	15,94	15	8,39	3	54
Number of operations sell	230	10,32	9	6,65	1	43
Number of operations	230	26,26	24	14,48	5	97
Return from winner selling	230	0,03	0,02	0,02	0	0,18
Loss from loser selling	230	-0,02	-0,02	0,02	-0,16	0
Capital Not-Inv.	230	576,51	505,42	464,87	0	3711,71

Table V Summary statistics - Trading Records 2/2

This table presents the type of stocks bought and sold. There are 5 types of stocks: 1 (−) with a likelihood to experience a rising in price about 35 per cent; 2 (-) of 45 per cent; 3 (0) about 50 per cent; 4 (+) 55 per cent and of 65 per cent for 5 (++). During the simulation subjects trade with 6 stocks with two stocks of the same type (-).

	Obs	Mean	Median	Std. Deviation	Minimum	Maximum
Type of stock - sell	198	3,62	3	1,65	1	6
Type of stock - buy	206	3,83	4	1,63	1	6

Table VI Regression Table: Disposition Effect

This table contains a set of Tobit regressions in explaining the tendency to ride losers instead of gains for the entire sample. The dependent variable is the disposition effect as measured by Odean (1998), DE = PGR – PLR. The independent variables include the personality traits (extraversion, conscientiousness, emotion stability, agreeableness and openness), demographics data (gender, country origin, education, stock-market knowledge and trading experience) and a variable for the trading frequency (capital not-invested). The dummy gender takes value of 0 if female, 1 if male. The dummy country takes value of 0 if the participant is Chinese and 1 if Italian.)

	1	2	3	4	5	6
	Disposition Effect	Disposition Effect	Disposition Effect	Disposition Effect	Disposition Effect	Disposition Effect
Constant	-0.079	-0.090	-0.070	-0.067	-0.084	-0.122
	(-0.67)	(-0.76)	(-0.58)	(-0.56)	(-0.71)	(-1.06)
Extraversion	0.059**					0.082***
	(2.50)					(3.50)
Conscientiousness		-0.069***				-0.067**
		(-2.73)				(-2.43)
Emotion Stability			0.004			0.016
			(0.16)			(0.66)
Agreeableness				-0.012		0.023
				(-0.50)		(0.89)
Openness					-0.081***	-0.083***
					(-2.85)	(-2.83)
Gender	0.005	0.003	0.009	0.011	0.016	-0.008
	(0.09)	(0.06)	(0.17)	(0.21)	(0.31)	(-0.17)
Dummy Country	-0.047	-0.003	-0.021	-0.022	0.020	0.004
	(-0.77)	(-0.05)	(-0.34)	(-0.37)	(0.33)	(0.07)
Education	0.032	0.051	0.029	0.032	0.027	0.043
	(0.72)	(1.14)	(0.63)	(0.70)	(0.62)	(1.00)
Knowledge	0.032	0.019	0.024	0.021	0.020	0.037
	(0.71)	(0.41)	(0.52)	(0.44)	(0.45)	(0.83)
Trad. Experience	-0.029	-0.020	-0.024	-0.024	-0.007	-0.008
	(-1.00)	(-0.70)	(-0.84)	(-0.83)	(-0.24)	(-0.30)
Capital Not-Inv.	0.165	0.230**	0.186*	0.192*	0.183*	0.194*
	(1.57)	(2.18)	(1.75)	(1.79)	(1.75)	(1.87)
N	230	230	230	230	230	230
R^2	0.06	0.06	0.02	0.03	0.07	0.15

t-statistics in parentheses;
* p<0.1, ** p <0.05, *** p<0.01.

Table VII Regression Table: PGR and PLR

Two Tobit regressions in explaining the tendency to ride losers and gains are presented for the entire sample. The dependent variables are the proportion of gains (Model 1) and losses (Model 2) realized as measured by Odean (1998), PGR = RG/(PG+RG) and PLR = RL/(PL+RL). For both the Models the independent variables include the personality traits (extraversion, conscientiousness, emotion stability, agreeableness and openness), demographics data (gender, country origin, education, stock-market knowledge and trading experience) and a variable for the trading frequency (capital not-invested). The dummy gender takes value of 0 if female, 1 if male. The dummy country takes value of 0 if the participant is Chinese and 1 if Italian.)

	1	2
	PGR	PLR
Constant	0.383***	0.503***
	(4.66)	(5.86)
Extraversion	0.078***	-0.008
	(4.68)	(-0.47)
Conscientiousness	-0.043**	0.023
	(-2.04)	(1.02)
Emotion Stability	0.018	0.002
	(1.05)	(0.11)
Agreeableness	-0.001	-0.015
	(-0.09)	(-0.83)
Openness	-0.036*	0.041**
	(-1.88)	(2.03)
Gender	0.053	0.069*
	(1.43)	(1.78)
Dummy Country	-0.194***	-0.184***
	(-4.60)	(-4.18)
Education	-0.009	-0,049
	(-0.28)	(-1.53)
Stock Market Know.	0.035	-0,006
	(1.1)	(-0.18)
Trading Experience	-0,013	-0,007
	(-0.63)	(-0.35)
Capital Not-Inv.	0.276***	0.086
	(3.72)	(1.12)
N	230	230
R^2	0.91	0.53

t-statistics in parentheses;
* $p<0.1$, ** $p<0.05$, *** $p<0.01$.

Psychological Profile and Investment Style

Marco Cecchini and Emanuele Bajo[*]

Abstract

We conduct a study to test whether psychological factors influence the trading behaviour in a sample of 176 Italian students. Through a trading simulation we combine financial data with the scores from a booklet of questionnaires in which demographics, psychological traits and risk-attitude are monitored. As a main result, we find that emotionally stable investors are more likely to exhibit higher trading volume, while high-conscientiousness seems to weaker it. Demographics and risk-attitude measures moderate the individual investment choices.

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[*]Marco Cecchini is a PhD Student at the University of Bologna, Department of Management. Emanuele Bajo is a Full Professor at the University of Bologna, Department of Management. Corresponding author: marco.cecchini10@unibo.it.

1.   Introduction

Over the last two decades, understanding how people behave in financial markets has been one of the main questions that economists have faced with. While scholars provided a large amount of evidence on different trading strategies carried out by the investors, it is no clear what are the inter-individual factors that drive some subjects to act differently from others. The difficulty in finding an adequate dataset to assess the role of investor characteristics during financial decision-making, prevented researchers from this endeavour. Dhar and Zhu (2006) and Grinblatt et al. (2011) are probably the central works in the analysis of the relation between investor personal marks and trading heuristics. Whether the first found that the level of investor literacy affects the attitude to ride losers instead of winners, Grinblatt et al. (2011) empirically demonstrated how a measure of intelligence (IQ) is a significant driver for heterogeneity in investment behaviour. Both the models imply that the systematic differences in financial phenomena can be described through a cross-sectional study in which individual and cognitive information are matched with trading records.

From this assumption and inspired by the literature on the effect of psychological variables on risky decisions (Lauriola and Levin, 2001; Nicholson et al., 2005; Mishra and Lalumiere, 2010 and 2011), we constructed a unique dataset to test whether psychological traits account for differences in the investment style among subjects.

Despite a long stream of research that links individual preferences to specific cognitive traits, no paper clearly address the question of what is the role of personality profiles within the theories of investment behaviours. We argue that personality data can be useful to enhance our understanding about several facts about in financial trading that have not received considerable attention. Specifically, in this paper we describe the insights of an experimental study designed to better explore the variance around individual investment patterns, in terms of the amount of cash not invested in assets and of the number of shares exchanged during

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the trading simulation (trading volume). If our results demonstrate a correlation between cognitive characteristics and investment heuristics, an evident implication on the analysis of markets irregularity is found, especially during bubbles and crashes.

Using a behavioural experiment, our paper differs from the previous works in that allows us to focus and control at the level of each individual. The sample is composed by 176 Italian students from Economics and Engineering Faculties at University of Bologna (Italy) who were asked to participate in a trading competition based on Weber and Camerer (1998) and to fulfil a booklet of questionnaires in which demographic and psychological variables are assessed.

The paper begins with the study of personality traits' effect on the size of capital not invested as a first proxy of market activity or trading volume[1]. Among the sample, we find strong heterogeneity in the volume of the budget used during the simulation. This result is distant from the rational theories in which a subject bases his own decisions on the maximization of the expected value of the stock-return[2]. Our insight seems to support the effect of cognitive characteristics in shifting the individual investment behaviour far from what predicted for a risk-neutral trader. In particular, controlling for trading experience and other demographics information, there is evidence of a relation between the traits of emotion stability and conscientiousness with an increased and reduced trading activity respectively.

In testing this conclusion, the second part of the paper analyses the number of securities bought and sold by the participants. As we posit above, high-conscientious subjects buy and sell shares in a reduced quantity, while the trait of emotion stability explains higher trading volume.

Finally, among the sample, we show that females exhibit less market activity than males, supporting the previous literature on individual differences in risk-taking (Byrnes et al.,

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[1]In this paper we refer to market activity and trading volume indistinctly.

[2]As described below, Weber and Camerer (1998) experiment is designed to isolate the individual investment decisions from the main rational reasons that could lead the subjects to trade. Therefore, phenomena as tax advantages and information asymmetry do not find space in explaining the differences in market activity among the participants.

1999, Fellner and Maciejovsky, 2002). Using this theory as a key to interpret our findings, we investigate whether the output from a psychometric measure of individual risk preferences (DOSPERT, financial and gambling domain) matches with the trading behaviour followed by the subjects in a experimental asset market. Moreover, we explore to what extent the role of personality traits differs in explaining the investment decisions made on paper with those involving real transactions. While we demonstrate that DOSPERT correlates with the subject trading behaviour, we do not find a convergence in the effect of personality traits over the two measures.

These results perfectly fit in two research branches. First, personality traits and trading behaviour relate with the established literature that links economics performances to social-psychology traits. Several works investigated a long list of potential relationships between cognitive characteristics and individual records for consumer orientation (Brandstatter and Guth, 2000; Brandstatter and Guth, 2002; Brown et al., 2002), financial markets (Fenton-O'Creevey et al., 2004; Andrew Lo et al., 2005), and job performance (Thoresen et al., 2004; Judge et al., 2013). However, whether there is a clear effect of some psychological dimensions on specific human behaviours, a missing explanation of what are the mechanisms underlie the role of subject's characteristics in driving different performances is revealed. Focusing on how and which personality trait influences the single facets of individual' behaviour, our study might give a better understanding of where these achievements come from.
Second, this paper can take a first step in suggesting a new study in the growing field of neuroeconomics (DeYoung et al., 2010; Frydman et al., 2014; DeYoung, 2014). Proving that the personality traits are able to explain a change in the individual investment behaviour, we put forward an analysis on the biological mechanisms underlie the role of each personality dimension in influencing the financial decision process.

The paper is organized as follows: Section 2 provides a brief literature review on personality

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traits and risky decision-making; in Section 3 we present the theory behind the goals of the paper; in Section 4 there is the design of the experiment while the results are described in Section 5. Final discussion in Section 6.

2.   Personality traits and decision-making: an economics' perspective

The question of what drives a person in taking a decision rather than others is a young grey issue that continue to seduce a big part of the modern research activity. From the cognitive literature on psychological traits there is substantial evidence of a link between social-personality factors and the heterogeneity in decision-making around subjects. In particular, elements as the environment in which we grew up or our education and experience seem to contribute in characterizing our choices. Through a pattern of toughs, emotions and cognitions, we elaborate a series of conscious and unconscious processes that result in our final decisions. Psychologists categorize these patterns in the human personality profiles.

A full literature review on the personality traits is beyond the scope of this work, however in this chapter we want to highlight some points that might help the reader during the paper. Starting from its definition, a personality trait is a stable set of thoughts, actions and emotions that influence the behaviour of the subject during his life (Kassin, 2003). With the aim to categorize and summarized all the elements behind the concept of personality traits, on 1961 Tupes and Christal developed a Five-factor model to describe the psychological characteristics of individuals. Their pioneering work is the cornerstone for the Big Five Theory that standardizes the main human personality traits in the following 5 dimensions: Extraversion, Neuroticism, Conscientiousness, Openness to Experience and Agreeableness. The first dimension, Extraversion, is often related with traits as being outgoing, energetic, sociable, friendly, talkative and gregarious. Instead, Neuroticism or Emotion Stability is associated with anxiety, shyness, irritability and moodiness. Common traits linked with the

dimension of Conscientiousness include being efficient, organized, prepared, dependable, self-disciplined and not careless. Openness to Experience is interpreted as intellect or curiosity and it is associated with high imagination, inventiveness and unconventional idea. Finally, subjects who score high on Agreeableness generally are courteous, modest, not demanding, warm, altruistic, trusting and generous.

Several researches focused on the role of the personality traits in addressing and endless list of behaviours across the population. For our purpose we restrict the area to those that have direct implications with financial markets. For example, in the study of the investment decisions, psychologists and economists have shown that the differences in the preferences expressed by the investors involve specific risk-attitude heterogeneity. Consequently, various models have been developed to examine the relationship between the five-factor personality domains and risk-taking in an economics perspective. In testing this correlation, Nicholson et al. (2005) observed that sensation seeking (a trait often associated with the attitude toward varied and novel experiences and feelings) is highly related with financial risky-trials[3]. These findings are supported by several analysis on gambling preferences (Wolfgang, 1988; Wong and Carducci, 1991; Lauriola and Levin, 2001; Mishra and Lalumiere, 2010 and 2011) which reveals that higher-risk attitude is positive associated with extraversion and openness to experience (the traits are often associated with sensation seeking[4]), while agreeableness and conscientiousness with higher risk aversion.

In better understanding how personality traits affect risky-decision making, psychologists documented a binary role of the traits for negative and positive states. Especially, according to Lauriola and Levin (2001), some traits better identify specific preferences when a subject faces with gain or loss trials. For example, in a lottery task where a sure gain is the alternative of an uncertain higher gain, high neurotics-persons will manifest a risk-averse behaviour choosing the first option. Conversely, in the loss domain the same subject will display a

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[3]The same finding has been recorded in the empirical work by Grinblatt and Keloharju (2009) in which sensation seeking is related to the tendency of investors to be active on the stock-market.
  [4]See Roberti J.W. (2004).

preference for the risky option that might lead him to entirely avoid the loss (risk-seeking over losses). The influence of personality in the sensitivity to punishment and reward cues is the basis of the model developed by Gray in 1987. The author proposes two stimulus systems underlie the human behaviour: a behavioural activation system (BAS) that regulates the motivations in obtaining appetite goals and a behavioural inhibition system (BIS) where aversive motives are controlled to avoid something unpleasant. Through a 20 items questionnaire, Gray identified some differences in the BIS/BAS systems across the population and he correlated this various sensitivity to the score' change in some personality traits. In particular, Gray found that where the approach to avoid punishment signals is the biological foundation of anxiety, the trait of impulsivity seems to play a relevant role in the regulation of the behaviours towards rewards.

