Review Paper

Behavioural Biases and Robo-Advisors: Analysing the Role of Automated Financial Guidance in Shaping Investor Choices

Anwar Sayeed[1], Dr. Geetika T. Kapoor[2]

[1]Research Scholar, Department of Commerce, University of Lucknow
[2]Associate Professor, Department of Commerce, University of Lucknow

Corresponding Author: Anwar Sayeed

ABSTRACT

This paper examines the relationship between the growing trend of Robo-advisors and the behavioural biases of individual investors. The research focuses on three main aspects: reasons for adoption of Robo-advisors for financial advice, wealth management, and portfolio construction by individual investors; the role of Robo-advisors on reducing investors' behavioural biases; and the various opportunities and challenges posed by the adoption of Robo-advisors by individual investors.

The study finds that Robo-advisors positively influence investor behaviour by improving portfolio diversification and enhancing overall investment efficiency. These automated platforms have been shown to reduce several behavioural biases commonly observed in individual investors, such as the disposition effect, home bias, and rank effect. By relying on algorithms and data-driven approaches, Robo-advisors help mitigate emotional decision-making and promote more rational investment strategies. However, while Robo-advisors effectively address certain biases, they do not completely eliminate them. There remain areas of behavioural influence that still impact investor decisions despite the use of automated advisory tools.

The paper also discusses the opportunities and challenges of adopting Robo-advisors for individual investors seeking more cost-effective and accessible financial advice. The findings suggest that while Robo-advisors have made significant strides in improving financial decision-making, there is still room for further development in reducing biases and enhancing investor outcomes.

Keywords: Robo-advisor, Behavioural finance, Behavioural biases, Automated financial advice.

INTRODUCTION

The quote "Banking is necessary, Banks are not," attributed to Microsoft founder Bill Gates, encapsulates the ongoing debate surrounding the increasing digitalization of banking (Alt & Puschmann, 2016). Traditionally, financial advice in wealth management relied on personal interactions and trust between the advisor and the client, a process that was often time-consuming and costly, and typically served only high net worth individuals. The push towards technological solutions in finance accelerated after the 2007−08 global financial crisis, which led to stricter regulations on traditional banks and spurred advancements in computer science. This environment fostered the growth of non-bank, technology-driven financial companies

(IFC, 2017). Innovations such as ATMs, mobile payments, and blockchain for trade finance exemplify technological advancements in the financial sector. Today, this disruption extends to wealth management services, where automated financial advisors, or Robo-advisors, are beginning to challenge traditional human advisors (Jung et al., 2018).
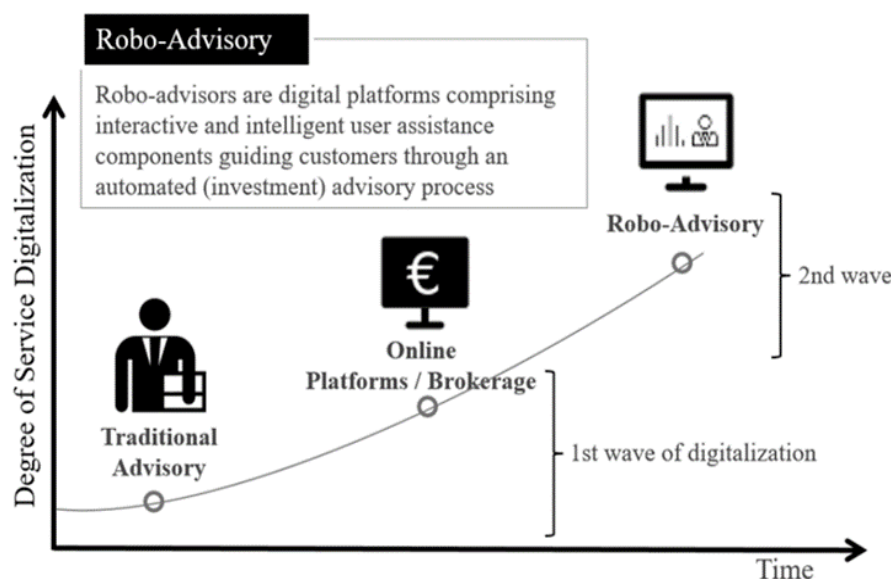
Source: Jung et al., 2018

Pioneering platforms like Betterment and Wealthfront, which launched in 2008 and 2011 respectively, have become emblematic of the Robo-advising movement, drawing significant investment and user adoption. In 2015, Charles Schwab's introduction of Schwab Intelligent Portfolios marked a significant shift, as established financial institutions began to integrate these technologies into their offerings (Filipsson, 2024).

The term "Robo-advice" combines "Robo," a shorthand for "robot," meaning a machine controlled by a computer to perform tasks automatically, and "Advice," which refers to guidance on actions or decisions (Cambridge Learner's Dictionary, 2024). Robo-advisors are AI-powered digital services designed to replace traditional human advisors. They transform the conventional, face-to-face advisory process into a digital, human-to-computer interaction. Instead of in-person interviews, investor profiling is conducted through online questionnaires and self-reporting tools. Algorithms and automated systems on digital platforms assess investment goals, risk tolerance, and return expectations to create tailored portfolios.

Most contemporary Robo-advisory models are based on Modern Portfolio Theory (MPT), which focuses on optimizing a portfolio according to the investor's risk preferences, complemented by the principles of passive investing supported by the efficient market hypothesis. These platforms use survey-based questionnaires to determine an investor's risk profile and investment objectives before applying MPT to develop a diversified portfolio. According to Market Data Forecast (2020), the global Robo-advisors market is projected to expand at a compound annual growth rate of 53.4% from 2020 to 2025, potentially reaching a revenue of USD 97.03 billion by 2025.

LITERATURE REVIEW

- ➢ **Rao & Lakshmi (2024)** examined the impact of fintech innovations, specifically Robo-advisors, on the personal finance landscape. They

highlighted how Robo-advisors enhance accessibility, cost-effectiveness, and user-friendliness in managing personal finances. Additionally, the study investigated their influence on investor behaviour, portfolio construction, and financial awareness through a systematic literature review. The research also addressed challenges such as regulatory concerns, cybersecurity, biased algorithms, and their effects on traditional financial service providers, offering valuable insights into the evolving financial decision-making process.

➢ **Nguyen et al. (2023)** explored the factors influencing the acceptance of Robo-advisors in wealth management in Malaysia, particularly after the 2008 global financial crisis and the surge in demand during the COVID-19 pandemic. Despite scepticism about Robo-advisors' ability to match human financial advisors, they identified key drivers of adoption. An online survey of 122 respondents found that relative advantage, effort expectancy, and social influence significantly positively affect the behavioural intention to accept Robo-advisors, while perceived risk showed no significant impact. Their study offered valuable insights into the growing acceptance of Robo-advisors in Malaysia.

➢ **Lisauskiene and Darskuviene (2021)** explored the relationship between Robo-advisors and behavioural biases in individual investors through a qualitative literature review. Key findings suggested that while Robo-advisors can reduce biases and promote informed decision-making, they may also activate automatic cognitive processes, leading to passive investment strategies and alienating investors from the stock market. They contributed by proposing a dual-process theoretical framework, defining Robo-advisors, and identifying future research directions on their impact on behavioural biases.

➢ **Torno et al. (2021)** conducted a systematic literature review of 42 peer-reviewed articles on Robo-advisors (RAs), analyzing research trends from 2019 and 2020. They provided descriptive statistics on research approaches and regional focuses, categorizing the literature into three themes: RA Users, RA Service, and RA Competition. They summarized key insights from each theme and their interrelations, offering future research directions to further explore the evolving field of Robo-advisors.

➢ **Oehler et al. (2021)** surveyed 231 undergraduate students to examine how retail investors' characteristics impact their decision to use Robo-advisors. Risk tolerance, extraversion, and optimism were significant in univariate tests, while risk tolerance and internal locus of control were key in multivariate analysis. Users of Robo-advisors tend to invest more and were more likely to invest independently in stocks and bonds. They also identified differences between exclusive Robo-advisor users and those who combine Robo-advisor use with personal investments.

➢ **Bhatia et al. (2020)** examined how Robo-advisory services can reduce behavioural biases in investment decisions, based on insights from experts in the BFSI, IT, FINTECH, and NBFC sectors in India. Using a qualitative approach, they highlighted the importance of increasing investor awareness through education and trust-building. The findings suggested that while Robo-advisors were effective, they still need to address biases during risk analysis and investor profiling for improved decision-making.

➢ **Shanmuganathan (2020)** explored the implications of AI-based applications in behavioural finance, highlighting recent advancements in algorithmic financial advisory services. They focused on the effectiveness of AI-driven Robo-advisors, which use theoretical learning

models to create reliable portfolios based on investor behaviour. They provided a longitudinal case study on the role of behavioural decision-making in the success of Robo-advisors and their impact on financial portfolio management. They emphasized the importance of understanding behavioural finance in the effective execution of customer financial portfolios.

➢ **Waliszewski & Zięba-Szklarska (2020)** examined robo-advice, a fintech innovation in personal financial planning, specifically investment consulting, which addressed the limitations of traditional investment advice, such as high costs and asset requirements. Using artificial intelligence and algorithms, Robo-advisors lower cost and eliminate asset minimums. They analyzed the strengths, weaknesses, opportunities, and threats (SWOT) of Robo-advisors compared to traditional advisors, emphasizing their complementary role rather than a replacement. Despite Robo-advisors' potential, their market penetration remains small, with assets under management around 2% in 2023, indicating a hybrid advisory model's likely future.

➢ **D'Acunto et al. (2019)** investigated the introduction of a wealth-management Robo-advisor that tailors portfolios to investors' holdings and preferences. They found that adopters are similar to non-adopters in demographics and prior human advisor interactions, but they were more active and have larger assets. Robo-advising leads to diversification benefits, with undiversified investors increasing stock holdings and achieving better returns with lower volatility. Well-diversified investors hold fewer stocks but experience reduced volatility and trade more. They also highlighted reductions in behavioural biases like disposition, trend chasing, and rank effects among adopters, emphasizing the

potential and challenges of Robo-advisors.

➢ **Jung et al. (2018)** examined the growing popularity of Robo-advisors in retail and private banking as a means to support financial decision-making, including risk measurement, portfolio selection, and rebalancing. While recent research suggests that Robo-advisors may eventually complement human financial advisors, they discussed their strengths, weaknesses, opportunities, and risks. The findings highlighted the significant potential of Robo-advisors to shape the future of financial advisory, although much of this potential remains untapped.

OBJECTIVES
1. To investigate reasons for adoption of Robo-advisors as personal financial advisor.
2. To examine the role of Robo-advisors in behavioural finance.
3. To assess the opportunities and challenges linked to the use of Robo-advisors.

RESEARCH METHODOLOGY
This descriptive paper involves a thorough examination of secondary data. The data was gathered from a range of online sources, including Google Scholar, academic journals, websites, articles, and blogs and is characterized by its qualitative approach.

REASONS FOR ADOPTION OF ROBO ADVISOR
1. **Accessibility:** Robo-advisors offer financial advice and investment management to a broader audience, often with lower minimum investment requirements than traditional financial advisors. This democratizes access to financial planning services.
2. **Cost-Efficiency:** They generally charge lower fees compared to human advisors because they rely on algorithms and automation. This helps in keeping investment management affordable for clients.

3. **Personalization:** Using algorithms, Robo-advisors tailor investment strategies based on individual risk tolerance, financial goals, and investment preferences. Many platforms use data analytics to continuously adjust and optimize portfolios.
4. **Convenience:** Investors can access and manage their portfolios online at any time, without needing to schedule appointments or visit a physical office. This fits well with the increasing demand for on-demand services.
5. **Transparency:** Robo-advisors often provide clear and detailed insights into fees, performance, and portfolio composition, which can help users make informed decisions.
6. **Integration with Technology:** Many Robo-advisors integrate with other financial tools and apps, allowing users to see a comprehensive view of their financial health in one place. They can also use machine learning to improve predictions and recommendations over time.
7. **Scalability:** Because Robo-advisors are software-based, they can scale their services easily. This means they can handle a large number of clients without the proportional increase in operational costs.

One factor influencing individuals' financial behaviour is their prior financial experience. For instance, research indicates that more experienced investors might be more inclined to use Robo-advisors (Epperson et al., 2015). Factors such as previous negative experiences with financial advisors, the demand for financial services, and personal confidence in one's investments contribute to the attraction of Robo-advisory services (Woodyard & Grable, 2018). Unlike human advisors, Robo-advisors are designed with specific user experience considerations, which can affect their adoption by investors (Capponi et al., 2022; D'Acunto & Rossi, 2021). Many firms have integrated social design elements into their Robo-advisors, such as avatars or names (e.g., Bank of America's Erica), to enhance their social appeal. Although some studies suggest that these social elements might undermine the perceived credibility of Robo-advisors (Hodge et al., 2020), other research indicates that such elements can positively influence trust in the Robo-advisor (Hildebrand & Bergner, 2021).

ROBO-ADVISOR IN BEHAVIOURAL FINANCE

Behavioural biases in finance are systematic deviations from rational decision-making exhibited by investors and financial analysts. These biases, rooted in psychological factors, often lead to suboptimal financial choices and market anomalies. Some of the behavioural biases are:

Disposition Effect:
Disposition bias refers to the higher tendency of the investors to sell their winning investments compared to their losing investments. In other words, assets that have made a profit are quickly sold off, but the assets that have declined in value are held on to by the investors.

Rank Effect:
Investors are more inclined to sell their extreme winning and losing positions in their portfolios, a phenomenon known as the "rank effect." This behaviour is not influenced by factors such as company-specific information, the holding period, or the return level, but rather by the prominence of extreme positions within the portfolio. Both retail traders and mutual fund managers display this effect. It suggests that investment decisions regarding a particular stock are influenced by how it ranks relative to other holdings in the investor's portfolio.

Home Bias:
Home bias in investment decisions refers to the inclination of investors to prioritize domestic assets over foreign ones, even though international diversification could provide potential advantages, such as higher returns or lower risk.

Trend Chasing Bias:

Trend-chasing bias is the tendency of individuals, particularly investors and traders, to purchase an asset or adopt a strategy based on its current upward momentum, or to sell assets in a downward trend, expecting the trend to persist. This bias is fuelled by the assumption that past performance will continue, often resulting in buying at the peak (when the trend is high) or selling at the trough (during a decline) as people follow the crowd.

Behavioural finance applies psychological principles to financial theory (Hirshleifer, 2015), offering an alternative approach to understanding investor behavioural and market anomalies. It provides insights into phenomena such as stock market bubbles and the overreaction or underreaction to new information, which traditional finance theories struggle to explain (Cooper et al., 2001; Zhou & Sornette, 2006). Heuristics can lead to behavioural biases, which in turn cause systematic deviations from rational behavioural (Tversky & Kahneman, 1974). Such irrational decisions may result in poor financial outcomes and decreased well-being. Research indicates that financial education and professional advice can help mitigate these biases (Bhandari et al., 2008; Feng & Seasholes, 2005). However, investors who would benefit from such advice often do not seek it due to perceptions of cost, complexity, or bias (Bhattacharya et al., 2012). Robo-advisors have been introduced as a solution to this issue, offering low-cost, high-quality financial guidance.

Bhatia et al. (2020) emphasized the importance for Robo-advisor developers to address biases in their questionnaires, though their study broadly addressed cognitive errors without specifying particular biases. Liaudinskas (2019) observed that while human professional day traders exhibit significant disposition effects, algorithms show minimal such effects. This suggests that automating decision-making processes and employing systematic programming can help achieve greater rationality and reduce behavioural biases. D'Acunto et al. (2019) found that while Robo-advisors reduced, they did not completely eliminate behavioural biases such as the disposition effect, trend-chasing, and the rank effect. They also observed that Robo-advisors enhanced portfolio diversification and reduced volatility for investors who initially held fewer than five stocks, but did not significantly impact those who already had more than ten stocks. Similarly, Loos et al. (2020) reported that investors using Robo-advisors increased portfolio diversification and decreased home bias. They noted improvements in portfolio efficiency, including a greater number of investments, improved geographical diversification, and a higher proportion of index or passive funds compared to investments managed without Robo-advisors, indicating that investors benefit from Robo-advisors' guidance.

Uhl and Rohner (2018) demonstrated that emotional biases create a 'behavioural gap,' which is the disparity between the performance of equity or bond indices and the actual returns experienced by average investors. They suggested that Robo-advisors with a strict rebalancing strategy might assist investors better than those attempting to time the market, as Robo-advisors encourage portfolio rebalancing by selling high-performing assets and buying underperforming ones. However, they did not specify particular behavioural biases in their assessment of the 'behavioural gap'.

The evidence on how Robo-advisors affect investor behavioural is varied. