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## From Which Planet Do They Come from? Biases in Trading Strategies: Does the Gender Matter?

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### **Abstract:**

*Using a qualitative design based on experimental finance, we analyzed to which extent behavioral and cognitive biases could develop in a differentiated way according to the gender of investors. To do this, we considered a sample of 17 students in a two-hour continuous trading situation. Our results, which were collected through descriptive socio-demographic data, reading trading journals, and answering closed questionnaires, confirm the findings of many studies devoted to this issue. They show that women trade more carefully, with higher levels of diversification than men. Beyond this result, we also demonstrate the importance of women's greater use of heuristics, which raises the question - not necessarily resolved in the scientific literature - of the influence of intuition and instinct on decision-making processes. This twofold observation seems even more important given that women's financial portfolios were the best value in the deteriorated stock market context of the experiment. We also argue that the chronic male overrepresentation in trading rooms could be a facilitating factor in the development of speculative bubbles.*

**Keywords:** Gender, experimental finance, individual investors, qualitative research, behavioral and cognitive biases, stock markets

## 1. Introduction

The question of the development of gender-differentiated behavior in decision-making processes is widely discussed in financial literature. The originality of this article comes from the decision-making process studied, namely stock market trading. Its specificity can be explained by several factors: firstly, the high levels of uncertainty about the financial influence of the decisions taken; secondly, the importance of the psychological reality of individuals (leading to the more or less significant manifestation of behavioral and cognitive biases); and thirdly, the importance of the information flows associated with the stock market life of companies. In this article, we analyze the way in which investment strategies in trading situations may be conditioned by gender. At the same time, we seek to identify gender-differentiated influences on the behavioral and cognitive biases traditionally found in trading. This approach is much less common in financial literature. To this end, we use a qualitative approach based on elements coming from experimental finance and built on an original experimental design. The article is organized as follows. Section 2 reviews the existing literature on the subject. Section 3 describes, firstly, the general experimental design, emphasizing its original character and, secondly, how the sample analyzed was constructed. Section 4 sets out the various results obtained and the answers to the research question. Section 5 discusses the results by comparing them with contributions from previous work. Section 6 presents a non-exhaustive list of future research that could be carried out.

## 2. Review of Scientific Literature

### 2.1. Uncertainty, Stock Markets and Individual Investors

Early studies considering decision-making show that it can be understood as a complex process involving the evaluation of multiple courses of action, leading to the selection of a single one (Simon, 1965; Newman, 1971; Mintzberg et al., 1976). Depending on the variable linked to uncertainty, the decision-making process is classically divided into three categories. The first concerns situations of certainty, where the consequences of the decision are fully known. The second category refers to the notion of risk, which implies that the individual is aware of the consequences and the likelihood of them occurring because of the decision taken. The third category relates to uncertainty, in other words, ignorance of the

probability of the outcome (Allain, 2013). Decision-making under uncertainty is characteristic of stock markets, where investment results can often follow a very random path.

In such a context, individual investors generally rely on their intuition, preferences and values rather than gathering more information before deciding (Chhapra et al., 2018; Al-Tarawneh, 2012). This tendency is explained by their limited cognitive abilities, which prevent them from optimally processing all available information (Pak & Mahmood, 2015; Allain, 2013). In addition, their low level of financial knowledge prevents individual investors from making effective use of the information available, which can lead to inappropriate or erroneous decisions (Aren & Aydemir, 2015; Junghans, 2016). The flows of information amplify the complexity of its analysis, frequently leading individual investors to settle for the first piece of information they find satisfactory (Simon, 1978, cited by Tran, 2018). Moreover, their investment decisions are largely influenced by their perception of risk (Bikas, 2013). On the stock markets, risk can be perceived as a fear of incurring losses and a chronic apprehension linked to a lack of control over an environment with a high level of complexity (Al-Tarawneh, 2012). Thus, risk appetite versus risk aversion - which varies according to investor preferences - is thought to play a determining role in investment choices and the degree of portfolio diversification (Marinelli et al., 2017). Numerous studies show that these elements (preferences and values, limited cognitive abilities and personal perception of risk) are strongly influenced by some socio-demographic factors: level of education (Guiso et al., 2001), age (Joshi et al., 2022), prior knowledge of stock markets (Aren & Aydemir, 2015) and the gender of investors (Mouna & Anis, 2015).