The fact that some personality traits predict risk-attitude during decision-making processes, pushed some scholars to investigate if a relation between psychological factors and various individual performances exists. With this goal, over the last 30 years, several meta-analytic studies emerged (Barrick and Mount, 1991; Tett et al., 1991 and Hurtz and Donovan, 2000). For example, Barrick and Mount (1991) demonstrated this relation using the Five-Factor personality model in a performance evaluation system among groups of professionals, policemen, managers, sales and skilled/semi-skilled. Whether the authors focused mainly on job-performances (high conscientiousness/ low impulsivity validates greater performances for all occupations), Fenton O'Creevy (2004), in a sample of 118 investment bankers, showed that lower neuroticism combined with higher openness to experience are the main ingredients for a successful trader.

The significant correlation between openness to experience and positive trading performances motivated some researchers to examine in detail if there are some sub-traits that better explain this relation. To this end, the work of Grinblatt and Keloharju (2009) studies the effect of sensation seeking in altering the individual investment choices. In particular, us-

ing speed tickets as proxy of the trait, Grinblatt and Keloharju (2009) demonstrate how sensation seeker investors, reporting higher trading activity, exhibit negative performances. With a similar research design, several authors analysed the effect of the intelligence[5] on the trading behaviour (Chevalier and Ellison, 1999; Gottesman and Morey, 2006). In strengthen this stream of literature, Grinblatt et al. (2011) combine IQ measure and trade data for the Finnish stock-market and they found in the raw scores of the intelligence a significant predictor of high returns and less biased trading behaviour. In particular, during their study the authors highlight how high-IQ investors are not affected by phenomena as the disposition effect and the transaction costs. Using a similar Finnish dataset, Conlin et al. (2015) measure the impact of personality data on individual stock-market participation. The authors show a role of the subscales of extraversion (excitability, extravagance and exploratory) in increasing the number of debt and asset held by the investors.

Unfortunately, Grinblatt and Keloharju (2009), Grinblatt et al. (2011) and Conlin et al. (2015) are the only works that tries to match the trading behaviour with psychological/cognitive variables. Indeed, no other researches address the question in a cognitive perspective and, in particular no other papers clearly investigate the overall influence of the big five personality dimensions on the individual trading activity. With the goal to reduce this gap, in the next chapters we analyse the role of psychological traits in explaining the financial behaviour across subjects.

3.   Theory

As already mentioned in the introduction, in this paper we observe whether the dimensions of human personality interact with the subject's market activity. With this term we refer to the amount of cash not invested in securities and to the magnitude of shares exchanged by the participants (trading volume).

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[5]Intelligence has been depicted as one of the main elements of openness to experience (Ashton et al., 2000; Harris, 2004).

The motivation underlying this study must be traced back to the biological basis of each of the psychological variables here analysed. For example, as from Digman and Takemoto-Chock (1981), McHenry et al. (1990) and Barrick and Mount (1991), conscientiousness predicts superior job performances for different occupation criterions (Almlund et al., 2011). Individuals who exhibit high respect for duties, perseverance and ability to organize efficiently, report better performance than who do not. These subjects exhibit an attitude to suppress impulsivity that leads them to lower risk-seeking behaviours (Gray, 1987). In a trading perspective, we hypothesize that the boundaries of conscientiousness drive careful and more precise operation that it turns into small investments and reduced number of shares exchanged. A negative effect on the trading volume in suggested.

Following this reasoning, Carrigan (1960) shows a relation between impulsivity and extraversion. Subjects with high extroversion are characterized by a predisposition toward not planned rapid responses without or with less concern about future outcomes. Extroverts are more sensitive to rewards than other individuals and, from Costa and McCrae (1992) and Daly et al., (2009), there is a clear evidence of their preference for immediate sure gains rather than uncertain higher delayed returns. For our purpose, the greatest is the value obtained by these subjects after a positive induced-affect, the highest is the probability that these investors repeat the same action to receive similar burst of utility (DeYoung, 2014). This potential pattern might imply a recurring dependent behaviour that can lead to a higher number of operations. We believe in the role of the extroversion in increasing the market activity among individuals.

Vice versa, in subjects with high neuroticism, the construct of anxiety generally increases the chances to overestimate the expectations of bad results during negative states (Eysenck and Eysenck, 1985). Butler and Mathews (1987) and Stober (1997) reinforce this theory suggesting a role of neuroticism on risk-averse behaviour during judgemental tasks, while the BIS/BAS model considers the aim at avoiding a punishment signal as the biological underpinning of the sub-dimension of anxiety. We hypothesize that when a stock experiences

a price decrease, investors less stable emotionally ascribe more value to that incoming loss than other subjects, and they activate a stronger respond to this non-reward event. Instead to monetize the loss, they maintain their position with a preference for an uncertain future outcome that could reduce the actual negative balance. According to this reasoning, we assume that during the experiment neurotics will manifest a reduced trading volume with smaller investment.

Agreeableness seems to be a not-relevant predictor for the study of the investor trading behaviour. Indeed, the trait refers to the attitude to friendly interact with other people and maintain good networks with them. Therefore, this characteristic can be easily used to forecast performances of specific jobs in which social-dimensions are taken into account (e.g. sales and management) while it might find difficulties in explaining differences in individual investment behaviour (Barrick and Mount, 1991). However, whether the cooperation and altruism do not influence choices during a trading simulation, we argue that the sub-dimension of compliance might be fruitful in driving careful selling and buying operations. The effect on market activity/trading volume is questionable.

Finally, we analyse the dimension of openness to experience. As mentioned before, this trait underlies the constructs of intellect, curiosity, imagination and unusual ideas. Following the Grey's model (1987), a person who scores high in openness to experience has the opposite behaviour from what observed for neuroticism. The trait of openness to experience negatively correlates with the behavioural inhibition system (BIS) (Smith and Boeck, 2006) that regulate the overreaction to negative signals. These subjects assimilate all the information they come in contact and they change their behaviour accordingly, even if it means to support bad payoff. These individuals barely avoid from punishment outcomes and still more unfrequently they repeat the same behaviour over time. With a pattern of unconventional choices, we expect an increasing volume in the number and in the width of the trading operations performed by these investors.

So far, we have discussed the mechanisms underlying the psychological traits that can help

us to better understand individual financial behaviour. However, looking at the existing literature on personality and risk-attitude we might have some preliminary support to what hypothesized above. For example, according to Nicholson et al. (2005), in the financial domain the trait of extraversion and openness to experience positively correlate with risk seeking, while conscientiousness, agreeableness and neuroticism drive to risk-averse behaviours. In explaining the market activity/trading volume among the subjects, these associations are perfectly consistent with what suggested above. Nevertheless, we need to be cautious in proposing this convergence since psychologists and economists found little evidence of a correlation between the investment-decisions made on questionnaires with those involving real market transactions. Hence, potential differences in the way personality traits relate with market activity and risk-preferences expressed on psychometric scales might me revealed.

In this paper, we test the role of personality traits in explaining individual-investment choices (i) and we observe whether these results differ for a risk-attitude questionnaire (ii).

4. Methodology – Experimental Protocol

176 subjects (121 male; M age = 22.5 yrs; SD age: 1.8 yrs) fulfilled a demographic/personality questionnaire and subsequently participated in a trading simulation with actual rewards[8]. Participants were graduate and undergraduate students from Engineering and Economics

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[8]The first classified received a total prize of 165 euro. The second was entitled of 100 euro, the third of 50 euro and the fourth of 15 euro. The structure of the rewarding system is different from that used in Weber and Camerer (1998) in which at the end of the trading simulation the total experimental value of cash and asset holdings is converted to real currency using a specific exchange rate. In our design, a legitimate concern is about the chance that at the end of the simulation subjects who are experiencing low performances will change their trading behaviour. Especially, these participants might be encouraged to take extreme high risk as a final chance to increase the returns and to win a prize without losing anything. We test this potential bias comparing the investment behaviour between subjects with low and high performances. In particular, we analyse whether these two subsamples differ in the trading activities performed at the ending of the simulation (last three periods) with respect to the investment style followed during all the simulation session. For the value of assets held by the participants, we did not find any statistical significant difference among the subsamples. Moreover, no evidence of a variation in the total number of assets traded is shown. Indeed, the entire sample exhibits a general trend in reducing the number of securities bought at the end of the simulation.

faculties at the University of Bologna (Italy). The recruitment process consisted in several announcements, during lessons and courses, of a trading contest organized by the Department of Management at the University of Bologna (DiSA). The subjects were told about the reward system used for the competition. All the communications and booking emails have been done through numerical codes to shield individual' sensible information. On average twenty subjects performed the experiment at the same time at the informatics laboratory of the University of Bologna. Participants took 45 minutes to complete all the tasks.

At the very beginning of the experiment, the subjects were asked to give their age, gender, education, stock-market knowledge and experience. Once these demographics variables have been recorder, the participants fulfilled a booklet of psychological questionnaires. We used a shorter version (50-items) of the Goldberg's (1999) public-domain personality survey (IPIP NEO: International Personality Item Pool) and an 8 items DOSPERT risk-taking scale for the specific financial/gambling domain (Weber et al., 2002)[9]. After the questionnaires, the subjects started the trading simulation. We developed a trading software that replicates what proposed on Weber and Camerer (1998). In particular, there are six risky assets (labelled from A to F) that the participants can trade for 14 periods. The subjects have an initial budget of 2000 euro (in experimental currency) to invest during the simulation. No short selling is allowed. The prices of the stocks are randomly generated and cannot be affected by buying and selling operations. From Weber and Camerer (1998), according to the changes of a price-increasing/decreasing, there are 5 types of stocks: 1 (−−) that has a probability of a price increase of 35 per cent; 2 (-) of 45 per cent; 3 (0) about 50 per cent; 4 (+) 55 per cent and of 65 per cent for 5 (++). Participants knew the chances of all six assets to rise and fall, but they did not know which share (A-F) had which probability of rising. Finally, the price could rise or fall just by 1, 3 or 5 euro.

To give an idea about stock trends, the software automatically generated the first 4 periods.

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[9]The sub-scale of DOSPERT that we use in this paper covers the financial domain. In particular, the questionnaire is composed by 8 items, 4 investment items and 4 gambling items in which the subjects rate the likelihood to engage in a risky-behaviour using a 5-point scale (1 = very unlikely to 5 = very likely). The highest is the score, the more risk-seeking is the subject.

Figure I illustrates the layout of the stock prices chart showed in the main screen of the simulation website.

[**Insert Figure I here**]

When the subjects make a choice, they knew both the historical rate of return of the assets they had in portfolio and the last price variation for all the 6 stocks.

In each period the participants have 120 seconds to analyze the information about the return distribution of the securities, decide their action and enter the decision they took. After these 2 minutes the software will automatically bring the subject to the next period.

5.   Results

Table I provides some summary statistics for the entire sample. In particular, Panel A and B show the demographics and psychological traits variables took into account in this paper. Among the 176 subjects, 55 are females and 121 are males, with ages varying from 19 to 27 (mean age of 22). 69 participants are undergraduates while 107 graduated. We asked students to report their stock market knowledge and their trading experience on financial markets. 77 participants denoted that their education or job is related to investment trading (101 do not have any stock-market knowledge) and 15 subjects are experienced in financial trading (163 do not have any trading experience).

Panel B reveals the personality raw data for the five broad domains of IPIP NEO five-factor model and for the DOSPERT risk-attitude questionnaire. On average participants scores 34.92 on extraversion, 38.46 on conscientiousness, 30.94 on emotion stability, 34.56 on agreeableness and 38.35 on openness. We compare these findings with what reported by Goldberg (1992). The author uses the International Personality Item Pool (IPIP) to measure the personality scores for a large sample aged 13–60 (n=19719). His study includes 177 Italian and Chinese individuals in the age range 18-35. Their results are for extraversion 28.86,

conscientiousness 31.95, emotion stability 22.29, agreeableness 37 and openness 40.5. Compared to the Goldberg (1992), our cohort scores higher on extraversion, conscientiousness and emotion stability and lower on openness and agreeableness.

Among our sample, no gender differences are found in four personality traits, while males and females seem to differ on emotion stability (men score higher than women, $p<0.01$). Gender differences were also found in subjects' risk-taking. In line with the previous literature[10], we show that females are more risk averse than males.

[Insert Table I here]

Finally, Panel C describes the individual financial records obtained through the trading simulation. In order to understand the variation in the market activity among the sample, we report the amount of cash held by each participant (budget not invested in assets) and the number of shares traded during the trading session. From Table I, on average, within the simulation, participants do not use 1470 euro (mean 1469,62, SD 477,75) and they trade almost 91 stocks (mean 90.89, SD 62.51).

5.1. Exploring the Trading Strategy

The main goal of this study is to analyse the subjects' trading behaviour and understand what are the factors that drive an active or passive investor' strategy. In order to do that, Table II contains the correlation coefficients between each demographic, psychological and financial records obtained from the trading simulation.

As a first result, age positively relates with conscientiousness (0.19, $p<0.01$) and agreeableness (0.21, $p<0.01$), while femininity negatively predicts emotion stability (0.32, $p<0.01$). DOSPERT' measure shows again a clear evidence of a different risk-attitude between males and females. In particular, the fact that DOSPERT positively relates with gender (0.31,

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[10]For detail see the meta-analysis conducted by Byrnes et al., 1999.

p<0.01) supports our previous results of male participants more risk seeking than female (Barber and Odean, 2001; Agnew et al., 2003; Grinblatt and Keloharju, 2009). The analysis of the risk-preference among our sample seems also to help us in the understanding of the sign of the correlation between the control factor "gender" and our dependent variables "capital not invested" (-0.24, p<0.01) and "number of shares traded" (0.31, p<0.01). Indeed, the theoretical explanation of a risk-averse subject who invests a lower amount of money and trades a reduced number of shares during his trading simulation is coherent with our findings on the DOSPERT risk-scale.

However, even if significant, the evidence of a not strong correlation between the capital not invested and the DOSPERT (-0.15, p<0.05) suggests that the two risky measures are not parallel and that they can be affected by different psychological dimensions. Indeed, we believe in a series of biological basis at the base of personality profile that may alter individual trading behaviour while not affecting choices made on paper. Especially, from Table II, while the traits of extraversion and openness highly correlate with DOSPERT' scale (p<0.01), no effect has been recorded between these two traits and the not invested capital. Conversely, conscientiousness, emotion stability and agreeableness correlate with the available cash not invested (p<0.05) although no associations are shown with the psychometric investment decisions. The results substantially do not change when we take into account the number of shares traded by the subjects during the experiment.

[Insert Table II here]

Table II still demonstrates a strong effect of gender and DOSPERT in predicting high number of shares exchanged. For the variable "number of shares traded" (total, sold and bought), with the exception of the conscientiousness and the agreeableness for which a little changed has been recorded (the traits seem not to relates with the variables "number of stocks traded"), the Big Five Personality traits tends to have a similar impact of what found

for the "not invested capital".

