# An investigation of Investors Bias on Saudi stock exchange

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*Abstract*

***Purpose*** *– The main purpose of this research is to examine how psychological biases affect Saudi investor's decision making. The paper highlights the major psychological factors affecting Saudi investor.*

***Design/methodology/approach*** *– We use a survey approach to gather primary data from a sample of Saudi investors. We distribute a questionnaire describing some scenarios related to behavioral biases, either suggested by the theory or extracted from the reality. The data were analyzed using descriptive statistics, correlation and factor analyses.*

***Findings*** *– The results suggest that Saudi investors are characterized by overconfidence, low opportunism, sensitivity to rumors and mimetism biases. The evidences in this research suggest that most of the psychological biases could possibly hinder investors from making rational decisions.*

***Research limitations/implications*** *– Understanding investors' biases can help them improve their decision-making processes. This study focuses on individuals' behavioral biases in investment decision-making. Our findings show that Saudi investors are not much different from other investors, which corroborate the predictions of behavioral finance. However, this paper didn't address the link between these biases and investor characteristics as age, gender, background, experience, origin etc….*

***Originality/value*** *– The paper investigates the most important market of MENA region using primary and timely data (December 2016). Moreover, we avoid direct or trivial questions and design scenarios to capture the inherent bias of investors in order to avoid subjective responses.*

***Keywords: Behavioral Finance, Behavioral biases, Overconfidence, over opportunism, mimetism, Saudi Stock Market***

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# 1. Introduction

Ernest and Young conducted an online survey during the period june-july 2016 to assess the market perception and sentiment on the GCC real estate sector due to the decline in oil prices. The results show a negative impact, but the majority of the respondents expect a recovery in one to two years. This optimistic attitude of investors contrasts with the concern of the government who came up with the 2030 vision to reduce the dependence on oil and find other sources of revenue. Another study (Canepa & Ibnrubbian 2014) investigated the effects of religious beliefs on stock prices of Saudi Stock Market. Their findings support that Sharia-compliant stocks have higher return and volatility than their non-Sharia compliant counterparts. A previous study (Alnajjar 2013) confirmed that Saudi investor behave irrationally. These findings raise the issue of rational behavior, especially during crises and appeal for the investigation of Saudi investors' biases after the sharp drop of oil price and its negative impact on the economy.

Moreover, another survey made by Sapienza & Zingales (2013), shows that 100% of economic experts agreed that it is hard to predict stock prices, whereas this percentage is only 55% of average Americans. This percentage decline to 42% when told that economic experts agree that such forecasts are difficult. These results explain the survival of the two schools of thought today to explain the behavior of the investors: the rational finance and the behavioral finance schools. The rational finance build on the first group (experts) and continues to believe in rationality and attributes anomalies observed in capital markets to new dimensions of risk. However, the behavioral finance built on the second group (average or normal people). Without any doubt, Saudi investors, as most investors in the region, belong to the second group (normal people).

Undeniably, rational finance continues to believe in rationality and attributes anomalies observed in capital markets to new dimensions of risk. The most proposed explanations are high price variation (Johnson 2002), Downside risk (Ang, Chen & Xing 2001), Business cycle variation (Chan, Jegadeesh & Lakonishock 1996, Yuong & Simon 2001 & Chordia & Shivakumar 2002), and increase in fiscal expenses (Grinblatt & Moskovitz 2004), natural persistence of cross sectional returns (Konrad & Kall 1998 & Berk, Green & Naik 1999) and industrial component of return (Moskowitz & Grimblatt 1999). However, behavioral finance argues that some financial phenomena cannot be explained using rational models. Sewell (2001) defined the behavioral finance as a study of the influence of psychology on the behavior of financial practitioners and the subsequent effect on markets. Statman (2010, 2014) defined behavioral finance as one dealing with normal people as contrasted with rational or standard finance which deals with rational people. What normal investors really want is utilitarian, expressive, and emotional benefits. The extrapolation of the psychological results to financial markets, asserts that under the effect of one or a set of natural and human cognitive biases, agents in financial markets could not be of full rationality, especially to understand and react to news immediately and appropriately.

Our goal is not to test how psychological biases drive anomalies in stock return, but to find evidence for the existence and the nature of these psychological biases in an emerging market, especially after crises and

economic decline. We are especially interested in investigating psychological biases that characterize Saudi investors after the price oil drop and compare them to those documented in earlier studies.

To investigate the behavioral biases on stock markets, the first studies used secondary data, especially market returns. However recent studies, especially those conducted in emerging markets, use more and more primary data and survey approaches[1]. In order to fulfil this objective, we could use the same approaches as DHS (1998), BSV (1998), Hong & Stein (1999), Hong et al (2000), etc. Nevertheless, we will have a problem of data availability and face the small sample problems. These approaches use secondary data and need big samples to split in sub samples in order to test the consequences of the proposed biases on stock returns. Even the use of analyst coverage cannot be used because this kind of information does not exist in Saudi Market. Furthermore, growing studies on emerging markets gave evidence to the superiority of behavioral finance in explaining portfolio choice (Bloomfield 2006, Chen, Chin & Liu 2009, Zoghlami & Matoussi 2009, Chandra & Sharma 2010 & Lim 2012). Our paper adds to this literature by investigating one among the most important emerging markets. The main purpose of this research is to examine the psychology of Saudi investors after the 2015-2016 oil crisis. Moreover, we try to identify which bias (es) characterize Saudi Markets and how theses biases are connected. We focus particularly on overconfidence, optimism bias, belief perseverance bias, retrospection bias, disposition bias, representativeness bias, conservatism bias and limited computation bias. We conduct a survey research to gather primary data from a sample of Saudi investors for the period of November-December 2016.

The findings of this paper suggest that Saudi investors are characterized by overconfidence, low opportunism, sensitivity to rumors and mimetism biases. However, other biases are not supported by our results.

The remainder of this paper is organized as follow. In section 2, we summarize the different psychological bias suggested by financial economists as driving market anomalies. This section provides the theoretical background supporting our questionnaire. In section 3, we describe data and methodology. In Section 4, we present our results and their interpretations. Finally, Section 5 concludes the paper and presents some limits.

## 2. Literature review and Behavioral implications

In this section, we emphasize first the development of the subject through a literature and then explain the most psychological biases, how they were documented by psychologists, and how financial economists gave them credence in driving the anomalies in stocks returns.

### 2.1. Literature review

The classical economy was closely linked to psychology when Adam Smith wrote on the Theory of Moral Sentiments and Jeremy Bentham wrote on the psychological underpinnings of utility. However, the neo-

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[1] Satish Kumar and Nisha Goyal (2015) conducted a review of the literature published in past 33 years on behavioural biases in investment decision-making. Their database included all the articles published up to October 2013. They report that only 21 out of the total 117 studies are based on primary data, whereas the others are based on secondary data.

classical economy inspired from natural science came up with the assumption of perfect market and rationality, to construct the theory of choice. The "**rational finance**" built on the rational economics to construct valuation models to price risky financial assets. In the late sixties, some empirical studies observed some anomalies (like momentum in stock returns) that couldn't be explained by rational finance. In the 1960s cognitive psychology (with the work of Edwards, Tversky & Kahneman) came up with cognitive models of decision-making under uncertainty. In 1979, Kahneman & Tversky wrote Prospect Theory, considered as the corner stone of behavioral economics and finance. This new school of thought provides other arguments to some financial phenomena not plausibly explained by rational models. This theory has two building blocks: limits to arbitrage and psychology.