## 2.2. Differentiated Trading Strategies: The Gender Explanation

The influence of the gender variable on the decision-making process is a widely documented research topic (Taqquadus et al., 2013; Cueva & Rustichini, 2015). It has been considered in many types of decision-making. Broadly speaking, three main categories of findings emerge:

- Firstly, many studies find gender-differentiated decision-making, with risk aversion more pronounced in the female population than in the male population:

The literature widely suggests that women's investment choices are more cautious than those made by men (Charness & Gneezy, 2012; Denerier, 2022). Secondly, they also appear to be less confident and less autonomous than their male counterparts (Almenberg & Dreber, 2015; D'Acunto, 2015; Marinelli et al., 2017). Thirdly, male portfolios would include stocks with a higher risk profile than those constructed by women (Marinelli et al., 2017). Some studies show that risk-taking is 'virilizing' (Penin, 2006; Le Breton, 2010) and that risk-taking behavior, which is biologically generated by the release of testosterone (Coates & Herbert, 2008), is much more deeply rooted in male DNA (Spell & Bezrukova, 2010). Cronqvist et al. (2016) also demonstrate that prenatal testosterone exposure masculinizes financial decisions and leads to higher risk-taking. If women would have a more cautious approach to risk-taking, they would invest with a view to generating income and not with a view to increasing the overall value of their portfolio (Jaiswal & Kamil, 2012). According to Lizárraga et al. (2007), women are also more concerned than men about uncertainty and the consequences of the decisions they make. Wann and Lobo (2010), working from an experimental logic, show that men trade more in a larger number of securities. They would also have a shorter-term investment horizon and be more inclined towards the derivatives market. In terms of portfolio volatility, it is higher for men than for women. On the other hand, women generally achieve better financial performance, which can be explained by the fact that they spend more time assimilating information (Prakash & Alagarsamy, 2022; Lu et al., 2016).

- Other studies have tried to refine the analysis by considering variables other than gender (expertise, age, marital status). The results obtained are more mixed than those emerging from the first category:

At this level, the gender issue should be analyzed simultaneously with other individual characteristics (Holden & Tilahun, 2022). Hibbert et al. (2013) suggest that when men and women have attained a high level of financial knowledge, the propensity to take risks is more evenly distributed, which tends to demonstrate that the level of education reduces differences in the decision-making process. On the mutual fund market, Dwyer et al. (2002) found that the male population took riskier decisions than the female population. However, this result tended to be attenuated by controlling for the level of financial knowledge (confirmed by Harris et al. (2006) and Sebai (2014). From an international approach, Adhikari and O'Leary (2011) argue that women need more advanced training to gain confidence in the international financial world. Taking marital status into account, the study by Embrey and Fox (1997) shows that single women tend to opt for investments with a long-term perspective in order to meet their needs over a longer period than when they are in a couple. After controlling for many socio-economic and individual variables, Christiansen et al. (2010), based on a sample of 10% of the Danish adult population between 1997 and 2004, found no difference between men and women in their propensity to invest in equities or bonds. For Schubert et al. (1999), Filippin and Crosetto (2016) and Bruna et al. (2019), any differential propensity to take risks would depend on the context in which decisions are taken, and the authors were unable to identify any truly significant difference between male and female behavior. Furthermore, any differences tend to diminish with age and experience (Byrnes et al., 1999).

- Finally, some analyses (less common) find no gender difference in the decision-making process. This could be explained by a stereotype conveyed by the financial literature:

According to Shapiro et al. (2010), gender has no effect on risk-taking propensity. Women's more conservative behavior is merely a stereotype (Powell & Ansic, 1997), which comes from mainly financial literature (Marlow & Swail, 2014). Following this perspective, for instance, Villanueva-Moya and Expósito (2021) argue that women under stereotype threat make more disadvantageous risk decisions than men.

### 2.3. Analysis of the Links between Behavioral and Cognitive Biases and Gender

Based on the financial literature, we consider the following biases:

- Overconfidence (behavioral bias) is defined as the tendency of individuals to overestimate their skills, underestimate risks and make poor decisions because of an over-optimistic view of their abilities. The appearance of this bias would lead to a lack of portfolio diversification and would have a negative influence on the financial value of the portfolio. Various authors also stress the role played by previous experience and beginner's luck (Merkle, 2017; Gao et al., 2021) in the development of overconfidence. Numerous studies show that men are more subject to this bias than women (Finet et al., 2022; Trejos et al., 2019; Meulders, 2010). Tekçe and Yilmaz (2015) also find that overconfidence is more frequently observed in the population of less mature, low-income and male individual investors.
- Availability bias (behavioral bias): The tendency of individuals to be satisfied with immediately available information and not to carry out additional research. The study by Onsomu (2014) highlights that, although there are differences in information use between men and women, there is no significant correlation between availability bias and gender.
- Representativeness bias (cognitive bias): the tendency of individuals to base their decisions on a very limited set of elements that they believe to be representative of the population. Using a sample of 342 German individual investors, Wawrosz and Schulz (2023) found that individual male investors had a greater tendency to base their decisions on a limited number of elements they considered representative of the situation. Furthermore, Sharma et al. (2022) and Onsomu et al. (2017) emphasized that gender significantly influences the occurrence of this bias. In contrast, Dickason and Ferreira (2017) observed that representativeness bias affects men and women in the same way. However, these results are not unanimous in literature. Some studies, such as those by Pandey and Dhimi (2021) and Koc (2021), conclude that gender has no significant impact on the prevalence of representativeness bias.
- Anchoring bias (cognitive bias): The tendency of individuals to make decisions based on a previous reference or information. According to Mouna and Anis (2015), there is a significant link between the gender of the investor and the reduction in the level of anchoring, particularly as experience is gained in the markets. Men would be characterized by higher levels of experience and this would lead to a reduction in the level of anchoring.
- Herding behavior (cognitive bias): The tendency of individuals to follow the general market trend. Studies suggest that general market conditions and security characteristics affect women and men in the same way (Zheng et al., 2021). Looking at the management of 3,490 mutual funds in China between 2003 and 2023, Fan et al. (2024) find that herding behavior is more detrimental to performance when portfolio managers are older, male and more experienced. Yang et al. (2024), using an experimental approach based on gaze orientation analysis, conclude that the attentional priority given to general trends would constitute a cognitive mechanism that could explain the greater tendency of women, compared with men, to follow social signals from other people with disparate information and financial incentives. The results of Salem (2019), obtained from a sample of Arab men and women investing in the stock market in Saudi Arabia and Jordan, indicate that women would have greater herding behavior, explained by lower levels of knowledge, confidence and tolerance of financial risk.
- Heuristics (cognitive bias): The tendency to use cognitive shortcuts to make a decision. Heuristics are generally considered to be a source of systematic errors. However, research in psychology and management science shows that intuition and heuristics also enable the use of adaptive decision-making strategies, particularly in complex and uncertain environments (Wilson et al., 2023). Various studies have shown that men tend to prefer the use of cognitive skills, whereas, for women, decision-making is strongly influenced by intuition (Bao et al., 2022; Sladek et al., 2010), which could lead to greater use of heuristics in the female population (Shiloh et al., 2002).
- All that glitters attracts (cognitive bias): Individual investors would prefer stocks that are in the spotlight: stocks of companies widely commented on in financial newspapers and characterized by abnormally high trading volumes (Yuan, 2015; Gambaro & Puglisi, 2015). Based on 28387 data from individual investors in the Chinese market, Chen et al. (2023) find that a significant part of investors mainly buy stocks that attract attention (so-called attention-based buyers). They are said to be more sensitive to news and more inclined to use online information as their main reference. Attention-based buyers would also use more speculative investment strategies. The results show that this bias is more pronounced among male individual investors.

At the end of this threefold theoretical analysis, we suggest that the state of the art in relation to both individual investors and gender differences in investment strategies is very extensive. However, the theoretical approaches to the differential development of biases as a function of gender are much less developed (except for overconfidence). From this observation, we are directing our research question towards the analysis of biases and not just gender differences in trading.

Our question is, therefore, as follows: To what extent does the appearance of behavioral and cognitive biases on the stock markets depend on the gender of the investor?

