BEHAVIORALBIASES IN INVESTMENT DECISIONS: A LITERATURE REVIEW

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ABSTRACT

In this analysis, which is based on a review of relevant literature, different theoretical and empirical studies relating to behavioural finance are examined. The objective of the study is to analyse the behaviour of investors in their decision-making within the context of financial markets and explain the cognitive anomalies that occur within them. For this purpose, specific investor behaviours have been identified, which relate to so-called financial biases, which influence the attitude of each individual at the time of investing. Two distinct types of financial bias - cognitive and emotional – have been identified by numerous studies, and they are known to correlate with demographic and psychological traits. This review aims to collect all the necessary information to understand the impact that biases have on investors' decision-making processes, identify possible determinants and provide arguments that can help to find possible risk groups wherein biased attitudes are more likely to be present.

Keywords: behavioural finance, financial biases, demographic characteristics, psychological characteristics.

1. Introduction

Behavioural finance is a knowledge discipline, which is linked to the economy and focused on analysing the decision-making process of investors. It is well known that a causal relationship between cognitive and emotional behaviour and activity in the financial markets exists, and this can affect returns. Some such behaviours are considered irrational. Currently, this area of study is attracting greater attention. In 2017, Richard H. Thaler won the Nobel Prize in Economics for his study of behavioural finance and the incorporation of psychology into economic science. Two categories of behavioural finance have been identified (Pompian, 2006):

Behavioural Micro-finance: examines behaviours or biases of individual investors that distinguish them from the rational actors envisioned in classical economic theory, with the aim of explaining investors' behaviour and their decision-making processes. This study is focused on this behavioural finance category.

Behavioural Macro-finance: detects and describes anomalies in the efficient market hypothesis that behavioural models may explain and suggests causes that are related with them. In addition, this field studies the reasons for differences between real market tendencies and efficient theoretical market models, which are defined in traditional finance and economics.

Various works identify financial biases that are associated with investors' different behavioural patterns in their decision-making processes in financial markets (Pompian 2006, Barber and Odean, 2001; Bhandari and Deaves, 2006, among other authors focused on this field). From these biases, different investors' irrational attitudes have been evaluated, which have confirmed the existence of anomalies in financial markets. The investors themselves have caused these effects because their decision-making processes have been altered and are therefore not as effective as they could be.

When anomalies are produced, they cause unexpected fluctuations in markets, so, following behavioural finance theories, efficient market theories fail to fully reflect this situation, relying instead on a theoretical ideal state of efficiency. This hypothesis, formed by Eugene Fama (1965 and 1970), affirms that assets are perfectly valued, because market information is freely available and investors obtain a return based only on risk.

Due to the existence of financial biases, investors can reach incorrect asset valuations, because they take irrational decisions that have an influence on financial markets and,

hence, these themselves are inefficient. Despite the fact that it is undeniable that individuals are influenced by cognitive and psychological factors, some literature claims that there is insufficient evidence that market fluctuations are entirely due to financial biases (Maialeh, 2019; Myagkov and Plott 1997). These authors suggest that these could have only a minor influence on changes in markets.

2. Behavioural Finance

As explained earlier, behavioural finance studies investors' decision-making processes, in order to analyse their behaviour in financial markets. In this field, it is often observed that investors deviate from standard models of utility function, because they have specific characteristics that diverge from standard decision-making theory. Therefore, differences have been observed between rational and irrational investors' theories, which are focused on explaining investors' decision-making processes.

2.1 Behavioural Micro-Finance Characteristics

Following behavioural micro-finance models, an investor tries to maximize his utility function in the decision-making process by using all available information. Consider the following stylized version of the standard model, modified from Rabin (2002), in which utility function U (x | s) is defined as the payment $x^{\frac{t}{i}}$ of player "*i",* and the future profit is discounted with a discount factor (consistent in time) δ. The individual *"i"* at time t = 0, maximizes the expected utility subject to a probability distribution *p (s)* of the states of the world s ∈ S:

$$\max_{x_i^t \epsilon X_i} \sum_{t=0}^{\infty} \delta^t \sum_{st \in St} p(st) U(x^{\frac{t}{i}} | st)$$

However, DellaVigna (2009) has documented some aspects of human behaviour that deviate from the axioms of the standard decision-making theory, especially relating to consumption and investment, which contradict efficient market theories. According to behavioural finance and DellaVigna's study, three categories can be identified: i) non-

standard preferences; ii) non-standard beliefs and iii) social preferences, taking into account that each one has a different impact on the decision-making process.

2.1.1 Non-standard preferences

Non-standard preferences are those priorities that consumers have and are not directly related to the utility function, but have an influence on the decision-making process. In this category, we can differentiate between some types of non-standard preference variations: self-control problems, reference dependence and social preferences.

Self-control problems: according to the micro-economic behavioural standard model, a utility variation between two future time periods does not exist. The decision maker has the same preferences about future plans at different points in time. However, temporal decisions have self-control problems, because individuals plan their future, but as the moment approaches, their decisions can change due to the discount factor, hence, time inconsistencies are created. It has been shown that, in cases like health insurance, homework deadlines or credit card take-up, among others, self-control problems are caused for consumers.

Reference dependence: the simplest version of the standard model proposes that people maximize the global utility function on lifetime consumption. Nevertheless, some experiments deny the existence of a global utility function, proposing a reference dependent utility model. In this case, most decision-making experimental evidence is adjusted. With this new model, some aspects can be explained, like excessive aversion to small risks in the laboratory, the endowment effect for inexperienced traders or the trend to sell assets at a profit rather than those that generate losses, also known as disposition effect.

Social preferences: following the stylized version of the standard model, it is assumed that consumers base purchases only on payment for the product itself. Even so, experiments like *Dictator Game* (Forsythe *et al*., 1994) or *Gift Exchange Game* (Fehr, Kirchsteiger, and Riedl, 1993) suggest that social preferences play an important role in decision-making. Hence, this new model claims to explain actions like charitable donations, workers' strikes and the giving of gifts at fundraising events. However, in contrast to the previous anomalies - self-control problems and reference dependence – social preference models extracted from laboratories are not easily applicable in reality.

2.1.2 Non-standard beliefs

Following the utility function standard model, it is assumed that consumers are, on average, correct about the distribution of states *p (s).* Despite this, some experiments have shown that consumers have systemically incorrect beliefs. This causes consumers to deviate from the expected distribution of states. In this category, three aspects can be distinguished: overconfidence, the law of small numbers and projection bias.

Overconfidence: it has been shown that individuals have more confidence in frequent actions, in such a way that they believe they know how to undertake an action better than they actually can. Overconfidence is more common when feedback is noisy and the decision-maker has an illusion of control. As such, overconfidence helps to explain patterns in credit card take-up, value-destroying mergers and investment-cash-flow sensitivity, not to mention excess trading, momentum, and long-term reversal.

The law of small numbers: this model suggests that individuals tend to believe that a sample distribution is distributed in the same way as a population distribution, regardless of the sample size. People tend to extrapolate population distributions in all cases. This effect can cause over-inference and induce a long-term negative returns correlation.

Projection bias: consumers expect similarity between future preferences and current ones; hence, projection bias influences their future economic predictions, without analysing any other important information that may be available.

2.1.3 Non-standard decision-making

Even following utility maximization theory and correct belief assumptions, it can still be possible for consumers to make non-standard decisions. Aspects like limited attention, menu effects, persuasion and social pressure or consumer emotions can cause this phenomenon.

Limited attention: in standard models, it is assumed that consumers have all the necessary information, however, this is rarely possible. In reality, individuals can neglect or not fully analyse essential information in the decision-making process, or directly not gain access to important data. Aspects like inattention to shipping costs and any kind of fees and charges, inattention to complex information in rankings or inattention to financial news, are examples of limited attention.

Menu effects: individuals usually try to simplify their range of choices within their options menu as much as possible. In such cases, decision-makers have the aim of avoiding diversification or difficult choices, thus increasing their preference for the familiar or salient, and preventing confusion. Applying these tactics, individuals may discard better options and entirely overlook others, thus serving to increase risk in their investments.

Persuasion and social pressure: in the standard model, individuals take the incentives of the information provider into account. However, many neglect the fact that incentives can cause an excessive impact of the information provider on the individual's beliefs, also known as persuasion. In addition, social pressure can change individuals' choices, leading them to make non-standard decisions.

Emotions: there is a large number of psychological studies, which suggest that emotions play a crucial role in the decision-making process. Furthermore, it has been observed that each emotion type can influence decisions in a different way. Within this arena, two emotion types have been studied: mood and arousal. On the one hand, mood has an impact on risk aversion or perception of volatility and a projection of the trajectory of economic fundamentals. On the other hand, arousal can have a powerful short-term effect on the decision-making process.

2.2 Investment Decision

Investment is defined as expenditure made now affected by past investments' returns and the expected returns in the future (Subash, 2012). There is a structured process for making investment decisions, starting with considering a set of different alternatives faced by the decision maker. Marchand (2012) explains that most investors only consider a narrow set of options that contain important or markedly different information from the other available alternatives, because the full range of possible actions exceeds comprehension. In addition, Sanglier, M. *et al* (1994) show that if different investors receive the same information they will make their own interpretation of this information, leading to different perception of the information and creating differentiated behaviours among investors.

A substantial body of literature affirms that investors act rationally and consider all information available in their respective markets. In fact, most traditional finance theories and propositions assume that financial markets and their participants behave rationally.

The “Efficient market hypothesis” (EHM), proposed by Eugene Fama (1965), suggests that, in a market, there are large numbers of rational investors, who make accurate decisions and aim to maximize profit. They actively compete and try to predict the future, using all freely available information. Therefore, we can define a rational investor as an individual who competes in a market with the objective of getting returns by using all available information.

However, a large number of researchers have documented numerous cases of irrational behaviour among investors. The overall findings pose many questions about the nature of investor’s homogeneous expectations in the market. For example, Peter (1999) defines ‘irrationality’ as the evidence of repeated patterns of inconsistency and incompetence in the assessment of market information: the ways by which each person arrives at a decision when faced with uncertainty. According to this work, we can define an irrational investor as an individual whose decisions are based on patterns and psychological aspects, creating biases in their investment decisions.

Kahneman and Tversky, in the field of financial behaviour, described three theories to explain how irrational investors behave. First of all, prospect theory, which was proposed in 1979, suggests that decisions on financial markets are based on the potential value of losses and gains, instead of considering the outcome. Secondly, heuristic theory, which was introduced in 1974, explains that individuals’ decisions are based on their beliefs, especially concerning the likelihood of uncertain events. Finally, in 1981, Kahneman and Tversky introduced framing in the investment field, in order to understand how investors make their decisions in financial markets, depending on how the situation is shown to them, during the moment of making financial decisions. They suggest that financial behaviour depends on the way that decision problems are framed to individual investors.

2.3 Prospect Theory

Kahneman and Tversky described prospect theory in 1979, which suggests that individuals make decisions based on the potential value of gains and losses, rather than focusing on the final net profit of those trades seen in aggregate. They observed that losses hurt about twice as much as gains make us feel good, because people experience more pain from loss than from pleasure with equal gain, as shown in Figure 1. Therefore, prospect theory aims to describe the current behaviour of people quite differently from utility theory.

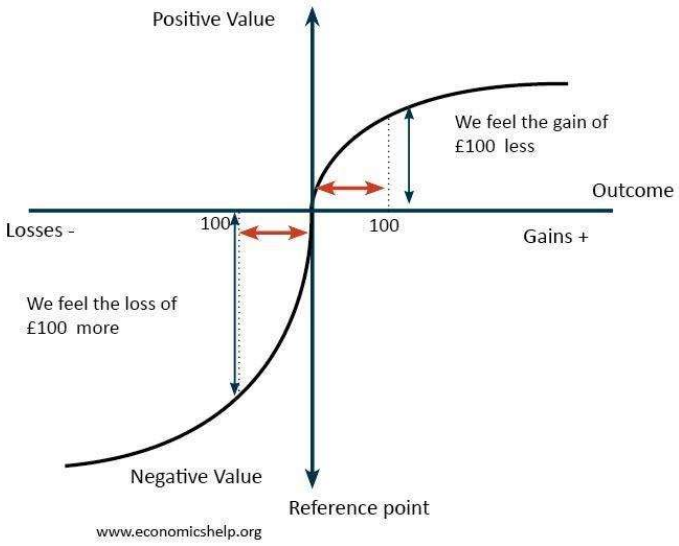

Figure 1: Graphic Description of Prospect Theory

Source: economicshelp.org

Prospect theory affirms that people tend to take larger risks to avoid losses, rather than taking risks to earn profits. Investors will tend to be risk-averse when they find benefits, but they will become risk-seekers when they perceive losses. This finding contrasts with the expected utility theory from Markowitz (1952), who suggested that rational investors exhibit consistent behaviour in all types of circumstances. This theory also tries to explain the cause of the disposition effect, a financial bias that is very common among investors, which describes how investors buy and sell assets, depending on the psychological value of them. Furthermore, prospect theory is also related to loss aversion bias, because it is focused on explaining how investors try to avoid generating losses. Both of these will be explained in more detail later.

According to Barberis (2013), prospect theory has applications in different fields, apart from investment. For example, in insurance, it has been shown that people tend to pay higher premiums because they prefer to protect themselves and avoid unexpected payments, which psychologically hurt more than paying a higher monthly premium. The endowment effect is also related to this theory, because people tend to add more value to an item when they lose it compared to when they first purchased or received it. Finally, consumption and saving decisions have interesting connections with prospect theory. Individuals are more sensitive to news about unexpected payments in the present than those that may occur in the future. As a result, people tend to save more whenever they are able, to reduce perceived pain when they need to make an unexpected payment.

2.4 Heuristic Theory

Tversky and Kahneman (1974) introduced the term heuristic, explaining that investors make their decisions using strategies to access complex problems and limit explanatory information. Those strategies are based on the beliefs about the probability of uncertain events. Some examples of heuristic strategies are using intuitive judgements or mental shortcuts, in order to reduce thinking time and make faster decisions.

Fromlet (2001), who concludes that investors interpret information quickly by relying on past experience and intuition under conditions of uncertainty, adds to heuristic theory. This behaviour increases investors' capacity to make mistakes, because they use rules of thumb in their investment decision-making process. Even so, this approach can help investors to reduce decision-making time and facilitate faster market reaction.

In their initial research, Tversky and Kahneman classified heuristics into three groups, according to different types of decision-making processes. The first, availability, explains that people tend to evaluate specific situations using immediately available examples and data, in order to optimize decision-making. Secondly, representativeness is shown in individuals when they use categories to classify situations and make faster decisions. Finally, anchoring affirms that people are influenced by a particular reference point which has an impact on decisions. Representativeness and anchoring will be explained also as financial biases.

2.5 Framing Theory

Framing was introduced in finance in 1981 by Kanheman and Tversky, who explain that the framing effect exists in investors. According to their study, individuals are influenced by the way that information is presented to them. In fact, investors can react differently to the same information, depending on how it is presented to them during their decision-making process.

According to Shefrin (2000), who explained some basics of framing theory related to investment, behaviour depends on how options or challenges are presented to investors. This theory differs from traditional proponents, who affirm that framing is transparent and individuals know all possibilities about how cash flows might be described. However, many frames are not so transparent, and are considered opaque, because investors have difficulty seeing through them clearly. Consequently, people change their behaviour

and decision-making processes because of their frame dependence (or because a particular frame is imposed).

Shefrin's study holds that framing is produced by three causes. One of them is loss-aversion, which suggests investors are susceptible to the notion of not being a loss-averse investor, so they tend to be more conservative. Another cause is making concurrent decisions. Investors must sometimes make several decisions at the same time and are influenced by their psychological condition. In addition, hedonic editing explains that investors can prefer some frames to others, as they tend to yield more perceived pleasure in how they make their decisions. The extreme view of this theory is narrow framing effect, which describes that investors tend to treat every decision as unique and separate. Kahneman and Lovallo (1993) affirm that individuals neglect the most complicated choices, focusing on a few aspects of a situation and changing their preferences during their decision-making process.

