Do investment fund managers behave rationally in the light of central bank communication? Survey evidence from Poland.

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ABSTRACT:

Purpose: This study aims to answer the question whether investment funds managers exhibit behavioural biases in their investment decisions. Furthermore, it investigates if fund managers, as a group of institutional investors, make decisions in response to central bank's communication as well as other information in relation to various behavioural inclinations.

Methodology: A comprehensive study was conducted based on a questionnaire, which is composed of three main parts exploring: (1) General information about the funds under the management of the surveyed group of fund managers, (2) Factors that influence the investment process with an emphasis on the National Bank of Poland (NBP) communication and (3) Behavioural inclinations of the surveyed group. In the first step, Cronbach Alpha statistic was applied for measuring the reliability of the survey questionnaire and then chi-squared test was used to investigate the relationship between the answers provided in the survey.

Findings: The central bank's communication matters for investors, but its impact on their decisions appears to be only moderate. Interest rates were found to be the most important announcements for investment fund managers. The stock market was the most popular market segment where the investments were made. The ultra-short time horizon played no, or only small, role in the surveyed fund managers' decisions as most of them invested in a longer 1-5 years horizon. Moreover, most respondents declared that they considered in their decisions the information about market expectations published in the media. Finally, majority of the fund managers manifested limited rationality and were subject to behavioural biases, but the decisions and behavioural inclinations were independent and, in most cases, they did not influence each other.

Originality: Apart from the commonly tested behavioural biases in the group of institutional investors in the existing literature, such as loss aversion, disposition effect or overconfidence etc., we focus in this paper also on the less intensively analysed behavioural inclinations, i.e. framing, illusion of the control, representativeness, sunk cost effect and fast thinking. The originality of this study further lies in the way the research was conducted through interviews with fund managers, who were found to be subject to behavioural biases, although those behavioural inclinations did not influence their investment decisions. This finding indicates that professionalism and collectivism in the group of institutional investors protect them from irrationality.

Practical implications: The results reported in this study can be used in practice to better understand and to improve the fund managers' decision-making processes.

Keywords: Investment Funds, Fund Managers, Central Bank, Decision Making Processes, Behavioural Finance, Rationality

JEL: G10, G11, G23, G41.

1. INTRODUCTION

Investment decisions on financial market often depend directly on the arrival of new information, so fund managers, as well as other groups of investors, constantly react to different types of news and to the inflow of macroeconomic data (see Bernanke and Kuttner (2005), Nikkinen et al. (2006), Wongswan (2009), Hanousek et al. (2009) or Brzeszczyński et al. (2015), among others). One of the most important categories of announcements originates from central banks, which inform the markets about their current (and/or anticipated future) monetary policy actions through such signalling mechanism and also by shaping changes in investors' expectations (see Edmonds and Kutan (2002), Ranaldo and Rossi (2010), Brzeszczyński et al. (2015), among others). The decision-making processes of these institutional investors are complex by nature and their behavioural inclinations may play an important role, because the specific behavioural biases can directly influence the way they react to new information and, consequently, may further affect their transactions on financial market (see a summary of different behavioural biases investigated in previous literature presented in Table 1, which further contains relevant references to studies examining particular behavioural inclinations).

Traditional neoclassical finance theory relies on the approach according to which the economic agents, in particular the participants of financial markets, are assumed to be rational. It means that they are efficient and unbiased processors of information. Under such circumstances, their decisions are aimed to achieve utility maximization (Byrne and Brooks, 2008). Barberis and Thaler (2003) further argue that the benefit of this traditional theoretical framework is that it is *"appealingly simple"*. However, they also state that *"unfortunately, after years of effort, it has become clear that basic facts about the aggregate stock market, the cross-section of average returns, and individual trading behavior are not easily understood in this*

framework" (Barberis and Thaler, 2003). On the other hand, behavioural finance is based on the alternative approach according to which investors, or at least a significant minority of them, are affected by behavioural biases. It means that their financial decisions can be less than fully rational and that they do not maximise the utility function (Byrne and Brooks, 2008), which is typically called "limited (or bounded) rationality".[1] The main sources of such biases have been investigated in the cognitive psychology literature and such concept has been further applied in research within the financial markets framework. In the context of this study, an important aspect of the discussions about rational and irrational investors is the extent to which institutional, professional investors succumb to the same behavioural biases as those which are more commonly considered in case of the individual investors. Although this matter has been examined in the previous literature, it is still not clear whether investment professionals are indeed subject to the impact of behavioural biases (i.e. they are not immune to them) or, as it is sometimes argued, the decisions of investment fund managers are mostly devoid of a psychological factors and they are influenced primarily by professional knowledge (Carpentier and Suret, 2021). Behavioural finance challenges also another pillar of the neoclassical finance theory, i.e. the conventional normative expected utility theory, by proposing the descriptive theory of decision making known as the prospect theory (Kahneman and Tversky 1979), which directly refers to both professional and individual investors.

Regardless of how institutional investors are classified, strong evidence of biases in this group of market participants was identified in earlier literature (see e.g. Menkhoff et al. (2010), Barber et al. (2007), among others). Grinblatt and Keloharju (2000), Luo and Li (2008) and

[1] According to traditional view, the notion of limited rationality is understood as the situation when each agent: (1) does not know all the options offered to him/her (i.e. informational limits) or (2) he/she is not able to evaluate all the consequences of his/her choices (i.e. computational limits) (Simon, 1979). However, as Rabin (2013) further argues, not all limits to rationality are based on computational unmanageability. In many cases humans are less than fully rational not because the right answers are complex, but because the wrong answers are enticing. Human intuition may mislead people in various ways that are not sufficiently well understood or described in terms of the difficulty or complexity of problems. This interpretation of the notion of limited rationality is applied in our paper.

Dichtl and Drobetz (2011) further confirmed the lack of rationality among institutional investors, although some other studies showed evidence indicating that they exhibit rational behaviour (see e.g. Keim and Madhavan (1995) or Chang and Wei (2011)). Overall, it can be concluded that there is no agreement (and, in fact, there is no clarity in terms of various empirical findings either) in the available literature regarding the nature of the decision processes of institutional investors. Therefore, our study fills the gap in research focused on the behavioural inclinations of this important group of market participants.

We present and discuss the results of an extensive survey conducted on a unique group of fund managers in Poland, which relies on a very comprehensive questionnaire dealing with questions about the nature of their reactions to the central bank's announcements, but at the same time it also covers the questions evaluating their behavioural biases.

Considering the existing literature, the contribution of our study is as follows.

Firstly, we tested not only the behavioural biases of fund managers as a group of institutional investors, but these inclinations were further linked to the decisions which they make. According to the results available in the earlier literature, professional investors may be subject to common biases, such as loss aversion, disposition, overconfidence, ambiguity aversion, herding, home bias, short termism etc. (see a summary in Table 1), which have impact on their decision-making processes (i.e. Ahmad et al. (2017a,b), Aren et al. (2016)). However, according to another approach, these inclinations do not have to necessarily influence their investment decisions. For example, Shiller (2001) assumes that institutional investors make investments considering the expected return and risk criteria consistent with the conventional finance theory and that they make their investment decisions without being affected by cognitive biases. In our study, we investigated which one of these competing views is more adequate for explaining professional investors' behaviour.

Therefore, based on the view dominating in the existing literature, we formulated our main hypothesis, which states that the behavioural inclinations of professional investors have an impact on their decision-making process.

Secondly, the novelty of our research, which constitutes another important contribution to the existing literature, is that apart from the commonly tested biases in the group of institutional investors (such as loss aversion, disposition effect, overconfidence etc. mentioned above) we focus in this paper also on the less intensively analysed behavioural inclinations, i.e. framing, illusion of the control, representativeness, sunk cost effect and fast thinking.

Thirdly, the originality of this study is also related to a large degree to the very comprehensive nature of our survey, which combines different aspects of the investment activity: information about the funds as financial institutions, factors that affect investment decisions, the decision-making patterns among fund managers and the analysis of their behavioural biases etc. This is also a new contribution to the existing literature.

Moreover, it is worthwhile to note that some markets, e.g. Germany or the USA, have been investigated more intensively comparing to others and, therefore, this paper fills the existing gap regarding institutional investors' rationality in other important markets, such as Poland. The capital market in Poland was chosen as a model example of the market that went through a significant transformation to a market economy and which has been growing faster than many other developed and emerging markets. It should also be noted that the Polish stock market became dominated over time by institutional investors, such as investment funds or pension funds etc., which contributed to the reduction of stock price volatility and to stabilisation effects at the Warsaw Stock Exchange (WSE), but at the same time there exists the evidence that they can affect stock returns (see e.g. Bohl and Brzeszczyński (2006), Bohl,

Brzeszczyński and Wilfling (2009) and Brzeszczyński, Bohl and Serwa (2019)).[2] Rapid growth of the investment funds industry on the Polish financial market (Filip and Miziołek 2019), i.e. faster than the European Union (EU) average, combined with the intensity of activity of professional institutional investors in Poland, make it further particularly interesting to analyse. Our results, reported in this paper, may also have important implications for other emerging markets.

Our survey was conducted in years 2019 - 2020.[3] During this period, we managed to gain access to 25 fund managers in Poland, which considering difficulties in persuading such professionals to take part in a lengthy survey like ours (in particular, in a relatively small market as in Poland) should be regarded as a success.[4] Similar circumstances are described in the existing literature by Cheung and Chinn (1999), Farnsworth and Taylor (2006), Freeman and Bartels (2000) and Kubińska et al. (2016).