## 3. Methodological Approach and Sampling

### 3.1. Methodological Perspective

The methods used to study gender differences in investment behavior are mainly oriented towards quantitative approaches. However, this type of methodology seems to overlook the psychological realities of individual investors. The

use of qualitative methodologies is receiving increasing interest due to the various possible orientations (Severin et al., 2022) because variables directly related to the personality of individuals are considered. For this last reason, we have decided to use experimental finance and adopt a qualitative methodological framework. The qualitative methodological approach and the use of laboratory experiments offered us the possibility of gaining a deeper understanding of decision-making in the stock markets (Floyd & List, 2016). In practical terms, qualitative methodology traditionally involves the use of various tools such as structured questionnaires (Glaser & Weber, 2007; Tekin, 2018), online surveys (Hoffmann & Post, 2016), psychometric tests (Abdeldayem & Sedeek, 2018) and personality measurement scales (Hassin & Trope, 2000). Most studies focus on the use of one of these tools. We have chosen to combine several instruments to achieve a convergence of our results. To begin with, we used closed questions to collect the socio-demographic characteristics of the participants (gender, age, personal interest in finance and academic interest in financial matters). At the end of the experiment, to approach the development of the biases taken into consideration in this study, we also asked the participants to answer a questionnaire adapted from Mer and Vishwakarma (2024). In order not to guide the participant's choice, only the statements (without mentioning the bias analyzed) were included in the questionnaire. For each statement, participants were asked to position themselves on a Likert scale with six positions. The aim of this six-notch choice was to avoid participants adopting a neutral position while at the same time offering them detailed statements in order to accurately reflect their impressions. We also consolidated these results with data from the trading journals. To assess overconfidence, we have drawn up a frequency table of asset holding periods, making it possible to classify trading strategies according to the investment time horizon. We assume that shorter holding periods reflect greater overconfidence. We also looked at the degree of diversification of investments to get an idea of the general orientation of the strategy adopted and any gender differences in risk-taking propensity. By reading the trading journals, we were able to analyze the concentration on certain stocks and their possible correspondence with the informational field.

Our experiment is based on the treatment method described by Smith (1982) cited by Serra (2012). This method breaks down each experiment into three elements. The first element describes the environment and the initial circumstances in which the participants are involved. The second element corresponds to the institution, which relates to the tasks that the participants have to perform. The last element focuses on the set of results and observations that arise from what has been achieved by the participants.

### 3.2. Sampling

In the field of experimental finance and in the analysis of the effect of emotional fields on decision-making (Rossignol et al., 2007; She et al., 2017), the use of student populations is widely adopted (study by Ackert et al., 2003) and seems to make sense (Biais et al., 2005; Bruguier et al., 2010; Widyarini, 2017). In addition, we have chosen an incentive scheme corresponding to a reward in the form of an increase in the exam mark for the three best portfolios at the end of the experiment. This reward mainly serves to encourage the motivation and cognitive effort of participants (Etchart-Vincent, 2006; Williams, 2008, cited by Gabbi & Zanotti, 2019).

The analysis was conducted on a student population following a Management Sciences course (second year of Bachelor's degree) at the University of Mons (Belgium) on the Charleroi site (Belgium) on the 21<sup>st</sup> of November 2024 between 8 a.m. and 12 a.m. The students were invited to take part in a stock market game as part of a subject taught (Introduction to Financial Reality), which made it easier to organize the experiment. As the experiment was developed as part of a course, this should a priori encourage student participation, especially since, firstly, part of the course (even small) was specifically devoted to trading activities and behavioral finance. Secondly, the incentive offered was supposed to motivate them to take part in the experiment. Basically, the students were not very familiar with trading norms, given that the course (24 hours) was only their first educational experience in finance. If we take this a step further, we can even assume that before the experiment, they were not at all familiar with the use of stock market sites, which could imply the need for a lengthy adaptation period. In terms of standardization, a threefold deficit could, therefore, be observed:

- A deficit in financial knowledge,
- A lack in knowledge of the underlying financial product and
- A lack in the use of online stock market platforms (this intuition will be confirmed by the descriptive statistics of our sample).