3. Financial Biases

Rational decision-making processes derive from structured and rational thinking, where different alternatives exist. As has been explained before, according to Sanglier *et al.* (1994), it can be shown that if different investors receive the same information, they will make their own interpretation of the data. These diverse interpretations will cause different market perceptions and will create different behaviours, which finally generate financial biases. The different behaviours have a market influence, through investors' decision-making processes, because the information interpretation is non-uniform and each investor will take a different decision. Behavioural factors are important in financial markets because they reflect perception and interpretation differences in investors' financial decisions.

From another perspective, financial biases are irrational behaviours that individuals show during the financial decision-making process and can alter the utility function of the micro-economic behaviour standard model. These anomalies are present in daily practice and can modify all of the economic decisions made by a person, from going shopping in a supermarket to asking for a bank loan. Given this, it is important to consider all existing financial biases, with the objective of explaining these behaviours, which are not rational and are related to finance and economics.

Since this study is focused on evaluating investor actions, the main topic is individual behaviours that intervene in financial markets. In such cases, financial biases cause the existence of anomalies in stock exchanges, such as high volatility, overreaction or low reaction to market changes, all of which cause inefficiency in markets. Hence, it is observed that different types of financial biases exist and these are associated with how investors make their decisions in stock markets.

In this analysis, attention has been paid to those biases that have helped investors' demographic and psychological analysis. Pompian (2006) classified financial biases in two categories, depending on the origin of them: cognitive and emotional biases. In short, cognitive biases involve decision-making based on established concepts that may or may not be precisely correct, while emotional biases are not based on conceptual reasoning, because they came from individuals' impulse or intuition. Furthermore, in general, emotional biases are more difficult to overcome than cognitive biases.

3.1 Cognitive biases

A cognitive bias can be defined as a psychological effect in humans, which produces deviations from accurate judgement, leading to irrational interpretations. It is believed that cognitive biases are originated in individuals because they try to make rapid decisions, rather than analyse the situation, in order to be more effective. Tversky and Kahneman introduced the notion of cognitive biases in 1972, explaining that they originated because people do not have sufficient numeracy, or they are unable to be intuitively reasonable at greater orders of magnitude. Tversky and Kahneman also explained that humans have differences in judgment and accordant decision-making deviations from rational thinking, referred to as heuristics. Since then, researchers have described a great number of cognitive biases, which could be present in our daily life. In this study, it is explained some examples of them:

Overconfidence: also explained as a non-standard preference, overconfidence is observed when an individual has a high level of confidence in his or her investments. Particularly, if investors work alone (as opposed to as part of a team), they tend to feel more confident because they have more security in themselves and in relation to all the existing investment possibilities. Barber and Odean (2001), also explain that investors have more security in their own investments than assessments offered by others. They affirm that disproportionate confidence in their own valuations is often present, which

leads to differences of opinion and influences trading. This bias occurs because individuals believe that they have greater capabilities and skills than other investors, hence, they may increase their purchases and sales and make mistakes doing so.

Representativeness: individuals who exhibit representativeness tend to make changes in their investments, basing them on rapid evaluations and simple rules. Such investors do not carry out a comprehensive investment analysis and often give too much importance to new information. Ritter (2003) explains that representativeness bias happens when individuals make their decisions based only on limited information from their immediate surroundings, ignoring other important data. In addition, people extrapolate past trading tendencies to the present in order to inform future purchase decisions, because investors think that past performance is the best indicator to follow. Future prospects also change, because investors with a high representativeness level expect to generate a quick profit without having evaluated risks.

Self-attribution: investors tend to attribute their own talent and skill to investments that generate gains, while the blame for those that cause losses is passed to others or written off to bad luck. In short, such investors tend not to accept responsibility for mistakes made. Normally investors do not assign guilt to themselves when they have losses in their investments. For these reasons, Odean and Gervais (2001) explain that self-attribution drives investors to take on inappropriate levels of financial risk and to trade aggressively, amplifying personal market volatility. Consequently, self-attribution bias usually generates over-confidence, and may cause investors to discard information that does not confirm their opinions.

Anchoring effect: a reference point such as economics news, market situations or company information, can influence investors' predictions and decisions. As there is often an excess of available information (but not necessarily relevant information), investors focus on data that they believe to be most important. According to Tversky and Kahneman (1974), anchoring bias occurs when people trust too much in pre-existing information or believe that the first information they find is the best when they are making decisions. The anchoring effect tends to cause investors to be drawn away from relevant information, above all new information, because they either fixate on a past reference point or else lose themselves in volumes of less relevant information. Either way, this causes investors to react too slowly to new, relevant data. For example, the most common anchor used in financial markets is asset prices, because purchasing and selling decisions are normally based on price, as a reference point.

Mental accounting: investors who show a mental accounting bias tend to take each portfolio item separately, rather than analysing the overall portfolio, and as such, they do not take enough account of the bigger picture and overall trajectory. Thaler studied this bias in 1999, describing mental accounting processes and observing that, firstly, investors evaluate past results to inform their future decisions, then, place their investments in specific categories and, finally, evaluate their investment categories. This tends to be comparatively slow and laborious, and leaves such investors at a relative disadvantage. Investors, who present a mental accounting bias, normally categorize their funds into either (a) the way that the money has been obtained or (b) the way in which the money is intended to be used.