These results lead us to be doubtful about the potential convergence of the role of personality traits on real versus hypothetical financial decisions. In particular, there is a clear evidence of different activations of the personality dimensions in influencing the individual choices expressed on the stock-market rather than those measured through the DOSPERT[11]. Moreover, Table II seems also to partially answer to our main question on the personality and market activity/trading volume. We do not support our overall theory of the role of each personality trait in explaining the heterogeneity in trading behaviour among subjects. In particular, where it is confirmed a reduced trading volume for high-conscientious subjects and an increase likelihood to find an active strategy for low-neurotics investors, some relations do not match with our expectations. First of all, the preliminary results do not show any role of extraversion and openness to experience in altering the individual trading activity. Second, we surprisingly show an effect of agreeableness that positively correlates with not invested capital ($p < 0.01$).

In confirming these results, Table III shows the trading records for the lowest (25th percentile) and the highest (75th percentile) scores for each personality dimension. The role of the traits in explaining investment choices is entirely consistent with our previous findings.

[Insert Table III here]

From Table III we observe how the emotion stability is a good predictor of the variation in the trading volume among the subjects. Indeed, where conscientiousness and agreeableness do not exhibit a relation with the average amount of securities traded during the simulation, the trait of emotion stability is positively associated with active trading strategies (extraversion and conscientiousness are respectively positively and negatively related with the number

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[11]Looking at the DOSPERT variable, the results in Table 2 hold also when we run a OLS regression analysis in which the dependent variable is DOSPERT (D) and the independent variables are the big five personality traits (PT), the level of education, gender, age, trading knowledge and experience (Dem) ($D = \alpha + \beta PT + \gamma Dem + \epsilon$).

of shares traded at p<0.1).

5.2. *Regression Analysis*

5.2.1. *Capital not invested*

As stated in the previous paragraphs, the individual investment choices can be influenced by the subject's demographic and psychological characteristics. In equation (1) we specify the regression analysis to better understand the role of cognitive traits in driving different trading behaviours:

$$NIC = \alpha + \beta PT + \gamma D + \delta DOSPERT + \epsilon \tag{1}$$

NIC is the dependent variable Not Invested Capital that summarizes the amount of money not invested by the participants during the simulation, PT includes the five personality traits and the D matrix consists of the demographics variables of each subject. DOSPERT contains the individual risk-taking preferences in the financial and investment domain while ϵ is the error term. The D matrix contained the age and the gender of the subjects and dummy variables for the education (Graduate), stock-market knowledge and trading experience.

Table IV shows the results for the regression using equation (1). From Model 1 through 5 we analyse the impact of each of the five traits on the trading strategy followed by the subjects. Colum 6 reports the output of the regression as specified in equation (1) in which all the personality traits are taken into account at the same time. Supporting the belief that the impulsiveness predicts careless and higher risky trading activity, in Table IV the coefficient of conscientiousness is positive and highly significant. Vice-versa the coefficient of emotion stability is negatively related with capital not invested during the simulation. Following the existing literature that combines risk-avoiding behaviour and personality traits, we confirm the inverse association between risk-taking and agreeableness. Indeed, people who score high

on this trait invest lower amount of money in trading activities during the simulation.

[Insert Table IV here]

For the set of demographic variables, we find that gender and DOSPERT negatively relate with our dependent variable. However, from the change of variables' statistical significance among the models, a potential concern is about the correlation among some personality traits.

In particular, for our purpose it is important to highlight that agreeableness significantly correlates with conscientiousness (0.35, p<0.01) and with emotion stability (0.29, p<0.01). From Table IV we use instrumental variables to test whether some collinearity problems bias our findings on the influence of personality traits on trading volume. For example, instead to regress for agreeableness in Model 6 of Table IV, we use agreeableness instrument. This new variable is computed regressing first the trait of agreeableness on conscientiousness and then we substitute the residuals from the first step regression into the regression in the Model 6. We repeat this operation to separate the impact of agreeableness and emotion stability on the attitude to invest larger (smaller) amount of money. Using the instrumental variables our findings are mostly coherent with what shown in Table IV. In detail, when residuals come into the six models presented in Table IV, the coefficients of conscientiousness and emotion stability are still positive and negative highly significant. In contrast, the trait of agreeableness seems to lose its marginal explanatory power just when we use in the regression model the instrument of emotion stability.

This result is also clearly shown by the Table V in which we re-ran the same regression presented in Table IV, where we dropping out from the predictors the traits of extraversion and openness to experience that seem to have a negligible role in regulating individual' investment choices (Model 1 in Table V predicts the same percentage of variance in the capital not invested than Model 5 where we use the linear combination of the five personality traits,

62

R^2=0.11).

[Insert Table V here]

From Column 4, consistent with our instrumental variable analysis, when we separate agreeableness from emotion stability, the first trait reduces its statistical significance. We find the same results controlling for demographics.

5.2.2.   Number of shares traded

If some participants invest a greater amount of money during the simulation, it is reasonable not be surprised to find a larger number of shares traded than in other's subjects. However, focusing on stocks with higher price, the investors might obtain the same result with a smaller number of shares. With the aim to better understand the heterogeneity in the trading volume among the participants, in this paragraph we detect whether personality and/or individual demographic characteristics relate with the amount of securities exchanged in a specific time interval.

Active/passive strategies are revealed looking at the quantity of shares traded during the simulation period, while psychological and demographics data come from the booklet of questionnaires we use in the first part of the experiment. From Tables II and III we already gave some preliminary insights on the individual facets that seem to affect the trading volume among the subjects. In particular, the fact that males are more active than females (number of shares traded, bought and sold positively correlate with gender) supports our relation on risk-seeking investors more prone to use larger amount of money and to trade higher number of shares (DOSPERT positively correlates with gender and with number of shares traded, bought and sold). Instead, among the personality traits, Tables II and III display the emotion stability as the only predictor of the trading volume.

As for the variable "not invested capital", using equation (2) we regress the trading volume

on the individual' psychological and demographics dimensions.

$$NS = \alpha + \beta PT + \gamma D + \delta DOSPERT + \epsilon \qquad (2)$$

NS is the number of shares traded during the simulation, while, as far as for equation (1), PT, D and DOSPERT are personality traits, demographics and a measure of risk-attitude respectively.

Table VI shows the results of trading volume regression. In Model 1 the dependent variable is the total number of shares traded during the simulation while in Model 2 and 3 we regress the number of shares bought and sold respectively.

At first glance, controlling for demographic and risk-attitude factors, we find a reduced predicting value among the big-five personality traits. In particular, the results from Table VI are in contrast with what found in Tables II and III.

[Insert Table VI here]

Moreover, the evidence of moderate correlations between the personality dimensions deserves a deeper investigation. Indeed, employing instrumental variables to overcome potential collinearity problems we find consistency with the preliminary descriptive insights.

Especially, in Table VII we show emotion stability, DOSPERT and gender to be significant predictors of greater trading volume among the subjects (even when we consider number of shares bought and sold separately). In contrast, participants who score high on conscientiousness are more likely to buy and sell a reduced number of shares during the simulation.

[Insert Table VII here]

To further test the robustness of these results, we regress the three trading volume variables on the personality traits without controlling for demographics and DOSPERT. The output revealed by Table VIII is entirely consistent with our main findings.

[Insert Table VIII here]

In line with the picture of a conscious investor who trades a reduced amount of money (in turn lower number of shares), in Table VIII the coefficient of conscientiousness is negative and highly significant. Vice-versa, a significant positive relation between emotion stability and number of shares traded/bought/sold is expression of a subject who, in suppressing anxiety and harm-avoidance behaviours, is more likely to manifest higher trading volume.

5.2.3. To sum up

Summarizing, our main results are as follows. We demonstrate that at an individual level of analysis, there is broad variation in the size of capital invested and the number of shares traded across investors. We find consistency between risky-decisions made on the questionnaire with those made during the trading simulation but not for the role of personality traits over the two measures. Risk-aversion mitigates the trading volume through a more passive investment strategy. According to previous psychological literature, gender also affects the trading strategy of subjects (males have higher trading volume than females). Finally, personality traits have a relevant role in explaining the heterogeneity in the individual' investment choices. In particular, emotion stability and conscientiousness are drivers for a more active and passive trading behaviour respectively. These results hold whenever we control or not for demographics.

6.   Discussion

Using psychological and financial data, obtained through an experimental analysis, we test the role of personality traits in altering investor's trading strategy. We support the cognitive predictions that see a connection between personality traits and individual investment choices. We find that conscientiousness and emotion stability predict higher and lower trading volume respectively. In particular emotion stability, a trait known to encode risk-taking decisions, is positively correlated with the amount of capital not invested and with the number of shares exchanged during the trading simulation. Conversely, among the subjects, we find that the width of the investments made and the quantity of securities traded negatively correlate with the conscientiousness. Finally, our results show a limited effect of agreeableness on the size of the budget employed by the participants in their trading simulation, while no analogous relations are revealed for extraversion and openness to experience[12].

Consistent with the existing literature, demographics influence both personality and individual financial choices (Barber and Odean, 2001; Agnew et al. 2003; Grinblatt and Keloharju, 2009). In particular, females are less emotionally stable and more risk-averse than males. We record differences in trading volume for men and women, where male subjects have been found to invest higher portions of their available budget and to buy and sell larger number of shares.

Age relates with personality traits (younger participants score low on conscientiousness and agreeableness) but it seems to be a not good predictor for risk-taking and trading volume.

Because of the correlations between some personality traits, the regression analysis of psychological dimensions on trading volume and market activity was conducted controlling for potential collinearity problems. However, our results mainly hold both when we use instru-

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[12]The no-role played by openness to experience in stimulating the individual investment behaviour might be in contrast with what found in Grinblatt and Keloharju (2009) in which sensation seeking is positively associated with higher trading activity. The reasons for this distance in the results can be summarized in three main points: 1) the differences in the way the cognitive traits data has been recorded (self-questionnaire versus empirical proxy); 2) the composition of the sample and, 3) where the financial records come from (sterilized and simplified experimental market versus real transactions).

mental variables and when we insert single personality factors in the main regression model. We interpret the role of emotion stability and conscientiousness in driving higher/lower trading volume as follows. As active investors, instead to be locked into harm-avoidance behaviours, less neurotics subjects suppress the role of negative emotions (as for example the construct of anxiety) encouraging risk-taking during financial-decision tasks. This leads these individuals to invest higher amount of capital and to increase the number of shares exchanged during the trading session. On the contrary, the facet of conscientiousness predicts careful decision-making based on low impulsivity. Facing with investment choices, these subjects exhibit a tendency to contain risk-seeking behaviours in favour of focused strategies that involved small size of capital invested and, in turn, a reduced number of securities traded.

Finally, since the subject' risk preferences are the key to understand our results, we investigate whether a psychometric measure of risk attitude (DOSPERT questionnaire) relates with the individual behaviour on experimental asset market and to what extent the role of personality traits differs in explaining investment decisions made on paper with those involving real transactions. While we demonstrate that DOSPERT significantly correlates with the subject trading behaviour, we do not find a convergence in the effect of personality traits over the two measures.

This study helps to better understand the heterogeneity in the investment behaviour among individuals. Our findings well tie with the current research that uncovers individual characteristics able to explain variations in human decision-making under uncertainty (Dhar and Zhu, 2006; Grinblatt and Keloharju, 2009; Grinblatt et al., 2011). In particular, suggesting an effect of some personality traits on the investment choices among subjects, we motivate theorists to accommodate individual psychological characteristics in financial models devoted to analyse the market liquidity and the securities price changes. Moreover, the fact that in our sample personality traits can explain differences in trading volume can provide relevant insights for portfolio theory, especially during financial bubbles and crashes.

In line with Grinblatt and Keloharju (2009), to better reach these goals and to overcome the limitations of a controlled experimental task (relatively small sample size and self-reported personality questionnaire) we emphasize the importance of a study where real financial data are matched with a proxy of a specific personality traits (e.g. caffeine intake has been often related with impulsiveness and sensation seeking[13]). Again, to shed lights on the underlying mechanism at the base of the relation between personality and investment behaviour further studies are suggested. In particular, in in line with previous literature on emotional responses and trading performances (Lo et al. 2005, Fenton-O'Creevy et al., 2010) we advise to explore the biological underpinning of the single cognitive sub-dimensions that are more likely to alter subjects' investment choices.

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[13]Jones et al. (2005); Gurpeguia et al. (2007) and Penolazzi et al. (2012).

References

1. Agnew J., Balduzzi P. and Sund?n A. (2003) "Portfolio choice and trading in a large 401(k) plan", American Economic Review, vol. 93;

2. Almlund M., Duckworth A., Heckman J. and Kautz T. (2001) "Personality psychology and economics", Handbook of the Economics of Education;

3. Ashton M.C., Leea K. Vernona P.A. and Jangb K.L. (2000) "Fluid Intelligence, Crystallized Intelligence, and the Openness/Intellect Factor", Journal of Research in Personality, vol. 34;

4. Barber B. M. and Odean T. (2001) "Boys Will Be Boys: Gender, Overconfidence, and Common Stock Investment", Quarterly Journal of Economics, vol. 116, n. 1;

5. Barrick M.B. and Mount M.K. (1991) "The big five personality dimensions and job performance: a meta-analysis", Journal of Personnel Psychology, vol. 44;

6. Brandstatter H. and Guth W. (2000) "A psychological approach to individual differences in intertemporal consumption pattern", Journal of Economic Psychology, vol. 21;

7. Brandstatter H. and Guth W. (2002) "Personality in Dictator and Ultimatum games", Central European Journal of Operations Research, vol. 10;

8. Brown T.J., Mowen J.C., Donovan D.T. and Licata J.W. (2002) "The Customer Orientation of Service Workers: Personality Trait Effects on Self and Supervisor Performance Ratings", Journal of Marketing Research, n. 1;

9. Butler G. and Mathews A. (1987) "Anticipatory anxiety and risk perception", Cognitive Therapy and Research, n. 11;

10. Byrnes J.P., Miller D. and Schafer W. (1999) "Gender differences in risk-taking: a meta-analysis", Psychological Bulletin, vol. 125;

11. Campbell, J. B. and Heller, J. F. (1987) "Correlations of extraversion, impulsivity and sociability with sensation seeking and MBTI introversion", Personality and Individual Differences, vol. 8;

12. Carrigan P. M. (1960) "Extraversion-introversion as a dimension of personality: a reappraisal", Psychological Bulletin, vol. 57;

13. Carver, C. S., and White, T. L. (1994) "Behavioural inhibition, behavioural activation, and affective responses to impending reward and punishment: The BIS/BAS scales", Journal of Personality and Social Psychology, n. 67;

14. Chevalier J. and Ellison G. (1999) "Are some mutual fund managers better than others? Cross-sectional patterns in behaviour and performance", Journal of Finance, vol. 54;

15. Cloninger C., Svrakic, M. and Przybeck T. (1993) "A psychobiological model of temperament and character", Arch. Gen. Psychiatry, vol. 50;

16. Conlin A., Kyrolainen P., Kaakinen M., Järvelin M., Perttunen J. and Svento R. (2015) "Personality traits and stock-market participation", Journal of Empirical Finance, vol. 33;

17. Costa P. and McCrae R. (1992) "NEO PI-R professional manual", Odessa, FL: Psychological Assessment Resources, Inc.;

18. Daly M., Harmon C. and Delaney L. (2009) "Psychological and biological foundations of time preference", Journal of the European Economic Association, vol. 7;

19. DeYoung C. (2014) "Cybernetic Big Five Theory", Journal of Research in Personality, forthcoming;

20. DeYoung C., Hirsh J., Shane M., Papademetris X., Rajeevan N. and Gray J. (2010) "Testing Predictions From Personality Neuroscience: Brain Structure and the Big Five", Psychological Science, vol. 21, n. 6;

21. Dhar R. and Zhu N. (2006) "Up close and personal: investor sophistication and the disposition effect", Management Science, vol. 52, n. 5;

22. Digman J. and Takemoto-Chock (1981) "Factors in the natural language of personality: Reanalysis, comparison, and interpretation of six major studies", Multivariate Behavioural Research, vol. 16;

23. Fenton-O'Creevey M., Nicholson N., Soane E. and Willman P. (2004) "Traders: Risks,

decisions, and management in financial markets", UK: Oxford University Press.

24. Fenton-O'Creevey M., Soane E., Nicholson N. and Willman P. (2010) "Thinking, feeling and deciding: The influence of emotions on decision making and performance of traders", Journal of Organizational behaviour, vol. 32;

25. Eysenck H.J. and Eysenck M.W. (1985) "Personality and individual differences", Plenum Press, London;

26. Fellner G. and Maciejovsky B. (2007) "Risk attitude and market behaviour: Evidence from experimental asset markets", Journal of Economic Psychology, vol. 28;

27. Frydman C., Barberis N., Camerer C., Bossaerts P. and Rangel A. (2014) "Using neural data to test a theory of investor behaviour: an application to realization utility", Journal of Finance, vol. 119;

28. Goldberg L. (1992) "The development of markers for the Big-Five factor structure", Psychological Assessment, 26;

29. Goldberg L. (1999) "A Broad-Bandwidth, Public-Domain, Personality Inventory Measuring the Lower-Level Facets of Several Five-Factor Models", Personality Psychology in Europe, vol. 7;

30. Gottesman A. and Money M. (2006) "Manager education and mutual fund performance", Journal of Empirical Finance, vol. 13;

31. Gray J. A. (1987) "The psychology of fear and stress", New York: McMGraw-Hill;

32. Grinblatt M. and Keloharju M. (2009) "Sensation seeking, overconfidence and trading activity", Journal of Finance, vol. 64;

33. Grinblatt M., Keloharju M. and Linnainmaa J. (2011) "IQ, Trading Behaviour, and Performance", Journal of Financial Economics, vol. 102;

34. Gurpeguia M., Juradob D., Lunac J. D., Fernández-Molinab C., Moreno-Abrilb O. and Gálvezb R. (2007), "Personality traits associated with caffeine intake and smoking", Progress in Neuro-Psychopharmacology and Biological Psychiatry, vol. 31, n. 5;

35. Harris J. (2004) "Measured intelligence, achievement, openness to experience, and

creativity", Personality and Individual Differences, vol. 36, n. 4;

36. Hurtz G. M. and Donovan J.J. (2000) "Personality and job performance: the big five revisited", Journal of Applied Psychology, vol. 85;

37. Jones H.A. and Lejuez C.W. (2005) "Personality Correlates of Caffeine Dependence: The Role of Sensation Seeking, Impulsivity, and Risk Taking", Experimental and Clinical Psychopharmacology, vol. 13, n. 3;

38. Judge T.A., Rodell J.B., Klinger R.L., Simon L.S. and Crawford E.R. (2013) "Hierarchical representations of the five-factor model of personality in predicting job performance: integrating three organizing frameworks with two theoretical perspectives", Journal of Applied Psychology, vol. 98;

39. Kassin S. (2003) "Psychology", Prentice-Hall fourth edition;

40. Lauriola M. and Levin I. (2001) "Personality traits and risky decision-making in a controlled experimental task: an explanatory study", Personality and Individual Differences, vol. 31;

41. Lo A., Repin D. and Steenbarger B. (2005) "Fear and greed in financial markets: a clinical study of day-traders", American Economic Association, vol. 95;

42. McHenry J. J., Hough L. M., Toquam J. L., Hanson M. A. and Ashworth S. (1990) "Project A validity result: The relationship between predictor and criterion domains", Personnel Psychology, vol. 43;

43. Mishra S. and Lalumière M. L. (2010) "You can't always get what you want: The motivational effect of need on risk-sensitive decision-making", Journal of Experimental Social Psychology, vol. 46;

44. Mishra S. and Lalumière M.L. (2011) "Individual differences in risk-propensity: Associations between personality and behavioural measures of risk", Personality and individual differences, n. 50;

45. Nicholson N., Soane E., Fenton-O'Creevy and Willman P. (2005) "Personality and domain-specific risk taking", Journal of Risk Research, vol. 8, n. 2;

46. Penolazzi B., Natale V., Leone L. and Russo P.M. (2012) "Individual differences affecting caffeine intake. Analysis of consumption behaviours for different times of day and caffeine sources", Appetite, vol.58, n. 3;

47. Roberti J.W. (2004) "A review of behavioural and biological correlates of sensation seeking", Journal of Research in Personality, vol. 38;

48. Smits D.J.M. and Boeck P.D. (2006) "From the BIS/BAS to the Big Five", European Journal of Personality, vol. 20;

49. Stober J. (1997) "Trait anxiety and pessimistic appraisal of risk and chance", Personality and Individual Differences, vol. 22;

50. Tett R.P., Jackson D.N. and Rothstein M. (1991) "Personality measures as predictors of job performance: a meta-analytic review", Personnel psychology, vol. 44;

51. Thoresen C.J., Bradley J.C., Bliese P.D. and Thoresen J.D. (2004) "The big five personality traits and individual job performance growth trajectories in maintenance and transitional job stage", Journal of Applied Psychology, vol. 89;

52. Tupes E. and Christal R. (1961) "Recurrent personality factors based on trait ratings", Technical Report, USAF, Lackland Air Force Base, TX;

53. Weber E. U., Blais A.R. and Betz N. (2002) "A domain-specific risk-attitude scale: Measuring risk perceptions and risk behaviours", Journal of Behavioural Decision Making, vol. 15;

54. Weber M. and Camerer C. (1998) "The disposition effect in securities trading: an experimental analysis", Journal of Economic Behaviour and Organization, vol.33;

55. Wolfgang A. K. (1988) "Gambling as a function of gender and sensation seeking", Journal of Gambling Behaviour, vol. 4.

Figure I below illustrates the time series chart of stock prices. As from the chart below, the trading software automatically generates the first 4 periods to give an idea about the stocks trend.

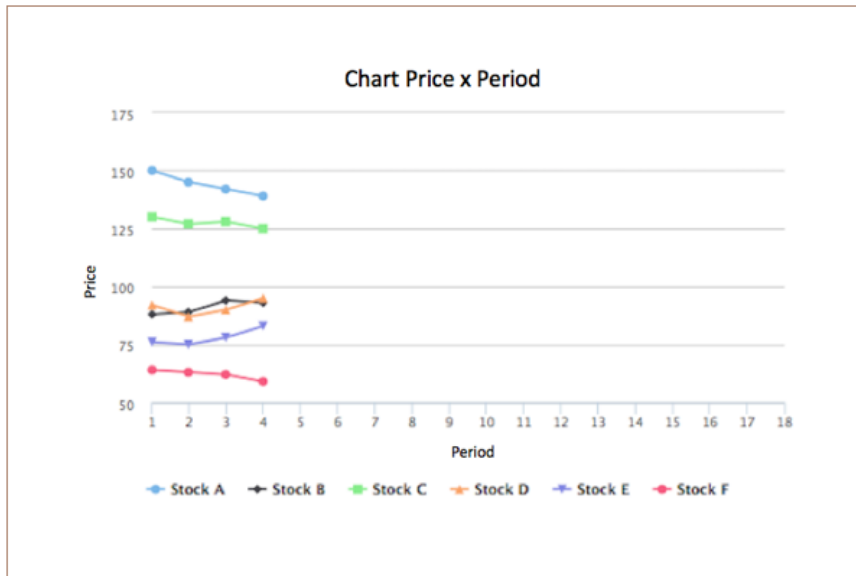**Figure I Chart Price x Period**

Table I Summary Statistics

Panel A describes demographics variables for the entire sample. Age is the age of the participant. Graduate is a dummy variable taking the values of 0 if the subject is an undergraduate student and 1 if he is a graduate student. Stock market knowledge is a dummy variable taking value of 0 whether participant has not knowledge on financial markets and 1 if he has a background education in finance or if he works/worked for stock-market services. Finally, trading experience takes the following values: 0 if the participant has low or no trading experience and 1 if he invested at least for one year. Panel B reports psychological variables for the entire sample. Extraversion, Conscientiousness, Emotion stability, Agreeableness and Openness are the Big-Five personality traits while DOSPERT is a measure of risk-seeking attitude. In conclusion, Panel C describes the main variables to analyse the trading volume in the entire sample. Not invested capital reflects the average amount of cash (not invested in assets) held by the participant during the simulation. Number of shares is the total number of securities traded by the participant during the simulation, while number of shares – buy(sell) refer to the number of securities bought (sold) by the subject during the simulation.

	Obs	Mean	Median	Std. Deviation	Minimum	Maximum
Panel A						
Age	178	22,54	23	1,84	19	27
Graduate	178	0,61	1	0,49	0	1
Stock-Market Knowledge	178	0,43	0	0,5	0	1
Trading Experience	178	0,08	0	0,28	0	1
Panel B						
Extraversion	178	34,92	35	4,96	19,2	47,5
Conscientiousness	178	38,46	39,18	5,74	20	50
Emotion Stability	178	30,94	30,8	7,18	13,3	48,3
Agreeableness	178	34,56	35	5,41	17,5	48,2
Openness	178	38,35	38,33	5,07	26,66	49,2
DOSPERT	178	19,56	19	4,64	8	37
Panel C						
Not Invested Capital	169	1469,62	1494,86	477,75	98	2992,43
Number of shares buy	169	52,26	43	31,52	6	193
Number of shares sell	169	38,63	28	31,76	2	214
Number of shares traded	169	90,89	70	62,51	12	416

Table II Correlations

This table presents the correlation matrix between measures of trading volume, personality traits, risk-attitude scale and demographics. Age is the age of the participant. Gender is a dummy variable that taking value of 0 if female and 1 if male. Graduate is a dummy variable taking the values of 0 if the subject is an undergraduate student and 1 if he is a graduate student. Stock market knowledge is a dummy variable taking value of 0 whether participant has not knowledge on financial markets and 1 if he has a background education in finance or if he works/worked for stock-market services. Finally, trading experience takes the following values: 0 if the participant has low or no trading experience and 1 if he invested at least for one year. Extraversion, Conscientiousness, Emotion stability, Agreeableness and Openness are the Big-Five personality traits while DOSPERT is a measure of risk-seeking attitude. Not invested capital reflects the average amount of cash (not invested in assets) held by the participant during the simulation. Number of shares is the total number of securities traded by the participant during the simulation, while number of shares – buy(sell) refer to the number of securities bought (sold) by the subject during the simulation.

Demographic variables

	Extraversion	Conscientiousness	Emotion stability	Agreeableness	Openness	Age	Gender	DOSPERT
Age	0,02	0,19**	0,09	0,21**	0,01			
Gender	0,11	-0,09	0,32**	-0,04	0,06			
Graduate	0	0,27**	0,11	0,17*	0,02			
Knowledge	-0,1	-0,09	-0,16*	-0,19*	-0,04			
Trad. Frequency	0,14	0,02	-0,05	-0,03	0,23**			
Risk Attitude								
DOSPERT	0,23**	0,14	-0,03	0,07	0,26**	0,03	0,31**	
Trading volume measures								
Capital Not-Inv.	0,03	0,23*	-0,16*	0,18*	0,02	0,04	-0,24**	-0,15*
#stocks traded	0,13	-0,11	0,17*	0,02	0,06	0,08	0,31**	0,22**
#stocks bought	0,13	-0,12	0,18*	0,00	0,05	0,08	0,31**	0,21**
#stocks sold	0,13	-0,09	0,15*	0,03	0,07	0,08	0,30**	0,22**
PT								

t-statistics in parentheses;
* p<0.05, ** p <0.01, *** p<0.001.

Table III t-test Analysis

In Table III, for each personality trait, it is reported the not invested capital, the number of stocks traded, bought and sold recorder for the 25th percentile and for the 75th percentile. The table provides also the t-test analysis to observe a preliminary result on the effect of each trait on trading volume.

	Extraversion			Conscientiousness			Emotion Stability			Agreeableness			Openness		
	Low	High	t-test	Low	High	t-test	Low	High	t-test	Low	High	t-test	Low	High	t-test
Capital Not-Inv.	626,3	637,3	-10,8	535,8	788,9	-253,1*	670,5	460,3	210,2*	473,1	674,7	-201,6*	575,7	641,3	-65,6
#stocks traded	81,8	101,1	-19,3	99,2	87,5	11,7	80,2	106,5	-26,3*	96,7	94	2,7	93,6	94,1	-0,5
#stocks bought	47,4	56,5	-9,1	56,9	49,6	7,3	47,2	61,1	-13,9*	56	53,2	2,8	53,8	52,4	1,4
#stocks sold	34,4	44,5	-10,1	42,3	37,9	4,4	32,9	45,3	-12,4	40,7	40,8	0,1	39,8	41,7	-1,9

t-statistics in parentheses;
* p<0.05, ** p <0.01, *** p<0.001.

Table IV Regression Table: Not Invested Capital

Table IV presents a set of OLS regressions in explaining the heterogeneity of the amount traded during the simulation for the entire sample. The dependent variable is the capital not invested that reflects the available budget that the participant does not use during the simulation The independent variables include the personality traits (extraversion, conscientiousness, emotion stability, agreeableness and openness), demographics data (age, gender, education, stock market knowledge and trading experience) and a measure of risk attitude (DOSPERT). Age is the age of the participant. Gender is a dummy variable taking values of 0 if female, 1 if male. Graduate is a dummy variable taking the values of 0 if the subject is an undergraduate student and 1 if he is a graduate student. Stock market knowledge is a dummy variable taking value of 0 whether participant has not knowledge on financial markets and 1 if he has a background education in finance or if he works/worked for stock-market services. Finally, trading experience takes the following values: 0 if the participant has low or no trading experience and 1 if he invested at least for one year.

	1	2	3	4	5	6
	Capital Not-Inv.	Capital Not-Inv.	Capital Not-Inv.	Capital Not-Inv.	Capital Not-Inv.	Capital Not-Inv.
Constant	1380.10*	1359.60*	1418.20*	1523.50*	1367.00*	1581.80*
	(2.15)	(2.16)	(2.22)	(2.39)	(2.12)	(2.54)
Extraversion	33.79					19.91
	(0.85)					(0.49)
Conscientiousness		102.90**				94.90*
		(2.80)				(2.39)
Emotion Stability			-64.39			-111.00**
			(-1.68)			(-2.81)
Agreeableness				76.14*		80.69*
				(2.17)		(2.15)
Openness					23.65	-3.07
					(0.51)	(0.06)
DOSPERT	-9.33	-12.87	-10.09	-9.49	-9.01	-18.69*
	(-1.07)	(-1.50)	(-1.17)	(-1.11)	(-1.02)	(-2.10)
Age	-22.18	-19.15	-23.38	-28.91	-21.50	-27.60
	(-0.72)	(-0.63)	(-0.76)	(-0.95)	(-0.70)	(-0.92)
Gender	-215.90*	-188.10*	-156.50	-204.90*	-212.80*	-81.68
	(-2.55)	(-2.26)	(-1.72)	(-2.45)	(-2.51)	(-0.90)
Graduate	121.40	55.56	144.60	116.70	118.30	92.92
	(1.04)	(0.47)	(1.23)	(1.01)	(1.01)	(0.80)
Knowledge	-87.14	-82.25	-108.60	-68.72	-91.57	-73.87
	(-1.13)	(-1.09)	(-1.42)	(-0.90)	(-1.19)	(-0.98)
Trad. Experience	45.47	56.62	46.87	61.15	45.50	21.34
	(0.33)	(0.42)	(0.34)	(0.45)	(0.32)	(0.16)
N	176	176	176	176	176	176
R^2	0.08	0.12	0.09	0.10	0.08	0.17

t-statistics in parentheses;
* $p<0.05$, ** $p<0.01$, *** $p<0.001$.

Table V Regression Table: Not invested capital and Personality

A set of OLS regressions in explaining the heterogeneity of the amount traded during the simulation is presented for the entire sample. The dependent variable is the capital not invested that reflects the available budget that the participant does not use during the simulation. The independent variables are the personality traits (extraversion, conscientiousness, emotion stability, agreeableness and openness))

	1	2	3	4	5
	Capital Not-Inv.	Capital Not-Inv.	Capital Not-Inv.	Capital Not-Inv.	Capital Not-Inv.
Constant	575.00**	571.30**	620.60**	546.30**	582.30**
	(13.87)	(13.65)	(16.24)	(13.17)	(12.33)
Extraversion					4.407
					(0.11)
Conscientiousness	95.57**	121.70**		88.70*	99.94*
	(2.61)	(3.47)		(2.36)	(2.60)
Emotion Stability	-113.30**	-93.11**	-107.80**		-112.20**
	(-3.17)	(-2.66)	(-2.97)		(-3.11)
Agreeableness	80.71*		111.80**	50.80	80.76*
	(2.20)		(3.17)	(1.40)	(2.18)
Openness					-23.36
					(-0.50)
N	176	176	176	176	176
R^2	0.11	0.77	0.07	0.06	0.11

t-statistics in parentheses;
* $p<0.05$, ** $p<0.01$, *** $p<0.001$.

Table VI Regression Table – Trading volume

Table VI contains a set of OLS regressions in explaining the differences in the amount of securities traded during the simulation. The dependent variables are the number of stocks traded (model 1), the number of stocks bought (model 2) and the number of stocks sold (model 3). The independent variables include the personality traits (extraversion, conscientiousness, emotion stability, agreeableness and openness), demographics data (age, gender, education, stock market knowledge and trading experience) and a measure of risk attitude (DOSPERT). Age is the age of the participant. Gender is a dummy variables taking values of 0 if female, 1 if male. Graduate is a dummy variable taking the values of 0 if the subject is an undergraduate student and 1 if he is a graduate student. Stock market knowledge is a dummy variable taking value of 0 whether participant has not knowledge on financial markets and 1 if he has a background education in finance or if he works/worked for stock-market services. Finally, trading experience takes the following values: 0 if the participant has low or no trading experience and 1 if he invested at least for one year.

	1	2	3
	# of shares traded	# of shares bought	# of shares sold
Constant	-127.3	-58.40	-68.89
	(-1.61)	(-1.47)	(-1.71)
Extraversion	6.79	3.62	3.17
	(1.28)	(1.35)	(1.17)
Conscientiousness	-9.21	-4.88	-4.33
	(-1.77)	(-1.87)	(-1.63)
Emotion Stability	7.61	4.35	3.26
	(1.51)	(1.71)	(1.26)
Agreeableness	0.23	-0.39	0.63
	(0.05)	(-0.17)	(0.26)
Openness	1.42	0.36	1.06
	(0.23)	(0.12)	(0.34)
Age	7.88*	4.03*	3.85*
	(2.08)	(2.11)	(1.98)
DOSPERT	1.84	0.90	0.94
	(1.62)	(1.58)	(1.62)
Gender	24.91*	12.32*	12.59*
	(2.12)	(2.08)	(2.10)
Graduate	-22.43	-11.12	-11.31
	(-1.51)	(-1.49)	(-1.49)
Knowledge	0.38	0.36	0.022
	(0.04)	(0.07)	(0.00)
Trad. Experience	-12.30	-6.50	-5.79
	(-0.70)	(-0.74)	(-0.65)
N	169	169	169
R^2	0.17	0.18	0.16

t-statistics in parentheses;
* p<0.05, ** p <0.01, *** p<0.001.

Table VII Regression Table – Trading volume/ Instrumental variables

A set of instrumental variables regressions in explaining the differences in the amount of securities traded during the simulation is presented. The dependent variables are the number of stocks traded (model 1), the number of stocks bought (model 2) and the number of stocks sold (model 3). The independent variables include the personality traits as extraversion, conscientiousness instrument, emotion stability instrument, agreeableness instrument and openness, demographics data (age, gender, graduate, stock market knowledge and trading experience) and a measure of risk attitude (DOSPERT). The instrumental variables are computed within a 2 steps process. For example, to separate the effect of conscientiousness and agreeableness (the traits are correlated), we first regress the trait of agreeableness on conscientiousness and then, from this regression, we compute the residuals (e.g. AgreeeablenessINS) that we include in the regression that we run in Table VII. We repeat this operation for the variables that significantly correlate with other psychological factors. Age is the age of the participant. Gender is a dummy variable taking values of 0 if female, 1 if male. Graduate is a dummy variable taking the values of 0 if the subject is an undergraduate student and 1 if he is a graduate student. Stock market knowledge is a dummy variable taking value of 0 whether participant has not knowledge on financial markets and 1 if he has a background education in finance or if he works/worked for stock-market services. Finally, trading experience takes the following values: 0 if the participant has low or no trading experience and 1 if he invested at least for one year.

	1	2	3
	# of shares traded	# of shares bought	# of shares sold
Constant	-27.68	-7.21	-20.47
	(-0.46)	(-0.24)	(-0.67)
Extraversion	6.79	3.62	3.17
	(1.28)	(1.35)	(1.17)
ConscientiousnessINS	-11.84*	-6.39*	-5.44*
	(-2.10)	(-2.25)	(-1.89)
Emotion StabilityINS	10.98*	5.85**	5.12*
	(2.47)	(2.62)	(2.26)
AgreeablenessINS	-2.54	-1.91	0.62
	(-0.50)	(-0.75)	(0.24)
Openness	-2.24	-1.62	-0.62
	(-0.37)	(-0.53)	(-0.20)
DOSPERT	2.76**	1.35**	1.40**
	(2.63)	(2.57)	(2.61)
Age	2.62	1.34	1.28
	(1.04)	(1.06)	(1.00)
Gender	28.88*	14.33*	14.55*
	(2.51)	(2.48)	(2.47)
Graduate	-29.29	-14.83	-14.46
	(-1.92)	(-1.93)	(-1.85)
Knowledge	0.38	0.36	0.022
	(0.04)	(0.07)	(0.00)
Trad. Experience	-12.30	-6.50	-5.79
	(-0.70)	(-0.74)	(-0.65)
N	169	169	169
R^2	0.17	0.18	0.16

t-statistics in parentheses;
* $p<0.05$, ** $p<0.01$, *** $p<0.001$.

Table VIII Regression Table – Regression Table – Trading volume and Personality traits

A set of OLS regressions in explaining the differences in the amount of securities traded during the simulation is presented. The dependent variables are the number of stocks traded (model 1), the number of stocks bought (model 2) and the number of stocks sold (model 3). The independent variables are the personality traits (extraversion, conscientiousness, emotion stability, agreeableness and openness).

	1	2	3
	# of shares traded	# of shares bought	# of shares sold
Constant	86.03**	50.02**	36.01**
	(13.61)	(15.75)	(11.16)
Extraversion	9.79	5.08	4.71
	(1.81)	(1.87)	(1.70)
Conscientiousness	-11.11*	-5.78*	-5.33*
	(-2.17)	(-2.24)	(-2.04)
Emotion Stability	10.93*	5.99*	4.93*
	(2.32)	(2.53)	(2.05)
Agreeableness	1,01	0,01	1.00
	(0.21)	(0.00)	(0.41)
Openness	2,88	1,03	1,86
	(0.47)	(0.33)	(0.59)
N	176	176	176
R^2	0,04	0,05	0,06

t-statistics in parentheses;
* p<0.05, ** p <0.01, *** p<0.001.

Personality Finance

Marco Cecchini and Emanuele Bajo*

Abstract

Financial markets are characterized by multiple anomalies that led economists to challenge the assumption of investor rationality in favour of alternative theories. Among all, scholars started to focus on cognitive models based on individual psychological differences in decision-making. Behind this new approach there is the common belief that profiling the personality of the investors may help in explaining what traditional theories cannot predict. However, the results from the studies that follow this new field of analysis, named personality finance, are few and puzzled. With the goal to clarify how psychological dimensions affect the formation of individual financial preferences, in this paper we present a literature review on the role of personality traits in altering the investor behaviour.

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*Marco Cecchini is a PhD Student at the University of Bologna, Department of Management. Emanuele Bajo is a Full Professor at the University of Bologna, Department of Management. Correspoinding author: marco.cecchini10@unibo.it.

1.   Introduction

In a paper of 1972, Paul Slovic examined the scientific/psychology dichotomy behind how individuals integrate information into judgment or decision processes. He argued that, within the investment domain, financial analysts usually act as "intuitive statisticians" bypassing, with their intuitions and emotions, the several mathematical models that should help them in making choices. In this scenario, the analysts incorrectly or do not update their beliefs with all the information they own, leading their preferences formation to be in contrast with what postulated by the rational agent theories. Indeed, most of the time, instead to base their decisions on Bayes' law or the Subjective Expected Utility (SEU) traditional tenets, individuals set their judgments on a variety of feelings and attitudes that characterize themselves as human beings. Understanding the nature of these cognitive processes and their associations with some investor attributes became an urgent task for researchers in different fields. To better comprehend and forecast the behaviour of financial markets, over the years, an outnumber of studies on personal aspects underpinning the investment behaviour has been proposed. Demographic, social, cultural and personality facets were analyzed and integrated with most of the behavioural economic models. With the aim to explain the dimension of the heterogeneity in subject financial decision-making, an endless list of variables has been taking into account.

In this paper, we discuss the emerging role of personality traits in explaining differences in individual investment choices. We want to acquaint the reader with a detailed literature review to answer to the following question: *How do the personality traits help in better understanding the individual investment behaviour?*

The cross-disciplinary endeavour in using psychological factors to investigate decision making under uncertainty is remarkable. Indeed, following the analysis that suggest a link between risky choices and personality, psychologists predicted many important outcomes as job performances, occupation and political attitude (see Ozer and Benet-Martinez, 2006). Nevertheless, the number of papers that focuses on the personality profile in subjects who

are facing with investment choices is not so exhaustive. In illustrating the main academic contributions that reveal a psychological portrait for the successful trader, we assess the progress in the field and we speculate about the future.

A distinct contribution of this study is that it uses the most common taxonomy in human personality traits, the Five Factor Model (FFM, Tupes and Christal, 1961), like a reference theory from which make sharp predictions about personality and investment behaviours. We evaluate recent works that include different measures of personality as from questionnaires, surveys, experiments, proxies and statistical learning models to address the need for a general perception of the influence of personality traits in financial decision-making. We believe this review is a useful instrument as guidance for students and scholars who want to approach or learn more about the new field of "personality finance".

2.   Personality Traits

The study of the differences in the decisions made by individuals have received a lot of attention over the last 25 years. A number of researchers fully investigated whether there are some factors that may help to understand the heterogeneity around subject's choices. Beyond demographic and social variables, scholars contributed to achieve this goal using the personality traits, as a pattern of thoughts, emotions and actions that characterize the human behaviour (Kassin, 2003). In many scientific areas, these traits are said to be central in determining the formation of individual preferences (e.g. from drug addiction to entrepreneurship) and in analyzing the sources of specific outcomes (e.g. successful career). However, since the too wide dimensions behind the concept of personality, from the very first study in this field, researchers faced with the need of a universal theory to identify and classify all the individual psychological facets in a delineated but well-defined personality framework. In Allport and Odbert (1936) probably there is a preliminary structure of a personality traits' classification. In order to outline a taxonomy of personality traits, the

authors use a lexical study to drawn, from dictionaries, all the personality terms encoded in the common language. This work, later improved by Norman (1967), mainly describe our behaviour providing seven initial domains of human personality: constant traits, physical and internal states, role within the society, actions judgment, our concern on others and finally the type of activities we take part in. Cattel (1943) and Tupes and Christal (1961) start from Allport and Odbert (1936) to proceed with a subsequent clustering of all the terms used by the authors, introducing the current most popular approach in the analysis of personality traits: the Big Five Theory. In this model, the human personality is described just looking at these following five factors that are: extraversion (introversion), neuroticism (emotion stability), conscientiousness (unconscientiousness), high openness to experience (low openness to experience) and agreeableness (disagreeableness).

Extraversion   The dimension of extraversion (introversion) has been frequently associated with the facets of being sociable, gregarious and talkative. Extroverts manifest energetic and active behaviour showing a clear attitudes toward impetuous, exhibitionist and initiative actions (Hogan, 1986). Extroverts enjoy more intensely rewarding situations than other individuals (Costa and McCrae, 1992; Stewart, 1996) and this behaviour is mainly driven by the excitement in obtaining immediate rewards over delayed rewards (Daly et al., 2009; DeYoung, 2014). A highly extravert subject tends to seek stimulation from the surroundings and to lead who is around him. High scores on extraversion suggest an attitude to be interactive and to enjoy expressive and positive situations (Goldberg, 1990). The extraverts are assertive that it means an increase likelihood to be appealing in order to influence the others with a more active than defensive behaviours. Vice-versa, low extraversion it refers to a solitary person who uses to be shy and distant. Who have introvert tendency is more prone to experience timid and reserved' interactions, most of the time, looking for some space for themselves.