The remainder of the paper is organized as follows. Section 2 provides a literature review about the reactions of investors to the information arriving on financial markets with a focus on the announcements released by the National Bank of Poland, as well as the investment fund managers' behavioural biases. Section 3 presents description of the data and the methods. Section 4 reports results from the survey regarding the factors affecting the decisions of

[2] It is worthwhile to note that capital flows generated by institutional investors can have positive effects on economic growth (Slesman et al. (2015)). Moreover, the evidence on the impact of institutional trading on stock prices, provided by Domowitz et al. (2001) or Chiyachantana et al. (2004) among others, shows that it is directly linked to the problem of investment fund managers' behaviour, which we investigate in this paper.

[3] This research was carried out as part of a broader project from the National Science Centre in Poland, focused on central banks communication with financial markets, conducted in years 2017-2021.

[4] Moreover, in the more mature and much larger markets, a directly comparable scale of surveyed financial institutions, using the interviews as a research method, was reported by Cohen et al. (2010), who conducted semi-structured interviews with only 30 respondents from the 'Big 4' accounting firms, and by Foster and Warren (2016), who interviewed staff in just 10 Australian superannuation funds and obtained a sample of only 10 questionnaires, which was considered to be sufficient and representative in their study. Jansen and Tuijp (2021) surveyed 14 fund managers from the Netherlands and Canada (9 Dutch and 5 Canadian pension fund managers and fiduciary managers) regarding their investment and management decisions about illiquid assets. Therefore, the number of the surveyed fund managers in our study is comparable to (or even greater than) the number of respondents in other surveys in similar papers in the previous literature.

institutional investors and their behavioural biases. Section 5 offers a discussion, which is followed by the last Section 6 with a summary and conclusions.

2. LITERATURE REVIEW

The reactions of investors to information that arrives on the financial markets, in particular the news released by central banks, have been analysed in the existing literature so far using mainly quantitative methods. Qualitative approaches, such as surveys, are far less common in this area of research, which concerns especially the work conducted among investment funds managers or financial advisors etc. The main reason is obviously the challenge in form of very limited access to those financial institutions.

We discuss first the literature about market reactions to the central banks' announcements. Early studies conducted on developed markets include Cutler et al. (1989), Berry and Howe (1994), Mitchell and Mulherin (1994), Anderson et al. (2000), Melvin and Yin (2000) and Edmonds and Kutan (2002), among others. More recently, Rosa (2011) investigated the effects of the Federal Reserve's decisions and statements on the US stock and volatility indices (Dow Jones Industrial Average, NASDAQ 100, S&P 500 and VIX) and found that both the surprise component of policy actions and official communications have statistically significant and economically relevant effects on equity indices. Bennani (2020) also tested the overconfidence of FED chair and linked it to investors' behaviour concluding that this indicator was significantly influencing investors' sentiment.[5]

[5] Other relevant papers in this line of literature include Ranaldo and Rossi (2010), Hayo and Neuenkirch (2012), Riordan et al. (2013) and Kubacki (2014). The related studies for emerging markets are Andrle (2009), Kubacki (2014) and Anufriieva and Skapoval (2019), among others.

Despite the existence of a substantial number of studies on advanced markets, there is scant research in this area for emerging markets. Brzeszczyński et al. (2015) presented a review of the literature on investors reactions and sentiment regarding public information in emerging markets. They considered three types of public information (monetary policy announcements, International Monetary Fund-related news, and other public and political news) as factors that influence the market responses. Brzeszczyński and Kutan (2015) also investigated empirically the reactions of the foreign exchange market to the National Bank of Poland (NBP) announcements and they found that central bank communication reduced uncertainty, stabilized the market and increased trading activity. Their findings further suggest that central banks can play an important role in market development. It can be concluded that both developed and emerging markets react to the new announcements. Those findings can be, however, further complemented by the information from qualitative studies explaining in more details the nature of the decision-making processes, which still constitutes a gap in this line of literature.

The asymmetry of the markets' responses to news was also analysed in the prior literature. Prast and De Vor (2005) investigated whether the depreciation of the euro/US dollar exchange rate could be attributed to asymmetric investor reactions with respect to economic and political news, including central bank announcements. The asymmetry in the investors' responses, depending on whether the news originated in the US or in the Euro area was reported. Moreover, investors reacted differently to 'good' and 'bad' news, which suggests cognitive dissonance related to risk aversion.

Taking into consideration the investment process and the factors that determine it, Chevalier and Ellison (1995) examined whether mutual funds' performance is related to fund managers' characteristics, which may indicate their ability, knowledge or effort. In particular, they analysed the relationship between performance and the managers' age, average composite Scholastic Assessment Test (SAT) score at the managers' undergraduate institutions and

whether the managers had te MBA degree. The results reported by Chevalier and Ellison (1995) show that managers who attended higher-SAT undergraduate institutions generated systematically higher risk-adjusted excess returns. In contrast, Menkfoff et al. (2006) reported that inexperienced fund managers yield significantly higher returns than their more experienced colleagues. Inexperienced fund managers tend to take greater risks, which may be explained by a higher degree of overconfidence, less herding behaviour, or a lower degree of risk aversion. Herding decreased with experience, while the evidence concerning risk-taking and overconfidence was mixed.

On the other hand, Arnswald (2001) presented results from a questionnaire survey where fund managers were asked about their practices, company performance and compensation incentives. While the reported findings suggest that professional investors primarily recognised underlying economic information as a source of superior value, there were also strong indications for destabilising behavioural factors related to investment strategies and styles. Drachter et al. (2007) based on telephone interviews with mutual fund managers reported that behaviour of managers depended heavily on particular characteristics of the funds. On the other hand, Beckman et al. (2008) presented comparative survey evidence on asset managers' views and behaviour in such markets as the United States, Germany, Japan and Thailand and they found that cultural differences were important in understanding country differences, which could not be explained by purely economic factors. The culturally different importance of herding, age, experience, gender, tracking error and research effort clearly affected investment behaviour, although in a complex way. Menkhoff (2010) investigated technical analysts and argued that they are experienced, educated and successful in their careers, but also largely overconfident in their decisions.

Fieger (2017) argued that behavioural biases can be grouped into five major categories: heuristics, prospect theory, overconfidence, misperceiving randomness and herding, which may

affect the efficiency of the market. Puetz and Ruenzi (2011) examined overconfidence among equity mutual fund managers in the USA and found that they traded more intensively after a period of good past performance. Using mutual fund annual reports filed in the SEC Edgar database, Eshraghi (2011) and Eshraghi and Taffler (2012) investigated to what extent mutual fund managers were prone to behavioural biases and whether they differed from less sophisticated investors in their potential susceptibilities. The results suggested that excess fund managers' overconfidence diminished mutual fund returns and that it was stronger among growth-oriented funds. Welch and Wang (2013) investigated whether there existed any differences in the characteristics and performance of mutual funds caused by the manager's gender and they found some evidence, which suggests that female managers were characterized by a lower risk tolerance than males. Moreover, the percentage of females managing a fund was negatively related to the performance results over time.

Behavioural biases among institutional investors have been investigated and described in the literature, with some of them being investigated much more frequently, and some others anaysed more sporadically.

Table 1 presents a summary of behavioural biases, which were tested in international markets in the group of the institutional investors.

A common feature among behavioural bias studies related to institutional investors behaviour is that they have been carried out mainly through historical data from financial markets. There is a shortage of insights into qualitative or unobservable factors which would help in understanding institutional investors' behaviour. Our paper aims to fill that gap by using standard behavioural finance tests to explore the institutional investors' biases following which we relate them to particular decisions concerning investors' reactions to the central bank's

announcements. To the best of our knowledge, this is the first such study, which applies this approach for research focused on the behaviour of institutional investors.