Table 1 shows a summary of cognitive biases, with authors and some conclusions:

FINANCIAL BIAS	DEFINITION	CONCLUSIONS
Overconfidence Barber and Odean (2001)	Investors have more confidence in their decisions, because they think they have good investment skills.	A false illusion of control exists; hence, investors take market decisions without seeking all possible data.
Representativeness Ritter (2003)	Simple rules and rapid analysis are used as a base to make their investment decisions.	Individuals only use limited data, avoiding analysing other sources and important market information.
Self-attribution Odean and Gervais (2001)	Gains are attributed to talent and investors' skill, but losses are assigned to bad luck or other circumstances.	Confidence increases when investors are earning income, leading them to seek information that confirms their ideas.
Anchoring effect Tversky and Kahneman (1974)	Investors will select an anchor (reference point), to simplify all available information and focus on what they believe to be the most important data.	Other relevant information could be overlooked, in addition to causing slower reaction to market changes.
Mental accounting Thaler (1999)	People create categories to classify gains and losses, depending on their origin or the way money is to be used.	Money is not evaluated as an outcome only, and investors' behaviour changes depending on their categorisation of money.

Table 1: definition and conclusions of cognitive biases (author's own analysis).

3.2 Emotional biases

An emotional bias can be defined as a distortion in thought, caused by emotional factors. Normally, emotional biases originate spontaneously, at or before the time a decision is made, and are influenced by personal feelings and experiences. People who tend toward emotional biases often pursue positive emotional experiences and avoid unpleasant feelings, in order to feel comfortable with their decisions. According to Shah *et al.* (2012), emotions have a huge impact on investors, because their decisions in financial markets are affected by their beliefs and mood, hence, they cannot remain rational for long periods of time. The main factor that influences emotions in investment decisions is risk. Loewenstein *et al.* (2001) described that people respond to risky situations too highly influenced by emotions, causing emotional biases to have a disproportionate impact. The emotional reaction to risks can differ from the cognitive evaluation of the same risks. Researchers have described different types of emotional biases, since behavioural finance emerged as a discipline. Some examples are explained below:

Disposition effect: investors tend to sell assets that have increased in value, but at the same time, they tend to hold those which have unrealized losses, due to the discomfort of losing and the enjoyment of generating gains. According to Kahneman and Tversky, and prospect theory (1979), investors add more emotional value to money when they make a loss, in comparison to when they make a profit, on equal terms. Consequently, the disposition effect causes a lesser reaction to new information, because investors are more focused on their assets' values than searching for new relevant data. Other studies undertaken by Odean (1998), Bailey *et al.* (2011) and Henderson (2012), confirm that investors have a greater propensity to sell assets with gains that those that have losses.

Herding: investors who do not plan their investments or do not research relevant information normally undertake "popular" investments in financial markets (they essentially follow the crowd). Humra (2014) affirms that herding bias occurs because large groups of investors who base their actions on similar information exist, ignore other relevant information. This behaviour has been observed for example during economic bubbles, wherein speculation causes relatively under-informed investments and high levels of purchases. In addition, herding bias can be also clearly observed in massive sell-offs, such as for example during the Coronavirus crisis, when many investors sold the majority of their holdings due to fear of a new, global economic crisis. As a result of herding bias, investors tend to be less risk-averse, because they are confident that common trends represent the safest and easiest way to generate profits.

Familiarity: this bias occurs when investors only invest in assets that are well known to them, because it is believed that having better knowledge about an investment will result in greater potential for profit. However, this phenomenon can lead to a false sense of security. Investors who present familiarity biases normally buy and sell national assets, because they tend to feel more comfortable and confident with that type of investment. Evidently, because of familiarity bias, diversification is reduced (concentrating risk in a narrower set of assets). Another example of familiarity bias is when individuals invest only in companies that are related to their own work sector, because they base their investments on having a better knowledge and confidence relating to such companies. Familiarity bias normally implies having positive attitudes toward the companies which are well known by investors. According to Aspara & Tikkanen (2008), individuals tend to invest in companies which have generated positive experiences for them in the past, and, conversely, people tend to get products from companies that they have invested in.

Over-optimism: normally, investors who show over-optimism bias have an unrealistically positive view of their acquisitions, and believe that those investments will generate profits. Furthermore, this type of investor tends to believe that they have greater skill than their peers or competitors. Prosad (2014) explains that this bias occurs because investors make mistakes in their future forecasts and overrate their ability to distinguish winning investments, thus causing them to believe that diversification is unnecessary. Having over-optimism bias can lead to poor long-term investment management, even in cases where assets generate profits. Another important aspect is that investors who show over-optimism tend to rely on leverage to finance their market movements. This can leave an investor enormously exposed in a highly leveraged acquisition, leading to large debts, even with profits.

Loss aversion: this approach assumes that investors make the majority of their mistakes during the moment of purchasing and selling assets, because individuals take disproportionate risks in order to balance profits and losses, in addition to losing focus on the long-term net outcome. This bias is related to prospect theory set out by Kahneman and Tversky (1979), explained previously. Investors who suffer loss aversion bias try to avoid selling assets when they are incurring losses, rather than sell and lose money. Barberis and Thaler (2003) relate this behaviour to stress amongst investors, because they try to be more prudent in their investment decisions, in order to reduce the risk of accruing losses. In addition, investors commonly discard commonly favoured options, choosing instead the option which is most remarkable (also known as isolation effect). This occurs because investors tend to think that choosing different options from

others in the same group will reduce risk and losses, but it often leads to inconsistent preferences, when the same option is shown in different ways.

Table 2 summarize emotional biases, with their definitions, authors and conclusions:

FINANCIAL BIAS	DEFINITION	CONCLUSIONS
Disposition effect Odean (1998) Bailey *et al.* (2011) Henderson (2012)	Money is valued more when it is lost that when it is gained, because there is a feeling of discomfort with losses.	People are more focused in how their investments are working, so they tend not to seek relevant information as often as they should.
Herding Humra (2014)	Individuals follow popular investment trends, because they think that doing so will work because it appears to be working for others.	Investors do not seek information to ensure that popular trends are correct, hence, inefficient decisions can be taken.
Familiarity Aspara & Tikkanen (2008)	Well-known assets are invested in, because people believe that they have better knowledge of them.	A false sense of security is created among investors and they also limit their range of investment.
Over-optimism Prosad (2014)	Investors tend to have positive feelings about their decisions, thinking that their investments will generate profits.	People overrate their assets and diversification is avoided, in addition they often rely on leverage, exposing themselves to debt.
Loss aversion Barberis & Thaler (2003)	Individuals prefer not to sell and incur in losses so they hold loss-making investments and sell those making profit.	Investors tend to be more prudent in order to not lose money, but doing so may cause flawed decisions at the moment of purchase or sale.

Table 2: definition and conclusions of emotional biases (author's own analysis).

4. Investors' Demographic Characteristics

There is a clear relationship between an investor's behaviours and biases, and their demographic characteristics. Each financial bias can be shown in a different way in a person, depending on which demographic aspect is evaluated. Those differences help to create an ex-post analysis of each kind of person, identify sensitive groups and anticipate or reduce their irrational behavioural impact on the decision-making process.

This part of the project is focused on a study of Indian investors published by Baker *et al.* (2019), which examined the relationship between financial biases and demographic variables, using the financial biases analysed previously. Currently, the Indian financial market is very attractive for individual investors, because it has high liquidity and efficiency. Furthermore, Indian stock market also provides a wide range of investment and saving products, in addition to being highly diversified. For now, Indian economy has nine times more individuals investing directly in its stock market than through mutual funds in comparison to those in any other equity market (Ramadorai, 2013).

Apart from demographic characteristics, financial knowledge has been also included in this study, as it is self-evidently a key factor for the analysis and is related to investors' behaviour. Some researchers like Takeda *et al.* (2013), suggest that financial knowledge is necessary for all investors, in order to improve their behaviour related to financial products and services. Agarwal *et al.* (2015) find that investors who have an elevated level of financial literacy base their decisions on interest rates, inflation and risk diversification, because they are also interested in market and financial dynamics. In addition, they report that financial knowledge is associated with better financial planning. According to Van Rooij *et al.* (2011), people with a lower level of financial literacy, usually participate less frequently in markets, because they are less interested in investing their money in financial markets and are more loss- and risk-averse.

Having analysed financial biases and their relationship with demographic characteristics and financial knowledge, Baker *et al.* (2019) and other authors provide the following results:

Gender: on the one hand, men tend to suffer overconfidence in comparison with women, because they believe themselves to have better market knowledge and tend to assume greater risk (Barber and Odean, 2001; Bhandari and Deaves, 2006; Lin, 2011; Kumar and Goyal, 2016). In addition, men also tend toward a higher level of mental accounting bias (Baker *et al.* 2019). On the other hand, it has been suggested that women are more prone to suffer herding bias, because they more commonly base their investments on general information and market tendencies (Eagly and Carli, 1981). Furthermore, they usually exhibit a higher disposition effect, because women generally have greater risk aversion and are more averse to having losses in their investments (Baker *et al.* 2019).

Age: this is a highly important variable, because it has a stronger association with behavioural biases than the other factors analysed. Overconfidence and familiarity tend to reduce with age, because over the years, people acquire more investment experience

and become more aware of the value of money (Prosad *et al.*, 2015; Bashir *et al.*, 2013; Tekçe *et al.*, 2016). Likewise, when age is greater, representativeness and anchoring biases are reduced and, to a lesser degree, self-attribution and herding bias decrease too (Baker *et al.* 2019).

Marital status: normally singles, in comparison to married people, are more prone to suffer over-optimism, loss-aversion and over-confidence, because they have a higher perceived degree of freedom and monetary independence, and therefore tend to take on greater risk (Ates *et al.*, 2016; Bashir *et al.*, 2013). In addition, married people tend to be less prone to mental accounting, because they usually have a greater knowledge of their accounts (Baker *et al.*, 2019).

Education: investors with higher education levels tend to suffer less noticeable disposition effect (Goo *et al.*, 2010) and use to be more overconfident (Bhandari and Deaves, 2006; Deaves *et al.*, 2010). However, when they possesses a lower education level, it is common for investors to suffer more representativeness and mental accounting (Ates *et al.*, 2016, Baker *et al.*, 2019). Both factors occur because investors who have achieved a higher education level tend to be more capable of evaluating and studying financial markets, using criteria that are more informed. Logically therefore, more highly educated investors tend to think that they are less prone to making mistakes, because they have more confidence in their decisions.

Occupation: investors who are employed present a higher association with over-confidence and over-optimism; while on the contrary, individuals without a job tend to suffer herding bias (Prosad *et al.*, 2015). It is also noteworthy that retired people and homemakers are more prone to suffer representativeness, the anchoring effect and overconfidence bias, in comparison to employees (Baker *et al.*, 2019). Perhaps counter-intuitively, employed investors tend to be more careful in the investment decision-making process, avoiding risks and seeking useful information. In addition, the disposition effect is less common in self-employed individuals, in comparison with employees who work in the private sector, and public sector employees tend to suffer more herding bias than self-employed and private sector workers (Baker *et al.*, 2019).

Annual income: on the one hand, the disposition effect and overconfidence are related to investors with low annual income, because they earn less money and losses have a greater financial and psychological impact. This type of investor tries to manage his or her investment situation in order to gain profits in the future, but they often do so by taking on more risk (Dhar and Zhu, 2006; Kumar and Goyal, 2016). On the other hand,

familiarity is more present in investors who have a high annual income, and they often take lower risks when investing in companies about which they have greater knowledge (Kumar and Goyal, 2016).

Investment experience in the stock market: investors who have more investment experience in financial markets tend to suffer more overconfidence, self-attribution and the anchoring effect (Glaser *et al.*, 2004, Ates *et al.*, 2016). In addition, a greater level of investment experience tends to minimize representativeness, the disposition effect and mental accounting (Baker *et al.*, 2019). On the one hand, investment experience in the stock market causes greater focus on data and its analysis, in order to avoid past mistakes. However, on the other hand, it creates a false sense of control over acquisitions, because investors relate their last experience with greater accuracy in their future investments.

Financial knowledge: investors with greater financial knowledge, such as using market dynamics, knowing asset classes and interest rates, tend to present less disposition effect (Dhar and Zhu, 2006), are less prone to overconfidence (Takeda *et al.*, 2013) and suffer comparatively little herding bias (Baker *et al.*, 2019). However, investors with high financial knowledge level tend to suffer mental accounting bias (Baker *et al.*, 2019), probably because this type of investor tends to have more complex portfolios, and they need to divide their stocks into separate mental accounts. Nonetheless, there are studies that suggest that greater financial knowledge has a comparatively weak effect on investor behaviour overall. According to Fernandes (2014), financial knowledge does not reduce, at all, the level of irrational behaviour amongst investors. Further research in this area is required in order to understand how financial literacy affects investors.

5. Investors' Psychological Characteristics

Financial biases are also related with investors' psychological characteristics, playing an essential role in the different ways of acting and thinking. This psychological analysis is based on the Big Five personality traits model proposed by Goldberg in 1993. In this theory, it is suggested that five dimensions describe how the people act and think within groups and by themselves. These big five traits contain most known human traits and are assumed to represent the basic structure behind all existent personality traits. The

five dimensions of Goldberg, with the support of the study made by Robbins *et al.* (2008), are explained, as follows:

Neuroticism: describes people with a tendency to be pessimistic, with regular feelings of anxiety and depression. Such individuals are described as being emotionally unstable. People with high levels of neuroticism are often stressed and tend to interpret ordinary situations as threatening or insignificant problems as being difficult to overcome. Aspects like insecurity, nervousness and impatience are related to neuroticism.

Extraversion: describes people who interact enthusiastically with others. Individuals who tend towards extraversion often have a greater group view, be more dominant in social situations and are perceived as people with a substantial amount of energy and vitality. Assertiveness, optimism and openness are examples of characteristics that are ascribed to extraverted people.

Agreeableness: describes people who are pleasant, kind, generous and rely on themselves and other people, engaging with others whenever necessary. Agreeable people tend to have positive relations with their environment, have leadership capabilities and tend to empathize with others' feelings. Agreeable people share characteristics like cooperativeness, trust and friendliness.

Openness: describes curious people that are attracted to new emotions and want to try new experiences. Open-minded individuals may undertake unpredictable actions, without a solid methodology or plan, often leading to high-risk conduct. These individuals often tend to seek extreme emotions, especially the euphoria associated with success. Widely open people are creative, curious and inventive.

Conscientiousness: describes a psychological characteristic linked to discipline and control. Conscientious individuals tend to regulate their impetus in order to avoid risks. This factor is more present in adults than in younger people, because as a function of time, people accrue greater responsibilities and must take care of themselves and others. Furthermore, people who present conscientiousness tend to be more persistent, focusing on their objectives and planning their actions carefully. Conscientiousness also refers to individuals who are serious, organized and dependable.

This section is based on Huei-Wen Lin's study published in 2011, which analysed psychological aspects and their relation to the population of Taiwan. It also draws on a study undertaken by Bashir *et al.* (2013), which focused on the same objective, but in

Pakistan. These articles are used as references, set alongside the disposition effect, herding and overconfidence financial biases. Using both studies, the relationship between financial biases and the Big Five personality traits model is described below:

Neuroticism: investors with neurotic aspects are more prone to suffer the disposition effect, because they tend to worry about their losses, irrespective of their net outcomes (Lin, 2011). Herding bias is also linked with neurotic people, because they tend to base their financial decisions on others' ideas and opinions, and may hold disadvantageous stocks in the hope of higher prices (Schaefer and Williams, 2004). Emotional instability causes investors to have a lower level of surety; hence, there is no correlation with the overconfidence bias (Bashir *et al.*, 2013).

Extraversion: there is positive correlation between investors that suffer extraversion and herding bias (Lin, 2011), because they prefer to follow popular trends that have been established and "proven" by other investors. In addition, overconfidence can also be observed in extraverted investors, because of their energetic nature and positive thought patterns (Barber and Odean, 1999; Bashir *et al.*, 2013).

Agreeableness: being agreeable is related positively with the herding bias (Bashir *et al.*, 2013); this type of investor tends to rely on other people and believe in their recommendations, in addition to thinking that popular trends will occur frequently. Overconfidence can be also identified in agreeable investors, because they are often more optimistic about their investments (Jamshidinavid *et al.*, 2012).

Openness: on the one hand, herding bias is normally present in open-minded people, because they prefer to try popular trends, but without doing an exhaustive analysis of the investment, seeking information only in generic media, like newspapers and institutional investors' suggestions (Lin, 2011). On the other hand, overconfidence is also related with open-minded people, because they tend to believe firmly in their investments, despite the risks taken (Barber and Odean, 1999; Bashir *et al.*, 2013).

Conscientiousness: investors with a high degree of conscientiousness are more prone to be associated with the disposition effect, because they take more care in their investments, in addition to trying to minimize their losses (Lin, 2011). Furthermore, there is also an excess of confidence in conscientious investors, because despite being careful with the process of acquisition and disposal, their action can create the illusion of control (Jamshidinavid *et al.*, 2012; Bashir *et al.*, 2013).

6. Conclusions and Final Discussion

In the behavioural finance field and through historical analysis focused on individual behaviour, it is clear that, firstly, financial biases are present in individuals' daily routine, from an insignificant one-off purchase to a sophisticated investment decision. Specifically, this study has investigated the latter case, and confirms that the existence of financial biases can cause irrational decisions in individuals' investments, and consequently, purchase, and selling mistakes. As such, investors often do not maximize the utility function proposed by Rabin (2002).

If individual investor's decision-making processes can be flowed, one has to consider the possibility that anomalies exist in financial markets, leading to inherent inefficiency. It is very important to recognise this fact, because it contradicts the efficient market hypothesis devised by Eugene Fama. As has been observed, people can rightly assume that financial markets are inefficient, due to the existence of financial biases, hence, it is possible to explain a number of financial phenomena. Cases such as the Wall Street Crash of 1929, the financial crisis of 2008 and the current economic crisis caused by the COVID-19 pandemic can readily be linked to financial biases and irrational behaviour.

This analysis has shown that demographic characteristics are related to financial biases and investors are almost by definition prone to suffer some kind of financial bias because of their demographic characteristics. On the one hand, age, occupation and investment experience are the most important characteristics in relation to financial biases overall. On the other hand, overconfidence, mental accounting and the disposition effect are the most common financial biases shown specifically amongst investors. Generally, it is important that people identify which biases they tend towards, which mistakes are made during the investment decision-making process as a result of those biases, and address them accordingly.

Financial knowledge is the most important characteristic when analysing investors' financial behaviour. Self-evidently, investors who do not have solid financial knowledge will be more prone to making mistakes. Again, this runs contrary to efficient market theory. Investors must try to seek the greatest amount of relevant information possible in order to make their own investments. To do so, it is essential for an investor to have an understanding of the fundamentals of finance, like knowing the market and being able to interpret companies' annual reports and accounts.

Investors' psychological characteristics appear to have a direct relationship with financial biases. Investors' natures may influence their investment decision-making processes, hence, it is important to analyse them and help investors, in order to reduce their use of feelings and intuition in investment decisions. Using the Big Five personality traits model proposed by Goldberg in 1993, conclusions have been drawn relating to each of them.

Neurotic investors are recommended to set stop limits, in order to control exposure to different asset classes and their accordant risk, and to try to avoid the disposition effect and herding bias. Extraverted investors should be supported by financial experts, with the objective of gaining accurate information and preventing overconfidence and herding effects. Regarding agreeableness, it can be helpful in gaining the greatest quantity of relevant information possible in order to avoid overly trusting others' recommendations. With reference to openness, it is an important characteristic when conducting an exhaustive market investigation, deciding which market movements are relevant, and thereby reducing unexpected risks and avoiding herding bias. Finally, conscientious investors should be carefully and repeatedly advised, in addition to being provided with relevant information, both of which can moderate their tendency towards overconfidence.

Financial biases influence investors, hence, it is important to reduce their irrational behaviour, in order to increase stock returns and reduce market anomalies. Ensuring that investors avoid making mistakes by themselves is difficult; hence, it is necessary that public and private financial institutions seek to limit the impact of financial biases on markets. On the one hand, public sector actors should try to ensure adequate financial education of the population at large, as it will help to increase financial knowledge and literacy, and reduce investment mistakes. Measures like economic education during school or public awareness programs to investors could be an important way of reducing investors' biased behaviours in financial markets. On the other hand, the private sector must devote greater attention to understanding investors' attitudes and analysing their behaviour during their decision-making processes, with individual evaluation programs, in order to limit mistakes and provide (in theory at least) greater investment success. Personal tests for investors and analysis of how they act in critical situations may also help private sector investors to improve individual investors' behaviour in markets.

Such actions could ultimately promote benefits for society. If financial knowledge and literacy are increased, investors will tend to reduce their irrational behaviours, which could have a net positive impact on the macro-financial landscape. As a result, financial welfare should increase overall, not only amongst investors, but also throughout society and the global economy.

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