Neuroticism   Neuroticism includes several traits that easily affect the way individuals perceive negative stimuli. A neurotic subject is more likely to go through unpleasant emotions than his counterpart (calm and secure person), and he is more vulnerable in experiencing anger, anxiety and depression. The dimension of neuroticism also describes an attitude to be less emotionally stable and excitable, that in contrast with a stable and calm personality, drive the subjects to be insecure and to rarely control their impulses. Individuals who score high on neuroticism are likely to be easily embarrassed and to manifest jealous and irritable behaviours. Several authors establish a positive significant association between the trait of neuroticism with the sensitivity to punishment (Torrubia and Tobeña, 1984; Ball and Zuckerman; 1990; Zuckerman, 1991; Zuckerman, Joireman, Kraft, and Kuhlman, 1999; Torrubia et al., 2001; Boksem et al., 2006). In particular, the trait can lead to a not efficient management of negative signals and to overreact to things that are not good for the subject, leading him to avoid harm behaviour.

Conscientiousness   Conscientiousness refers to several constructs that lead people to act dutifully and efficiently. In particular, conscious subjects tend to be organized and efficient, they are dependable and manifest high self-discipline. The dimension of conscientiousness relates to the ability in suppressing impulsivity preferring pre-planned behaviour (Holt et al., 2003, Daly et al., 2009). Properly handled, this trait is an important attribute since it refers to the degree to which a person is practical, task-focused and persistent (Costa and McCrae, 1992; Mount and Barrick, 1995). Conscientious individuals are also more likely to excel in academic and job tasks, being associated with ambitious and prompt qualities (Higgins et al., 2007; Almlund et al., 2011; Roberts et al., 2012). In particular, the trait of conscientiousness motivates subjects to work for medium-long term activities that could bring them bigger rewards (Holt et al., 2003; Daly et al., 2009). In contrast, low conscious persons take spontaneous/impulsive decisions and might be considered as easy-going and inattentive. Unconsciousness is also related with negligent and irresponsible behaviours that

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lead individuals to not focus enough on details and to ignore others suggestions.

Agreeableness   The dimension of agreeableness reflects, as the extraversion does, individual interpersonal attitudes (Trapnell and Wiggins, 1990). Indeed, the trait of agreeableness mainly covers how people concern about the others. For example, high scores on this trait relates with being benevolent, complaint, compassionate, cooperative and trustful towards who is around us. Agreeable subjects are often moderate and patient, with an appetitive for generous and altruistic behaviours. A stream of psychological literature also demonstrates a clear negative correlation between the trait and the tendency toward aggressive conducts (Costa and McCrae, 1992; Zuckerman et al., 1993). In contrast, low agreeableness usually detects skeptical, aggressive and competitive people, who value insensitive and hostile actions as a good option to face with their social and work interactions.

Openness to Experience   Finally, openness to experience includes various factors of the following traits: intellect, curiosity, inventive and novelty. It is not uncommon that a high open person manifests interest on art, adventure sports and innovative ideas. According to Feist (1998), among the Big Five traits, high openness is the facet that is more likely to be associated with talented artistic and outcomes. These subjects exhibit a learning orientation toward new approaches of doing things that can lead them to greater knowledge and skills (Costa and McCrae, 1992 and Rolfhus and Ackerman, 1999). High openness to experience might also be translated in independent and non-predictable behaviours, and rarely the trait of openness to experience relates with dependent (routine/close mind) and harm-avoidance operations. Open individuals are well-known to follow non-conforming practices, relying their preferences on independent and original beliefs (Goldberg, 1990; Costa and McCrae, 1992).

Finally, from Almlund et al. (2011), these cognitive processes bring these subjects to obtain better job performance and, during decision-task with actual reward, to be more sensitive not to the reward itself but to the value of information that they can use to yield positive results.

[Insert Table I here]

The assessment of Big Five traits takes place mainly through self-report questionnaire. Among the others (TCI, TDA and BFI[1]), the most used questionnaire is the one developed in 1992, and revised in 1994, by McCrae and Costa: the Big-Five Questionnaire (BFQ). The original version is composed by 240 items and can usually be completed in 35/40 minutes. Over the years, different versions (shorten and high calibrated) have been developed (120, 100, 60 and 50 items) in order to help multiple research investigations. The questionnaire reports a pair number of items for each of the big five personality dimensions and it uses a 5-point scale to let the subject to express disagreement (1 = very inaccurate) or complete agreement (5 = very accurate) to specific situations. Here there are few examples of the items included in the BFQ (McCrae and Costa, 1992):

1. *Don't talk a lot*
2. *I am the life of the party*
3. *I pay attention*

The BFQ has been successful calibrated in different languages and for many countries, highlighting the efficacy of what developed by McCrae and Costa in 1992. An endless list of scholars employs the BFQ to address the human behaviour' heterogeneity across the population. From medical to marketing topics, thank to the BFQ, measures of personality have been used to predict and forecast several outcomes from different research areas (e.g. Ozer and Benet-Martinez, 2006).

For our purpose, in the next chapter we first introduce the existing economics and finance literature on human personality, then we restrict our attention on the studies that employ

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[1]TCI stands for Temperament Character Inventory (Zuckerman et al., 1991 and Cloninger, 1994), while TDA is Trait Descriptive Adjectives (Goldberg, 1992) and BFI is Big Five Inventory (John et al., 1991)

BFQ' raw scores in explaining the individual investment behaviour. Since the limited use of the BFQ in behavioural finance models, we also decided to drawn on all the empirical analyses that correlate individual financial records with proxies of the personality traits[2].

3.   Personality in Economics and Finance

We examine the association between human's personality and a number of investment behaviour and trading performance. To reach this goal, a detailed literature on the recent growing area of personality finance is a mandatory task. However, since the difficulties in interviewing or finding large and adequate dataset among traders or bankers, only a reduce number of studies addressed personality analyses in a behavioural finance mind-set.

A complete investigation of human personality usually involves the administration of specific psychological tools (questionnaires or experiments) that require a certain willingness to share sensitive information and to spent considerable amount of time. Whether the design of this kind of research is not an issue for students or households, the likelihood to collect a significant large sample drop off dramatically when professionals are considered. Nevertheless, although the measurement of personality traits discouraged researchers to administer costly questionnaires (in terms of time) to financial agents, in the management science an opposite pattern emerged. Interestingly, during the last twenty years, scholars within the fields of behavioural and organizational management, developed and an exhaustive literature on individual characteristics and firm outcomes. For example, MacMillan et al. (1985) demonstrated that, when the venture capitalists (VCs) decide for the rejection or financing of an investment project, they usually base their preferences on the characteristics of the entrepreneur rather than on a valuation of the proposal itself. The authors found in the entrepreneur' personality a relevant predictor of the VCs investment choice. Again, Stumpf

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[2]For example, in case it is impossible to obtain personality data from a questionnaire, we might be able to profile a subject using specific individual behaviour as the caffeine intake. Indeed, from the existing literature in personality traits, caffeine consumption has been often related with the trait of novelty seeking in the openness to experience's dimension (Gurpeguia et al., 2007).

and Dumbar (1991) used a behavioural simulation on a sample of managers to test the influence of specific personality types on strategic decision situations, while, more recently, Kaplan et al. (2012) showed that an executive candidate with some specific characteristics and abilities (e.g. efficient, organized, listening skills, open to criticism, treats people with respect, aggressive, fast mover, persistent, and proactive) has more chance to be hired by VCs and by companies involved in buyout (LBO).

Drawing from previous theories that use CEOs personality to understand the variations across organizational performance (Kets de Vries and Miller, 1984; Miller and Toulouse; 1986), in the first part of this chapter, we pause on the behavioural management' literature that contribute to a better comprehension of the relationship between cognitive traits and financial decision-making. We restrict our "management" thoughts to the analysis of the executives' psychological characteristics since the high profile of the majority of decision-makers in real financial markets. We believe that the abundance of organizational and management studies on the influence of CEO personality on firms 'outcomes, could reveal fascinating supports in the understanding of the individual investment preferences.

3.1.   The role of CEO' personality within the firm

In a recent work, Gow et al. (2015) demonstrate a clear association between the Big Five personality factors and a series of CEO behaviours and outcomes. Using a model based on the combination of BFQ raw scores and linguistic analysis, the authors extract personality facets of 84 CEOs from 1220 conference calls and relate the traits to the following firm characteristics/insights/performances: industry, size, R&D investments, operating performance (ROA, asset turnover and profit margin) and financial policy.

As a preliminary finding, Gow et al. (2015) show that CEOs who score high on introversion are more likely to have a role in the apparel industry, while neuroticism, openness to experience and disagreeableness are found to be higher in executives who run petroleum

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companies. The trait of unconscientiousness instead, seems to be a relevant trait in CEOs who operate in railroad sector. The authors discover also a significant relation between the traits of neuroticism and disagreeableness with the firm size (in terms of firm's total asset). The less (more) the CEO is disagreeable (neurotic) the highest is the chance that he or she is managing a big size company.

If these first results give just simple correlations among two variables, the core insights of Gow et al. (2015) are based on a precise psychological interpretation of the individual management behaviour. Especially, from the cognitive literature on human features and decision-making, the authors provide an accurate understanding of the associations between CEOs personality and both their business strategies and operating performances. Starting point is the variation in the volume of Research and Development' investments made by the executives. Consistent with the ideas that the trait of optimism is related to greater risk attitude and innovation seeking (Giat et al., 2009), and that the disagreeableness is negative associated with the optimism (Sharpe et al., 2004), Gow et al. (2015) demonstrate that being disagreeable significantly related (negatively) with the R&D investment intensity. The authors use a similar reasoning to discuss their findings on CEO' personality and operating performances and financial policy. They report a negative correlation between extraversion, conscientiousness and agreeableness with return on assets (ROA), asset turnover and profit margin, while high open to experience is positively associated with increased ROA and asset turnover. Following Gow et al. (2015) the neuroticism relates with low interest coverage, cash holdings and corporate investment, however, at the same time, the trait seems to be positive associated with higher firm' leverage. For the firm policy, except for the negative correlation among neuroticism and corporate investment, the results found in Gow et al. (2015) do not resonate with the idea of a neurotic CEO who, being risk averse and skeptical (non optimist) (Goel and Thakor, 2008, Heaton, 2002), prefers higher debts than cash holdings (Hackbarth, 2009)[3].

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[3]According to Hackbarth (2009), whether there is no reason to prefer debts rather than cash, a subject who scores high on optimism will exhibit a tendency towards debts.

The work of Gow et al. (2015) is a clear exercise to detect the role of Big Five personality in driving different firm' strategies and performances. Their results find partial consistency in what discovered by other authors who consider psychological attribute, different from the Five Factor taxonomy, in the explanation of the entrepreneur performance heterogeneity.

For example, Miller and Toulouse (1986) conduct an empirical analysis on 97 firms to investigate the association between three features of CEOs who operate in small organizations and their business performance. The authors focus on companies with a median of 100 employees to better highlight the impact of CEO choices within the firm strategies. To describe the personality of the executives analyzed, they observe some personality traits that, according to their reasoning, predict correctly the CEO operational behaviour: flexibility, need for achievement and locus of control. A flexible subject is prone to change his behaviour or thoughts according to external inputs or social interactions (Gough, 1960)[4]. Miller and Toulouse (1986) hypothesize that a CEO with high flexibility will adapt his strategy depending on events or new information, easily taking risk, and with an informal control structures to follow. Almost in the opposite direction is the behaviour of the executives with high need for achievement (conscientiousness). They express preference for organized and cautious decisions, facing directly with business issues through a methodical approach that lead them to think solutions to growth and do things correctly (Atkinson, 1958; McClelland, 1961). Miller and Toulouse (1986) relate this trait to well defined centralized strategies that do not involve aggressive and uncertain investments. Finally, the locus of control refers to the attitude of individuals to believe in their ability to control or influence what surrounds them (Rotter, 1966). Rotter (1966) states that an "internal person" perceives the environment as something that can change according to his or her actions, in contrast with an "external person" who has a distinguished passive behaviour that lead him to think about fate as a relevant explanation of the episodes of his life[5]. Miller and Toulouse (1986) refer to an

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[4]Whitbourne (1986), Black (2006) and Hoare (2006) associate flexibility with openness to experience.
[5]High score of locus of control (external persons) correlates positively with neuroticism and negatively with conscientiousness and agreeableness (Garma, 1992).

internal CEO as a confident subject who takes risks and invests in innovation as a source of competitive future advantages. The authors test their hypothesis matching raw scores of personality questionnaires, administered to CEOs of 97 Canadian companies, with multiple variables for the structure, strategy and performance of the firms (e.g. R&D investments, Future planning, Proactiveness of strategy-making, Risk-taking, Marketing strategy, Return on Investments, Profitability, Growth in net income and Growth in sales). The authors successfully demonstrate that in CEO who scores high on flexibility (high openness) is more likely to observe an informal company structure, intuitive risk-taking and simple business strategies. Miller and Toulouse (1986) confirm the association between the need for achievement with organized firms and analytical decision-making processes. Finally, they demonstrate that locus of control positively correlates with higher innovation and adapting CEO behaviours. Miller and Toulouse (1986) indicate that when locus of control and flexibility are found in a CEO of a particular firm, that company has more chances to obtain superior performance. The authors, especially for the trait of locus of control, are supported by a more recent work of Lee and Tsang (2001) in which, among 168 Chinese companies, the effect of entrepreneurs' personality on business performances is analysed.

To sum up, in the organizational and management studies analyzed so far, we find that the role of some personality traits are consistent among multiple investigations while others seem less so. Table II presents these findings.

[Insert Table II here]

CEOs who score low on extraversion, agreeableness, conscientiousness and high on openness to experience have more chances to run successful organizations (in term of operational performances) (Miller and Toulouse, 1986; Lee and Tsang, 2001; Gow et al., 2015). R&D positive relates with extraversion and neuroticism (Miller and Toulouse, 1986 and Gow et al., 2015) while the entity of Research and Development expenses negatively correlate with

the trait of conscientiousness (Miller and Toulouse, 1986). The relationship between R&D and agreeableness is unclear. Finally, in Gow et al. (2015) we find that emotionally stable and disagreeable CEOs are more likely to be in charge of bigger size firms.

3.2.   Investment Behaviour

From this useful overview on CEOs personality and firm outcomes, in this paragraph, we introduce the works that combine psychological and trading data to reveal potential implications of individual characteristics in influencing investment outcomes. We zoom on those models developed to examine the relationship between the Five Factor theory and the individual trading behaviour. From the evidence of a specific profile for successful traders, we map each cognitive facet that has been proved to affect the investors activities and their trading performance. We present this analysis pointing out on the main financial facts that, over the last 20 years, have not received a complete and comprehensive explanation. After a preliminary look on the investor financial performance, the core of our literature review will be on the variations across the stock-market participation, the trading volume and the attitude to ride losers instead of winners (the disposition effect).

3.2.1.   Trading Performance

In analyzing how the personality traits affect the investor behaviour, we might find some ideas of what the relation is about, simply looking at the studies that mix psychological factors with risky decision-making. To date, among the economists and psychologists there is a common belief that personality traits, in predicting individual preferences, may help to understand the decision made by subjects under uncertainty. The list of the works that correlate personality dimensions with risky behaviour is long and straightforward, however a particular issue related to the different risk-taking domains emerges. Especially, Weber et al. (2002), Nicholson et al. (2005) and Soane and Chmiel (2005) find that the same subject can express precise judgments according to the type of risk that he is facing with (e.g. health

or gambling risk). These difficulties are clearly highlighted in the work of Nicholson et al. (2005) in which, the Five Factor Model is tested on an overall measure of various risk domains (health, financial, career, social, safety and recreational). Beside the differences in the correlations for each separate risk type, the authors find in the sub-dimension of sensation seeking[6] the only significant predictor of the individual risk-attitude.

However, for the aim of our paper, it is necessary to restrict the area of analysis to those studies that match gambling and financial preferences with psychological surveys. In detail, the works of Lauriola and Levin (2001), Nicholson et al. (2005) and Mishra and Lalumiere (2010 and 2011) reveal that the traits of extraversion and openness to experience significantly correlate with higher risk-taking, while conscientiousness and agreeableness are linked to greater risk aversion[7]. Since the role of individual risk attitude in predicting the behaviour of the investors, we may expect a link between the traits described above and real subjects' financial decisions. Motivated by this goal, researchers started to address a more accurate analysis to detect whether personality relates with investor trading activity. Chronologically, the first step that has been taken in this direction, underlies the effort made by scientists in showing a personality profile for a successful trader. The appeal towards a precise picture of an investor who obtain higher trading performance brings Fenton-O'Creevey et al. (2004) to analyze the remuneration of 118 traders from an investment bank based in London, and to match these records with the traders' score on specific personality questionnaire (NEO-PI-R[8]). The preliminary insights were interesting showing emotion stability and openness to experience as positive factors in obtaining superior financial performances. While from the work of Fenton-O'Creevey et al. (2004) the trait of extraversion drives reduced remunerations among the investors, the facets of conscientiousness and agreeableness seem to play a

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[6]The trait of sensation seeking has been often associated with the trait of extraversion (Eysenk, 1967; Zuckerman, 1969; Aluja et al., 2003).

[7]Using a sample of professionals, McInish (1982) demonstrated that the trait of locus of control is related with the engagement in different investment opportunities. Considering the locus of control, along with the sensation seeking, to be strictly associated with high risk-attitude, McInish (1982) proved that externals person manifests a tendency toward risky portfolios characterized by higher beta.

[8]NEO-PI-R stands for Revised Neo Personality Inventory and it consists of 240 questions to measure the Big Five personality traits (Costa and McCrae, 1992).

marginal role in explaining the trader behaviour. The results found by the authors might be interpreted looking, for example, at the work of Carrigan (1960) in which the sub-trait of impulsivity is underpinning the dimension of extraversion. According to the author it is more likely to observe a not planned behaviour in subjects who score high on extroversion than in their counterpart. Intuitively, adopting the reasoning of Carrigan (1960) the results of Fenton-O'Creevey et al. (2004) on extraversion are explained by a careless and impulsive response that leads the extraverts to perform poorly.

With regard to what found for the neuroticism, as we mentioned in the description of the big five personality traits, we highlight a trait' characterization to a greater sensitivity to negative signals. In particular, Eysenck and Eysenck (1985) demonstrate a role of the construct of anxiety in increasing the chances of subjects to over judge negative states and to strongly increase harm-avoidance behaviours. This definition of the neuroticism and of its implicit distance with the idea of the homo economicus, are the main reasoning behind the reduce output obtained by less emotionally stable individuals.

Finally, Fenton-O'Creevey et al. (2004) focus on the trait of openness to experience. Here the link with greater trading performance is the opposite of the neuroticism. In particular, the cognitive mechanism underlies higher performance in persons with high openness to experience is the following. In negatively correlating with the overreaction to negative signals, curious and intellectual subjects adjust their behaviour according to the information they come in contact with. To reach superior performances these individuals barely avoid from punishment outcomes and frequently prefer unconventional choices.

With a slightly different research design, Lo et al. (2005) tried to replicate the study of Fenton-O'Creevey et al. (2004) unfortunately without the same results. Indeed, while Lo et al. (2005) successful tested the role of fear and greed on financial markets, they did not find any correlation between personality traits and trading performances. The smaller and less diversified sample (n=33) seems to be the main reason for the divergence of Lo et al. (2005)' findings with those of Fenton-O'Creevey et al. (2004).

A similar and more recent work is the one of Grinblatt and Keloharju (2009) in which the role of sensation seeking has been analyzed with respect to the investor behaviour. Combining Finnish trading data with driving records, the authors were able to investigate the relation between the trait of sensation seeking and real trading operations. In detail, based on the idea that the stock market is perceived as financially risky, Grinblatt and Keloharju (2009) use the driving tickets as a measure/proxy of the individual sensation seeking that might explain variations in the way subjects behave. In line with what found by Fenton-O'Creevey et al. (2004), Grinblatt and Keloharju (2009) demonstrate that high sensation seekers alter their trading activity, in turn exhibiting negative performances.

Still using a large dataset from the Finnish stock-market, on 2011 Grinblatt et al. correlate real individual trading records with a different psychological measure. In particular, merging five datasets (Finnish central securities depository registry - FCSD; Helsinki Exchanges – HEX; Thomson Worldscope; HEX Microstructure data; Finnish Armed Forces (FAF) intelligence score data), the authors focus on a sub-dimension of openness to experience that is the intellect or intelligence (Ashton et al., 2000; Harris, 2004). Through a pure empirical analysis, the purpose of the authors was to clearly address the issue of whether intellectual ability influences trading performance. This work ensues and implement the papers of Chevalier and Ellison (1999) and Gottesman and Morey (2006) that relate GMAT and SAT scores with mutual funds' performances. Whether these authors used school level IQ assessment, Grinblatt et al. (2011) point the attention on a more individual score (prior to the college). Even if the sample of Grinblatt et al. (2011) was just composed by male subjects, among their results there was a clear evidence of a positive relation between trading performance and IQ raw scores.

The findings here discussed imply a limited but clear direction in profiling successful traders. Consistently with what found for the CEOs, the trait of extraversion and of openness to experience seem to play a relevant role in addressing a reduced and increased financial records respectively. With the main goal to support and better investigate these results, in the next

chapters we will introduce the papers that link the personality of the investors with three well-known financial phenomena (stock market participation, trading volume and disposition effect).

3.2.2.   Stock-Market Participation

The work of Conlin et al. (2015) is the only paper that cover the study of investors' heterogeneity in the stock-market participation. The authors use personality traits to deeply understand which factor better explain the decision of the subject to participate or not in the stock market. According to Conlin et al. (2015), the way in which individuals vary in terms of wealth and risk-aversion partially clarify the attitude of the investors to be part of the market. To describe the effect of personality variables on stock-market participation, Conlin et al. (2015) combine two datasets from Finland. In their analysis they employ the Northern Finland Birth Cohort 1996 (NFBC) and the Finnish Central Security Depository (FCSD). The first contains personality raw scores from a battery of Temperament and Character Inventory (TCI) questionnaires, while the FCSD reports the official records of individual holdings in the Finnish stock-market. In line with the above description of the link of personality traits and trading performances, Conlin et al. (2015) illustrate the cognitive processes underlie the influence of each trait on the individual stock-market participation. In particular, the authors start from the novelty seeking (or sensation seeking) as a trait that might stimulate actions and propensity to invest in a market where there is a room for potential gains. The positive relation between sensation seeking (extraversion) and stock-market participation is thus expected. The same conclusion is also presented for the trait of the impulsiveness. Quoting Cloninger et al. (1994) the authors suggest how impulsivity alters individual instincts toward rewards without any concern about the future. Finally, Conlin et al. (2015) expect a negative relation between the harm avoidance subscales of worry/pessimism and fear of uncertainty with the stock market participation. Following the authors, the pessimism and fear push the subjects to not enter in the market avoiding the

negative states from potential losses or poor returns.

In line with what found for the trading performances, Conlin et al. (2015) show a role of the subscales of extraversion (sensation seeking, impulsivity, excitability, extravagance and exploratory) and of neuroticism (harm-avoidance, shyness and fear) in altering the individual investment behaviour. The authors demonstrate how sensation seeking, impulsivity, excitability, extravagance and exploratory increase the number of debts and assets held by the investors while harm-avoidance, shyness and fear reduce it.

3.2.3.   Trading Volume

In this chapter we mainly recall the paper of Grinblatt and Keloharju (2009) already mentioned above for the analysis of the relationship between trading performance and personality traits. In their work, Grinblatt and Keloharju (2009) investigate how the need for novel and intense experiences may lead the individuals to modify their trading behaviour. Motivated by the puzzling effect of inter-individual differences on trading propensity, the authors use a Finnish dataset to demonstrate that, distinctly from the risk-aversion, the heterogeneity in the level of sensation seeking among subjects may explain various magnitudes of trading activity. Similar to what found by Conlin et al. (2015) for the stock-market participation, Grinblatt and Keloharju (2009) hypothesize that the subjects who search for complex and strong sensations are more prone to be active on the stock-market. According to the authors, an active trading strategy based on the constant diversification of the portfolio with new stocks could be a more exciting experience than a passive buy and hold strategy. Therefore, high sensation seekers might be more willing to refresh their investments to maintain their excitement on the financial markets.

Measured by the number of individual driving violations tickets, the sensation seeking positively correlates with three measures of trading volume (number of stocks traded, number of stocks in the portfolio and portfolio turnover). In particular, the regression tables shown by Grinblatt and Keloharju (2009) on average illustrate, for each additional speeding ticket, a

10 percent increase in the number of trades performed by the investors. These results hold also controlling for multiple variables as gender, age and job.

3.2.4. *Disposition Effect*

On 2001 Chui experimentally investigated whether the disposition effect is related with the trait of the locus of control. The author demonstrated that internal subjects are more prone to sell quickly stocks at gains instead to close losing positions, exhibiting positive disposition effect levels.

Ten years later, the work of Grinblatt et al. (2011) adds some insights to what found by Chui on 2001. Among a sample of Finnish investors, the authors use a measure of intelligent quotient (IQ) to detect whether the individual intellectual ability explains variations in financial records. In their paper, Grinblatt et al. (2011) continue a stream of literature (Chevalier and Ellison, 1999; Gottesman and Morey, 2006) that identifies in GMAT, SAT and other intelligence assessment tools, a predictor variable of mutual fund and manager's performances. However, through an individual level of analysis, Grinblatt et al. (2011) are able to depict not only the positive relation between IQ's raw scores and trading performances, but to disentangle the entire investor trading behaviour, highlighting for example his attitude to be prone or not to the disposition effect. Using the trading data from the Finnish central securities depository registry and the intelligence scores from Finnish Armed Forces, Grinblatt et al. (2011) demonstrate a significant negative correlation between IQ and the disposition effect. In particular, following the authors, low IQ subjects are more likely to exhibit systematic disposition effect' values greater than zero. According to Grinblatt et al. (2011), the motivation behind the reduced disposition effect level in subjects with high IQ lies in their ability to detect the potential tax-advantages from selling stocks at loss. In particular, the regression analysis from Grinblatt et al. (2011) shows an attitude to sell losing stocks in a greater extent during December than in other months. Their results control for hundred of regressors.

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In demonstrating how high-IQ investors engage in "trading mistake" rarely than their counterpart, Grinblatt et al. (2011) delineate in the dimension of openness to experience, and in particular of the intelligence, a plausible subject' attribute for a successful trading and more in general, for a greater market efficiency.

4. Conclusions

4.1. To sum up

Using a literature review analysis, we investigate the role of personality traits in explaining the trading behaviour among individuals. Our exercise supports the cognitive and economics studies that, matching psychological and financial data, predict a clear investor' psychological profile in altering individual' investment choices. Since the limited number of studies addressing personality analyses in a behavioural finance mind-set, we start our literature review exploring the potential effect of CEOs personality on firm outcomes (Table II presents the main results). Drawing from this behavioural management' literature we contribute to a better comprehension of the relationship between cognitive traits and financial decision-making.

We then introduce the finance research on personality. We first explore the broad variation around the trading performances across investors. Second we observe the potential relation between traits and three well-known financial phenomena (stock market participation, trading volume and disposition effect) likely to drive heterogeneity in the individual investment records. We test whether a consistency between the two analysis emerges.

Table III summarizes all our findings and demonstrates that the results from the studies on trading performances and investment patterns, are coherent. In particular, we find a distinct role of the trait of openness to experience (and one of its sub-dimensions, the intelligence) in rising the performance of the trader (Fenton-O'Creevey et al., 2004; Grinblatt et al., 2011) and in mitigating the level of disposition effect among investors (Grinblatt et

al., 2011). In contrast, motivated by impulsive and careless investment choices together with high sensitivity to rewards, even if an extravert is more likely to participate actively to the financial markets (higher stock-market participation and trading volume - Grinblatt and Keloharju, 2009; Conlin et al., 2015) he is found to exhibit lower trading performances (Fenton-O'Creevey et al., 2004; Grinblatt and Keloharju, 2009).

[Insert Table III here]

A clear patter emerges also for the trait of neuroticism or emotion stability. Indeed, in suppressing the dimensions of anxiety and fear, emotionally stable investors are less locked into harm-avoidance behaviours that lead them to prefer buy-hold strategies. Conlin et al. (2015) translates this cognitive mechanism in a higher participation to the activity of the financial markets, while Fenton-O'Creevey et al. (2004) highlights superior trading performances in subjects with low neuroticism.

Finally, our literature review shows a negligible effect of agreeableness and conscientiousness in stimulating the individual investment behaviour.

4.2.   Discussions

Personality finance is a young and puzzling field, placed within the bigger area behavioural finance, that has recently start in taking shape. Almost all of the studies we have discussed were published during the last 10 years, therefore a need to clarify where we stand or which progress has been made is essential. These points are the main purposes of our literature review, that documents the variations of the investment choices among subjects through a personality profile analysis.

Even if the accomplishment of a specific personality finance repertoire in the field of financial economics is still too far, some very relevant efforts have been made. The empirical evidence of a correlation between psychological traits and trading patterns is just the beginning of

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a prominent research agenda. From the inter-disciplinary studies around the main area of economics, we know enough to forecast about the future progress of the field. For example, from Table III the relations between disposition effect and/or trading volume with significant traits as neuroticism and extraversion is still missing. A complete overview on the influence of all the Big-Five personality traits on the most common financial phenomena is suggested. Moreover, we cannot resist to dream up on what could be coming next. With this regard, how the cognitive mechanisms behind the personality facets influence the individual investor behaviour is a fascinating question to answer using a multi-disciplinary analysis. Uncovering the biological underpinning of the single personality sub-dimension that are more likely to alter subjects' investment choices is not a mere economics challenge but a future broader research appointment. In committing to this research vision, with this review we tried to take a first step in this direction providing a useful instrument for everyone interested in the study of personality finance.