Table 1. Behavioural biases tested among institutional investors

Biases	Publications
Herding	Suto and Toshino (2005), Voronkova and Bohl (2005), Menkhoff et al. (2006), Susai and Moriyasu (2007), Beckmann et al. (2008), Lütje (2009), Menkhoff and Nikiforow (2009), Menkhoff et al. (2010), Chang et al. (2012), Kudryavtsev et al. (2013), Holmes et al. (2013), Gavriilidis et al. (2013), Hsieh (2013). Lakonishok, Shleifer and Vishny (1992), Grinblatt, Titman, Wermers(1995), Wermers (1999), Sias (2002), Hong, Kubik and Stein (2003), Fong, Gallagher, Gardner and Swan (2005), Chan, Hwang, and Mian (2005),
Home bias	Suh (2005), Lütje and Menkhoff (2007), Oehler et al. (2008), Fong et al. (2008), Parwada (2008), Menkhoff and Nikiforow (2009), Ke et al. (2010), Menkhoff et al. (2010), Anderson et al. (2011), Mishra and Ratti (2011), Giofré (2013), Hamberg et al. (2013), Fedenia et al. (2013), Hochberg and Rauh (2013), Beracha et al. (2014)
Disposition	Barber et al. (2007), Susai and Moriyasu (2007), Choe and Eom (2009), Menkhoff et al. (2010), Chou and Wang (2011), Cici (2012), Kudryavtsev et al. (2013), Sun et al. (2013), Bodnaruk and Simonov (2014). Shapira and Venezia (2001), Garvey and Murphey (2004), Dhar and Zhu (2006), Rzeszutek (2016)
Overconfidence	Menkhoff et al. (2006), De Venter and Michayluk (2008), Waweru et al. (2008), Menkhoff (2010), Puetz and Ruenzi (2011), Eshraghi (2011), (2014), Eshraghi and Taffler (2012), Braihanne et al. (2014), Rzeszutek (2016)
Short-termism	Suto and Toshino (2005), Lütje (2009), Menkhoff (2010)
Loss-aversion	Olsen (1997), Waweru et al. (2008), Bodnaruk, Simonow (2016)
Ambiguity aversion, Uncertainty avoidance	Bantwal and Kunreuther, (2000), Beckmann et al. (2008)
Confirmation bias	Menkhoff and Nikiforow (2009)
Framing	Almilia et al. (2020)
Sunk costs	Rzeszutek (2016)
Anchoring	Waweru et al. (2008), Freiburg and Grichnik (2013), Liao et al. (2013)
Availability	Waweru et al. (2008), Kudryavtsev et al. (2013)
Mental accounting	Waweru et al. (2008), Rzeszutek (2016)
Representativeness	Waweru et al. (2008)
Endowment effect	Furche and Johnstone (2006)
Optimism	Eshraghi (2011), (2014), Eshraghi and Taffler (2012), Braihanne et al. (2014)
House money effect	Menkhoff and Nikiforow (2009)
Reflection effect	Menkhoff and Nikiforow (2009)
Winner and spotlight Stocks	Arnswald (2001)
Gambler's fallacy	Waweru et al. (2008), Kudryavtsev et al. (2013)
Hot hand fallacy	Kudryavtsev et al. (2013)
Self-marketing	Suto and Toshino (2005)
Gut feelings	Lai et al. (2001)
Excessive portfolio Turnover	Bodnaruk and Simonov (2014)
Emotion	Tuckett and Taffler (2012)

Our study provides addition to the scarce international literature on the fund managers' behaviour and their decision-making processes by focusing on the extensive analysis of their behavioural biases. Previous papers for other markets, based on questionnaire surveys or interviews, include Cheung and Chinn (1999), Freeman and Bartels (2000), Arnswald (2001), Drachter, Kempe and Wagner (2007) and Foster, Warren (2016), Przychodzen et al. (2016), Ahmad et al. (2017a,b), Hartwig et al. (2017), Gomez-Bezarez and Przychodzen (2018), Jansen and Tuijp (2021) and they are typically subject to certain limitations, such as reatively small samples or low response rates. As argued by Azim (2019), large scale surveys of professional investors simply do not exist due to high costs of conducting such research projects. The existing literature also focuses either on the decisions or on the behavioural biases of managers. In case of our study, even though the number of respondents is limited, their answers are valuable for understanding the decisions made by investment funds managers

3. DATA AND METHODS

The data reported and analysed in this paper is derived from a survey, which was conducted among fund managers on the Polish financial market. It was addressed primarily to the institutions, which in their decisions can consider the announcements of the National Bank of Poland (as the Polish central bank).

3.1. The Population of the Study

The research presented in this paper was performed on a group of 25 professionals managing investment funds, who constituted the population of the study. The questionnaire was designed to be addressed to those fund managers who have an influence on the decisions made in their institutions. As a rule, they were typically the managers with professional investment

certificates, such as CFA or local Polish license of an investment advisor, or with securities broker qualifications. The education, however, was not a decisive inclusion criterion, because we focused on the selection of respondents with the key decision-making roles in their respective firms, i.e. they had to have a real influence on the management of the fund and they had to posses the relevant investment permissions. Depending on the institution, the respondent could be the main decision maker in the fund or he/she could be part of a broader team of decision makers. Males were dominant among the respondents in the analysed population of this study (there was only one woman in the investigated group), which reflects the typical gender structure of the fund managers profession in Poland. The survey record had to be slightly reduced in response to the respondents' opinions. For example, most respondents did not want to answer questions about the age and they also refused to make public the name of the fund which they worked for. Any questions allowing to identify the respondents personally were met with resistance. Hence, we had to ensure full anonymity of the respondents.

3.2. Sample Size and Sampling Strategy

Our research is based on a total of 25 responses to comprehensive survey questionnaire which was completed by fund managers from different investment funds. In Poland the investment funds are run by specialised investment fund companies (but, as mentioned above, the exact data about the names cannot be disclosed, because the respondents wanted to keep the names of either the funds or their owners as anonymous). The respondents were searched through personal contacts and through indirect contacts obtained from other respondents. In addition to personal and indirect contacts, the request was sent to the Association of Brokers and Investment Advisors in Poland, which is the institution which also contacted their members asking for help in completing our questionnaire. Unfortunately, the response rate achieved through this channel was very low, so ultimately the personal contacts turned out to be the most

effective recruitment method. We contacted all the respondents personally. Some of the questionnaires were completed by direct interview during the visits to financial institutions where the respondents were asked the questions. In some cases, however, a direct visit was not possible due to the lack of time of fund managers. In other cases, the completion of the questionnaires was preceded by a personal visit and a conversation in which the assumptions and objectives of the study were explained. Subsequently, a Google Forms survey was made available to those respondents. In one case, the survey was also conducted over the phone and it took about one hour to complete. Regardless of the method of completion, the duration of the responses naturally depended on the individual person and the ability to analyze the behavioural questions. The biggest differences in time concerned open questions, where the respondent had to properly develop the answers. Both the reluctance to reveal a company confidential information, as well as limited time that could be devoted to this survey, were the natural limiting factors in this research. Nevertheless, they did not affect the main objective of this study and its cognitive value.

3.3. Questionnaire Development

The questionnaire consists of 3 main parts which concern general information about the analysed funds (Part I), factors influencing the decisions made by fund managers (Part II) and their behavioural biases (Part III). The construction of the questionnaire was a step-by-step process in which a critical analysis of the literature was applied and it was subsequently combined with the objective of the conducted research. We have developed Parts I and II by discussing the scope of the questions asked in order to adjust them to the needs of further analyses, which were carried out subsequently. We included questions that could be combined next with the research hypotheses and with the questions from Part III of the survey. Part III contains behavioural tasks that replicate the original questions typically used by behavioural

finance experts in the existing prior literature (which is described in more details further in Section 3.4 below).

The survey questions regarding the behavioural biases are underpinned by the behavioural finance theory, in particular we used the methodology described by Kahneman and Tversky (1979), Shefrin and Statman (1985), Langer (1975), Ellsberg (1961), Arkes and Blumer (1985) and Frederick (2005), while the survey questions related to the nature of decision-making processes of fund managers, such as their choices of the length of the investment horizon etc., were based on the empirical literature about investors and their reactions to the release of public information (see e.g. Brzeszczyński and Kutan (2015), Brzeszczyński et al. (2015), among others).

3.4. Data Analysis Methods

3.4.1. *Data analysis*. For the analysis of our survey data, the Cronbach's alpha (Cronbach, 1951) - which is the coefficient that measures the reliability, or internal consistency, of a questionnaire – was applied. Moreover, descriptive statistics such as mean, median, minimum and maximum, standard deviation, skewness and kurtosis were also calculated. Subsequently, following Turhan (2020) the chi-squared test was used and symmetric measures were tested based on the null hypothesis that there is no relationship between decisions and the behavioural biases of the surveyed fund managers. The chi-squared was employed to test the independence of observations. Subsequently, likelihood ratio, Phi and Cramer's V were calculated as well. Moreover, we also performed four tests of the normality of the distribution of responses: Doornik-Hansen, Shapiro-Wilk, Lilliefors and Jarque-Bera tests.

3.4.2. *Behavioural biases*. In our survey we exploited 10 questions commonly known in the existing literature, which are related to behavioural biases. The detailed explanation of

the individual tasks, with the relevant literature background and their justification, is included in the Appendix.

3.4.3. *Decisions in relation to the behavioural biases.* The relationship between the answers to the questions about the decisions and the behavioural biases was examined in the final stage of the research. We formulated the following 13 potential relationships with respect to the surveyed responses:

R1: There is a relationship between loss aversion effect related to profits examined in Task 1 and a strategy related to fund risk.

R2: There is a relationship between loss aversion effect related to losses examined in Tasks 2 and a strategy related to fund risk.

R3: There is a relationship between framing effect examined in Task 3 and NBP information taken into consideration by managers.

R4: There is a relationship between disposition effect examined in Task 4 and NBP information taken into consideration by managers.

R5: There is a relationship between disposition effect examined in Task 4 and investment perspective.

R6: There is a relationship between overconfidence effect examined in Task 5 and NBP information taken into consideration by managers.

R7: There is a relationship between overconfidence effect examined in Task 5 and investment perspective.

R8: There is a relationship between illusion of control effect examined in Task 6 and the timing of opening of market position.

R9: There is a relationship between illusion of control effect examined in Task 6 and investment perspective.

R10: There is a relationship between ambiguity aversion effect examined in Task 7 and NBP information taken into consideration by managers.

R11: There is a relationship between representativeness heuristic examined in Task 8 and markets where managers make investments.

R12: There is a relationship between sunk cost fallacy effect examined in Task 9 and the role of the ultra-short investment time horizon.

R13: There is a relationship between fast thinking effect examined in Task 10 and the role of the ultra-short investment time horizon.