**Limits to Arbitrage:** Barberis & Thaler (2002) stated that although, many financial economists argued that Efficient Markets Hypothesis had to be true two decades ago because of the forces of arbitrage, we know now that this is a naïve view: the limits of arbitrage can permit substantial mispricing.

**Bounded Rationality and Prospect Theory:** The bounded rationality hypothesis and empirical findings of cognitive psychologists (such as Tversky & Kahneman 1973, Kahneman & Tversky 1974 and 1979), help writing down formal models more accurate to describe human behavior than purely rational models.

Three eminent papers addressed the most popular psychological biases. According to Daniel, Hirshleifer & Subrahmanyam (1998) overconfidence and the self-attribution biases draw anomalies to stock returns. Barberis, Shleifer & Vishny (1998) explained anomalies through the psychological biases of conservatism and representativeness. Finally, Hong & Stein (1999) was interested with the limited capacity of computation of agents.

Late studies focused more on empirics than theory. Doukas & Petmezas (2007) investigated the overconfidence bias of managers during acquisitions. They found that "high-order acquisitions (five or more deals within a three-year period) are associated with lower wealth effects than low-order acquisitions (first deals)". They explain this result by the overconfidence of the managers who tend to credit the initial success to their own ability and engage in more deals. Barber & Odean (2008) showed that individual investors are net buyers of stocks experiencing high abnormal trading volume, and stocks with extreme one-day returns. Ekholm & Pasternack (2008) explore the interrelation between investor size and behavior. They provide evidence that investor size affects investor behavior under new information. They found that larger investors on average react more positively to good news than smaller investors and vice versa. Fernandez, Garcia-Merino, Mayoral, Santos & Vallelado (2011) conducted an experiment to explain the investors' herding behavior by analyzing the interaction between the availability of financial information and individuals' cognitive profiles. They found that the cognitive profile of investors is more relevant when information is more available and as the number of previous transactions in the market is low.

Salamouris & Muradoglu (2010) investigated analysts' forecast accuracy using behavioral measures (Herding) in the United Kingdom. They found a positive and significant relationship between analysts' forecasts and herding behavior. Seasholes & Zhu (2010) analysed the link between Individual investors and local bias. They

conclude that individuals do not help incorporate information into stock prices. Zaidi & Tauni (2012) studied the influence of investor's personality traits and demographics on overconfidence bias using a survey approach on Lahore Stock Market. Their findings validate a positive relationship between overconfidence bias and Agreeableness, Extroversion & Consciousness; and negative relationship between Overconfidence bias and Neuroticism. Durand, Newby, Tant & Trepongkaruna (2013), demonstrated that personality traits are associated with overconfidence and overreaction in financial markets. Cai & Shefrin (2016) investigated the impact of preferences and biases on the risk-value profile of acquiring firms. They found that firms with negative prior returns are more likely to become acquirers and record value destructive acquisitions. This result was explained by psychological biases such as overconfidence and confirmation bias.

## 2.2. The principal behavioral biases

### 2.2.1. The overconfidence bias

The overconfidence is a bias in which judgment is reliably greater than objective accuracy of an individual2. This psychological bias was documented in several experimental studies, where individuals appear to underestimate their error variance in making predictions and overestimate their own forecasts relative to those of others (Alpert & Raiffa 1982 & Fischhoff, Slovic & Lichtenstein 1977). Evidence of overconfidence has been found in several contexts3. DHS (1998), built on these findings of overconfidence bias to construct a theoretical 3 period's model. People get their private information during period 1. The public signal starts to arrive during period 2, but with noise. It becomes clear progressively until the full achievement of the public signal during period 3. Overconfidence in the private signal causes the period 1 stock price to overreact. During period 2, when noisy public information signal arrives, the inefficient deviation of price is partially corrected, on average. The correction will be achieved in the subsequent period 3.

### 2.2.2. The Self-Attribution Bias

The self-attribution bias refers to a tendency to attribute their success to their own talents, but their failures to external or situational factors. This bias is a mechanism for individuals. Doing this repeatedly lead people to protect or enhance their own self-esteem. This was documented in several experimented studies (i.e. Fischhoff 1982, Langer & Roth 1975). DHS (1998) integrated this bias with the overconfidence one in a model to show that  the confidence of the investor raises when public information coincide with his private information, but doesn't fall when it doesn't.

### 2.2.3. The Conservatism Bias

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[2] For example, overconfident investors and traders tend to believe they are better than everyone else in choosing best stocks and funds etc. This bias usually happens when an investor tastes a few easy successful investments.

[3] Examples include physicians and nurses (Christensen, Szalanski and Bushyhead 1981 and Baumann, Deber and Thompson 1991), engineers (Kidd 1970, Attorneys, Wagenaar and Keren 1986), negotiators (Neale and Bazerman 1990), entrepreneurs (Cooper, Woo, and Dunkelberg 1988), managers (Russo and Schoemaker 1992), investment bankers and market professionals such as security analysts and economic forecasters (Vonholstein 1972, Ahlers and Lakonishock 1988, Froot and Frankel 1989)….

The conservatism bias was first documented by Edwards (1962). His experimentation shows that people tend to overweight their past evidences, and underweight the recent ones. Building on this conclusion, Barberis, Shleifer & Vishny (1998) argue that under the conservatism bias, the investor seems to forget the random character of stock returns and tends to overweight his prior impression and belief about the stock. This attitude may let him underreact to recent evidences and news. During this period of under-reaction, it's very plausible to observe anomalies in stock returns.

### 2.2.4. The Representativeness Bias

The representativeness bias leads people to reduce or to shorten spontaneously evidences and information in making decision and judgment (Kahneman & Tversky 1974). People tend to overweight evidences they think important and underweight those they think unimportant and trivial. BSV (1998) add this bias to their model. This bias appears in their model when the investor has to choose the regime of earnings announcement evolution "reverting or trending". So, the beliefs and anticipations of the investor are spontaneously affected by the representativeness bias and the investor is likely to rely more on his belief about the regime, and underweight new evidences. Particularly, when the new announcements are as anticipations, there will be overreaction and conversely when earnings announcements are of opposite sign.

### 2.2.5. The Slow Diffusion Information or Limited Capacity of Computation bias

The psychological bias does not underline the way of mind thinking and processing, but the incapacity of human mind to process all available and potential information and evidence when making decision or judgment. Hong & Stein (1999) build a model assuming heterogeneity across investors, who observe different pieces of private information at different point in time. They consider two types of agents "new watchers" and "momentum agents". The first group observe and rely only on new private evidences, while the second group doesn't observe or receive private signals, but try to infer them from the previous change of stock prices. These agents are called momentum agents, because they usually react in the same direction stock price movements. To test the assumption that firm-specific information diffuses gradually across the investing public, Hong, Lim & Stein (2000) and Doukas & McNight (2003) used the residual analyst coverage as a proxy for the rate of information diffusion. They find that momentum strategies work better in stocks with low analyst coverage.