References

1. Allport G. and Odbert H. (1936) "Trait-names: A psycho-lexical study", Psychological Monograph, vol. 47;

2. Almlund M., Duckworth A., Heckman J. and Kautz T. (2001) "Personality psychology and economics", Handbook of the Economics of Education;

3. Aluja, A., Garcıa, O. and Garcıa L. (2003) "Relationship among extraversion, openness to experience, and sensation seeking", Personality and Individual Differences, vol. 35;

4. Ashton M.C., Leea K. Vernona P.A. and Jangb K.L. (2000) "Fluid Intelligence, Crystallized Intelligence, and the Openness/Intellect Factor", Journal of Research in Personality, vol. 34;

5. Atkinson J. (1958) "Motives in Fantasy, Action and Society", Van Nostrand, Princeton;

6. Ball S. and Zuckerman M. (1990) "Sensation seeking, Eysenck's personality dimensions and reinforcement sensitivity in concept formation", Personality and Individual Differences, vol.11;

7. Black M. (2006) "Reason, Intuition and Engagement: A trilateral model of adaptive career decision-making", Unpublished doctoral dissertation, University of Kansas, Lawrence;

8. Bokesem M., Tops M. and Wester A. (2006) "Error-related ERP components and individual differences in punishment and reward sensitivity", Brain Research, vol. 92;

9. Carrigan P. M. (1960) "Extraversion-introversion as a dimension of personality: a reappraisal", Psychological Bulletin, vol. 57;

10. Cattel R. (1943) "The description of personality: Basic traits resolved into clusters", Journal of Abnormal and Social Psychology, vol. 38;

11. Chevalier J. and Ellison G. (1999) "Are some mutual fund managers better than others? Cross-sectional patterns in behaviour and performance", Journal of Finance, vol. 54;

12. Cloninger C., Przybeck T., Svrakic D. and Wetzel R. (1994) "The Temperament and Character Inventory (TCI): A Guide to Its Development and Use", Washington Uni-

versity, Center for Psychobiology of Personality, St. Louis;

13. Conlin A., Kyrolainen P., Kaakinen M., Järvelin M., Perttunen J. and Svento R. (2015) "Personality traits and stock-market participation", Journal of Empirical Finance, vol. 33;

14. Costa P. and McCrae R. (1992) "NEO PI-R professional manual", Odessa, FL: Psychological Assessment Resources, Inc.;

15. Daly M., Harmon C. and Delaney L. (2009) "Psychological and biological foundations of time preference", Journal of the European Economic Association, vol. 7;

16. DeYoung C. (2014) "Cybernetic Big Five Theory", Journal of Research in Personality, forthcoming;

17. Eysenck H.J. (1967) "Biological dimensions of personality", Handbook of personality: theory and Research, New York: Guilford;

18. Eysenck H.J. and Eysenck M.W. (1985) "Personality and individual differences", Plenum Press, London;

19. Fenton-O'Creevey M., Nicholson N., Soane E. and Willman P. (2004) "Traders: Risks, decisions, and management in financial markets", UK: Oxford University Press.;

20. Garma S. (1992) "Locus of control and the five-factor model of personality", Psychology - Dissertations. Paper 102;

21. Giat Y., Hackman S. and Subramanian A. (2009) "Investment under uncertainty, heterogeneous beliefs, and agency conflicts", Review of Financial Studies, vol. 23;

22. Goel A. and Thakor V. (2008) "Overconfidence, ceo selection, and corporate governance", The Journal of Finance, vol. 63;

23. Goldberg L. (1990) "An alternative 'description of personality': the Big-Five factor structure", Journal of Personality and Social Psychology, vol. 59;

24. Goldberg L. (1992) "The development of markers for the Big-Five factor structure", Psychological Assessment, vol. 4;

25. Goldberg L. (1999) "A Broad-Bandwidth, Public-Domain, Personality Inventory Mea-

suring the Lower-Level Facets of Several Five-Factor Models", Personality Psychology in Europe, vol. 7;

26. Gottesman A. and Morey M. (2006) "Manager education and mutual fund performance", Journal of Empirical Finance, vol. 13;

27. Gough H. (1960) "California Psychological Inventory", Consulting Psychologists Press;

28. Gow I., Kaplan S., Larcker D. and Zakolyukina A. (2015) "CEO Personality and Firm Policies", Unpublished paper;

29. Grinblatt M. and Keloharju M. (2009) "Sensation seeking, overconfidence and trading activity", Journal of Finance, vol. 64;

30. Grinblatt M., Keloharju M. and Linnainmaa J. (2011) "IQ, Trading Behaviour, and Performance", Journal of Financial Economics, vol. 102;

31. Gurpegui M., Jurado D., Luna J., Fernandez-Molina C., Moreno-Abril O. and Galvez R. (2007) "Personality traits associated with caffeine intake and smoking", Progress in Neuro-Psychopharmacology and Biological Psychiatry;

32. Hackbarth D. (2009) "Determinants of corporate borrowing: a behavioural perspective", Journal of Corporate Finance, vol. 15;

33. Harris J. (2004) "Measured intelligence, achievement, openness to experience, and creativity", Personality and Individual Differences, vol. 36, n. 4;

34. Heaton J. (2002) "Managerial optimism and corporate finance", Financial management;

35. Higgins D, Peterson B., Lee A., Pihl O. (2007) "Prefrontal cognitive ability, intelligence, Big Five personality, and the prediction of advanced academic and workplace performance", Journal of Personality and Social Psychology, vol. 93, n.2;

36. Hoare C. (2006) "Handbook of adult development and learning", Oxford, University Press;

37. Hogan R. (1986) "Manual for the Hogan Personality Inventory", Minneapolis: National Computer System;

38. Holt R. and Barfield M. and Gonzalez A. (2003) "Impacts of environment variability in open populations and communities: "inflation" in sink environments",

39. Theoretical Population Biology, n. 64;

40. John O., Donahue E. and Kentle R. (1991) "The Big Five Inventory – Version 4a and 54", Berkeley Institute of Personality and Social Research;

41. Kahneman D. and Tversky A. (1979) "Prospect Theory: An Analysis of Decision under Risk", Econometrica, vol. 47, n.2;

42. Kaplan S., Klebanov M. and Sorensen M. (2012) "Which CEO characteristics and abilities matter?, Journal of Finance, vol. 67;

43. Kassin S. (2003) "Psychology", Prentice-Hall fourth edition;

44. Kets de Vries M. and Miller D. (1984) "The Neurotic Organization", Jossey-Bass, San Francisco;

45. Lauriola M. and Levin I. (2001) "Personality traits and risky decision-making in a controlled experimental task: an explanatory study", Personality and Individual Differences, vol. 31;

46. Lee D. and Tsang E. (2001) "The effects of entrepreneurial personality, background and network activities on venture growth", Journal of Management Studies, vol. 38;

47. Lo A., Repin D. and Steenbarger B. (2005) "Fear and greed in financial markets: a clinical study of day-traders", American Economic Association, vol. 95;

48. Mayfield C., Perdue G. and Wooten K. (2008) "Investment management and personality type", Journal of Financial Services Review, vol. 17;

49. MacMillan I., Siegel R. and Narasimha S. (1985) "Criteria used by venture capitalists to evaluate new venture proposals", Journal of Business Venturing, vol. 1;

50. McClelland D. (1961) "The Achieving Society", Van Nostrand, Princeton;

51. McInish T. (1982) "Individual investors and risk-taking", Journal of Economic Psychology, vol. 2;

52. Miller D. and Toulouse J. (1986) "Chief executive personality and corporate strategy

and structure in small firms", Management Science, vol. 32;

53. Mishra S. and Lalumière M. L. (2010) "You can't always get what you want: The motivational effect of need on risk-sensitive decision-making", Journal of Experimental Social Psychology, vol. 46;

54. Mishra S. and Lalumière M.L. (2011) "Individual differences in risk-propensity: Associations between personality and behavioural measures of risk", Personality and individual differences, n. 50;

55. Nicholson N., Soane E., Fenton-O'Creevy and Willman P. (2005) "Personality and domain-specific risk taking", Journal of Risk Research, vol. 8, n.2;

56. Norman W. (1967) "2800 personality traits descriptors: Normative operative characteristics for a university population". Unpublished Manuscript, Department of Psychology, University of Michigan;

57. Ozer D. and Benet-Martinez V. (2006) "Personality and prediction of consequential outcomes", American Review of Psychology, vol. 57;

58. Roberts B., Lejuez C., Krueger R., Richards J., Hill P. "What is conscientiousness and how can it be assessed?", Developmental Psychology, vol. 50, n.5;

59. Rolfhus E. and Ackerman P. (1999) "Assessing individual differences in knowledge: Knowledge structure and traits", Journal of Education Psychology, 91;

60. Rotter B. (1966) "Generalized Expectancies for Internal versus External Control of Reinforcement", Psychological Monograph, vol. 80;

61. Sharpe J., Martin N. and Roth K. (2011) "Optimism and the Big Five factors of personality: Beyond neuroticism and extraversion", Personality and Individual Differences, vol. 51;

62. Shiller R. (2000) "Irrational Exuberance", Princeton University Press;

63. Slovic Paul (1972) "Psychological Study of Human Judgement: Implications for Investment Decision Making", The Journal of Finance, vol. 27;

64. Soane E. and Chmiel N. (2005) "Are Risk Preferences Consistent? The Influence of

Decision, Domain and Personality", Personality and Individual differences, vol. 38, n.8;

65. Stewart G. (1996) "Reward structure as a moderator of the relationship between extraversion and sales performance", Journal of Applied Psychology, vol. 81;

66. Stumpf S. and Dumbar R. (1991) "The effects of personality type on choice made in strategic decision situations", Decision Sciences, 22;

67. Torrubia R., Avila C., Molto J. and Caseras X. (2001) "The Sensitivity to Punishment and Sensitivity to Reward Questionnaire as a measure of Grayos anxiety and impulsivity dimensions", Personality and Individual Differences, vol. 31;

68. Torrubia R. and Tobena A. (1984) "A scale for the assessment of susceptibility to punishment as a measure of anxiety: preliminary results", Personality and Individual Differences, vol. 5;

69. Trapnell P. and Wiggins J. (1990) "Extension of the interpersonal adjective scales to include the Big Five Dimensions of Personality", Journal of Personality and Social Psychology, vol. 59;

70. Tupes E. and Christal R. (1961) "Recurrent personality factors based on trait ratings", Technical Report, USAF, Lackland Air Force Base, TX;

71. Weber E. U., Blais A.R. and Betz N. (2002) "A domain-specific risk-attitude scale: Measuring risk perceptions and risk behaviours", Journal of Behavioural Decision Making, vol. 15;

72. Whitbourne S. (1986) "Openness to experience, identity flexibility, and life change in adults", Journal of personality and social psychology, vol. 50;

73. Zuckerman M. (1969) "Theoretical formulations", Appleton-Century-Crofts;

74. Zuckerman M. (1991) "Psychobiology of personality", New York: Cambridge University Press;

75. Zuckerman M., Kuhlman D., Joireman J., Teta P. and Kraft M. (1993) "A comparison of three structural models for personality: The Big Three, the Big Five, and the

Alternative Five", Journal of Personality and Social Psychology, vol. 65;

76. Zuckerman M., Joireman J., Kraft M. and Kuhlman D. (1999) Where do motivational and mood traits fit within three factor models of personality, Personality and Individual Differences, n. 26.

Table I Big Five Personality Traits

This table contains the list of adjectives describing the Big Five traits of the Five Factor Model (Tupes and Cristal, 1961). The adjectives lists is from Table 3 in Goldberg(1992) pp. 34–35.

Traits	Adjectives
Extraversion/	Active, assertive, bold, daring, energetic, extraverted, sociable, talkative, unrestrained, verbal, vigorous;
Introversion	Bashful, inhibited, introverted, quiet, reserved, retiring, shy, timid, unadventurous, withdrawn.
Conscientiousness/	Careful, conscientious, efficient, neat, organized, practical, prompt, steady, systematic, thorough;
Unconscientiousness	Careless, disorganized, haphazard, inconsistent, inefficient, impractical, negligent, sloppy, undependable, unsystematic.
Neuroticism/	Anxious, emotional, envious, fearful, fretful, high- strung, insecure, irritable, jealous, moody, nervous, self-pitying, temperamental, touchy;
Emotion Stability	Imperturbable, relaxed, undemanding, unemotional, unenvious, unexcitable.
Agreeableness/	Agreeable, considerate, cooperative, generous, helpful, kind, pleasant, sympathetic, trustful, warm;
Disagreeableness	Cold, demanding, distrustful, harsh, rude, selfish, uncharitable, uncooperative, unkind, unsympathetic.
High Open /	Artistic, bright, complex, creative, deep, imaginative, innovative, intellectual, introspective, philosophical;
Low Open	Imperceptive, shallow, simple, uncreative, unimaginative, uninquisitive, unintellectual, unintelligent, unreflective, unsophisticated.

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Table II Relations between CEOs personality traits and management behaviour/firm outcomes

This table contains the relations between each of the CEOs Big Five personality traits included in the Five Factor Model (Tupes and Cristal, 1961) and the aspects of the management behaviour and firm outcomes analyzed in the paper.

	Firm size		R&D Investment Entity		Operating Performances	
	Sign	*Papers*	*Sign*	*Papers*	*Sign*	*Papers*
Extraversion	n.a.	n.a.	Positive	Gow et al. (2015)	Negative	Gow et al. (2015)
Conscientiousness	n.a.	n.a.	Negative	Miller and Toulouse (1986)	Negative	Miller and Toulouse (1986), Lee and Tsang, (2001) and Gow et al. (2015)
Neuroticism	Negative	Gow et al. (2015)	Positive	Miller and Toulouse (1986)	Positive	Miller and Toulouse (1986) and Lee and Tsang, (2001)
Agreeableness	Negative	Gow et al. (2015)	Positive and Negative	P: Gow et al. (2015); N: Miller and Toulouse (1986)	Negative	Miller and Toulouse (1986), Lee and Tsang, (2001) and Gow et al. (2015)
Openness	n.a.	n.a.	n.a.	n.a.	Positive	Miller and Toulouse (1986) and Gow et al. (2015)

Table III Relations between personality traits and individual investment behaviour

This table contains the relations between each of the Big Five personality traits included in the Five Factor Model (Tupes and Cristal, 1961) and the aspects of the individual investment behaviour analyzed in the paper: trading performance, stock-market participation, trading volume and the disposition effect.

	Trading Performance		Stock-Market Partecipation		Trading Volume		Disposition Effect	
	Sign	*Papers*	*Sign*	*Papers*	*Sign*	*Papers*	*Sign*	*Papers*
Extraversion	Negative	Fenton-O'Creevey et al. (2004); Grinblatt and Kelohariu (2009)	Positive	Conlin et al. (2015)	Positive	Grinblatt and Kelohariu (2009)	n.a.	n.a
Conscientiousness	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a
Neuroticism	Negative	Fenton-O'Creevey et al. (2004)	Negative	Conlin et al. (2015)	n.a.	n.a.	n.a.	n.a
Agreeableness	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a
Openness	Positive	Fenton-O'Creevey et al. (2004)	n.a.	n.a.	n.a.	n.a.	Negative	Grinblatt and Kelohariu (2009)

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