Despite the various elements above, only 17 students (61% of the audience) took part in the experiment; we argue that the rewards offered were not sufficiently motivating and/or that the students were not really interested in financial subjects (the experiment was only indirectly part of the subject to be studied for the exam).

ABC Bourse was chosen as the stock market platform; this platform enables students to create stock market games based on fictitious portfolios worth 100,000 euros, place orders and observe the influence of these orders on the financial value of the portfolio. The platform includes a range of macroeconomic and political information, company information and the more common technical analyses (moving averages and RSI, both of which were taught in the theory course). For operational purposes, a game was developed, and students were invited to sign up. ABC Bourse enables all the movements made by each participant over the experimental period to be visualized, as well as the financial scale of these movements. For each transaction, we asked the students to enter in a trading journal the time at which it was made, its nature (purchase or sale), the name of the share concerned, the number of shares bought or sold, the price at which the transaction was made and the total amount invested or sold. As the platform did not provide this information on a continuous basis, we also manually computed the history of the cash in the portfolios at the end of each transaction. It should be noted that every hour, the platform ranked the various participants based on the value of their portfolios.

### 3.3. Conduct of the Experiment

The experiment took place in three stages. During the first hour, participants were asked to fill in a questionnaire concerning socio-demographic data. Table 1 shows the socio-demographic characteristics (gender and age) of the participants. We note that there was no over-representation of a specific gender, which can certainly be explained by the fact that participation was not voluntary. Indeed, the literature shows that males have a greater natural propensity to play (for instance, Wegrzycka, 2007), regardless of the incentive offered (except that all the people who did not take part in the experiment were male). As we are addressing a single audience, it is not surprising to find a concentration of age among the participants. What is more interesting (even if it is surprising for an audience enrolled in a Management Science course) is that people's interest in the stock market seems to be very low, and when it is present, it is simply a question of willingness to pass the exam. This observation leads us to hypothesize that the public is very unfamiliar with the use of financial sites and stock market data beyond what they are taught in courses (confirmed by a high average attendance rate at the course). Without considering any gender differences, the lack of prior knowledge leads us to believe that participants should develop their investment strategy based on very rudimentary elements and a large dose of intuition, to a greater or lesser extent. A simple reading of these descriptive statistics leads us to believe that behavioral and cognitive biases should develop relatively strongly during the experiment. Without falling into caricature and in an approach derived from crowd psychology, the people taking part in the experiment have a very "academic" profile; they take part because it had been planned in their timetable, it allowed for the eventual granting of a reward and that it ensured a certain satisfaction for the organizers.

Before the official opening of the stock markets, we also dealt with various technical problems and familiarized participants with the use of the stock market platform, which made sense in relation to the various observations made above.

Data	Values	Quantity	Percentage
Gender	Women	8	0,47
	Men	9	0,53
	Total	17	1
Age	18 years	2	0,12
	19 years	6	0,35
	20 years	5	0,29
	21 years	3	0,18
	22 years	1	0,06
	Total	17	1
Course Attendance Rate	Less than 30%	1	0,06
	Between 30% and 60%	1	0,06
	More than 60%	15	0,88
	Total	17	1
Personal Interest	Yes	2	0,12
	No	15	0,88
	Total	17	1
Academic Interest	Yes	7	0,41
	No	10	0,59
	Total	17	1

Table 1: Characteristics of Participants by Gender, Age, Course Attendance, Personal and Academic Interest

The next two hours were devoted to carrying out the experiment and to the trading activity itself. During these two hours, participants worked on an individual basis and were able to place orders. We limited the investments to the companies included in the CAC 40 (a general presentation of the companies in the index had been planned prior to the experiment); to avoid any confusion, we also broadcast the composition of this index continuously. The first portfolio only included the total amount of liquidity provided by the platform (100,000 euros). Thereafter, students could invest all or part of their financial assets. No limit was set on the number of transactions they could make, no transaction costs were charged, and no instructions were given on the minimum number of shares to be held in the portfolio. In order not to complicate the use of the trading platform, transactions were carried out at the market price (the site also offered the unused option of defining a limit price or trigger thresholds). After an hour's trading and based on the information provided by the platform, we announced the interim rankings. At the end of the two hours of trading, the names of the three owners of the highest fictitious portfolios were revealed. The last hour of the experiment was devoted to a questionnaire designed to identify any biases that might have been developed.

### 3.4. Stock Market Conditions Prevailing during the Experiment

The stock market environment in November 2024 was strongly influenced by the results of the US elections on 4 November and the re-election of D. Trump, as well as by the geopolitical tensions caused by the war between Russia and Ukraine. On the previous day of the experiment, we observed a degree of stability in the US stock market indices, an appreciation of the dollar and the Swiss franc against the euro, and a rise in the price of gold. The Asian markets closed at the beginning of the morning (European time) with a fall in the TOPIX index in Japan. These factors seemed to indicate a

degree of risk aversion at the opening of the European markets. The most decisive news for anticipating the market sentiment at the opening was the announcement by US company Nvidia (made after the close of the US markets), which forecast better-than-expected results for the fourth quarter but was judged disappointing by US investors. The share price fell by 2.5% in after-hours trading on the New York Stock Exchange.

At 08:32, information from the trading platform indicated that the Paris Bourse should have regained in early trading, even though Nvidia's quarterly results had not totally convinced investors. At around 8:15 a.m., the 'future' contract on the CAC 40 index - December delivery—was up 28 points at 7,242 points, suggesting a positive opening.

Among CAC 40 companies, STMicroelectronics presented its sales forecasts for the period 2025-2027 on 20 November, prompting financial analysts (UBS, Deutsche Bank) to issue positive opinions or to maintain their recommendations on the stock (Goldman Sachs, Jefferies, Barclays, Oddo BHF) on 20 and 21 November. On November 20, Air Liquide also announced the appointment of a new industrial director to its executive team. On 21 November, no major announcements were due to be made by CAC40 companies, so market behavior was likely to be heavily influenced by factors not directly linked to the companies in the index.

On the chart, it is possible to identify several key moments in a general stock market configuration which developed in a W-shape. A very short bullish period in the first exchanges - between 09:00 and 09:10 - during which the index reached the maximum level observed during the experiment (and even during the day) at 7204 points, followed by a downward trend until 09:30 when CAC 40 was trading at 7156 points. Between 09:30 and 10:00, the uptrend resumed (the CAC reached 7185 points at 10:00). Between 10:00 and 10:30, a major downtrend took shape, and the CAC 40 bottomed out for the duration of the experiment (and also for the day) at 7132 points. The end of the experiment was characterized by a bullish configuration that allowed the index to more or less regain its level at 09:30 (7180 points) by 11:00. During the experiment, the CAC40 finally lost 0.3%. The five time zones described above will be used to analyze any differentiated behavior depending on the direction of the markets to identify possible sheep-like movements.

Concerning the results and their analysis, the data collected come from the questionnaire issued prior to the experiment (collection of socio-demographic data), the trading journals (analysis of the biases) and the questionnaire collected at the end of the experiment (analysis of the biases).

#### 4. Results

From the analysis of the questionnaires and the trading journals, we were able to identify certain trends. Regarding the questionnaires, in order to detect the development of possible biases, we focused on participants who selected the top three levels of the Likert scale for each bias considered. The analysis highlighted the presence of three preponderant biases: representativeness bias, the presence of heuristics and "everything that glitters attracts".

The representativeness bias appears to be equally distributed between men and women. In their choice of decisions, the participants appear to have used very rudimentary graphical instruments and only in relation to the securities in their portfolios. The fact that the participants had very little familiarity with the stock markets may have reinforced its development. In fact, few people mentioned a real personal interest in the financial sector. Lack of experience seems to explain the development of representativeness bias, with no differences explained by the gender of the participants. On the other hand, seven out of eight women responded positively to questions about heuristics, compared with three men. The presence of heuristics would, therefore, appear to be more prevalent among women than men. This finding suggests that intuition and instinct have a greater influence on the female part of the sample. This result could be explained by the fact that heuristics could be part of adaptive strategies for short decision-making times, based on what has been written in the scientific literature and which is in line with what we found. This result seems logical given the widespread lack of knowledge or interest in the subject being taught, the relatively short duration of the experiment (the construction of structured decision-making tools takes time) and the high levels of uncertainty. We could argue, with all due caution, that intuition, mainly found in the female gender, is what remains when the rational field has been exhausted or is difficult to access.

Concerning the 'all that glitters attracts' bias, it seems to have developed strongly during the experiment for all the participants. For example, although students were told that they should limit their investments to CAC40 stocks, some of them regularly asked whether it was possible to invest in companies that were getting a lot of media coverage at the time of the experiment but were not included in the index. They mentioned, for example, the case of Soitec, which had announced confirmation of its annual targets. To confirm the presence of this bias, analysis of the trading journals revealed that 13 participants, or 76.5%, had directed part of their investments towards Air Liquide and STMicroelectronics, the only two companies for which information had been communicated to the markets. We also compared the presence of this bias by gender (see Table 2). The results show that this bias is perceptible for both men and women, without any significant differences being observed (even though three of the four people who did not invest in the two companies in the spotlight were men).

Participant	Gender	Investment Concentration in Air Liquide	Investment Concentration in STMicroelectronics	Total
1	Man	11.11%	0%	11.11%
2	Man	15.38%	0%	15.38%
3	Woman	0%	0%	0%
4	Woman	0%	0%	0%
5	Man	9.52%	0%	9.52%

Participant	Gender	Investment Concentration in Air Liquide	Investment Concentration in STMicroelectronics	Total
6	Woman	7.69%	15.38%	23.07%
7	Man	13.64%	0%	13.64%
8	Man	14.29%	0%	14.29%
9	Woman	0%	0%	0%
10	Woman	3,85%	1,92%	5.77%
11	Woman	12,50%	0%	12.50%
12	Woman	20,69%	0%	20.69%
13	Woman	3,70%	0%	3.70%
14	Man	0%	0%	0%
15	Man	16,67%	0%	16.67%
16	Man	12,50%	0%	12.50%
17	Man	10,53%	0%	10.53%

Table 2: Investment Concentration by Gender

Regarding overconfidence, an analysis of participants' portfolios using trading journals revealed several observations. Firstly, based on the cash available variable (see Table 3), we show that the owners of the portfolios with the lowest cash holdings were men, which suggests that men take greater risks than women do. Secondly, the level of portfolio diversification appeared to be greater among women. Four women held shares in between 9 and 35 different companies, compared with just one man in the same category (see Table 3). Thirdly, the average holding time by gender differs only slightly (Table 4), suggesting that the overconfidence bias is not really differentiated between men and women. These different observations seem to demonstrate a more cautious behavioral tendency on the part of the women in the sample, with no discernible differential in overconfidence (in all cases, the levels of available cash remain very high).

Cash Available	Quantity	Percentage	Men	Women
Between 88,000 and 99,937	5	0,2941	1	4
Between 69,000 and 85,000	7	0,4117	3	4
Between 26,000 and 64,000	5	0,2941	5	0
Number of Companies	Quantity	Percentage	Men	Women
Between 9 and 35	5	0,2941	1	4
Between 6 and 8	8	0,47	5	3
Between 3 and 5	4	0,2353	3	1
Total	17	1	9	8

Table 3: Cash Available and Portfolio Diversification

Men's Average Holding Time	Women's Average Holding Time
52 minutes and 42 seconds	55 minutes and 30 seconds

Table 4: Average-Holding Time by Gender

About herding behavior, we have analyzed changes in the number of transactions as a function of the general direction of the markets at the time they took place (see Table 5). We did not find any distinctive herding behavior, apart from a slight tendency for women to sell more than men during downturns and a slight tendency for men to buy more during upturns.

Moment	% Men Purchase	% Women Purchase	% Men Sales	% Women Sales
Bearish	0,44	0,472	0,38	0,46
Bullish	0,56	0,528	0,62	0,54
Total	1	1	1	1

Table 5: Breakdown of Movements by CAC 40 Direction

In addition to the possible presence of different biases (which is our central research question), we also looked at the level of performance of the portfolios at the end of the experiment. We worked in terms of net return (relative performance), i.e. we compared the portfolio's performance with that of the index for the period. During the experiment, participants seemed to focus mainly on changes in the value of their portfolio without considering changes in the benchmark index. Prior to any analysis, we noted relatively concentrated levels of performance, as the difference between the best and worst-performing portfolios was barely 1%. We have, therefore, not observed the development of investment strategies that are positively or negatively atypical in terms of profitability. The three best-performing portfolios (and, therefore, the winners) were owned by women, and most women's portfolios showed a net return (table 6). It should be noted that, in this bearish context, the winner could have been someone who had not made any transactions since the net return on the best-performing portfolio is less than 0.30% (the loss recorded by the index during the experiment).

Participant	Gender	Net Return
1	Man	-0,0002
2	Man	0
3	Woman	0,0029
4	Woman	0,0015
5	Man	-0,0025
6	Woman	0,0021
7	Man	-0,0058
8	Man	-0,0017
9	Woman	0,003
10	Woman	0,0029
11	Woman	-0,0012
12	Woman	0,0019
13	Woman	-0,0031
14	Man	-0,0065
15	Man	0,0002
16	Man	0,0012
17	Man	-0,0047

*Table 6: Analysis of Net Return by Gender*

According to us, this result can be explained by several factors that we are trying to link to the behavioral and cognitive biases considered. Firstly, the higher levels of caution and portfolio diversification in the female component of the sample seem appropriate to the general negative market configuration at the time of the experiment. Secondly, as we did not identify any overconfidence, herding behavior, anchoring bias, representativeness bias or availability bias, the performance differential between men and women can only be attributed to greater use by women of one of the last three bias analyzed. From this point of view, even if we confirm, for the sample as a whole, the presence of the “all that glitters attracts” bias and that of the representativeness bias, we do not identify any trends that would allow us to conclude that there are differentiated influences based on gender. And so, by elimination, the positive delta in performance recorded between men and women could, in our view, only be explained by greater use of heuristics by women.

Our initial research question will, therefore, be answered as follows. According to our results, gender does not necessarily condition the appearance of behavioral and cognitive biases, or only for a very limited number of them: in the context of this study, only one, the use of heuristics. It should be added that this use also seems to explain the performance differentials between men's and women's portfolios in the context of our experiment.

## 5. Discussions

The analysis of gender differences in decision-making processes is widely documented in financial literature. Previous studies on this subject have generally found differences between men and women. However, other studies demonstrate the need to consider variables other than gender or even show no distinction in the decision-making process between men and women. The literature also includes many studies concerning the possible appearance of both behavioral and cognitive biases. However, aside from overconfidence, few studies have specifically focused on differences in the development of biases based on gender. Our analysis, to some extent, fills this gap. In line with the literature, we find more cautious behavior on the part of women, based on more intense efforts to diversify their portfolios. In the context of our experiment conducted in a bearish stock market environment, this female prudence enabled the development of financial value. This conclusion raises the question of better female representation on trading floors, in particular, to avoid the development of speculative bubbles.

Our results also tend to show that, even if some biases can be commonly developed regardless of gender, the influence of the use of heuristics, influenced by ways of thinking that give pride of place to intuition, are more at work within the female population, particularly in decision-making contexts characterized by high levels of uncertainty. To the question of which planet individual investors come from, we can answer as follows: Yes, men do come from Mars, and yes, women do come from Venus, although the two planets are not necessarily as far apart as they are in space.

## 6. Limitations and Additional Research Avenues

Firstly, even if the results we got are in line with the scientific literature on the issue under consideration, we feel it is important to point out that their generalization would be all the easier if, firstly, the sample analyzed were larger and, secondly, the experiment was spread over a longer period of time. In terms of sampling, it could also be interesting to work on the basis of a higher level of heterogeneity. Secondly, to the extent that the theoretical definitions of bias are, in some cases, relatively close, future studies could also analyze the degree of porosity between the different biases likely to influence the behavior of stock market traders, even if it means focusing on a limited number of generic biases. In addition, the emotional field *stricto sensu* was not considered in the analysis (the emotional influence was integrated into the heuristics); future studies could make it an angle of a specific approach and determine the possible interaction with the biases developed. Finally, the performance differentials observed based on the gender variable are strongly conditioned by the bear market configuration at the time of the experiment. From this point of view, replicating the approach in bullish stock market contexts could be a factor in developing individual investor mappings.

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