## 3. Empirical Research Design

As mentioned earlier, our goal is not to test how psychological biases drive anomalies to stock market returns, but to provide evidence for their existence and determinants in an emerging markets. Moreover, we would like to investigate to what extent these biases are impacted by economic and social conditions of investor (age, background, experience, expertise, wealth…). To achieve our purpose we adopt a survey approach that uses the investigation technique through the development and distribution of a questionnaire.

Our approach differs from previous studies at three levels. First, we investigate how behavioral biases are impacted by crisis (economic decline of Saudi Arabia during 2015-2016). Second, we designed some scenarios that could help to capture investors' biases when taking decision[4]. Third, we try to link theses biases to investors' environment.

## 3.1. Survey design and delivery

We develop the broad hypotheses and the specific questions of the initial survey instrument based on our review of the literature on behavioral biases. We supplement this review with interviews of professionals (brokers and analysts) to identify issues that are potentially missed or under developed in the academic literature.

## Questionnaire Conception

In the development of the questionnaire, we split our questions into three categories: the first part (questions 1 to 10) deals with the biases which could characterize Saudi investors. The second part (questions 11 and 12) tries to explore the information set used by Saudi investors when transacting.

### 3.1.1. Questions coming from the theory

The questions one to four deals with the overconfidence bias (DHS 1998). Question seven deals with the slow diffusion of information or the limited capacity of computation bias (Hong & Stein 1999). Questions 10.1 to 10.3 deal with the conservatism bias (BSV 1998). Finally, Question 12 deals with the representativeness bias (BSV 1998).

### 3.1.2. Questions suggested by the professionals

In our primary investigation and while conducting our preliminary interviews, the professionals suggested three other biases: over opportunism (questions 5 and 6), sensitivity to rumors (questions 8.1 to 8.3) and mimetism (questions 9.1 and 9.2). These biases can be justifies as follow:

- The existence of mimestism bias can be justified in emerging markets where most investors don't have enough knowledge about financial rules and security analysis. That's why they built on the decision of others who are supposed to better know the market and firms[5]. Question ten is intended to test for the existence of this bias.

- Being over opportunistic means that the investor tries to realize the maximum gain from each opportunity. Particularly, when the investor identifies an opportunity in buying some stocks, his tendency is to buy the maximum quantity and at any price. If this attitude is quickly transmitted to

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[4] Even if this method is more difficult to understand by the respondents than the classical open questions, it is more suited, avoid subjective answers and improve the validity of the results (Zikmund 2003).

[5] Although this bias was not suggested to explain momentum, many researchers suggested mimestism as an anomaly to explain abnormal returns.

other investors, we should observe a trending move in the stock prices, which drives anomalies[6]. This issue is addressed by questions five and six.

- According to the professionals of the Saudi Stock Exchange, people are highly sensitive to rumors, particularly those concerning a liquid stock. In fact, being very sensitive to rumors creates a trending and continuous move in stock prices, driving anomalies in stock returns. Questions eight and nine are designed to test for the existence of this bias.

## 3.2. The Questions Design

The general design of the questions adopted in our investigation is as follow:

**The question construction:** for each question, we imagine a particular situation or a scenario that may occur in the financial market and that allow to underline the influence of a particular psychological bias. Then, we propose the different potential behaviors that investors may show about his position. Usually, there are five possible behaviors the investor might have in financial market, given a situation or information set about a particular stock: (1) sell aggressively to liquidate his position, (2) weaken his position, (3) abstain and maintain the same position, (4) buy moderately or to reinforce his position, (5) buy aggressively to strengthen his position. The five choices option was not adopted for all our questions. The number of choices depends on the nature of the question asked.

A scenario describes a situation about the stock (the firm performance or the market price). For example to underline the over confidence bias, we asked about the behavior of the Saudi investor in a situation of no realization of his expectation about the stock price behavior. To underline the conservatism bias, we asked about his reaction after a change in the past performance of the stock. To underline the mimetism bias, we asked about his behavior after identifying a trend in the stock price history, without any informational content. To underline the over opportunism bias, we asked about his behavior when he identifies some opportunity in a particular stock.

**The attitude rating scale**: Researchers developed a range of attitude rating scales to measure the intensity of an attitude's affective, cognitive, and behavioral components. Since attitude is a resulting from a number of external and internal factors, appropriate scales are designed depending upon the attitude to be measured. In our study, we are seeking to extract biases from the behavior of Saudi investor in a given a situation or information. To fulfil this goal, we adopted two types of scales, a **Category Scale** to approach the intensity of use of some information (questions 11 and 12) and a **Constant Sum Scale** for the questions related the investor decision face to the scenario (questions 1 to 10). For the latter case, since the options given to the respondent are not independent, the sum of all these options should describe the whole situation. Hence, each option is a

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[6] This behavior can take place as follow: to take advantage of an opportunity the seller may offer high prices, exceeding the maximum allowed by the market authority (open price + 3 per cent). By this way, any effective transaction wouldn't be achieved, and the stock will be reserved on the rise during some subsequent period. During this period, we should observe a trending move in stock price and anomalies in the stock returns.

component of the situation and represents a frequency. The sum of all these options should describe the whole situation and must equal 100 per cent[7].

**The pre-test phase:** In our pre-test phase, we started with questions inspired from the theory. These questions were revised and enriched by contextual ones. Then we redistribute the questionnaire and collect all responses.

### 3.3. Sample and Data

It is useful to remind that the data we are interested in are the attitudes of investors that might drive anomalies. These data cannot come from the prices of stocks, but should come from investors. Hence, our target population is investors on Saudi stock market. We distribute the questionnaire to 180 investors and after elimination of questionnaires with missing data, we ended up with a final sample of 162 investors. While the survey is anonymous, we gather some demographic information on the respondents (first part of the questionnaire) to explore to what extent it may affect investors' behavioral biases. Table 1 reports descriptive data on the surveyed investors.

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More than half of the responding are under 30 years (58%), while 32.7 % are between 30 and 50 years and only 8% are over 50 years. The sample is almost equally distributes between those investing their wealth (44.4%) and those working for a company (49.4%). Most of them don't have business background (63.6%). They have a diverse area of expertise (Bus Adm 19.8%, Finance 33.3%, Acc 11.3%, and Economics 9.3%). Finally, most of them came from educated family (73.5% of their parents have a university degree). As in other contexts, Saudi investors have short experience in trading (46.9% less than 5 years and 27.8% less than 10 years). Finally, the big part of our respondents (40.7%) manage small portfolio (less than 10,000 SAR). 20.4% of them are in the bracket (10,000 – 50,000 SAR) and 15% are in the bracket (50,000 – 100,000 SAR). Only 14.4% have a portfolio of more than 100,000 SAR.

## 4. Empirical results

Before presenting the results of the statistical analysis, let's recall that the purpose of this survey is to identify which kind of psychological and cognitive biases that might drive anomalies in emerging markets, and especially in Saudi stock market. To fulfil this goal, we conduct two types of statistical analysis: a univariate and a multivariate analysis. We present the results of these analyses.

### 4.1. Searching typical behaviors: the results of the univariate analysis

Table 2 presents the results of the descriptive statistics (mean, median mode and t test for the constant sum scale variables and the frequency and t test for the category variables) related behavioral biases.

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[7] Adding to that, the constant sum scale works best with respondents with high educational levels (Zikmund 2003, 312). Our respondents are investors and portfolio managers of banks.

