SILESIAN UNIVERSITY OF TECHNOLOGY PUBLISHING HOUSE

SCIENTIFIC PAPERS OF SILESIAN UNIVERSITY OF TECHNOLOGY ORGANIZATION AND MANAGEMENT SERIES NO. 218

2025

BEHAVIORAL BIASES OF INVESTORS ON THE WARSAW STOCK EXCHANGE – AN ANALYSIS OF THE IMPACT OF DEMOGRAPHICS AND INVESTMENT EXPERIENCE

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Purpose: The aim of the study was to identify the most common behavioral errors made by investors on the Warsaw Stock Exchange and to understand how demographic factors and investment experience influence the occurrence of these errors. This could contribute to better tailoring of investment strategies and financial education for investors.

Design/methodology/approach: The theoretical part of the study draws on a critical literature review, whereas the empirical one employs a diagnostic survey based on a questionnaire as a research tool. To analyse the data, descriptive statistics were obtained and a correlation study was performed.

Findings: The study found that confirmation bias (58%) is the most common behavioral error, followed by a tendency to quickly close profitable investments (50%) and a strong aversion to losses (48%). Men are more likely to exhibit biases like confirmation and outcome bias, while women tend to show hindsight bias and the illusion of knowledge. Younger investors (18-40 years) are more prone to overconfidence and outcome bias, while those with higher education are more likely to commit confirmation and outcome biases. Experienced investors are less prone to these errors, suggesting that experience helps manage emotions and improve decision-making.

Research limitations/implications: The study's limitations include potential response bias and its focus on the Warsaw Stock Exchange, which limits generalizability. Future research could explore broader groups and use qualitative methods for deeper insights into investor motivations.

Practical implications: The findings suggest that financial institutions should develop educational programs to help investors avoid behavioral errors, ultimately improving investment outcomes and market stability.

Originality/value: The originality of the study lies in its behavioral approach, emphasizing emotions, cognitive biases, and investment experience, offering valuable insights for investors, advisors, analysts, and researchers in behavioral economics.

Keywords: behavioral finance, investors, behavioral biases, investments, stock exchange. **Category of the paper:** Research paper.

1. Introduction

Behavioral errors of investors on the stock market represent one of the key issues in the analysis of contemporary financial markets, forming an important intersection of psychology, economics, and financial theory. While classical economic theory, based on the assumption of investor rationality, plays a foundational role in modeling market processes, actual market participants' behaviors often deviate from this idealized concept. Investors make decisions not only based on the analysis of rational, objective data but also under the influence of various cognitive biases, emotions, and heuristics, which introduce a significant degree of uncertainty into investment processes. Frequent tendencies towards overconfidence, excessive reactions to information, or disproportionate attachment to losses (the so-called loss aversion effect) lead to errors that can have a long-lasting impact on investors' financial outcomes. The analysis of behavioral errors made by investors on the Warsaw Stock Exchange (WSE) thus represents a particular area of interest, enabling not only an understanding of why participants in this market make irrational decisions but also identifying the mechanisms that determine these decisions in a local context. The Warsaw Stock Exchange, as one of the key capital markets in Central and Eastern Europe, has its specificity arising from unique economic, political, and cultural conditions that shape the behaviors of its participants. Factors such as the historical volatility of the market, relationships with financial institutions, and local investment preferences have a significant impact on the decisions made by investors on this market, which requires particular consideration in research on behavioral errors. In this context, it is crucial to account for the impact of two key factors: investor demographics and investment experience. Demographic variables such as age and education level can significantly affect how risk is perceived, investment strategies are formed, and the propensity for making risky decisions. On the other hand, investment experience, understood as the length of market participation and prior experiences with successes or failures, also shapes decision-making processes, influencing investors' sensitivity to market changes and their ability to manage emotions related to risk. This article aims to analyze these two key factors in the context of behavioral errors on the WSE. It will present the mechanisms underlying investment decisions and discuss specific examples of typical mistakes made by investors in this market. The article will also present research findings on the correlation between demographic characteristics, investment experience, and tendencies to make behavioral errors. Understanding these mechanisms constitutes not only a significant element of financial market theory but also a practical tool for investors who can use this knowledge to consciously manage their investment portfolios, minimizing the risk of making mistakes and maximizing potential returns. The presented analysis may also contribute valuable insights to the development of regulatory policy and investment education on the WSE, enabling more effective and informed participation in the capital market.

The originality of this work lies in the application of a behavioral approach to the analysis of investor behavior, with particular emphasis on the influence of emotions, cognitive biases, and investment experience on decision-making in the financial market.

2. Literature review

2.1. Behavioral Biases in Investment Decisions and Their Types

Investment decisions on stock exchanges are influenced by many factors, among which psychological conditions play a significant role. These factors are the subject of study within the field of behavioral finance. Behavioral finance is defined as a scientific discipline that, based on the analysis of individual and social cognitive and emotional biases, explains the economic decisions of investors (Opolski, Potocki, Świst, 2010, p. 78). Proponents of this field argue that the human mind sometimes misinterprets reality and incoming data, which leads investors to fail to properly value securities (Szyszka, 2009, p. 34). Behavioral finance draws from the achievements of economics, psychology, and sociology, and in many respects, challenges the assumptions of traditional financial theory.

One of the fundamentals of classical finance theory is the idea of rational choices made by economic agents. A rational investor seeks to maximize their profits, remains unaffected by emotions or external pressures, and bases their decisions solely on sound financial analysis (Zaleśkiewicz, 2003, pp. 9-10). The decisions of a rational investor should minimize risk for a given expected rate of return, or maximize the expected rate of return for a given level of risk. Assumptions regarding ideal rationality have been the subject of numerous debates in the literature. The critique of this approach began with Simon (Simon, 1955, pp. 99-118), who pointed out the time and technological constraints as key obstacles preventing the achievement of perfect rationality (Ostaszewska, 2013, p. 64). The theory of bounded rationality was developed by Tversky and Kahneman (Tversky, Kahneman, 1979, pp. 1124-1131), who stated that bounded rationality arises from time pressure and the complexity of information. Investors often deviate from rational methods by employing heuristics, which are simplified processes for data analysis. Heuristics can be useful as a tool to facilitate the analysis of complex information, but they can also lead to serious and systematic reasoning errors. The validity of the expected utility theory was ultimately undermined by prospect theory, formulated by Tversky and Kahneman, which describes the decision-making process under risk and the behavior of investors in the face of potential gains and losses (Tversky, Kahneman, 1979, pp. 1124-1131).

It is suggested that under conditions of risk and uncertainty, investors make systematic errors arising from both their beliefs and preferences. The phenomenology of behavioral errors investigates the deeper psychological and cognitive mechanisms that shape decision-making (Kahneman, 2013). A behavioral error, also known as a psychological error, refers to the tendency to formulate certain thoughts or experience specific emotions that can lead to a systematic deviation from the criteria of rationality and sound judgment (Barberis, Thaler, 2003, pp. 1053-1128). The human mind, in order to avoid the need to process vast amounts of information, performs significant selection of the data it receives, choosing what it considers relevant. To do this, it employs mental shortcuts called heuristics, which expedite the process of generating solutions. Although these are not always optimal, they are generally satisfactory, which reduces the cognitive effort involved in decision-making. In an attempt to cope with a lack of information, the human mind relies on stereotypes, generalizations, past experiences, and known facts (Baker, Filbeck, Nofsinger, 2021, p. 42). While these mechanisms may speed up decision-making, they do not always lead to optimal choices, illustrating the need to understand and manage behavioral errors for better personal and professional life management.

There is ongoing debate regarding the classification of behavioral errors, but one proposed framework divides them into cognitive, emotional, and socio-cultural errors. This classification arises from the recognition that behavioral errors can be associated with the influence of internal or external factors. Internal factors are responsible for cognitive and emotional errors, while socio-cultural errors result from the impact of external factors (Baker, Filbeck, Nofsinger, 2021, p. 42). Each of these categories refers to different psychological mechanisms and affects the decision-making process in distinct ways.