The relations from R1 to R13 serve as supporting relationships for the purpose of verifying the main hypothesis about the influence of the behavioural biases on investors' decisions. We followed the practice from the psychological literature, which underpins the behavioural biases investigated in our paper, where the chi-squared test is commonly applied and which allows to verify the hypothesis about the existence of the relationship between two phenomena and not about the causal influence of one phenomenon on another phenomenon. Therefore, we formulated relations from R1 to R13 as statements (in the format "There is a relationship between …") rather than as causal (directional) relations (in the format "X has an impact on Y"), which is a common practice in this line literature (see e.g. Nicolas et al. (2013), Zouhayer, M. (2014) or Koc (2022)).

Each time when the chi-squared test shows the independence of responses to the task testing the existence of behavioural inclinations and the answers to questions about the fund managers' decisions, it can be concluded that there is a support for the statement that the rationality of managers does not matter for the fund performace.

Based on the formulated main hypothesis in this study, and the supporting relations from R1 to R13, our working expectations were that all R1 to R13 will be empirically verified and confirmed.

4. RESULTS

In this section, we present first the general information about the surveyed population (Part I of the questionnaire), the results about the decision-making processes of fund managers (Part II of the questionnaire) and the factors that affect them, in particular those which are related to the NBP communication in the light of the behavioural finance biases (Part III of the questionnaire). Subsequently, we apply Cronbach's alpha for the questionnaire evaluation and chi-squared test to assess the relationships among the answers.

4.1. General Information

Part I of the questionnaire reports direct information about the respondents and the investment funds which they manage. Among the 25 respondents who took part in the survey, there were 24 males and 1 female. The specification of their investments is presented below in Table 2.

Table 2. Specification of investments.

Feature	Specification	No. of answers	Percentage
Investment perspective	less than 1 year	3	12.00%
	1-5 years	18	72.00%
	5-10 years	3	12.00%
	10-20 years	1	4.00%
Strategy related to fund risk:	Aggressive	10	26.32%
	Moderate	17	44.74%
	Conservative	9	23.68%
	Other	2	5.26%
Fund currency	National currency	23	53.49%
	Foreign currency	10	23.26%
Fund currency	PLN	23	65.71%
	EUR	6	17.14%
	USD	5	14.29%
	TRY	1	2.86%

Source: Own study.

The information presented in Table 2 allowed us to test for such effects as the home-bias and short-termism. Majority of investments were made on a local market in a period longer than 1 year indicating that home-bias (but not short-termism) can be confirmed.

4.2. The Decision-making Processes of Fund Managers and the Factors Affecting Them in Light of the NBP Communication (Part II of the Questionnaire)

In ths section, we present and discuss factors affecting the decision process of the surveyed group of institutional investors. The discussion below follows the order of the survey questions.

Question 1

Do you consider the impact of information about macroeconomic data published by the National Bank of Poland (NBP) in your investment decisions, market analyses and forecasts of financial instruments prices? If so, which of the following do you pay attention to: …… (*Please assign weights to each category on a scale from 0 to 10, where 0 is completely unimportant and 10 is the most important*).

The responses indicate that interest rates are the most important factor for investment fund managers. 22 respondents chose this answer with the average weighted value of 7.67. Other indicators important in the decision process are public debt (with a value of 3.08 and pointed out by 16 respondents), money supply (2.79 and 15 respondents) and balance of payments (2.75 and 17 respondents). Managers assigned the lowest value to money reserves (0.83 and 9 respondents). The results are comprehensively presented in Table 3.

Question 2

What other macroeconomic data published in Poland by institutions other than the NBP do you consider important in your decision-making processes regarding investments on the financial market in Poland?

This is an open question and respondents could answer spontaneously. The respondents' statements identified several indicators. Some responses were standardised to simplify the analysis. For example, the "macroeconomic forecasts of banks" category was included in the "banking sector data" category. Overall economic activity measured by industrial production, GDP and sales and inflation measured by CPI were the key factors that investment fund managers pointed out in the decision making. The results are presented also in Table 3.

Question 3

What other macroeconomic data published on foreign markets do you consider important in your decision-making processes regarding investing on the financial market in Poland?

Question 3 is an open question. Most respondents (11) pointed out GDP in different countries, while 10 managers indicated interest rates, 6 selected inflation, 5 pointed out PMI and 4 opted for the Chicago PMI. The Purchasing Managers' Indexes (PMIs) were indicated in the survey 20 times, factors related to the level of return were mentioned 14 times, indicators based on labour market data were indicated 11 times. Indicators constructed based on inflation were mentioned 10 times and indexes related to the real estate market were indicated 9 times. Interest rate representing the cost of borrowing is another key variable. The answers presented in Table 3 related to Questions 3 were grouped for the purpose of better presentation clarity.

Question 4

Do you also consider information about market expectations published in the media in your market analyses and investment decisions, considering the announcements of the NBP?

The respondents in Question 4 could answer "yes" or "no". 18 respondents answered "yes" and 7 of them "no" indicating that most managers take into account information about market expectations published in the media.

Question 5

If so, which categories does the information about expectations relate to?

If the respondents answered affirmatively in Question 4, then in Question 5 they were further asked to specify which categories the information relates to. Interest rates were the most frequently indicated category, which was selected by 15 respondents. The grouped results are presented in Table 3.

Question 6

Where does your information about market expectations come from?

Various forms of information obtained from Bloomberg meant that the answers were divided into 3 categories. Bloomberg was mentioned 13 times, PAP (Polish Press Agency) 5 times and Reuters 4 times. The results related to market expectations are presented in Table 3.

Table 3. Results of survey for questions 1 - 3 and 5 - 6

The impact of NBP announcements on investment fund managers' decisions (Q1)			
NBP information	Average weighted value	No. of answers	Percentage of answers
Interest rates	7.67	22	18.48%
Public debt	3.08	16	13.44%
Money supply	2.79	15	12.61%
Balance of payments	2.75	17	14.28%
Official reserves	1.50	12	10.08%
International investment position	1.42	14	11.76%
Liquid assets and liabilities in foreign currency	1.17	9	7.56%
Other	1.04	5	4.20%
Money reserves	0.83	9	7.56%
Other factors influencing the decisions of investment fund managers published in Poland (Q2)			
Indicator		No. of answers	Percentage of answers
Industrial production		10	11,90%
CPI / inflation		10	11,90%
GDP		9	10,71%

Table 3. (continued)

Retail sales	8	9,52%
Unemployment level	6	7,14%
Other indications (mentioned four times or less)	1 - 4	48,81%*
Foreign macroeconomic data influencing the decisions of respondents. Grouped answers related to the economic data (Q3)		
PMIs	20	31.25%
Interest rate-related indices	14	21.87%
Employment indices, GDP	11	17.19%
Inflation related indices	10	15.62%
Real Estate Indices	9	14.06%
Factors that investment fund managers consider (Q5)		
Interest rates	15	37,50%
Balance of payments	5	12,50%
Money Supply	4	10,00%
Inflation, Foreign debt, International investment position	3	22,50%*
GDP	2	5,00%
Consumption, QE, Official reserves, Liquid assets and liabilities in foreign currency, Exchange rate	1	12,50%*
Information sources mentioned by investment funds managers (Q6)		
Bloomberg	10	27,03%
PAP (Polish Press Agency)	5	13,51%
Reuters	4	10,81%
Bloomberg – consensus, Industry portals, Information agencies/services (in the sense of agencies, mainly PAP)	2	16,22%*
Bloomberg – surveys, Broker reports, Financial services, Consensuses, Own analysis, Banks – market analysis, Banks – reports of economic departments, Press – aggregated surveys (e.g. Parkiet, Puls Biznesu), Press, Sentiment indicators, Analysts, Internet	1	32,43%*

* The number of responses was summed up, thus the "percentage of answers" column includes the number of all responses.
Source: Own study.

Question 7

In your decisions on the financial market, do you use the information on deviations between market expectations and the macroeconomic data announced by the NBP?

The respondents in Question 7 could answer ‘yes’ or ‘no’. 10 of the respondents replied that they did not use information about deviations relative to market expectations in their decisions. 15 respondents stated that they use such information noting also that they take into account the

degree of divergence between expectations and announcements. Based on the answers related to Question 7, it can be concluded that most investors consciously use the information about the expectations with respect to the National Bank of Poland announcements releases.

Question 8

If you make investments on the financial market based on the announcement of new macroeconomic data by the NBP, for how long in advance do you observe information on market expectations regarding the relevant macroeconomic categories?

This is an open question, which was allowing the respondents to specify the period on their own. If managers consider the information about market expectations, it is usually fairly far in advance. 7 answers evidence a period of more than a week, while 9 responses indicate an immediate response. The results are presented in Table 4.

Question 9

If you make an investment on the financial market based on the publication of new macroeconomic data by the NBP, when do you open the relevant market positions?
a) Before new information is announced by the NBP
b) After the announcement of new information by the NBP

10 respondents chose option "a", while 16 respondents chose option "b". This means that most of the positions are opened after the NBP makes announcements of new information.

Question 10

Specify the type of information which you take into consideration regarding Question 9.

This is an open question and in most cases the respondents did not answer it. Nevertheless, the most frequent information taken into consideration was related to interest rates. The results are presented in Table 4.

Question 11

In relation to Question 9, specify whether decisions are spontaneous or whether a decision support system is applied.

According to the obtained results, most reactions were spontaneous.

Question 12

How long, usually, is the time horizon of your investments on the financial market after new information is announced by the NBP?