**Overconfidence Bias:** we can see from table 2 panel A that among the responses to questions 1 to 4, those who have the higher load are response 11 (Sure and confident to execute with), response 14 (Sure and confident in your opinion), response 17 (Maintain his buying strategy and strengthen his position), response 20 (Persevere in his buying strategy, despite the price fall) and response 21 (you tend to analyze the reason and duration of this unexpected drop). The t test is positive and statistically significant for all these variables at 5%, which means that the sample average score is significantly higher than the neutral hypothesis. All other alternatives related over confidence bias have a negative or non-significant t. These results show clearly that Saudi investors are over confident in transmitting orders, when building their forecast and in strengthening their position eighter in the case of price rise or price fall.

**Over opportunism Bias:** Panel B of table 2 shows that only response 24 (As high as possible. Buy the maximum of shares, you use all available and potential financial resources) have high and significant load. All other responses are not significant. Since the only option that shows over opportunism is response 24 (all other options report less opportunistic behavioral), we can conclude that Saudi investor is over opportunistic.

**Limited Computation Capacity Bias:** This bias is addressed by question 7. The results displayed in Panel C of table don't not allow us to decide between the options. Since response 29 (Buy the entire quantity of securities set beforehand) and response 30 (Go gradually) have almost the same score and are both significant. Hence we say that the existence of Limited Computation Capacity Bias is not supported by our results.

**Sensitivity to rumors Bias:** This bias is addressed by questions 8.1 to 8.3. The results displayed in table 2 panel D show that this present among Saudi investors only for liquid stock. Undoubtedly, response 23 (Aggressive: Positive/negative rumor leads to a strong purchase/sale) have a high and significant score. The results don't support the presence of this bias in the case of a non-liquid stock.

**Mimetism Bias:** The results displayed in table 2 panel E do not demonstrate that Saudi investor is mimetic. No one of the scores is significant at 5%.

**Conservatism Bias:** Questions 10.1 to 10.3 deal with conservatism bias. The responses 49 to 53 investigate this bias in the case of a particular situation or information about a stock. The results exhibited in table 2 panel F show that only the score to response 49 (Consider this as a white noise (doesn't affect your perception about the company)) is significantly positive, which support that Saudi investor is conservative. The score of all the other responses is either non-significant or negative. The negative sign indicates that the sample average score is less that the neutral hypothesis, which corroborate the conservative attitude of Saudi investor.

Questions 10.2 and 10.3 investigate this bias vis a vis the behavior of top management and insiders. Panel G of table displays the score to responses 54 to 59. Globally, the low frequency of "*strong agree*" and negative score of response 55 (Maintain your position and do nothing), 56 and 59 (Highly upset, start liquidating the initial

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position immediately) indicate that Saudi investor is not sensitive top management and insider trading, which corroborates his conservative attitude.

**Representativeness bias:** The results of table 2 panel H show that Saudi investor integrates both public and private information to form an opinion on a company. He looks also at synthetic information (like PER, BMR and Growth), business model and strategy and listens to the broker advice before investing. However, he doesn't give credit to strategic decisions (like merger, partnership…) and stock prices.

### 4.2. Looking at global attitudes: the results of the factor analysis

After looking at most behavioral biases through a univariate and bivariate analysis, let's see now if the Saudi investors' behavior biases can be aggregated in global attitudes. The factor analysis is suited to this kind of analysis. After extracting the factors using the Principal Component Analysis, we run a Factor Analysis to rotate the extracted factors using the varimax method. We end up with twelve factors (see table 3).

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A careful examination of the output table allows us to retrieve roughly the findings of the univariate and bivariate analyses. We now try to interpret the extracted factors according to our conceptual analysis. The main result of the analysis is that the biases are captured by a single factor, but sometimes by two or three factors.

**Over confidence bias:**

The over confidence bias is spread in three factors (7, 8 and 10). Factor 7 is positively correlated with variable 16 and negatively correlated with variable 14. Factor 8 is positively correlated with variable 12 and negatively correlated with variable 11. Factor 10 is positively correlated with variable 17 and negatively correlated with variable 18. The opposite sign of the correlation coefficients, indicates an opposite attitude of investors towards the phenomenon investigated. For example, in the case order transmission, when you give high score to sure you should give a low score to unsure to be coherent.

**Over opportunism and Limited Computation Capacity:**

The over opportunism bias is captured by factor 1, while limited computation capacity is captured by factor 4. As in the former case, we the variables indicating an opposite attitude have an opposite sign of the correlation with the factor.

**Sensitivity to rumors Bias:**

This bias is captured by three factors (2, 4 and 6). We can make here the same observation about the opposite sign of the correlation coefficient of the variables belonging to the same factor. According to the professionals of the Saudi Stock Exchange, people are highly sensitive to rumors, particularly those concerning a liquid stock. In fact, being very sensitive to rumors creates a trending and continuous move in stock prices, driving anomalies in stock returns. Questions eight and nine are designed to test for the existence of this bias.

**Representativeness Bias:**

This bias is captured by three factors (5, 9 and 11). The interpretation here is slightly different since we asked about investors to rate the importance of information used when transacting. So the responses this question don't need to be opposite. However, we make some interesting comments. For example, when the investor has some private information, he doesn't listen to broker advice. Also, when he knows how to use synthetic information, he doesn't trust broker advice. Finally, when he know how to value a strategic decision or event, he doesn't rely on broker advice.

### 4.3. Investor's social conditions and behavioral bias: the results of one way ANOVA

To investigate if there is a link between social and economic conditions of respondents (like his age, his background, his area of expertise, his experience, his wealth…), we run a one way ANOVA to see if there is a differ among investors according to their social and economic conditions. Table 4 displays the results of the analysis of variance.

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Globally, we don't any specific impact of social or economic conditions of Saudi investors on their behavioral biases. However the overconfidence bias seems to be affected by the age, the area of expertise and the experience of investors. The Limited computation capacity bias is also determined by the experience and the age of investors. The sensitivity to rumors bias is commonly present among investors no matter what are their conditions. Finally, the representativeness bias seems to be differentiated by the background, the status and the wealth of Saudi investors.

Our findings corroborate previous studies that investigated emerging markets and used survey approach in many regards. Like Zoghlami & Matoussi (2009), Al-Horani & Haddad (2011) and Alquraan & al. (2016) we find evidence for the overconfidence bias, mimestism bias and sensitivity to rumors bias. Specifically, the overconfidence bias was validated by Alquraan & al. (2016) through a survey conducted during December 2015 on Saudi market[8]. However, they differ from Chandra & Kumar (2011) conclusions who validate under-confidence in the Indian market. Our results are similar to Zoghlami & Matoussi (2009) who found evidence for over opportunism in the Tunisian market. Finally, unlike Zoghlami & Matoussi (2009) and Chandra & Kumar (2011), conservatism is weekly validated by our findings.

Our approach is in the line of previous studies that used survey method. However, our contribution is threefold: (1) first, we use scenarios and constant sum scale in the questionnaire, which is more suited to investigate behavioral biases. (2) Second, we conducted our survey just after the starting of economic decline in Saudi Arabia. This atmosphere can create doubt among investors, who may lose confidence, increase their conservatism, and reduce their over opportunism, mimestism and sensitivity to rumors. Our findings show that Saudi investors behave the same way during normal time or crises. (3) Third, we investigate the link between behavioral biases and economic and social conditions of surveyed investors.