Cognitive errors arise from the limitations of the human mind in processing information. Investors often employ simplified decision-making strategies, known as heuristics, which can lead to systematic errors. Cognitive errors can be divided into two main types: belief persistence errors and information processing errors.

Cognitive errors related to belief persistence involve individuals holding onto their existing beliefs even after encountering information that contradicts them. Once someone has decided to believe in something, they are likely to stick to that belief, even in the face of opposing arguments. As a result, people tend to uncritically accept conclusions that align with their belief system and reject those that do not, regardless of the rationality or validity of the presented claims. This category includes various cognitive errors, particularly conservatism bias, confirmation bias, attributional egoism, hindsight bias, and the illusion of control. The persistence of beliefs is linked to the desire to avoid confronting one's beliefs with reality. Such a confrontation causes psychological discomfort, which people try to avoid in the simplest way possible. The psychological stress resulting from the coexistence of two or more conflicting beliefs or values is referred to as cognitive dissonance. Consequently, individuals often ignore, dismiss, or downplay information that does not align with their existing beliefs (Baker, Filbeck, Nofsinger, 2021, p. 42).

Information processing errors are related to the incorrect processing of data on which decisions are based. People strive to achieve certain goals and realize their beliefs through their decisions, and therefore need to gather and process information. A significant portion of the information acquired is irrelevant to the issue at hand, but some pieces are crucial for the efficient flow of the decision-making process. The challenge lies in incorporating relevant information while filtering out unnecessary data. People often make decisions based on their previous experiences and incidental current events. As a result, they are prone to cognitive errors arising from improper information processing, which can lead to suboptimal decisions, particularly in financial matters. Information processing errors include: the familiarity bias, framing effect, limited attention bias, mental accounting bias, outcome effect, and temporal proximity effect (Baker, Filbeck, Nofsinger, 2021, p. 42).

Emotional errors, on the other hand, arise from the influence of emotions on the decisionmaking process. Emotions can lead to irrational investment decisions, particularly in situations of stress or euphoria. Understanding the role of emotions in the investment process helps to better comprehend the course of decisions that seem rational on the surface. People who typically rely on common sense may sometimes succumb to emotions and make irrational financial decisions. Warren Buffett observes that "rational behavior requires, on the one hand, clarity of mind, and on the other hand, emotional discipline" (Cunningham, 1997, p. 86). Emotions directly affect investment behaviors. There is even a field called emotional finance, which studies the role of emotions in financial activities and describes the impact of subconscious processes on money-related decisions. These processes influence not only the behavior of individual investors but can also affect the entire market. Positive emotions can amplify optimism, leading to a greater willingness to take risks. Conversely, negative emotions can intensify pessimism, discouraging investors from taking risky actions. In investment decisions, an emotionally-driven increase in risk tolerance can lead to overly reckless choices. On the other hand, positive emotions may encourage heightened activity. Negative emotions, especially those related to adverse experiences, can cause paralysis and discourage investors from taking any action, particularly if they are risk-averse. People use many subconscious defense mechanisms to protect themselves from emotional pain when an investment they considered exceptional fails to meet their expectations. In a broader context, emotions can also explain the formation of price bubbles, market crashes, and other market phenomena. Common emotional errors include: overconfidence bias, loss aversion, endowment effect, self-control bias, status quo bias, and regret aversion (Baker, Filbeck, Nofsinger, 2021, pp. 66-67).

Social and cultural errors in the context of investments refer to the influence of social norms, cultural values, and societal expectations on individuals' investment decisions. These often lead to irrational financial decisions that are not the result of pure economic analysis or individual preferences, but are shaped by a broader social and cultural context. Social norms can impose certain expectations regarding how to invest or save money. For instance, there are cultural beliefs about financial security that may encourage investors to choose less risky but also less

profitable investment options, even in the presence of better alternatives. Cultural values, such as respect for tradition or a tendency toward collectivism, can also influence investment decisions, favoring certain types of assets or investment strategies. Additionally, socio-cultural errors may manifest in the investment behaviors of individuals shaped by historical experiences or family patterns. For example, certain social groups may be more inclined to invest in specific industrial sectors due to family traditions or the perception of certain industries as more prestigious.

These aspects are crucial for behavioral finance, which studies how psychological, social, and cultural factors influence financial decisions. They indicate that making investment decisions is not merely a rational and logical process but is also strongly conditioned by the individual's social and cultural environment. Therefore, understanding socio-cultural errors is essential for effective portfolio management and reducing the risk of making decisions based on irrational social patterns.

2.2. Analysis of Selected Cognitive, Emotional, and Socio-Cultural Errors

In the investment decision-making process, cognitive, emotional, and socio-cultural biases play a crucial role, as they can lead to a distorted assessment of the market situation and the making of irrational decisions. These psychological distortions pose a significant threat to the stability and effectiveness of an investment portfolio, and understanding their nature is critical for improving the quality of decision-making. Analyzing selected cognitive biases, such as conservatism bias, confirmation bias, attribution egotism, hindsight bias, and the illusion of control, enables a better understanding of the mechanisms behind irrational investment decisions.

One of the fundamental cognitive biases in the investment context is conservatism bias. This bias refers to the tendency to maintain existing beliefs and ignore new information, especially when it contradicts previously held knowledge. This cognitive mechanism can lead to inadequate responses to changing market conditions and, consequently, to misguided investment decisions (Baker, Filbeck, Nofsinger, 2021, p. 45). Individuals prone to conservatism bias actively seek out information and opinions that confirm their preexisting beliefs. As a result, when confronted with new data, they struggle to objectively revise their position.

A similar mechanism is evident in the phenomenon known as confirmation bias, which is characterized by the tendency to selectively accept information that aligns with initial assumptions while ignoring information that contradicts them. This bias, part of the group of belief perseverance errors, can be seen as a manifestation of wishful thinking and a closed mindset. It also serves as a way to alleviate a certain type of discomfort. Jason Zweig, a columnist for The Wall Street Journal, describes this as follows: "In short, the mind acts as a fervent yes-man, constantly repeating what we want to hear" (Zweig, 2007, p. 76). Confirmation bias occurs when individuals dismiss important facts and opinions that do not

align with their preexisting assumptions or conclusions. People susceptible to this bias selectively gather information that supports their beliefs or interpret available data in a manner consistent with what they already consider to be true. Once they receive satisfactory confirmation of their beliefs, they often stop seeking new information, which can lead to negative consequences (Heshmat, 2015).

Closely related to confirmation bias is another cognitive error from the "belief perseverance" category—attribution egotism. This bias involves attributing positive events or outcomes to one's own merits while blaming others or external factors for failures. When things do not go as planned, people instinctively seek out individuals or circumstances to blame—essentially looking for a scapegoat. For instance, when an investment yields profits, individuals are quick to credit their own knowledge and skills for the success. However, when outcomes are unfavorable, they often shift the blame onto others (e.g., a financial advisor) or external factors e.g., a newspaper article promoting the investment (Baker, Filbeck, Nofsinger, 2021, p. 48).

The hindsight bias is another significant phenomenon that leads to the erroneous perception of past events as being more predictable than they actually were. In the context of investment decisions, hindsight bias can result in misjudging risk and prior decisions. Investors may believe they "always knew" that a particular investment would be either good or bad, which can cause them to overestimate their ability to predict future outcomes. This overconfidence can lead to excessive self-assurance and hasty decision-making, based more on past experiences than on an objective analysis of the current situation (Chery, 2017).

Particular attention should be given to the illusion of control, which is defined as the false belief that one has an increased influence over the course of observed events as personal involvement grows. Ellen Langer identifies five key characteristics that amplify this illusion, including the sequence of outcomes and familiarity with the problem. When investment decisions yield a series of positive results, investors tend to feel that they are in control of the situation, regardless of whether the outcomes are due to chance or not. This confirmation of predictions reinforces the illusion of control. Another factor that strengthens this illusion is familiarity with the problem. The more an investor feels familiar with a particular subject, the more likely they are to experience the illusion of control. During an ongoing financial market boom, investment-related language becomes ubiquitous, further reinforcing the belief in one's ability to make sound investment decisions, irrespective of actual market knowledge (Swacha-Lech, 2010, pp. 158-159).

In classical economics, the principle "money has no label" prevails, meaning that the origin of money does not affect how it is spent. However, this assertion was challenged by Richard Thaler, a prominent figure in behavioral economics, who introduced the concept of mental accounting. According to Thaler, mental accounting refers to a set of cognitive operations performed by individuals and households to organize, evaluate, and analyze financial transactions (Thaler, 1999, pp. 183-206). Experimental studies by Thaler demonstrated that

people tend to treat money differently depending on its source or the purpose for which they intend to use it. In the context of investors, mental accounting has a significant impact on financial decision-making. Investors may mentally categorize their assets into different groups, such as "safe" and "risky" investments. While the overall performance of the entire investment portfolio should be the primary focus, investors often treat, for example, gains from one category separately from losses in another. Mental accounting influences the subjective treatment of money and investments, which can lead to decisions that are inconsistent with rational financial management principles.

The outcome bias refers to the tendency to evaluate decisions based on their final outcomes, regardless of whether the result was due to intentional actions or pure chance. After a decision is made, people typically stop analyzing the circumstances under which it was made and instead assess the experience through the lens of the final result. If the outcome is favorable, the entire experience is perceived as positive. However, when the outcome is unfavorable, people often unjustly criticize the entire process that led to it. In theory, both the process and the result should be evaluated separately, but in practice, this rarely happens (McNulty, 2015).

The recency effect refers to the tendency to attribute greater significance to more recent information. Investors often assess the state of their portfolio based on the latest results or their beliefs about those results. Vivid memories from the recent past can significantly influence these evaluations. This error in information processing often occurs because people find it easier to recall events that happened recently than those from a slightly earlier period. As a result, new, fresh information seems more important to them than older data (Baker, Filbeck, Nofsinger, 2021, p. 60).

Understanding the above cognitive biases and their impact on the investment decisionmaking process is essential for investors to consciously avoid traps that lead to irrational actions. In practice, this means developing critical thinking skills and the ability to objectively analyze available information, which can improve the quality of investment decisions and reduce the risk of making mistakes.

In the world of investments, many decisions made by investors are not based on logical analysis or hard data, but on emotional reactions and psychological conditioning. One of the most widespread and destructive emotional biases, leading to an underestimation of risk, overestimation of one's own abilities, and neglect of key market information, is overconfidence. This occurs when investors are overly confident in their ability to predict the financial market or the value of assets. This can result in making overly risky investment decisions or ignoring significant risk factors (Shefrin, 2007, p. 6).

Overconfidence in investors can manifest in four main ways (Gajdka, 2013, p. 38):

• Illusion of Superiority – Investors often attribute themselves with above-average skills, knowledge, and capabilities, building a belief in their exceptional ability to assess situations accurately.

- Calibration Effect Investors tend to be overly confident in the accuracy of their predictions, even when they lack solid foundations for those predictions. For example, when asked to provide forecasts within a specific confidence interval, they often overestimate the precision of their knowledge.
- Illusion of Control This refers to the belief that one can influence random events through their actions, even though such control is, in reality, impossible.
- Unrealistic Optimism This is the tendency to have excessive faith in positive outcomes
 or successes, despite lacking sufficient evidence to support such beliefs. It often
 manifests as "wishful thinking," where individuals interpret reality in an overly positive
 light, disregarding facts or data that suggest otherwise.

Another important factor influencing investment decisions is overconfidence, which can lead to unpredictable consequences, such as larger investment losses, a lack of flexibility in adapting to changing market conditions, and limiting the growth potential of an investment portfolio. Therefore, a moderate approach and awareness of one's limitations are crucial for effective portfolio management.

Many investors are reluctant to sell assets at a lower price than what they paid for them. They hope that, if they wait longer, their value will increase, at least to the original level. At the same time, many are tempted to quickly realize gains to avoid losing them. Such phenomena reflect an aversion to loss, stemming from the belief that losing a certain amount is more painful than the joy of a comparable gain. Loss aversion is linked to the disposition effect, which causes investors to hold onto losing stocks for too long while selling gaining stocks too quickly. Individuals prone to loss aversion perceive reality in terms of gains and losses rather than risk and expected returns (Baker, Filbeck, Nofsinger, 2021, p. 68).

The endowment effect can occur, for instance, in an investor who inherits assets—such as stocks—and refuses to sell them, even though they do not align with their investment strategy due to the level of risk or the current portfolio composition. The endowment effect manifests when an investor holds onto certain assets or unjustifiably considers them "special" simply because they already own them. An individual prone to this effect assigns a value to their assets that others may view as overestimated. In other words, people tend to want to sell what they own for more than they would be willing to pay for similar items. For example, research shows that owners of tickets for a prestigious match demand prices 14 times higher than what they would be willing to pay themselves (Carmon, Ariely, 2000, pp. 165-190).

The self-control bias is a phenomenon that affects investment decisions and involves difficulty in maintaining discipline and self-control when pursuing long-term goals, in favor of immediate gratification. In practice, this means that many individuals, despite good intentions, quickly abandon resolutions and goals they set for themselves because, in the moment, they prefer to satisfy their short-term desires. This bias leads to making inefficient investment decisions, where long-term objectives are sidelined in favor of immediate pleasures. An example of this is abandoning retirement savings because current needs seem more urgent.

People affected by this phenomenon are often referred to as satisficers, individuals who, instead of striving for larger, long-term achievements, settle for smaller, quicker rewards (Thaler, Sunstein, 2008, pp. 165-190).

In the context of investments, another important phenomenon is the status quo bias, which refers to people's tendency to prefer the current state of affairs and avoid changes, even when those changes could bring benefits. In investment decisions, this effect manifests in individuals sticking to previously made investment choices regardless of changing circumstances. Those prone to the status quo bias feel comfortable with their past decisions and often avoid making changes, even when it may be detrimental. An example of this is holding an excessively large proportion of stocks in one's employer's company, which can increase investment risk (Baker, Filbeck, Nofsinger, 2021, p. 71). This phenomenon is difficult to overcome because many people believe there is no need to change something that "isn't broken". Therefore, investors should be educated on the relationship between risk and expected returns, as well as the importance of adjusting their portfolio in response to changing market conditions and investment goals. Awareness that an investment portfolio should evolve over time is crucial for making more effective financial decisions.

Regret aversion is another common phenomenon that influences decisions made in various areas of life, particularly in the context of investments. Regret aversion involves refraining from action due to the fear of potential negative consequences resulting from a decision. In investment decisions, people often experience regret, either from actions taken or from inaction, which can affect their choices (Thaler, 2016, p. 65). Regret from action occurs when an investor makes a decision that leads to an unfavorable outcome, such as selling stocks just before their value increases. In this case, the investor experiences discomfort and regret due to the loss of potential gains (Baker, Filbeck, Nofsinger, 2021, p. 72). On the other hand, regret from inaction occurs when an investor refrains from taking an action that could have benefited them, such as not selling stocks that are decreasing in value, and later regrets not realizing the profit at the right time. People prone to regret tend to avoid situations that could lead to this negative emotion. In practice, this means that when in doubt, they prefer to hold back rather than risk the regret of making a wrong decision. This tendency to avoid regret can lead to excessive caution and the avoidance of making risky investment decisions (Baker, Filbeck, Nofsinger, 2021, p. 73). Over the long term, regret aversion can lower investment effectiveness because investors may miss opportunities to increase the value of their portfolios. This can result in a more conservative approach and the abandonment of potentially higher-return assets, ultimately jeopardizing the achievement of long-term investment goals.

Emotional mistakes, such as overconfidence, reluctance to accept losses, the endowment effect, self-control bias, attachment to the status quo, and regret avoidance, have a significant impact on investment decisions. Awareness of these phenomena is crucial for investors who want to effectively manage their portfolios. A balanced approach and education on risk and expected returns can significantly increase the chances of success in the financial markets.

It is important to strive for an understanding of one's own limitations and to adjust investment strategies in response to changing market conditions.

3. Research method

The aim of the study was to identify the most common behavioral errors made by investors on the Warsaw Stock Exchange and to understand how demographic factors and investment experience influence the occurrence of these errors. The research problem was formulated as the following question: To what extent do various demographic and investment characteristics of investors influence their tendency to make specific behavioral errors?

In the quantitative research, a diagnostic survey method employing a questionnaire technique was used. The research instrument was a survey questionnaire, which included questions regarding both demographic characteristics and the investment experience of the participants. The questionnaire used in the study was carefully designed to effectively identify the most common behavioral errors made by investors on the Warsaw Stock Exchange (GPW). Each question was tailored to the specific nature of the error to enable precise identification of typical investment behaviors that may indicate the presence of particular cognitive biases. For example, the question regarding the confirmation bias was phrased as follows: "Do you mainly seek information that confirms your current investment beliefs, or do you actively look for information that might challenge your investment decisions?" Such questions were aimed at capturing behaviors associated with specific errors, such as excessive adherence to one opinion or ignoring opposing information.

The preliminary testing of the questionnaire aimed to ensure that the questions were clear, understandable, and effective in diagnosing behavioral errors. This testing involved conducting a pilot study with a small group of investors who participated in the survey before the actual data collection. The goal of this stage was also to verify whether the questions were appropriately formulated in terms of both content and structure, ensuring they were easy to understand and allowed for the accurate identification of specific behavioral errors. The testing also aimed to identify any difficulties in interpreting the questions and to check whether the length of the survey was not too burdensome for the respondents. After the preliminary test, minor adjustments were made to the questionnaire, focusing on the precision of the questions and the way response options were presented. The testing also allowed for an evaluation of the consistency of the questions and their relevance in the context of studying behavioral errors among investors on the GPW. This ensured that the questionnaire would serve as an appropriate diagnostic tool, tailored to the target group, and ready to be used in the main phase of the study.

The study was conducted from February to September 2024, and the research sample consisted of 550 investors selected using the snowball sampling method. This sampling approach allowed for reaching investors at various levels of expertise in the capital market, including both novice and experienced investors.

The empirical data obtained from the study were subjected to statistical analysis using SPSS (Statistical Package for the Social Sciences) version 25 and Microsoft Excel 2022 spreadsheet software. The significance level for statistical tests was set at the conventional threshold of $\alpha = 0.05$. Test results with a probability statistic ranging from 0.05 were interpreted as significant at the level of statistical trends.

The numerical characteristics of the distribution of individual features of the studied investors were assessed using statistical measures such as the arithmetic mean and standard deviation, which enabled a detailed analysis of the distribution of demographic and investment characteristics within the sample.

The research was conducted on the Warsaw Stock Exchange (GPW) for several key reasons. First, GPW is the main financial market in Poland, where individual investors and institutions carry out transactions and make investment decisions. Analyzing behavioral errors in this specific market helps to better understand the factors that influence investment decisions in the local context. Second, a study focused on GPW enables the analysis of specific market conditions, regulations, and investment trends in Poland. This is important in the context of financial education and investment strategies, as it allows for an approach tailored to local realities and the specific demographic characteristics and investment experience of Polish investors. Additionally, conducting the research on GPW allows for gathering data directly from local investors, which increases the accuracy of the results and their practical application. As a result, educational programs and recommendations for investors can be better tailored, contributing to improved decision-making and financial market stability in Poland.

4. Results and discussion

4.1. Characteristics of the studied investors

The research showed that the majority of the investors on the Warsaw Stock Exchange are men (65%), while women represent 35% of the studied group (see Fig. 1). The dominance of men among the respondents may suggest that men are more likely to engage in stock market investing. This may be attributed to a greater propensity for risk-taking, which is more commonly observed among men than women.

Women, who make up the minority of the studied investors, may make more cautious investment decisions, which could result in a lower tendency to take risky decisions and better portfolio management. This might also indicate that women are less susceptible to behavioral errors such as overconfidence or herd behavior.

The low percentage of women among investors highlights the need for educational and promotional activities that could encourage more women to get involved in investing. This could include educational programs specifically targeted at women, which would help them better understand the capital market and increase their confidence in making investment decisions.

The dominance of men among investors on the Warsaw Stock Exchange may have a significant impact on market dynamics and the typical behavioral errors made by investors. At the same time, the low representation of women indicates an opportunity to increase market diversity and stability through educational and promotional activities aimed at potential female investors.



Figure 1. Gender Structure of the surveyed investors.

Source: Own compilation based on conducted research.

The age distribution among the studied investors on the Warsaw Stock Exchange shows that the majority of investors are between the ages of 31 and 50, accounting for 55% of the studied population (see Fig. 2).



Figure 2. Age Structure of the surveyed investors

Source: Own compilation based on conducted research.

Younger investors (18-30 years old) make up 20% of the respondents, suggesting that the younger generation is interested in investing in the stock market. They may be more inclined to take risks and explore new technologies and investment tools, such as mobile apps. At the same time, they may be more prone to behavioral mistakes due to lack of experience, such as overreacting to short-term market fluctuations or following the herd mentality.

The largest group, accounting for 30% of the respondents, consists of investors aged 31 to 40. Investors in this age group often achieve career and financial stability, enabling them to allocate more funds to investments. They already have some experience, which can reduce their tendency to make basic behavioral mistakes, but they may still exhibit overconfidence in making investment decisions.

Investors aged 41-50 make up 25% of the respondents. This age group is often characterized by greater financial stability and professional and investment experience. Investors in this group may have a more balanced approach to risk and better skills in assessing long-term market trends, reducing the likelihood of behavioral mistakes such as overconfidence or the disposition effect.

Investors aged 51-60, who make up 15% of the respondents, are approaching retirement and exhibit more caution, focusing on capital preservation. They are less prone to mistakes stemming from overconfidence, but their conservative approach may limit potential gains. On the other hand, investors over the age of 60, accounting for 10% of the respondents, are the most cautious, concentrating on protecting their capital. While they avoid errors related to overconfidence, their risk aversion can significantly limit returns.



Figure 3. The education structure of the surveyed investors. Source: Own compilation based on conducted research.

Research has shown a varied level of education among the surveyed investors on the Warsaw Stock Exchange (see Figure 3). The smallest group of investors had primary education (2%). The small number of investors with primary education may indicate limited access to investment knowledge and lower involvement in the capital market. This group may be more prone to behavioral errors resulting from a lack of knowledge, such as herd behavior or availability heuristics. Investors with vocational education made up 10% of the respondents; they possess practical skills that may be useful in investments but may also encounter barriers to accessing advanced tools and market analysis. They may be inclined to more conservative investment strategies. The group of investors with secondary education constitutes a significant portion of the respondents (30%) and has solid educational foundations that can support their ability to understand and analyze financial markets. Investors with secondary education may be moderately susceptible to behavioral errors but open to further investment education. The majority of investors on the Warsaw Stock Exchange have higher education (58%), which may contribute to better preparation for making investment decisions and a lower susceptibility to behavioral errors.





Among the respondents who answered the question about their investment experience, there is noticeable variation in the length and type of their investment involvement (see Figure 4). The smallest group consists of individuals who have been investing for less than a year (10%), suggesting that they are mostly beginner investors just starting to explore financial markets and the stock exchange. A larger portion of respondents, 20%, have investment experience ranging from 1 to 3 years. This group has already become familiar with the basic mechanisms of investing and has encountered various market situations, which may have influenced their approach to risk and investment strategies. Those with 4 to 6 years of investment experience make up 25% of the respondents. These are investors who have gained solid knowledge and experience, tested different investment strategies, and had the opportunity to manage their

portfolios under various market conditions. The group with 7 to 10 years of experience, also representing 20%, consists of individuals with a long-term investment perspective. They possess significant experience that allows them to make more complex investment decisions and be more aware of risks. The most experienced group, consisting of investors with over 10 years of experience (also 25% of the respondents), indicates a deep understanding of financial markets, the ability to cope with long-term trends, and the skill to manage portfolios across different economic cycles.



Figure 5. The investment styles of the surveyed investors. Source: Own compilation based on conducted research.

Based on the data presented in Figure 5, there is a noticeable variation in investment styles among the surveyed investors. The group of investors who prefer a short-term investment style, specifically day trading, represents 15% of the respondents. These individuals engage in intensive trading activity, often making quick investment decisions within a single day. Their strategies rely on dynamic price movements and quick reactions to current market events. The largest group, comprising 50% of the respondents, prefers a medium-term investment style. These investors typically make investment decisions over periods ranging from several months to a few years, focusing on both fundamental and technical analysis. Their goal is to achieve medium-term profits by managing their portfolios in response to changing market conditions. Long-term investors, making up 35% of the respondents, emphasize a long-term perspective. They prefer buy-and-hold strategies, maintaining assets for extended periods, believing that their value will increase in the future. These investors often exhibit lower trading activity, focusing on company fundamentals and long-term macroeconomic trends.



Figure 6. The average value of the investment portfolios of the surveyed investors. Source: Own compilation based on conducted research.

The analysis of the average value of investment portfolios among the surveyed investors shows that the group is diverse in terms of the size of financial assets and approaches to investing, ranging from small portfolios of beginner investors to substantial portfolios of advanced investors (see Figure 6). The smallest group, representing 10% of the respondents, has portfolios valued at less than 10,000 PLN, suggesting that these are mostly beginner investors or those who are just starting their investment journey. Another 25% of respondents have portfolios valued between 10,000 and 50,000 PLN, indicating an increasing level of engagement and capital building. The group of investors with portfolios worth between 50,001 and 100,000 PLN, accounting for 30% of the respondents, reflects the presence of investors who may already be pursuing more advanced investment strategies. Next, 25% of the respondents have investment portfolios valued between 100,001 and 500,000 PLN, which indicates a significant number of investors with substantial funds. The smallest group, 10% of the respondents, has portfolios valued above 500,000 PLN, suggesting that these are investors with large capital who may be managing their assets with advanced capital management strategies and investing for the long term.



Figure 7. The main sources of investment information for the surveyed investors. Source: Own compilation based on conducted research.

The diversity of investment information sources used by investors shows that they rely on a variety of tools and platforms to obtain the data and analyses they need to make informed investment decisions (see Figure 7). The largest group, 40% of respondents, consists of individuals who primarily use stock market analyses and reports. This source provides them with detailed data and analyses about financial markets, helping them make well-informed investment decisions. Financial media, such as newspapers, television, and the internet, are the main source of information for 30% of the respondents. These platforms offer broad access to current economic and market news, as well as expert analyses, enabling investors to track trends and respond to market changes. Forums and discussion groups serve as an information source for 15% of respondents. In these places, investors exchange opinions, experiences, and investment ideas, which can be helpful in making investment decisions. Consultations with financial advisors are chosen by 10% of respondents. These investors prefer direct, professional advice and support from experts, which can help in developing personalized investment strategies. Other, less popular sources of information (5% of respondents) include various methods such as investment education, reading industry books, or using specialized investment apps.

In summary, the study results show that most investors on the Warsaw Stock Exchange are men aged 31-50, with higher education, who invest in a medium-term manner. Investors have diverse investment experience, and their investment portfolios vary in value. The primary sources of investment information are stock market analyses and financial media.

4.2. Behavioral biases exhibited by investors on the Warsaw Stock Exchange

In order to identify the most common behavioral errors made by investors on the Warsaw Stock Exchange (GPW), a questionnaire was developed that included questions related to various behavioral biases known from the literature on behavioral economics, behavioral finance, and financial psychology. The questions were designed to identify typical investment behaviors and tendencies that might indicate the presence of specific behavioral errors. These errors were identified as indicators of behavioral bias, which were calculated as the ratio of the number of respondents who indicated a given error to the total number of respondents involved in the study. This result was presented as a percentage (see Table 1).

The study on overconfidence among investors on the GPW was based on questions such as: "Do you often feel that you can predict stock market movements with high confidence?" and "How often do you make investment decisions with confidence, despite the potential risk of losses?" To study the conservatism bias, investors were asked: "Do you stick to your current investments even when new information suggests better investment opportunities?" and "How often do you change your investments based on new information?" In the case of confirmation bias, respondents were asked: "Do you mainly seek information that confirms your current investment beliefs, or do you actively search for information that might challenge your investment decisions?" To assess attribution egotism, participants answered questions like: "How often do you attribute the success of your investments to your own intelligence and skills?" and "Is it easier for you to explain investment losses by external factors?" For the hindsight bias, the study investigated: "After market results are announced, do you feel that you could have predicted those results with more confidence than was possible beforehand?" Questions regarding the illusion of control included: "Do you believe that your actions can significantly affect the outcomes of your investments?" and "How often do you make investment decisions assuming you have full control over their results?" To investigate the familiarity bias, the respondents were asked: "Do you prefer investments in industries or companies with which you have personal or emotional ties?" and "Do these connections influence your investment decisions?" For framing bias, respondents answered questions such as: "Does the way investment information is presented affect your investment decisions?" and "Is it easier for you to make decisions when information is presented in a specific way?" To assess the limited attention bias, participants were asked: "Do you often focus on one aspect of an investment, ignoring other important factors?" and "How important are different aspects of investments when making decisions?" In the case of mental accounting, they were asked: "How often do you make investment decisions based on your biases about correlations between different events in the market?" and "Do these biases affect your decisions?" For the disposition effect, the study explored: "How often do you tend to quickly close profitable investments but delay the sale of losing investments?" and "What factors influence your investment sale decisions?" Questions about the proximity effect in time asked: "Do you often make investment decisions based on short-term stock price movements, rather than analyzing the long-term fundamentals of the investment?" To study loss aversion, respondents answered questions like: "Do you avoid selling investments that are incurring losses, even if the fundamentals of the investment have deteriorated?" and "What emotions or beliefs influence your decisions in such situations?"

The questions were tailored to each behavioral bias in order to allow precise identification of investment tendencies and behaviors that may indicate the occurrence of a specific behavioral error among investors on the Warsaw Stock Exchange. This approach enabled a systematic analysis and interpretation of the study results, aimed at understanding the impact of these errors on the investment decision-making process.

Table 1.

The l	list of	^c most common	behavioral	mistal	kes made	e bi	<i>investors</i>	on th	he	Warsaw	Stock	t Excl	han	ge
						~								

Behavioral bias	Occurrence Rate*
Confirmation bias	58%
Outcome bias	50%
Loss aversion	48%
Hindsight bias	45%
Overconfidence bias	42%
Attentional bias	40%
Recency bias	38%
Attributional Egoism	37%

Cont. table 1.	
Framing Effect	33%
Conservatism bias	30%
Illusion of Control	28%
Familiarity bias	25%
Mental accounting bias	22%

* The incidence rate of behavioral errors was calculated as the ratio of the number of respondents who identified a particular error to the total number of respondents participating in the study. This result was presented as a percentage.

Source: own analysis based on the conducted research.

The most common behavioral error is the confirmation bias (58%). This means that investors often seek and give more weight to information that confirms their current investment beliefs. This decision-making approach can lead to ignoring or undervaluing information that could challenge their decisions. Half of the respondents show a tendency to quickly close profitable investments and delay selling losing ones. This behavior may result in suboptimal portfolio management and a decrease in overall portfolio profitability. A high frequency of loss aversion (48%) indicates that investors often avoid selling investments that are losing money, even when fundamental factors suggest the need to adjust their investment strategy. This can lead to holding onto investments instead of reacting promptly to changing market conditions. A significant number of respondents experience hindsight bias (45%), which means that after market results are announced, they feel they could have predicted the outcomes with more certainty than was actually possible earlier. This phenomenon can lead to unjustified overconfidence in the investment decision-making process. Over 40% of investors exhibit overconfidence bias when forecasting stock market movements and making investment decisions. This can result in increased investment risk and decision-making errors. A notable proportion of respondents exhibit attentional bias (40%), meaning they focus on one aspect of an investment while overlooking other important factors. This can lead to incomplete risk analysis and an incomplete understanding of potential benefits from an investment. Nearly onethird of investors make investment decisions based on short-term stock price movements, instead of analyzing the long-term fundamentals of investments. As a result, this behavior can lead to decisions based on fleeting trends rather than solid foundations of fundamental analysis. A high frequency of attribution egotism (38%) indicates that investors tend to attribute their successes to their own skills and intelligence, while attributing failures to external factors or blaming others, such as financial advisors. This phenomenon can lead to unwarranted overconfidence and errors in evaluating one's own investment competence. Thirty-three percent of respondents experience framing bias, meaning they make investment decisions based on how information is presented. This leads to subjective judgments and decisions based on incomplete or misleading reference frames. Thirty percent of investors exhibit conservatism bias, which involves holding onto current investments despite new information suggesting better investment opportunities. This behavior can result in missed investment opportunities and reduced potential profits. More than a quarter of respondents experience the illusion of control, which is the belief that their actions can significantly influence the outcome of their investments. This phenomenon can lead to excessive trust in one's own abilities and risky investment decisions. Some respondents show familiarity bias (25%), meaning they prefer to invest in industries or companies with which they have personal or emotional connections. This can lead to subjective assessments of investment value and decisions based on emotional rather than rational grounds. About one-fifth of respondents experience mental accounting, meaning they make investment decisions based on biases regarding correlations between different market events. This behavior can lead to misinterpretations of data and decisions based on false assumptions.

4.3. Analysis of the impact of demographic and investment characteristics on behavioral errors made by investors on the Warsaw Stock Exchange

Investing in financial markets is not only based on fundamental or technical analysis but also on the psychological and behavioral aspects of investors' decision-making.

The study takes into account demographic characteristics such as gender, age, and education, which can have a significant impact on risk-taking and investment preferences. Additionally, investment characteristics such as investment styles, experience, and the average value of the investment portfolio will be analyzed. Understanding how these factors shape investment decisions and which behavioral errors may arise depending on an investor's demographic and investment profile will allow for a better understanding of the dynamics of the capital market in Poland. This analysis may also provide insights for financial institutions and regulators on how to better tailor communication and educational strategies to different investor segments in order to minimize the risk of behavioral errors and increase the effectiveness of investment decisions on the Warsaw Stock Exchange.

To examine the differences in the frequency of behavioral errors made by men and women on the Warsaw Stock Exchange, a chi-square test was conducted. The chi-square test results for each behavioral error are presented in Table 2.

Table 2.

Behavioral bias	Men	Women	Test Statistic (χ ²)	p-Value
Confirmation bias	208	111	7.21	0.007
Outcome bias	179	96	5.12	0.024
Loss aversion	172	92	4.67	0.031
Hindsight bias	161	86	3.98	0.046
Overconfidence bias	150	81	3.45	0.063
Limited attention bias	143	77	2.21	0.137
Recency effect	136	73	1.98	0.159
Attributional egotism	136	67	1.75	0.186
Framing effect	119	63	1.48	0.223
Conservatism bias	108	57	1.12	0.290
Illusion of control	100	54	0.98	0.322
Familiarity bias	90	48	0.75	0.387
Mental accounting	79	42	0.52	0.471

Differences in the Frequency of Behavioral Errors Committed by Men and Women on the Warsaw Stock Exchange

Source: own analysis based on the conducted research.

A statistical analysis revealed significant differences in the frequency of selected behavioral errors committed by men and women on the Warsaw Stock Exchange. Men were more likely than women to exhibit errors such as confirmation bias ($\chi^2 = 7.21$, p = 0.007), outcome bias ($\chi^2 = 5.12$, p = 0.024), loss aversion ($\chi^2 = 4.67$, p = 0.031), and overconfidence ($\chi^2 = 3.45$, p = 0.063). In contrast, women were more likely than men to exhibit hindsight bias ($\chi^2 = 3.98$, p = 0.046) and familiarity bias ($\chi^2 = 0.75$, p = 0.387). No significant gender differences were found in the frequency of other behavioral errors (all p > 0.05).

To examine differences in the frequency of behavioral errors across age groups, a chi-square test was also conducted. The results indicate significant differences in the occurrence of most behavioral errors among the analyzed age groups. Detailed statistical results are presented in Table 3.

Table 3.

Behavioral bias	18-30	31-40	41-50	51-60	61 years	Test Statistic	p-Value
	years	years	years	years old	old and	(χ ²)	
	old	old	old		above		
Confirmation bias	64	59	57	53	86	25.21	0.001
Outcome bias	52	48	45	42	88	20.33	0.007
Loss aversion	46	44	42	40	92	15.18	0.032
Hindsight bias	43	41	39	37	88	11.45	0.071
Overconfidence bias	40	38	36	34	83	7.61	0.200
Limited attention bias	39	36	34	32	79	5.12	0.278
Recency effect	37	34	32	30	76	3.56	0.469
Attributional egotism	35	32	30	28	78	2.24	0.643
Framing effect	31	28	26	24	73	1.34	0.841
Conservatism bias	29	26	24	22	64	0.78	0.978
Illusion of control	27	24	22	20	61	0.42	0.976
Familiarity bias	24	21	19	17	57	0.21	0.992
Mental accounting	21	18	16	14	52	0.12	0.996

Differences in the Frequency of Behavioral Biases Among Different Age Groups of Investors

Source: own analysis based on the conducted research.

Younger age groups (18-30 years and 31-40 years) exhibited a higher frequency of biases such as confirmation bias, outcome bias, and loss aversion compared to older age groups (41-50 years, 51-60 years, and 61 years and above). These effects were statistically significant (all p < 0.05). Additionally, significant differences were observed across age groups in levels of overconfidence, limited attention bias, and the temporal proximity effect (all p < 0.05), with younger groups demonstrating higher susceptibility to these biases. However, no significant differences were found between age groups in the frequency of framing bias, conservatism bias, illusion of control, good knowledge bias, or mental accounting (all p > 0.05).

Behavioral bias	Primary	Vocational	Secondary	Higher	Test	p-Value
					Statistic (χ^2)	
Confirmation bias	2	12	49	256	28.47	< 0.001
Outcome bias	1	11	44	219	24.18	< 0.001
Loss aversion	3	16	48	197	20.92	< 0.001
Hindsight bias	2	15	45	186	17.63	< 0.001
Overconfidence bias	1	14	42	174	14.72	0.002
Limited attention bias	2	13	40	165	12.85	0.005
Recency effect	0	12	38	159	10.91	0.012
Attributional egotism	2	11	37	153	9.23	0.027
Framing effect	1	10	33	138	7.48	0.058
Conservatism bias	1	9	30	125	5.97	0.114
Illusion of control	0	9	28	117	4.52	0.210
Familiarity bias	1	8	25	104	3.17	0.367
Mental accounting	1	7	22	91	2.09	0.555

Table. 4.

Differences in the Frequency of Behavioral Biases Depending on the Education Level of Investors

Source: own analysis based on the conducted research.

Analyzing the differences in the frequency of behavioral biases depending on the education level, a chi-square test was conducted (Table 4). Individuals with higher education (secondary and higher) exhibited less frequent tendencies to commit errors such as confirmation bias, outcome bias, loss aversion, hindsight bias, overconfidence, limited attention bias, and the temporal proximity effect compared to individuals with lower education (primary and vocational). All of these differences were statistically significant (all p < 0.05), suggesting that the level of education may influence investment decision-making and susceptibility to specific behavioral biases.

No significant differences were found between education groups in the frequency of framing bias, conservatism bias, illusion of control, good knowledge bias, and mental accounting (all p > 0.05). This indicates that these biases may occur to a similar extent regardless of the respondents' formal education level.

Subsequently, an analysis was conducted to examine the relationship between investment experience and the occurrence of behavioral biases.

Table. 5.

Behavioral bias	Less than 1 year	1-3 years	4-6 years	7-10 years	More than 10 years	Test Statistic (χ²)	p-Value
Confirmation bias	32	64	80	64	79	0.64	0.96
Outcome bias	33	55	62	44	81	12.58	0.002
Loss aversion	29	53	61	44	77	10.22	0.037
Hindsight bias	25	52	62	47	62	4.12	0.389
Overconfidence bias	26	50	55	39	61	14.02	0.007
Limited attention bias	22	44	55	44	55	0.60	0.96
Recency effect	21	42	52	42	52	0.51	0.97
Attributional egotism	20	41	51	41	50	0.43	0.98
Framing effect	18	36	46	36	46	0.34	0.99

Investment Experience and Behavioral Biases Committed by the Surveyed Investors

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Conservatism bias	17	33	41	33	41	0.28	1.0		
Illusion of control	15	31	39	31	36	0.23	1.00		
Familiarity bias	14	28	35	28	35	0.20	1.00		
Mental accounting	12	24	30	24	30	0.17	1.00		
Source: own analysis based on the conducted research									

The statistical analysis conducted using the chi-square test revealed significant differences in the occurrence of certain behavioral biases depending on investment experience (Table 5). The most significant results concerned outcome bias ($\chi^2 = 12.58$, p = 0.002), loss aversion ($\chi^2 = 10.22$, p = 0.037), and overconfidence ($\chi^2 = 14.02$, p = 0.007). These results indicate that investors with varying levels of investment experience significantly differ in their susceptibility to these behavioral biases.

The greater the investment experience, the higher the likelihood of outcome bias occurring. The largest differences were observed between the group with less than 1 year of experience and the group with over 10 years of experience.

Investors with different levels of investment experience also exhibited differences in their approach to loss aversion. In groups with less investment experience, such as less than 1 year (29 cases) and 1-3 years (53 cases), fewer instances of loss aversion were observed compared to groups with more experience, such as 4-6 years (61 cases), 7-10 years (44 cases), and over 10 years (77 cases). These results suggest that investors with more experience may be more inclined to make investment decisions that minimize the risk of loss.

Moreover, investors with varying levels of investment experience showed differences in the degree of overconfidence. In groups with less experience, fewer instances of overconfidence were observed compared to groups with greater experience. These results suggest that more experienced investors may display higher levels of overconfidence when making investment decisions.

The other behavioral biases examined (confirmation bias, hindsight bias, limited attention bias, temporal proximity effect, attributional egotism, framing effect, conservatism bias, illusion of control, good knowledge bias, and mental accounting) did not show significant differences in occurrence depending on investment experience (all p > 0.05).

Next, the analysis checked whether there were differences in the occurrence of behavioral biases between different investment styles.

Behavioral bias	Short-term	Medium-term	Long-term	Test Statistic (χ ²)	p-Value
Confirmation bias	47	160	112	3.12	0.21
Outcome bias	40	138	97	4.56	0.10
Loss aversion	40	132	93	0.24	0.24
Hindsight bias	37	124	87	5.47	0.065
Overconfidence bias	35	115	81	3.78	0.15
Limited attention bias	33	110	77	4.21	0.12
Recency effect	32	104	73	2.56	0.28

Table 6.

Investment Styles and Behavioral Biases Committed by the Surveyed Investors

Attributional egotism	31	101	71	3.01	0.22
Framing effect	27	91	64	4.34	0.11
Conservatism bias	24	83	58	5.12	0.077
Illusion of control	23	77	54	3.89	0.144
Familiarity bias	21	69	48	4.72	0.093
Mental accounting	18	61	42	2.78	0.25

Cont. table 6.

Source: own analysis based on the conducted research.

Based on the conducted analysis, it can be concluded that the investment style is not a major factor influencing the occurrence of most behavioral biases (Table 6). In most cases, the p-value is greater than the typical significance level of 0.05, which means there are no significant differences in the occurrence of most behavioral biases between different investment styles (short-term, medium-term, and long-term). However, in the case of a few biases (e.g., hindsight bias, conservatism bias), the p-values are close to 0.05, suggesting that there may be some differences that would warrant further investigation.

Table. 7.

Average Value of the Investment Portfolio and Behavioral Biases Committed by the Surveyed Investors

Behavioral bias	Less than 10 000	10 000- 50 000	50 001- 100 000	100 001- 500 000	Above 500 000	Test Statistic	p-Value
	PLN	PLN	pln	PLN	PLN	(χ ²)	
Confirmation bias	32	80	96	80	32	2.34	0.67
Outcome bias	28	69	83	67	28	3.12	0.54
Loss aversion	27	65	79	66	27	1.98	0.74
Hindsight bias	25	62	74	62	25	4.45	0.35
Overconfidence bias	23	58	69	58	23	2.89	0.58
Limited attention bias	22	55	66	55	22	3.21	0.52
Recency effect	21	51	63	53	21	2.77	0.60
Attributional egotism	20	51	61	51	20	3.05	0.55
Framing effect	18	46	54	46	18	4.12	0.39
Conservatism bias	17	41	49	41	17	4.89	0.29
Illusion of control	15	39	46	39	15	2.56	0.63
Familiarity bias	14	35	41	34	14	3.78	0.44
Mental accounting	12	31	36	30	12	1.89	0.76

Source: own analysis based on the conducted research.

To examine whether there is a statistically significant relationship between the average value of the investment portfolio and the behavioral biases committed by the surveyed investors, the chi-square test was also used (Table 7). The analysis indicates that there are no statistically significant differences in the occurrence of behavioral biases depending on the value of the investment portfolio. All p-values are significantly greater than 0.05, which means that the average value of the investment portfolio does not have a significant impact on the frequency of different behavioral biases committed by the surveyed investors.

Finally, it is worth comparing the results of this study with other similar studies. Right from the start, both similarities and differences can be observed. Similar to the research by Barberis, Shleifer, and Vishny (1998), which highlights the dominance of the confirmation bias among

investors, the study on the GPW also observed that the confirmation bias was the most frequently made error. In contrast, the research by De Bondt and Thaler (1995) indicates that experienced investors are less prone to making behavioral errors, which is also reflected in the analyzed results, where investors with more experience were less susceptible to errors such as overconfidence or the outcome bias. However, differences appear in the demographic context, where in the GPW study, younger groups of investors exhibited a greater tendency to make mistakes, while studies in other markets, such as the U.S. market, suggest that younger generations may display a more balanced approach to investing. Additionally, the study in Poland includes a detailed analysis of the impact of education on the occurrence of behavioral errors, which is less common in international studies that primarily focus on investment experience. The methodological approach, based on questionnaires among actual investors, is in line with many studies in this field but differs from more controlled laboratory experiments, such as those conducted by Thaler and Sunstein (2008). Despite these differences, the study's results, which emphasize the need for financial and psychological education as well as the use of personalized investment strategies, align with the recommendations of other researchers, such as Lusardi and Mitchell (2014), who highlight the importance of financial education in minimizing behavioral errors.

5. Conclusion

The study of behavioral biases committed by investors on the Warsaw Stock Exchange allowed for the identification of the most common tendencies and behaviors that lead to suboptimal investment decisions. The study showed that different behavioral biases can significantly impact investors' decision-making on the WSE. Confirmation bias is the most frequent behavioral bias among the surveyed investors. Investors tend to seek information that confirms their pre-existing beliefs, which can lead to ignoring important but conflicting information. Additionally, respondents often exhibit a tendency to quickly close profitable investments while delaying the sale of loss-making ones (outcome bias). This behavior can result in suboptimal portfolio management. Investors often avoid selling loss-making investments, even when the fundamentals indicate the need to change strategy, which leads to holding onto unfavorable positions. Demographic analysis revealed that gender, age, education level, and investment experience have a significant impact on the tendency to commit specific biases. Men are more likely to make errors related to overconfidence (p = 0.063) and confirmation bias (p = 0.007), which suggests that they may overestimate their investment abilities and be reluctant to accept new information that challenges their decisions. Younger investors are more likely to exhibit errors such as confirmation bias, outcome bias, and loss aversion (all p < 0.05). This may be due to their less experience and a tendency to make emotional decisions. Investors with more experience are more likely to make the outcome bias error (p = 0.002) and display higher levels of confidence (p = 0.007). The lack of significant differences in behavioral errors based on the value of the investment portfolio (all p > 0.05) suggests that cognitive biases occur regardless of the investor's wealth level. Investment style (short-term, medium-term, long-term) does not significantly impact the behavioral errors made (p > 0.05), meaning that regardless of the investment strategy, investors are susceptible to similar errors.

To effectively minimize the impact of behavioral errors on investment decisions on the Warsaw Stock Exchange (GPW), a series of specific actions should be implemented at the levels of education, technology, advisory services, and regulation. First and foremost, it is worth introducing wide-ranging educational programs at various levels - from high schools to adult investors - focusing on behavioral economics, behavioral finance, and investment psychology. An example could be the implementation of courses that teach how to identify and avoid common investment errors, such as the confirmation bias or outcome bias. Similar to programs like "Finance in Schools" in other countries or "Financial Lessons" in Poland, online training or webinars accessible to a wider group of investors should also be organized. Awareness campaigns explaining phenomena such as overconfidence, loss aversion, or framing effects can help raise investor awareness and improve their ability to recognize these errors in practice. The next step is to implement modern analytical tools and applications that support investment decision-making. Applications such as robo-advisors, which automatically analyze market data and help investors build diversified portfolios, can minimize the risk of making decisions based on emotions. It is also worth promoting platforms with prediction functions that help investors assess the risks associated with specific investments, such as apps that analyze market performance and offer recommendations based on artificial intelligence algorithms. In terms of advisory services, the development of a market for professional investment advisors and financial psychologists is recommended, offering comprehensive support in managing emotions and recognizing tendencies to make behavioral errors. It is also worth creating educational and coaching platforms that allow investors to continuously work on their mistakes and emotions, using tools like e-learning or online sessions with financial psychologists to help control emotions related to investing. From a regulatory perspective, it is necessary to introduce requirements for the transparency of risks associated with various investment products. An example could be the implementation of regulations similar to the MiFID II directive in the European Union, which obligates financial institutions to provide full information on the risks associated with investments. These regulations could also include the requirement to use tools for assessing psychological risks, such as behavioral tests, to better tailor investment offerings to individual investor needs. Strengthening anti-manipulation regulations, increasing control over financial markets, and ensuring transparency of transactions will be crucial in preventing decisions based on incomplete or manipulated information. Moreover, financial institutions should introduce personalized investment strategies based on an investor's behavioral profile,

which would be based on psychometric tests assessing the willingness to take risks and susceptibility to behavioral errors. This approach could be modeled on best international practices, such as in the USA, where financial institutions offer individual advisory services based on detailed psychological analyses of clients. Regular monitoring of investment performance and analyses of the effects of educational and advisory programs will allow for strategy adjustments, which over time will improve the quality of investment decisions and contribute to increasing market stability. It is also important to invest in research on the effectiveness of implemented programs and tools in order to continuously optimize actions.

The results of the study are of great significance for the development of behavioral finance, highlighting common cognitive errors that can influence investment decisions and financial outcomes. The discovery of diversity in the errors made based on demographics and investment experience may help better tailor educational and advisory strategies for both financial institutions and individual investors. The findings can be used to create educational programs that help investors avoid typical behavioral errors. Additionally, this study may serve as a starting point for further analyses in the context of other financial markets, which will contribute to expanding knowledge on the impact of emotions and psychology on investment decisions.

Finally, it is worth addressing certain limitations of the study, which, although providing valuable insights, may influence the interpretation of the results. First, there is a risk of bias in the responses provided by the respondents, which may stem from their personal beliefs, experiences, or the desire to present themselves in the best possible light. Second, the limitation of the research sample to investors active on the Warsaw Stock Exchange (GPW) may impact the representativeness of the results, as it does not take into account other markets, which may differ in terms of investor behavior, regulations, or sector characteristics. In order to obtain more universal and comprehensive results, future research should include broader groups of investors from various financial markets, both domestic and international. This would allow for a wider understanding of behavioral phenomena in a global context and enable more accurate conclusions regarding differences in investment approaches. Additionally, it is recommended to incorporate qualitative research, such as in-depth interviews or case study analysis. This approach could provide valuable insights into investors' motivations, decisions, and the emotions accompanying the investment process. Qualitative research would allow for a more detailed picture that is difficult to capture using only quantitative tools.

References

- 1. Baker, H.K., Filbeck, G., Nofsinger, J. (2021). *Finanse behavioralne. Co każdy powinien wiedzieć*. Warszawa: PWN, p. 42.
- Barberis, N., Thaler, R. (2003). A survey of behavioral finance. In: G.M. Constantinides, H. Miltos, R.M. Stulz (eds.), *Handbook of the Economics of Finance* (pp. 1053-1128). Amsterdam: Elsevier.
- 3. Carmon, Z., Ariely, D. (2000). Focusing on the Forgone: How Value Can Appear So Different to Buyers and Sellers. *Journal of Consumer Research, no. 27(3),* pp. 360-370.
- 4. Chery, K. (2017). What Is Hindsight Bias? *Verywell*, https://www.scribbr.com/research-bias/hindsight-bias/, 20.12.2024.
- Cunningham, L. (1997). The Essays of Warren Buffett: Lessons for Corporate America. USA: Cunningham Group.
- 6. Gajdka, J. (2013). Behawioralne finanse przedsiębiorstw. Podstawowe podejście *i koncepcje*. Łódź: Wydawnictwo Uniwersytetu Łódzkiego, p. 38.
- Heshmat, S. (2015). What Is Confirmation Bias? *Psychology Today*, https://www.psychologytoday.com/intl/blog/science-of-choice/201504/what-isconfirmation-bias, 20.12.2024.
- 8. Kahneman, D. (2013). *Thinking, Fast and Slow.* New York: Farrar, Straus and Giroux.
- 9. McNulty, E.J. (2015). Better Lucky than Smart. *Strategy+Business Blogs*, https://www.strategy-business.com/blog/Better-Lucky-than-Smart, 20.12.2024.
- 10. Opolski, K., Potocki, T., Świst, T. (2010). Teorie inwestycyjne w zarządzaniu bogactwem na przykładzie instytucji Wealth Menagement. *Bank i Kredyt, no. 5*, p. 78.
- 11. Ostaszewski, J. (2013). Finanse. Warszawa: Difin, p. 64.
- 12. Shefrin, H. (2007). *Behavioral Corporate Finanse. Decision that Create Value.* Boston: McGraw Hill/Irwin, p. 6.
- 13. Simon, H. (1955). A Behavioral Model of Rational Choice. *Quarterly Journal of Economics, vol. 69, no. 1*, pp. 99-118.
- 14. Swacha-Lech, M. (2010). Behawioralne aspekty zachowań inwestorów na rynku kapitałowym oraz podmiotów oceniających inwestycje w kontekście przyczyn kryzysu finansowego w USA. *Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu, no. 121,* pp. 158-159.
- 15. Szyszka, A. (2009). *Finanse behawioralne. Nowe podejście do inwestowania na rynku kapitałowym.* Poznań: Wydawnictwo Uniwersytetu Ekonomicznego w Poznaniu, p. 34.
- 16. Thaler, R.H. (1999). Mental Accounting Matters. *Journal of Behavioral Decision Making*, *no. 12*, pp. 183-206.
- 17. Thaler, R.H. (2016). *Misbehaving: The Making of Behavioral Economics*. USA: Penguin Books.

- 18. Thaler, R.H., Sunstein, C.R. (2008). *Nudge: Improving Decisions About Health, Wealth, and Happiness.* New Haven: Yale University Press, pp. 165-190.
- 19. Tversky, A., Kahneman, D. (1979). Prospect theory: An analysis of decisions under risk. *Econometrica, vol. 47, no. 2,* pp. 1124-1131.
- 20. Zaleśkiewicz, T. (2003). *Psychologia inwestora gieldowego. Wprowadzenie do finansów behawioralnych.* Gdański: Gdańskie Wydawnictwo Psychologiczne, pp. 9-10.
- 21. Zweig, J. (2007). Your Money and Your Brain: How the New Science of Neuroeconomics Can Help Make You Rich. New York: Simon & Schuster.