It is also an open question, in which 9 respondents did not specify the length of the investment. Only 1 manager indicated a period of several minutes in the response. 4 answers indicated investments over a period of one or several days. Other managers pointed to long periods, i.e. even longer than a year. Short-termism bias was not confirmed although many investors did not answer this question. The results are presented in Table 4.

Question 13

If you make investments on the financial market based on announcements of new macroeconomic data by the NBP, in which markets are these investments made?
a) Stock market
b) Bond market
c) Foreign exchange market
d) Money market
e) Other markets (please specify): ……..

This question allowed the respondents to choose more than one answer. One of the answers in the "other" category pointed to the futures market. In 14 cases the stock market was selected, in 11 cases the currency market and the bond market were chosen, in 8 cases the investments were made on the money market and in 1 case on the futures market. Overall, the fund managers are active in all major markets only except for the futures market. The results are presented in Table 4.

Question 14

Does the impact of information about the publication of new macroeconomic data by the NBP in your investment decisions affect your investment results?

a) Yes, it has a very big influence
b) Yes, but the impact is moderate
c) No

12 respondents replied that the impact was moderate, providing the "b" answer. 11 respondents answered "no", thus selecting option "c". Only 2 respondents chose answer "a" indicating that the influence is very strong. Therefor, it can be concluded that NBP communication has a moderate impact on decisions made by investors.

Question 15

What role does the ultra-short time horizon play in your investment decisions?

a) Big
b) Medium
c) Small
d) It does not play any role

For 17 respondents the ultra-short time horizon plays no role or only a small one. For 8 respondents it plays medium role and it does not play a big role for anyone. This finding means that the fund managers do not consider very short-term horizon (which would reflect a focus on speculative decisions) as important in their investment process. The results are presented in Table 4.

Table 4. Results of survey for questions 8, 10-13 and 15.

Expectation horizons of investment fund managers (Q8)		
Answer	No. of answers	Percentage of answers
No answer	5	20,00%
I do not have expectations, 1 week	3	24,00%*
As soon as it appears, From several months to several minutes, Several days, 1 month	2	32,00%*
As long as possible, even over a year, From 1 to 12 months, 3 days, I compare it to the current consensus, Shortly before the expected publication of the data, Up to 1 month	1	24,00%*
Specification of information taken into consideration (Q10)		
No answer	8	32,00%
Interest rates	3	12,00%

Table 4. (continued)

As in question 9,,Depends on the situation and further expectations, We do not play for publications, only the result of companies	2	24,00%*
Balance of payments. Basically before, with the proviso that macroeconomic data have the function of supporting long-term investments and their use after publication occurs only when they are radically different from the previously observed trend. I don't have a rigid rule. Most positions are taken before the NBP releases new information due to an attempt to anticipate the market scenario earlier in relation to the market reaction to the given information - the earlier the analysis is carried out and the earlier the position is taken, the more likely it is to "overtake" other market participants. In a few cases, we take positions after the announcement of new information - most often when the data significantly affects our perception of the market or / and was strongly detached from consensual market predictions. Published decisions are an argument to rethink investment theses, it does not make decisions solely on the basis of NBP publications. Attempt to predict traffic at% rates based on MPC forward guidance and recent macroeconomic readings (IP, RS). Positions in PLN before the decision on interest rates. Those from question 1. Fixing	1	32,00%*
Are the decisions spontaneous or is a decision support system applied? (Q11)		
Spontaneously	15	60,00%
Decision support system	6	24,00%
No answer	4	16,00%
Time horizon of) investments after the NBP announcement (Q12)		
No / no answer / difficult to determine	9	36,00%
From 1 day to 1 month, From several days to several months	4	16,00%*
Long-term, There is no rule, Couple months, A few weeks,More than a year, From several minutes to several months, One month, Several weeks to several months, Up to 2 weeks, Until new information appears, One year, One day	1	48,00%*
Markets where managers invest in (Q13)		
Stock market	14	36,84%
Currency market Bond market	11	28,95%
Money market	8	21,05%
No answer	4	10,53%
Futures market	1	2,63%
The significance of the ultra-short time horizon (Q15)		
Does not play any role	10	40,00%
Medium	8	32,00%
Small	7	28,00%
Big	0	0,00%

* The number of responses was summed up, thus the "percentage of answers" column includes the number of all responses.
Source: Own study.

4.3. Behavioural Inclinations (Part III of the Questionnaire)

In this section, we present the results related to behavioural inclinations of the surveyed fund managers. Part III of the questionnaire was composed of 10 tasks.

Task 1
Imagine that you must make the following choice between options A and B:
Participation in a lottery in which:
A:
Ø there is an 80% probability you could win 4000 PLN
Ø there is a 20% probability you would not win anything
or
B: There is a guaranteed win of 3000 PLN

Task 1 measures susceptibility to the loss aversion regarding profits. Most respondents in this survey, i.e. 18 out of 25 fund managers, selected answer A and, therefore, they did not succumb to the behavioural inclination of loss aversion regarding profits.

Task 2
Imagine that this time you have to make the following selection between options A and B:
Participation in a lottery in which:
A:
Ø there is a 20% probability you would not lose anything
Ø there is an 80% probability you would lose 4000 PLN
B:
There is a certain loss of 3000 PLN

Task 2 is related to loss aversion regarding losses. 9 respondents chose answer A and 16 selected answer B indicating that in majority of cases there is no evidence of the opposite effect. Taking into account both Tasks 1 and 2, it can be concluded that 14 managers did not succumb to the loss aversion effects, i.e. they chose answer A in Task 1 and answer B in Task 2.

Task 3

Imagine that you are an investment adviser. Your client has invested 60,000 PLN in a portfolio of stocks. Shortly thereafter, there was a huge stock market crash. Select how you would behave in this difficult situation for you and your client:

A. Strategy A means that your client will definitely keep 20,000 PLN

B. Strategy B means that there is a 1/3 probability that your client will save the entire amount (60,000 PLN) and a 2/3 probability that he will not save anything

C. I don't care which strategy (A or B) to choose, because my client will lose anyway.

And now imagine the following situation.

Your client has reinvested 60,000 PLN in a portfolio of stocks. Shortly afterwards, there was a great stock market crash. Select how you would behave in this difficult situation for you and your client:

A. Strategy A will mean your client loses 40,000 PLN

B. Strategy B means that there is a 1/3 probability that your client will not lose anything and a 2/3 probability that he will lose the entire sum

C. I don't care which strategy (A or B) to choose, because my client will lose anyway

Task 3 measures the framing effect. Out of the 25 fund managers surveyed in this research project, only 7 answers were unbiased, i.e. the respondents chose in both parts of the task the answer indicating that they are indifferent (answers C and C, respectively). In other words, one can cautiously conclude that the narrow frame effect occurred among some of respondents. Moreover, when the answers A and B were chosen, it was relevant in 4 cases only, so the prospect theory was confirmed.

Task 4

After analysing the financial situation of a certain company, you decide to invest in the stocks of this company. Unfortunately, the stocks that you bought lose 10% in value in the following days. How will you behave:

A. I find that I made a mistake in assessing the company and I sell stocks quickly at a loss to protect myself against any further fall in the exchange rate and deepening of the loss

B. I find that I did not make a mistake, but after I bought the stocks, new negative information appeared which I could not have foreseen, and which badly affects the company's assessment. I am not sure what will happen next. I will not sell stocks, and I will wait

C. I find that I have not made a mistake and the declines are temporary, and soon the stock price will start rising; therefore, I do not sell stocks

D. I find that I did not make a mistake and the declines are temporary, and soon the stock price will start to rise, so I not only do not sell stocks, but I buy more, and I take advantage of the opportunity that they are cheaper

Task 4 measures susceptibility to the disposition effect, which is one of the most commonly described inclinations of irrationality in investors' behaviour according to prospect theory. Only 6 respondents behaved rationally, i.e. they chose to sell losing stocks quickly (option A). It can be concluded that the disposition effect occurred among the respondents who chose answer B (19 answers).

Task 5

Please select the statements, which best reflect your beliefs (choose 'YES' or 'NO'):
1. I know the economy better than the average person in my surrounding (YES/NO)
2. I have more insight into politics than the average person in my surrounding (YES/NO)
3. I have more cultural knowledge than the average person in my surrounding (YES/NO)
4. I am a better observer while watching movies than the average viewer (YES/NO)
5. I have a better sense of humour than the average Polish person (YES/NO)
6. I have more luck in games of chance than the average Polish person (YES/NO)

Task 5 measures the respondents' susceptibility to the belief that they are better informed than average, which represents the inclination to be overconfident. 18 managers marked "YES" in at least 3 questions in this task, which confirms their overconfidence.

Task 6

You have a choice of 2 tasks to perform related to the ability to predict stock prices. Please specify which would be easier to perform: A or B?
A. Stocks of a certain company were selected by lot. Try to predict whether these stocks will rise or fall tomorrow? If your answer is correct, you will win 1000 PLN
B. The stocks of a company were selected by lot. Try to answer without looking in the newspapers: did the stock price rise or fall yesterday? If your answer is correct, you will also win 1000 PLN

Task 6 measures a component of overconfidence, i.e. the illusion of control. Only 8 managers chose answer A, which indicates that they are inclined to believe that they are in control. In other words, it can be cautiously assumed that most of the respondents were not susceptible to the overconfidence component.

Task 7

Imagine you are playing a two-stage game in which you must make a choice.
Game 1:
There are 50 white balls and 50 black balls in box A. There are also 100 balls in box B – they may also be black or white, but it is not known in what proportion. Therefore, there may be 100 white

balls and 0 black, or 0 white and 100 black. If you draw a white ball, you will win 1000 PLN. Which box you would like to draw from, A or B?
Game 2:
Now imagine that you throw the previously drawn ball back into the box from which it was taken. Then you draw again, but this time, to win 1000 PLN, you must draw a black ball. Which box you would like to draw from, A or B?

Task 7 is related to the Ellsberg paradox, which analyses the phenomenon of ambiguity aversion. 20 managers chose box A in both cases. It means that a strong aversion to ambiguity was detected among the surveyed fund managers.

Task 8
Imagine a woman named Anna. Anna is a calm person who loves to learn and is interested in social issues. During her studies, she excelled in humanities and natural sciences. Based on this information, select the most likely variant of the following responses by choosing option A or B:
A. Anna is probably a librarian and also a member of the Green Planet nature protection society
B. Anna most likely works in banking

Task 8 is related to a modified version of the decision-making task known as the Linda's problem referring to the representativeness. 17 respondents chose option A, which indicates that their decisions are biased.

Task 9
Imagine that you are the manager of a company called Omega. Omega is working on a project worth 10 million PLN out of which 5 million PLN has already been invested. The outcome is to be a modern hybrid engine for electric vehicles. The prototype model is undergoing the first tests. At the same time, the project manager discovers, to his surprise, that company Alfa is now ready to launch a similar product on the market. Alfa's competitive design is lighter and smaller - predestined for commercial success. As Omega's manager, you must decide:
A. Interrupt the investment and invest the remaining 5 million PLN in another project
B. Continue the project

Task 9 measures susceptibility to sunk cost, which captures the impact of past costs on future investment decisions. Only 7 respondents chose the answer indicating that they succumbed to this inclination (answer B).

Task 10
Solve the following mathematical problem:
A baseball bat and a ball cost 1 dollar and 10 cents. A bat costs one dollar more than a ball. How much does the ball cost?

Task 10 measures whether the managers succumb to the fast-thinking effect. Only 3 respondents provided an answer that indicates that they indeed succumb to the fast-thinking bias.

The overview of the results of our survey regarding the behavioural inclinations is concisely presented in Table 5.

Table 5. Summary of the results of the survey on behavioural inclinations

Tasks	Name of effect	Heuristic/ Inclination			No heuristic/Inclination		
		Answer	No of ans.	% of ans.	Answer	No of ans.	% of ans.
1	Loss aversion (profits)	B	7	29%	A	17	71%
2	Loss aversion (losses)	A	9	36%	B	16	64%
1,2	Loss aversion combined	Other combinations	11	44%	AB	14	56%
3	Framing	Other combinations	18	72%	CC	7	28%
3	Prospect	AB	4	16%	Other combinations	21	84%
4	Disposition	Other	19	76%	A	6	24%
5	Overconfidence	Over 3, yes	18	72%	Up to 3, yes	7	28%
6	Illusion of control	A	8	32%	B	17	68%
7	Ambiguity	AA	20	80%	AB	5	20%
8	Representative and conjunction error	A	17	68%	B	8	32%
9	Sunk costs	B	7	28%	A	18	72%
10	Fast thinking	10c	3	12%	5c	22	88%

Source: Own study.

In the next step, we analysed the distribution of the answers, which is presented in Table 5. Four tests failed to reject the hypothesis that there is a lack of normality of the distributions,

which provides evidence about robustness of our findings. The tests results are presented in Table 6.

Table 6. Tests for normality of answers when the effect does not occur

Test	Statistic	p-value	H0: distribution is normal, a=0.05
Doornik-Hansen	3.56	0.17	fail to reject H0
Shapiro-Wilk	0.89	0.11	fail to reject H0
Lilliefors	0.22	0.12	fail to reject H0
Jarque-Bera	1.23	0.54	fail to reject H0

Source: Own study.

In all tests, the p-values are higher than the level of significance at 0.05, which means that the null hypothesis, about the lack of normality of the distribution, was rejected in favour of the alternative hypothesis.

Descriptive statistics are further presented in Table 7.

Table 7. Descriptive statistics of the percentage of respondents confirming the lack of successive effects.

N	12	Variance	0.06
Mean	53%	Standard deviation	25%
Median	60%	Skewness	-0.05
Minimum	20%	Kurtosis	-1.57
Maximum	88%		

Source: Own study.

In most cases, the respondents provided answers suggesting no behavioural biases. Skewness is negative and equals -0.05. Negative kurtosis indicates a platykurtic distribution. The mean of 53% and the median of 60% suggest that the majority of answers provided by the respondents show that they are not subject to behavioural biases.

4.4. Cronbach's Alpha Test for the Questionnaire Regarding Behavioural Biases

Cronbach's alpha as a test allows to evaluate how many questions are able to identify the occurrence of certain behavioural effects. For the sensitivity analysis, the output data is presented in the form of a matrix in Table 8.

Table 8. Number of responses in subsequent variants of the analysis

Variant	Task and number of answers																
I	**1**	**2**	**3a**	**3b**	**4**	**5a**	**5b**	**5c**	**5d**	**5e**	**5f**	**6**	**7a**	**7b**	**8**	**9**	**10**
A	17	9	15	12	6	22	17	11	14	15	1	8	20	19	17	18	22
B	**7**	16	2	6	4	3	8	14	10	9	24	15	2	4	8	7	3
C	0	0	7	7	4	0	0	0	0	0	0	0	0	0	0	0	0
D	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0
II	**1**	**2**	**5a**	**5b**	**5c**	**5d**	**5e**	**5f**	**6**	**7a**	**7b**	**8**	**9**	**10**	**x**	**x**	**X**
A	17	9	22	17	11	14	15	1	8	20	19	17	18	22	x	x	X
B	**7**	16	3	8	14	10	9	24	15	2	4	8	7	3	x	x	X
III	**1**	**2**	**3a**	**3b**	**4**	**5**	**6**	**7a**	**7b**	**8**	**9**	**10**	**x**	**x**	**x**	**x**	**X**
A	17	9	15	19	6	80	8	20	19	17	18	22	x	x	x	x	X
B	**7**	16	7	6	16	68	15	2	4	8	7	3	x	x	x	x	X

Source: Own study.

The behavioural survey is composed of 10 questions. Question 3 is characterised by two sub-tasks in which the respondents could choose answers A, B or C. In addition, the fourth question is characterised by 4 possible answers. This situation required equating the number of possible answers for all questions in the test. In place of additional answers, 0 was then entered. The matrix constructed according to this design was tested and the results are presented in Table 9.

Table 9. Cronbach's alpha test results in option 1

Average	102.75	Sum	411
Standard deviation	111.61	Variance	12456,92
Bias	0.65	Kurtosis	-2.30
Minimum	8	Maximum	243
Cronbach's Alpha	0.96	Standardised alpha	0.96
Average correlation between positions	0.85		

Source: Own study.

The results presented in Table 9 show that Cronbach's alpha takes on a high value of 0.96 and it can be therefore concluded that the internal consistency of the questionnaire is very high.

4.5. The Relationship Between Decisions and Behavioural Biases in the Group of Fund Managers

In the first step of the analysis presented in this section, the cross tables were created to test for the correlation between variables. The matrix depicts the answers to the questions related to the management of investment funds and results of the tasks regarding the behavioural biases. This compilation allows to trace the respondents' answers depending on whether a given effect occurred or not in relation to the fund management decisions.

The results are presented in Table 10.

The crosstabs, although they present the answers, do not allow for verification of the research hypothesis and they are only the starting point for further analysis. Hence, subsequently the chi-squared tests and symmetric measures were calculated and they are presented in Table 11.

Table 10. Relationships crosstabulation

R1	Effect does not occur	Effect occurs	Total	R2	Effect does not occur	Effect occurs	Total
Aggressive	3	7	10	Aggressive	3	7	10
Conservative	4	5	9	Conservative	4	5	9
Other	2	0	2	Other	2	0	2
Sustainable	6	12	18	Sustainable	9	8	17
Total	15	24	39	Total	18	20	38
R3	**Effect does not occur**	**Effect occurs**	**Total**	**R4**	**Effect does not occur**	**Effect occurs**	**Total**
Balance of payments	55	11	66	Balance of payments	12	54	66
Foreign debt	61	13	74	Foreign debt	25	47	72
Interest rates	147	37	184	Interest rates	53	126	179
International investment position	23	10	33	International investment position	12	21	33
Liquid assets and liabilities in foreign currency	19	8	27	Liquid assets and liabilities in foreign currency	10	17	27
Money supply	53	14	67	Money supply	10	57	67
Official reserves	22	14	36	Official reserves	7	29	36
Other	34	0	34	Other	0	34	34
Reserve money	17	3	20	Reserve money	4	16	20
Total	431	110	541	Total	133	401	534
R5	**Effect does not occur**	**Effect occurs**	**Total**	**R6**	**Effect does not occur**	**Effect occurs**	**Total**
< 1 year	1	1	2	Balance of payments	48	18	66
1-5 years	4	13	17	Foreign debt	49	25	74
5-10 years	1	2	3	Interest rates	118	66	184
Total	6	16	22	International investment position	21	12	33
				Liquid assets and liabilities in foreign currency	18	9	27
				Money supply	41	26	67
				Official reserves	25	11	36
				Other	16	18	34
				Reserve money	16	4	20
				Total	352	189	541

Table 10. (continued)

R7	Effect does not occur	Effect occurs	Total	R8	Effect does not occur	Effect occurs	Total
< 1 year	2	1	3	After the announcement of new information by the nbp	9	5	14
1-5 years	11	7	18	Before new information is announced by the nbp	5	4	9
5-10 years	3	0	3	Total	14	9	23
10-20 years	1	0	1				
Total	17	8	25				
R9	**Effect does not occur**	**Effect occurs**	**Total**	**R10**	**Effect does not occur**	**Effect occurs**	**Total**
< 1 year	2	0	2	After the announcement of new information by the nbp	2	14	16
1-5 years	11	5	16	Before new information is announced by the nbp	4	6	10
5-10 years	3	0	3	Total	6	20	26
10-20 years	1	0	1				
Total	17	5	22				
R11	**Effect does not occur**	**Effect occurs**	**Total**	**R12**	**Effect does not occur**	**Effect occurs**	**Total**
Balance of payments	11	55	66	Bond market	7	4	11
Foreign debt	21	53	74	Foreign exchange market	7	4	11
Interest rates	58	126	184	Money market	5	3	8
International investment position	5	28	33	Other markets	2	0	2
Liquid assets and liabilities in foreign currency	5	22	27	Stock market	10	4	14
Money supply	13	54	67	Total	31	15	46
Official reserves	4	32	36				
Other	20	14	34				
Reserve money	4	16	20				
Total	141	400	541				
R13	**Effect does not occur**	**Effect occurs**	**Total**				
Average	5	2	7				
Does not play any role	8	0	8				
Small	8	0	8				
Total	21	2	23				

Source: Own study.

Table 11. Chi-Squared tests and symmetric measures

R1	**Value**	**df**	**Asymptotic Significance (2-sided)**	**R2**	**Value**	**Df**	**Asymptotic Significance (2-sided)**
Pearson Chi-Squared	3.839	3	.279	Pearson Chi-Squared	3.675	3	.299
Likelihood Ratio	4.473	3	.215	Likelihood Ratio	4.483	3	.214
Phi	.314	n/a	.279	Phi	.311	n/a	.299
Cramer's V	.314	n/a	.279	Cramer's V	.311	n/a	.299
N of Valid Cases	39			N of Valid Cases	38		
R3	**Value**	**df**	**Asymptotic Significance (2-sided)**	**R4**	**Value**	**Df**	**Asymptotic Significance (2-sided)**
Pearson Chi-Squared	21.063	8	.007***	Pearson Chi-Squared	27.539	8	.001***
Likelihood Ratio	26.420	8	.001***	Likelihood Ratio	35.605	8	.000***
Phi	.197	n/a	.007***	Phi	.227	n/a	.001***
Cramer's V	.197	n/a	.007***	Cramer's V	.227	n/a	.001***
N of Valid Cases	541			N of Valid Cases	534		
R5	**Value**	**df**	**Asymptotic Significance (2-sided)**	**R6**	**Value**	**Df**	**Asymptotic Significance (2-sided)**
Pearson Chi-Squared	.696	2	.706	Pearson Chi-Squared	9.436	8	.307
Likelihood Ratio	.640	2	.726	Likelihood Ratio	9.441	8	.306
Phi	.178	n/a	.706	Phi	.132	n/a	.307
Cramer's V	.178	n/a	.706	Cramer's V	.132	n/a	.307
N of Valid Cases	22			N of Valid Cases	541		
R7	**Value**	**df**	**Asymptotic Significance (2-sided)**	**R8**	**Value**	**Df**	**Asymptotic Significance (2-sided)**
Pearson Chi-Squared	2.277	3	.517	Pearson Chi-Squared	.175	1	.675
Likelihood Ratio	3.467	3	.325	Likelihood Ratio	.175	1	.676
Phi	.302	n/a	.517	Phi	.087	n/a	.675
Cramer's V	.302	n/a	.517	Cramer's V	.087	n/a	.675
N of Valid Cases	25			N of Valid Cases	23		

Table 11. (continued)

R9	**Value**	**df**	**Asymptotic Significance (2-sided)**	**R10**	**Value**	**Df**	**Asymptotic Significance (2-sided)**
Pearson Chi-Squared	2.426	3	.489	Pearson Chi-Squared	2.622	1	.105
Likelihood Ratio	3.707	3	.295	Likelihood Ratio	2.574	1	.109
Phi	.332	n/a	.489	Phi	-.318	n/a	.105
Cramer's V	.332	n/a	.489	Cramer's V	.318	n/a	.105
N of Valid Cases	22			N of Valid Cases	26		
R11	**Value**	**df**	**Asymptotic Significance (2-sided)**	**R12**	**Value**	**Df**	**Asymptotic Significance (2-sided)**
Pearson Chi-Squared	33.948	8	.000***	Pearson Chi-Squared	1.300	4	.861
Likelihood Ratio	32.583	8	.000***	Likelihood Ratio	1.909	4	.753
Phi	.251	n/a	.000***	Phi	.168	n/a	.861
Cramer's V	.251	n/a	.000***	Cramer's V	.168	n/a	.861
N of Valid Cases	541			N of Valid Cases	46		
R13	**Value**	**df**	**Asymptotic Significance (2-sided)**				
Pearson Chi-Squared	5.007	2	.082*				
Likelihood Ratio	5.214	2	.074*				
Phi	.467	n/a	.082*				
Cramer's V	.467	n/a	.082*				
N of Valid Cases	23						

*** significant at level 0,01 both sided,
Source: Own study.

According to the results presented in Table 11, the alternative hypothesis was accepted in 3 cases out of 13 analysed relationships. It was accepted for relations R3, R4 and R11 with a 0.01 level of two-sided significance. In all cases, when the alternative hypothesis was accepted and the existence of dependence was demonstrated, the Cramer's V coefficient was analysed.

For the relationship R3 and R4, its value is about 0.2, for R11 it equals 0.25 . This means that the relationship can be considered strong for those 3 instances.

It is worth mentioning here that for relationships R5, R6, R7 and R10, which demonstrated the existence of a behavioural effect, the null hypothesis could not be rejected in favor of the alternative and the Cramer's V coefficient is statistically insignificant. In case of the remaining analysed relationships, the alternative hypothesis is rejected, so we can conclude that there is no relation between the behavioural biases and investment decisions.

If the variables tested by the chi-squared test are independent, it means that especially in those cases where the existence of an effect was demonstrated, it can be concluded that the characteristics of the individual fund manager do not have a significant impact on the decisions made in this fund. As mentioned earlier, the explanation of this finding may be related to collective style of the decision-making processes of fund management business. Presumably due to the teamwork nature of fund management, the behavioural inclinations of individual managers appear to have a limited impact on the way the decisions are made and on the functioning of the analysed investment funds, which is manifested through the lack of the overall relation between questions regarding investment decisions and behavioural biases.

5. DISCUSSION

In our research we verified which one of the competing views concerning the impact of professional investors' behavioural biases on their decision-making is valid, i.e. whether professional investors are subject to the popular behavioural biases, as it is argued by much of the existing previous literature, or if consistently with Shiller's (2001) view they make investments according to the conventional finance requirements without being affected by the cognitive biases.

The results of our survey show that, in general, the majority of respondents manifested limited rationality of their decisions as the respondents were susceptible to 5 of 10 tested behavioural inclinations. The results of our research are consistent with the findings from other studies conducted in developed countries. For instance, Strong and Xu (2003) found that fund managers from the United States, the United Kingdom, continental Europe and Japan exhibit a significant relative optimism towards their home equity market. They argue that the behavioural determinants contribute towards an explanation of the home bias existence. In comparison, we found that most of the investments of Polish funds was allocated in national currency, which confirms the findings of Strong and Xu (2003) related to the home bias. Moreover, Lütjeand Menkoff (2007) presented the multivariate analyses and conducted the survey of mutual funds mangers from Germany, which indicate that home bias is related to overconfidence. In our research the managers were characterized by higher overconfidence level and, moreover, the existence of the relationship between the overconfidence effect and the NBP announcements, representing the home market news, was not rejected. Jansen and Tuijp (2021) surveyed fund managers in the Netherlands and in Canada and focused on the investigation of their investments in illiquid assets. They found that the Dutch pension funds invested 15% of their portfolio in such instruments, whereas the Canadian pension funds invested a relatively higher proportion equal to 34%. In the survey conducted in this paper, the Polish fund managers invested 12% of their portfolio in illiquid assets, which is a similar level as the one reported by Jansen and Tuijp (2021) for the Dutch funds sector.

All the biases tested in our study were to some degree present in the sample of investigated fund managers in Poland as a group of professional investors. However, the majority of them, consistently with the previous literature, succumbed to such biases as framing (see Almilia et al. (2020), among others), disposition effect (Garvey and Murphey (2004) and Dhar and Zhu (2006), among others), overconfidence (Menkhoff et al. (2006) and

De Venter and Michayluk (2008), among others), aversion to ambiguity (Bantwal and Kunreuther, (2000) and Beckmann et al. (2008), among others) and representativeness (Waweru et al. (2008), among others). Other biases were detected in much smaller number of cases. In some questions the professional investors provided answers, which were quite opposite to the theory underpinning the behavioural finance field. An interesting example are Task 1 and Task 2, which were first used in the previous literature by Kahneman and Tversky (1978) in their seminal paper proposing and formulating the prospect theory, which is one of the most influential pillars of behavioural finance. Both those tasks concern the issue regarding the way people make choices in face of risk and uncertainty and they offer two options for the answers (A and B). In case of the results reported by Kahneman and Tversky (1978) , the answers were as follows:

Task 1: A = 20% (lottery) / B = 80% (guaranteed win)

Task 2: A = 92% (lottery) / B = 8% (certain loss)

whereas we in our survey we obtained quite opposite answers:

Task 1: A = 71% (lottery) / B = 29% (guaranteed win)

Task 2: A = 36% (lottery) / B = 64% (certain loss).

The results of Kahneman and Tversky (1978) support the concept of loss aversion and emotional impact on decision making (the prospect theory is, in fact, sometimes called "the loss aversion theory"). Our research in turn shows that despite some biases the professional investors tend to avoid emotions and the resulting distortions in their decisions-making processes, which are the effects postulated by the behavioural finance theory. Such finding may further explain the results of our research concerning the relations between biases and the decision-making patterns. Among 13 examined relations, only in 3 cases (R3, R4 and R11) we found significant connections between the professional investors' biases and the decisions which they make. These behavioural inclinations are: framing, disposition effect and

representativeness. In case of other biases, we did not detected a significant impact on the fund managers' decision making, so - generally speaking - we were not able to state that our main hypothesis was confirmed in most cases.

Our study also confirmed, more specifically, the surveyed professional investors' reactions to the central bank's announcements, which is a result consistent with other findings relying on econometric models presented in Brzeszczynski and Kutan (2015). More specifically, in our research the framing and disposition biases were related to the information taken into consideration by fund managers, representativenes was related to the markets where they invested and, finally, fast thinking was related to the ultra-short investment time horizon.

In summary, our overall findings indicate: (a) existence of the impact of central bank's communications (albeit limited) on fund managers decisions and (b) limited rationality of decisions among the fund management professionals who operate on the financial market, which is the overarching result reported also by other studies related both to emerging markets (e.g., Rzeszutek, Szyszka and Czerwonka (2015) and Rzeszutek (2016)) and developed countries (e.g., Glaser, Lange, Weber (2005 and 2007), Strong and Xu (2003), Haigh and List (2005) and Cici (2012)).

Nevertheless, the results of the research focused on the relationship between the investment strategies and the method of fund management and behavioural inclinations indicate that in most cases the behavioural effects are not transmitted to fund management style (only in 3 out of 13 veryfied relationships we found such transmissions). This result, therefore, did not allow for a positive verification of the main research hypothesis investigated in our study stating that the behavioural inclinations of professional investors have an impact on their decision-making processes.

6. CONCLUSIONS

The aim of this paper was to understand the reactions of fund managers in Poland to the arrival of new market data, in particular the announcements revealed by the National Bank of Poland, and also to assess how rational they are in their investment decisions. We found that Polish fund managers react to different news, especially to the data revealed by the NBP and other institutions. Interest rates are found to be the most important type of information for them.

The decision-making processes of fund managers are complex and their behavioural inclinations play a role. In half of the cases the managers' answers were biased, so we conclude that their rationality is limited.

Our survey was challenging to conduct, in particular because the Polish investment funds market is relatively young and the fund managers are not very willing to share their experience. In order to overcome this challenge, we used several channels to gain access to respondents (direct requests, mailing, phone calls etc.). In light of the existing literature, the number of institutions which we managed to analyse through the survey in our paper should be seen as reasonably successful. We also believe that our study may serve as a helpful guide and that our results may constitute a benchmark as well as opening of a new research direction for other emerging markets researchers.

Even though the Cronbach's alpha result indicates that the survey questions were appropriate, some limitations of our study should be mentioned here. First, the behavioural tasks may always seem somewhat artificial (or too "academic") for fund managers who in their daily work face more complex investment problems. Moreover, these tasks replicated original decision-making scenarios known in the previous literature in economics and behavioural finance, which have been proposed quite a long time ago (in the 1970s and 1980s) in a different

socio-economic reality, although on the other hand Kahneman (2011) argues that such decision-making tasks allow for the universal evaluation of behavioural inclinations among respondents.

We detected a weak relationship between the decisions made by investment fund managers and behavioural effects. The reasons behind this finding may be related to the collective nature of fund management business. We presume that the decisions are not made only by specific managers and, therefore, the responsibility in the decision-making processes is spread within a broader group. In consequence, such management systems tend to eliminate the irrationality of decisions that can be otherwise made by the individuals. Moreover, experience and specialization may influence the process of decision-making and fund managers may be bised in a general approach but not in the field of their specialization.

In summary, our study can help better understand the behaviour of fund managers and it makes contribution to the theory concerning limited (bounded) rationality of professional investors in the two following aspects:

1. Firstly, we provided evidence about professional investors' psychological biases and our research covered both the well known and popular biases, such as loss aversion, disposition effect, overconfidence, but also the less intensively investigated behavioural inclinations, i.e. framing, illusion of the control, representativeness, sunk cost effect and fast thinking. These are the behavioural inclinations, which have been studied rather seldom before.
2. Secondly, another novelty of our research in comparison with previous literature is that in our study we used the standard behavioural finance survey, in order to recognize whether institutional investors are affected by psychological inclinations, and subsequently we conducted a detailed investigation focused on the identification of the relationships among the biases and the fund managers' decision-making processes. We

showed that only some biases, which are found among professional investors, have an impact on their investment decisions following the central bank's announcements. This analysis helped in delivering new evidence that can be used to enhance the limited utility theory.

Last but not least, our study has also important practical implications. Despite some limitations mentioned above, it should be emphasized that our results, in addition to strictly cognitive academic value, can also be used in practice to help fund managers make better investment decisions.

One of our key conclusions, according to which not all biases detected among the professional investors have impact on their decision-making processes, should also provide a solid basis for future research concerning the origins of this phenomenon. A possible explanation of this finding may be related the team nature of decision-making processes, which reduces the damaging effects of psychological biases of individual professional investors, which opens a new avenue for future studies using new data.

Finally, referring to what has been argued by Kahneman (2011), the practical recommendation which follows from our research is that the best way to avoid succumbing to behavioural errors is to become aware of their existence.

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APPENDIX

This section in the Appendix refers to sub-secton 3.4.2. *Behavioural biases* in the main body of the paper and explains in more details the individual tasks from the survey in relation to the literature and also provides their justification.

The first 3 tasks measure anomalies in the field of preferences resulting from prospect theory, i.e. the theory developed by Kahneman and Tversky (1979). Task 1 is related to the effect of loss aversion for profits. It measures whether a person chooses a guaranteed profit, but with a lower expected value (option B – susceptibility to the effect of certainty), or chooses a more rational option with a potentially higher expected value (option A). The vast majority of people choose option B, which means that they are susceptible to the effect of certainty. Task 2, in turn, measures the loss aversion effect on the condition that most people are characterised by risk aversion in the area of profits and by risk tendency in the area of losses. In Kahneman's and Tversky's findings (1979), most people chose option A (they preferred to risk in the area of losses than choose a certain loss, i.e. option B). As a rule, a person would choose option A in Task 1 and B in Task 2, which is typical behaviour. Task 3 is assessing the framing effect, which means that different ways of presenting the same decision problem can affect the respondents' decisions. In both situations the respondent should choose strategy A or B because the expected value of both scenarios is identical. However, Kahneman and Tversky noted that in the first case, most people choose strategy A and in the second case, they choose option B. Task 4 represents Shefrin's and Statman's (1985) disposition effect, i.e. investors' reluctance to sell stocks, which have lost value. In this case, the only rational option is A, while the alternatives represent the disposition effect. The way a particular decision problem is presented can affect the overall change in the individual's choices and preferences. This contradicts von

Neumann's and Morgenstern's (1944) theory of expected utility and axioms of preferences. Task 5 is testing for overconfidence, i.e. the self-perceived effect of being better than average. Task 6 measures the illusion of the control effect, which is based on false belief that people can affect the course of future random events (Langer (1975)). The connection between the illusion of control and magical thinking is very strong. In this task, answer A indicates that respondents are inclined towards the illusion of control. Task 7 is a complex task regarding the Ellsberg paradox (Ellsberg (1961)), which analyses the phenomenon of ambiguity aversion. The respondents choose not to draw balls from the box they know nothing about, so they cannot predict which balls dominate or how the probability of winning is shaped. When answers A and A are chosen in both tasks, then the effect of ambiguity is recognised. Furthermore, the ambiguity is related to experiencing anxiety and a sense of uncertainty. Task 8 is a modified version of the task proposed by Tversky and Kahneman (1983), known as the, so called, Linda's problem. In the experiment 85% of respondents were affected by the heuristics of representativeness and, in particular, the conjugation fallacy. In our research, the task was modified so that answer A is related to the representativeness heuristics. Task 9 measures susceptibility to the sunk cost effect, which describes the impact of past costs on future investment decisions (Arkes and Blumer (1985)). According to classical theory of finance, only the analysis of current and future profits and losses should influence the investment decisions. However, investors too often pay attention to past expenditure on a given investment and it is these past costs that significantly affect their current and future decisions. Finally, Task 10 measures whether the respondents succumb to fast thinking. In Kahneman's (2011) study as many as 70% of respondents did not answer that question (related to the price of a bat and a ball) correctly.