## 5. Conclusion

Why do investors behave the way they do? Often, emotions, mental errors, and individual personality characters complicate investment decisions. Hence, investors may behave rationally if they control their emotions and has all the relevant information. Nevertheless, asymmetric information, limited computation capacity and emotions may engage investors in non-objective investment strategies and trading rules. Hence, cognitive and behavioral biases occur and create anomalies in the market. Financial crises or turmoil may amplify these behavioral biases. We focused in this research on behavioral biases that might drive anomalies to emerging markets during crises. We investigate Saudi market after the sharp oil price decline. We started identifying the most common psychological biases suggested by behavioral finance theory and then those suggested by Saudi market professionals. We made some analyses from the collected data in order to understand Saudi market investors and explain the observed anomalies. We run a set of univariate, bivariate and multivariate analysis. Although the timing of our questionnaire coincides with the economic decline of Saudi Arabia, the results do not differ substantially from previous studies. Saudi investors are overconfident,

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[8] Nonetheless, these researchers investiged only oveconfidence bias.

conservative, mimetic, over-opportunistic and sensitive to rumors. These findings are supported by the descriptive, correlational and factor analyses.

Our study can be helpful either for investors, analysts, portfolio managers or financial market authorities. For investors, it may help them understand the subjective part of their behavior and control their emotion. Although investors cannot avoid all biases, they can reduce their effects. Undoubtedly, many experienced investors have learned that success frequently derives from reining in emotions and overcoming their biases. It may also help financial analysts and portfolio managers to give their recommendations more accurately. Finally, it may help financial market authorities to assist traders and investors with information that could elucidate the market. The most important recommendation we can advise to the market authorities is to work on the diffusion of maximum of public information to investors. Market transparency would reduce asymmetric information and let people rely more on public than private information and be less sensitive to rumors.

Like all studies using primary data, our investigation suffers the most limitation of survey researches. The quality of the numbers collected from the questionnaires may suffer from the subjectivity of the respondents. To improve the quality of primary data and the external validity of the results, some researchers suggest conducting panel survey. Another way to increase external validity is to do distribute the same questionnaire across all GCC countries and compare the findings. Another limitation of our research is the socio-economic factors that influence behavioral biases. A way to extend our research is to investigate the impact of age, background, experience, portfolio size, social origin of investors on behavioral biases. A third idea to be investigated is the impact of Information Technology (IT) of mitigating these biases. These limitations and other not suggested here can be addressed in future research.

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# Table 1: Demographic characteristics of the survey participants (N = 162)

| Panel A - Age | Freq | % |
|---|---|---|
| Valid | 2 | 1.2 |
| < 30 years | 94 | 58.0 |
| 30 - 50 years | 53 | 32.7 |
| > 50 years | 13 | 8.0 |
| Total | 162 | 100.0 |

| Panel B - Status | Freq | % |
|---|---|---|
| Valid | 10 | 6.2 |
| Investing his own wealth | 72 | 44.4 |
| working for a company | 80 | 49.4 |
| Total | 162 | 100.0 |

| Panel C - Background | Freq | % |
|---|---|---|
| Valid | 3 | 1.9 |
| MBA | 47 | 29 |
| CFA | 7 | 4.3 |
| AICPA | 2 | 1.2 |
| Other | 103 | 63.6 |
| Total | 162 | 100 |

| Panel D - Area of expertise | Freq | % |
|---|---|---|
| Valid | 2 | 1.2 |
| Bus Adm | 32 | 19.8 |
| Finance | 54 | 33.3 |
| Economics | 15 | 9.3 |
| Accounting | 19 | 11.7 |
| Other | 40 | 24.7 |
| Total | 162 | 100 |

| Panel E - Parents' job | Freq | % |
|---|---|---|
| Valid | 4 | 2.5 |
| Real Estate | 28 | 17.3 |
| Industry | 12 | 7.4 |
| Financial Sector | 40 | 24.7 |
| Service | 27 | 16.7 |
| Other | 51 | 31.5 |
| Total | 162 | 100 |

| Panel F - Parents' education | Freq | % |
|---|---|---|
| Valid | 23 | 14.2 |
| Primary School | 13 | 8.0 |
| High school | 7 | 4.3 |
| University | 119 | 73.5 |
| Total | 162 | 100.0 |

| Panel G - Experience in trading | Freq | % |
|---|---|---|
| Valid | 4 | 2.5 |
| < 5 years | 76 | 46.9 |
| 5-10 years | 45 | 27.8 |
| 10-20 years | 28 | 17.3 |
| > 20 years | 9 | 5.6 |
| Total | 162 | 100 |

**Panel H - Investment Amount Bracket**

| Period / Bracket | Jan-17 Freq | Jan-17 % | Feb-17 Freq | Feb-17 % | Mar-17 Freq | Mar-17 % | Average Freq | Average % |
|---|---|---|---|---|---|---|---|---|
| Valid | 21 | 13.0 | 12 | 7.4 | 13 | 8.0 | **15** | **9.5** |
| < 10,000 SAR | 64 | 39.5 | 67 | 41.4 | 67 | 41.4 | **66** | **40.7** |
| 10,000 – 50,000 SAR | 32 | 19.8 | 37 | 22.8 | 30 | 18.5 | **33** | **20.4** |
| 50,000 – 100,000 SAR | 23 | 14.2 | 22 | 13.6 | 28 | 17.3 | **24** | **15.0** |
| > 100,000 SAR | 22 | 13.6 | 24 | 14.8 | 24 | 14.8 | **23** | **14.4** |
| Total | **162** | **100.0** | **162** | **100.0** | **162** | **100.0** | **162** | **100** |

## Table 2: Descriptive Statistics of Behavioral Biases

**Panel A - Statement : Overconfidence Bias**

| Variable Code | Label | Mean | Median | Mode | t | sign |
|---|---|---|---|---|---|---|
| Survey responses to question 1: *When transmitting an order, you feel: (3 scenarios)* | | | | | | |
| 11 | *Sure and confident to execute* | 51.7593 | 50.0000 | 50.00 | **7.749** | **.000** |
| 12 | *Unsure and hesitant. You try to get an idea of the market and the intermediaries opinion* | 28.4444 | 25.0000 | 0.00 | -2.396 | .018 |
| 13 | *Lacking any idea of intervention, you listen to the broker's advice.* | 19.8025 | 12.5000 | 0.00 | -7.843 | .000 |
| Survey responses to the question 2: *When building forecasts about the future price of a security, you are: (3 scenarios)* | | | | | | |
| 14 | *Sure and confident in your opinion* | 46.9753 | 50.0000 | 50.00 | **5.643** | **.160** |
| 15 | *Rather doubtful in your opinion* | 27.1296 | 25.0000 | 30.00 | -3.399 | .000 |
| 16 | *Suspicious. Recognizing the unpredictability of the market, you prefer abstain.* | 25.9877 | 20.0000 | 0.00 | -3.798 | .001 |
| Survey responses to the question 3: *Assume you anticipated a rise in the price of one stock and decided to be a buyer.* | | | | | | |
| *As your expectation has been realized, you would like to: (3 scenarios)* | | | | | | |
| 17 | *Maintain his buying strategy and strengthen his position.* | 46.8210 | 40.0000 | 40.00 | **5.980** | **.000** |
| 18 | *Abstain and do nothing. Expect further price rises before start selling.* | 31.4506 | 27.5000 | 0.00 | -.765 | .445 |
| 19 | *Stop buying, and begin to sell.* | 21.8634 | 20.0000 | 10.00 | -7.552 | .000 |
| Survey responses to the question 4: *Suppose you anticipated a price rise, but actually price falls. You would like to: (4 scenarios)* | | | | | | |
| 20 | *Persevere in his buying strategy, despite the price fall.* | 32.5617 | 30.0000 | 10.00 | **3.752** | **.000** |
| 21 | *Abstain and do nothing (you tend to analyze the reason and duration of this unexpected drop).* | 32.2222 | 25.0000 | 10.00 | **3.349** | **.001** |
| 22 | *Start selling and weaken your position. (gradually)* | 17.9012 | 10.0000 | 10.00 | -4.889 | .000 |
| 23 | *Immediately sell all your position.* | 17.3765 | 10.0000 | 10.00 | -4.857 | .000 |

Respondents were asked to give a score to each scenario on a scale from 0 (totally disagree) to 100% (totally agree)). The total score for all scenarios should equal 100%. Columns 3 to 5 indicate the mean, the median and the range respectively. Column 6 reports the results of a t-test of the null hypothesis that each average response is equal to 33.33% (neutral) in the case of 3 scenarios, to 25% in the case of 4 scenario and to 20% in the case of 5 scenarios

## Table 2: Descriptive Statistics of Behavioral Biases

### Panel B - Over opportunism Bias

| Variable Code | Label | Mean | Median | Mode | t | Sign |
|---|---|---|---|---|---|---|
| Survey responses to questions 5 and 6: *Suppose you have identified a good opportunity. You decided to take a position. this position would be: (5 scenarios)* | | | | | | |
| 24 | *As high as possible. Buy the maximum of shares, you use all available and potential financial resources* | 40.2778 | 40.0000 | 50.00 | **2.938** | **.004** |
| 25 | *Moderate, and within the limits of your financial capacity.* | 37.2531 | 30.0000 | 20.00 | 1.705 | .090 |
| 26 | *Very low, reflecting an uncertainty, mistrust and reluctance.* | 22.4691 | 20.0000 | 10.00 | -5.995 | .000 |
| 27 | *Open (if the stock is traded in a call market) or at market prices (if the stock is traded in continuous trading)* | 53.3642 | 60.0000 | 50.00 | 1.230 | .220 |
| 28 | *A limit order* | 46.6358 | 40.0000 | 30.00 | -1.510 | .133 |

### Panel C - Limited Computation Capacity Bias

| Variable Code | Label | Mean | Median | Mode | t | Sign |
|---|---|---|---|---|---|---|
| Survey responses to question 7: *Assume the arrival of a good news on a particular stock, you would: (3 scenarios)* | | | | | | |
| 29 | *Buy the entire quantity of securities set beforehand.* | 41.0802 | 32.5000 | 30.00 | **3.348** | **.001** |
| 30 | *Go gradually: buy small quantities on intervals based on market reaction.* | 42.0679 | 40.0000 | 20.00 | **3.858** | **.000** |
| 31 | *Postpone.* | 16.8519 | 10.0000 | 10.00 | -11.233 | .000 |

### Panel D - Sensitivity to rumors Bias

| Variable Code | Label | Mean | Median | Mode | t | Sign |
|---|---|---|---|---|---|---|
| Survey responses to question 8.1: *Suppose a rumor began to circulate on the market (merger, acquisition ...) on a liquid stock, your reaction would be: (3 scenarios)* | | | | | | |
| 32 | *Aggressive (Positive/negative rumor leads to a strong purchase/sale.* | 38.4877 | 35.0000 | 60.00 | **2.180** | **.031** |
| 33 | *Moderate.* | 29.8765 | 20.0000 | 20.00 | -1.698 | .091 |
| 34 | *Nothing. No immediate reaction, investors prefer waiting for the confirmation of the news.* | 31.6358 | 20.0000 | 0.00 | -.711 | .478 |
| Survey responses to question 8.2: *A rumor is invading the market. How would do you do in the case of a liquid stock? (4 scenarios)* | | | | | | |
| 35 | *Intervene aggressively in the direction of the rumor (buy if good news and sell if bad news).* | 26.9444 | 20.0000 | 10.00 | **5.788** | **.000** |
| 36 | *Be prudent. Intervene in small amounts in the direction of the rumor.* | 26.3580 | 20.0000 | 20.00 | **2.398** | **.018** |
| 37 | *Abstain, and wait for the market reaction.* | 24.2284 | 20.0000 | 10.00 | **2.784** | **.006** |
| 38 | *Abstain and wait for the confirmation of information.* | 22.5926 | 20.0000 | 10.00 | .958 | .340 |
| Survey responses to question 8.3: *Suppose the same scenario of the previous question, but with a non-liquid stock (4 scenarios)* | | | | | | |
| 39 | *Intervene aggressively in the direction of the rumor (buy if good news and sell if bad news).* | 21.3272 | 20.0000 | 20.00 | .721 | .472 |
| 40 | *Be prudent. Intervene in small amounts in the direction of the rumor.* | 24.2284 | 20.0000 | 10.00 | -.449 | .654 |
| 41 | *Abstain, and wait for the market reaction.* | 27.9321 | 20.0000 | 10.00 | -1.431 | .154 |
| 42 | *Abstain and wait for the confirmation of information.* | 26.5123 | 20.0000 | 0.00 | -2.107 | .037 |

Respondents were asked to give a score to each scenario on a scale from 0 (totally disagree) to 100% (totally agree)). The total score for all scenarios should equal 100%. Columns 3 to 5 indicate the mean, the median and the range respectively. Column 6 reports the results of a t-test of the null hypothesis that each average response is equal to 33.33% (neutral) in the case of 3 scenarios, to 25% in the case of 4 scenario and to 20% in the case of 5 scenarios.

## Table 2: Descriptive Statistics of Behavioral Biases (cont'd)

*Panel E - Mimetism Bias*

| Variable Code | Label | Mean | Median | Mode | t | Sign |
|---|---|---|---|---|---|---|
| Survey response to question 9.1: *Suppose you detect an unpredictable stock price movement (Bull or Bear market). Convinced that this movement has no information content, what would you do? (3 scenarios)* | | | | | | |
| 43 | Take advantage by Buying (selling) with large quantities | 31.0494 | 25.0000 | 0.00 | -1.033 | .303 |
| 44 | Be prudent by Buying (selling) with small quantities | 37.1914 | 30.0000 | 30.00 | 1.789 | .076 |
| 45 | Do nothing and wait for confirmation | 31.8210 | 25.0000 | 10.00 | -.698 | .486 |
| Survey response to question 9.2: *Suppose a bubble in the market with no informational basis. What would be your reaction? (3 scenarios)* | | | | | | |
| 46 | Not "miss the boat". Intervene aggressively in the direction of the movement. | 37.6852 | 30.0000 | 30.00 | 1.909 | .058 |
| 47 | Be prudent. Intervene moderately in the direction of movement. | 31.8519 | 30.0000 | 20.00 | -.791 | .430 |
| 48 | Wait until the bubble is gone. | 30.4630 | 20.0000 | 0.00 | -1.289 | .199 |

*Panel F - Conservatism Bias*

| Variable Code | Label | Mean | Median | Mode | t | Sign |
|---|---|---|---|---|---|---|
| Survey response to question 10.1: *Suppose a well-established company with sustainable trends (sales and profits) and good rating. This company reported a bad performance (profit fall of 30%) last month. What would be your reaction? (5 scenarios)* | | | | | | |
| 49 | Consider this as a white noise (doesn't affect your perception about the company) | 29.4444 | 20.0000 | 10.00 | **4.574** | **.000** |
| 50 | Sell by small quantities, while waiting for the confirmation of this tendency. | 20.9568 | 20.0000 | 20.00 | .632 | .528 |
| 51 | Persevere and hold a strong position in this stock. | 22.1914 | 20.0000 | 10.00 | 1.345 | .180 |
| 52 | Afraid by this bad news, liquidate the position in this stock | 14.6296 | 10.0000 | 10.00 | -4.828 | .000 |
| 53 | Little bit scared, weaken the initial position. | 12.6543 | 10.0000 | 0.00 | -6.555 | .000 |

Respondents were asked to give a score to each scenario on a scale from 0 (totally disagree) to 100% (totally agree)). The total score for all scenarios should equal 100%. Columns 3 to 5 indicate the mean, the median and the range respectively. Column 6 reports the results of a t-test of the null hypothesis that each average response is equal to 33.33% (neutral) in the case of 3 scenarios, to 25% in the case of 4 scenario and to 20% in the case of 5 scenarios

## Table 2: Survey participants Behavioral Biases (N = 162)

*Panel G - Conservatism Bias / Top management and insider trading*

| Variable Code | Label | Most (% 5 or 4) | Least (%2 or 1) | Average rating | Test Value = 3 t test | Test Value = 3 Sig |
|---|---|---|---|---|---|---|
| | Survey responses to the question: *Suppose a movement in stock price (increase or decrease) due to top management trading (buying or selling the stock of the company). What would you do in this situation* | | | | | |
| 54 | *Buy (sell) the stock with large quantity and strengthen (weaken) the position* | 27.16 | 34.57 | 2.93 | -.787 | .432 |
| 55 | *Maintain your position and do nothing* | 33.33 | 45.68 | 2.75 | -2.485 | .014 |
| 56 | *Highly upset, start liquidating the initial position immediately.* | 29.01 | 45.68 | 2.79 | -2.099 | .037 |
| | Survey responses to the question: *Suppose a movement in stock price (increase or decrease) due to insider trading (such as royal family or people connected to royal family). What would you do in this situation* | | | | | |
| 57 | *Buy the stock with large quantity and strengthen the position* | 38.27 | 34.57 | 3.07 | .740 | .460 |
| 58 | *Maintain your position and do nothing* | 35.19 | 32.72 | 3.04 | .400 | .690 |
| 59 | *Highly upset, start liquidating the initial position immediately.* | 27.78 | 45.68 | 2.69 | -3.055 | .003 |

*Panel H - Representativeness bias*

| Variable Code | Label | Most (% 5 or 4) | Least (%2 or 1) | Average rating | Test Value = 3 t test | Test Value = 3 Sig |
|---|---|---|---|---|---|---|
| | Survey responses to the question: *To form an opinion on a particular stock, and take an adequate position, your information set is:* | | | | | |
| 60 | *All available information (historical, current and forecasted)* in a comprehensive way | 40.74 | 37.04 | 3.22 | **1.971** | **.050** |
| 61 | *Synthetic information (like PER, sales growth or book to market value).* | 37.65 | 25.31 | 3.17 | **1.864** | **.064** |
| 62 | *Strategic decision (merger, partnership...)* | 38.89 | 27.16 | 3.12 | 1.337 | .183 |
| 63 | *Analyze the business model and business strategy of the company* | 41.98 | 29.01 | 3.19 | **2.014** | **.046** |
| 64 | Private information | 38.27 | 30.25 | 3.20 | **2.087** | **.038** |
| 65 | *Rely mostly on prices because they believe that prices are the best indicators* | 32.10 | 35.19 | 3.05 | .562 | .575 |
| 66 | *Trust the broker advice.* | 50.00 | 27.78 | 3.27 | **2.650** | **.009** |

Respondents were asked to indicate the level of agreement with statements on a scale of 1 (Strong agree) to 5 (Disagree). Column 3 presents the percent of respondents indicating agreement levels of 5 or 4. Column 4 presents the percent of respondents indicating agreement levels of 2 or 1. Column 5 reports the average rating, where higher values correspond to higher agreement. Column 6 reports the results of a t-test of the null hypothesis that each average response is equal to 3 (neutral).

**Table 3: Results of Factor Analysis**

| Code | Label | Component | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| **Over confidence bias** | | | | | | | | | | | | | |
| 11 | Sure and confident to execute orders. | .119 | .046 | .073 | .064 | .030 | .049 | -.189 | -.882 | .028 | .029 | .140 | .035 |
| 12 | Unsure and hesitant. He tries to get an idea of the market and the intermediaries | .043 | -.011 | .039 | -.105 | .098 | -.212 | .067 | .841 | .160 | .032 | .130 | .062 |
| 14 | Sure and confident in his opinions. | .120 | .176 | .033 | .076 | .017 | .032 | -.770 | -.151 | .106 | .152 | .016 | -.039 |
| 16 | Suspicious. Recognizing the unpredictability of the market, he prefers abstain. | -.138 | -.038 | -.140 | -.153 | .061 | .089 | .846 | .078 | -.012 | .066 | .129 | -.030 |
| 17 | Maintain his buying strategy and strengthen his position. | .026 | .054 | -.014 | .041 | -.005 | .013 | -.077 | -.065 | .001 | .919 | -.061 | .023 |
| 18 | Abstain and do nothing. Expect further price rises before start selling. | .012 | .044 | .038 | -.041 | -.032 | .010 | -.005 | -.043 | .091 | -.929 | .006 | .033 |
| **Over opportunism Bias** | | | | | | | | | | | | | |
| 24 | As high as possible. | .366 | .278 | .324 | .267 | -.017 | .209 | .104 | .134 | .201 | .068 | .383 | -.096 |
| 27 | Open (if the stock is traded in a call market) or at market prices (if the stock is traded in continuous trading) | -.019 | -.002 | .974 | .014 | -.030 | -.096 | -.077 | -.017 | .028 | -.027 | -.025 | -.044 |
| 28 | A limit order | -.032 | .015 | -.958 | -.020 | -.002 | .079 | .080 | .059 | -.061 | .031 | -.001 | .048 |
| **Limited Computation Capacity Bias** | | | | | | | | | | | | | |
| 29 | Buy the entire quantity of securities set beforehand. | .851 | .043 | -.041 | .097 | .112 | .085 | -.173 | -.043 | -.076 | .054 | -.102 | -.005 |
| 30 | Go gradually: buy small quantities on intervals based on market reaction. | -.851 | .003 | -.012 | -.097 | .031 | -.142 | .148 | .057 | .236 | .027 | .054 | .126 |
| **Sensitivity to rumors Bias** | | | | | | | | | | | | | |
| 32 | Aggressive (Positive/negative rumor leads to a strong purchase/sale. | .228 | .008 | -.015 | .841 | -.077 | .214 | -.045 | -.042 | -.043 | .062 | -.049 | -.017 |
| 34 | Nothing. No immediate reaction, investors prefer waiting for the confirmation of the news. | -.006 | -.088 | -.051 | -.788 | -.093 | .119 | .331 | .195 | .006 | -.025 | .047 | -.059 |
| 35 | To intervene aggressively in the direction of the rumor (buy if good news and sell if bad news). | .354 | .598 | -.141 | .009 | -.092 | .418 | -.155 | -.138 | .029 | .122 | -.026 | -.024 |
| 36 | To be prudent. Intervene in small amounts in the direction of the rumor. | -.110 | .112 | .167 | -.045 | -.049 | -.858 | .101 | .039 | .036 | .061 | .060 | .015 |
| 38 | To abstain and wait for the confirmation of information. | -.128 | -.794 | .026 | .075 | -.051 | .248 | .080 | .055 | -.139 | .009 | -.063 | -.122 |
| 39 | To intervene aggressively in the direction of the rumor (buy if good news and sell if bad news). | .005 | .624 | .099 | .294 | .064 | .318 | .033 | .012 | -.100 | -.017 | -.205 | -.471 |
| 40 | To be prudent. Intervene in small amounts in the direction of the rumor. | -.083 | .043 | -.003 | -.036 | -.034 | -.774 | -.256 | .214 | .025 | -.073 | .041 | -.319 |
| 41 | To abstain, and wait for the market reaction. | -.187 | .063 | -.017 | .034 | -.007 | .110 | .016 | -.045 | .010 | .036 | -.003 | .935 |
| 42 | To abstain and wait for the confirmation of information. | .270 | -.672 | -.069 | -.271 | -.020 | .293 | .184 | -.155 | .058 | .042 | .152 | -.288 |

**Table 3: Results of Factor Analysis (cont'd)**

| Code | Label | Component | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| *Representativeness bias* | | | | | | | | | | | | | |
| 68 | Limit their information set to private information. | .203 | .075 | .010 | .034 | .113 | .113 | -.083 | .045 | -.070 | .032 | -.843 | -.007 |
| 69 | They trust the broker advice. | .174 | .030 | -.052 | -.243 | -.147 | -.081 | .170 | .140 | -.447 | -.109 | .543 | .137 |
| 70 | They just looks at synthetic information (like PER, sales growth or book to market value). | -.122 | .164 | .081 | .054 | .206 | -.083 | -.028 | .176 | .721 | -.121 | .221 | -.069 |
| 71 | They trust the broker advice. | .088 | .065 | -.010 | .117 | -.206 | -.009 | .077 | .002 | -.838 | .017 | .143 | -.127 |
| 72 | They use strategic decision as an event (merger, partnership...) | .026 | .016 | -.018 | .016 | .971 | .031 | .020 | .031 | .170 | .015 | -.094 | .000 |
| 73 | They trust the broker advice. | -.026 | -.016 | .018 | -.016 | -.971 | -.031 | -.020 | -.031 | -.170 | -.015 | .094 | .000 |

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 11 iterations.

| Code | Label | Background | | Area of expertise | | Experience in trading | | Status | | Age | | Investment Value | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | F | Sig. | F | Sig. | F | Sig. | F | Sig. | F | Sig. | F | Sig. |
| **Over confidence bias** | | | | | | | | | | | | | |
| 11 | Sure and confident to execute orders. | 0.604 | 0.613 | 2.136 | .079 | .162 | .922 | 2.295 | 0.132 | 0.445 | 0.642 | 1.594 | .123 |
| 14 | Sure and confident in his opinions. | 1.751 | 0.159 | 1.243 | .295 | 2.050 | .109 | 4.177 | 0.043 | 0.887 | 0.414 | 1.107 | .362 |
| 17 | Maintain his buying strategy and strengthen his position. | 0.845 | 0.471 | **2.612** | **.038** | 2.493 | .062 | 0.967 | 0.327 | **5.318** | 0.006 | 1.348 | .219 |
| 20 | Persevere in his buying strategy, despite the price fall. | 1.046 | 0.374 | .892 | .470 | **2.672** | **.049** | 0.084 | 0.772 | 2.709 | 0.07 | 1.029 | .420 |
| 21 | Abstain and do nothing. | 1.358 | 0.258 | .930 | .448 | 2.118 | .100 | 3.67 | 0.057 | 0.439 | 0.645 | 1.032 | .418 |
| **Over opportunism Bias** | | | | | | | | | | | | | |
| 24 | As high as possible. | 2.556 | 0.057 | 2.824 | .027 | .366 | .778 | 1.97 | 0.163 | 0.15 | 0.861 | 1.394 | .198 |
| **Limited Computation Capacity Bias** | | | | | | | | | | | | | |
| 29 | Buy the entire quantity of securities set beforehand. | 0.657 | 0.58 | .251 | .909 | 1.730 | .163 | 1.272 | 0.261 | 2.783 | 0.065 | .741 | .671 |
| 30 | Go gradually | 1.127 | 0.34 | .488 | .744 | **3.051** | **.030** | 0.049 | 0.825 | **6.628** | **0.002** | .886 | .539 |
| **Sensitivity to rumors Bias** | | | | | | | | | | | | | |
| 32 | Aggressive (Positive/negative rumor) | 2.978 | 0.033 | .788 | .534 | .283 | .838 | 9.983 | 0.002 | 1.885 | 0.155 | 1.688 | .098 |
| 35 | To intervene aggressively in the direction of the rumor | 0.581 | 0.628 | 1.125 | .347 | 1.718 | .166 | 0.054 | 0.816 | 0.172 | 0.842 | .930 | .501 |
| 36 | To be prudent | 1.194 | 0.314 | .386 | .819 | .717 | .543 | 2.277 | 0.133 | 0.717 | 0.49 | .713 | .696 |
| 37 | To abstain, and wait for the market reaction. | 0.906 | 0.44 | 2.403 | .052 | 2.925 | .036 | 1.694 | 0.195 | 1.289 | 0.278 | 1.002 | .442 |
| **Sensitivity to rumors Bias** | | | | | | | | | | | | | |
| 49 | Consider this as a white noise | 0.265 | 0.85 | .356 | .839 | .742 | .529 | 0.009 | 0.923 | 0.68 | 0.508 | .960 | .476 |
| **Representativeness bias** | | | | | | | | | | | | | |
| 60 | They use all available information | **4.652** | **0.004** | .216 | .929 | 1.006 | .392 | 0.001 | 0.981 | 1.395 | 0.251 | 1.662 | .105 |
| 61 | They just looks at synthetic information | 0.757 | 0.52 | 1.135 | .342 | .606 | .612 | 2.21 | 0.139 | 0.956 | 0.387 | 1.023 | .425 |
| 63 | Analyze the business model and business strategy | 0.262 | 0.853 | 2.463 | .047 | 2.524 | .060 | 0.567 | 0.452 | 0.274 | 0.761 | .540 | .843 |
| 64 | Limit their information set to private information. | 0.507 | 0.678 | .239 | .916 | .010 | .999 | 0.088 | 0.767 | 1.411 | 0.247 | **3.549** | **.001** |
| 66 | They trust the broker advice. | 0.647 | 0.586 | 1.140 | .340 | .474 | .701 | **7.338** | **0.008** | 0.416 | 0.66 | 1.195 | .303 |

Table 4: Results of the one way ANOVA analysis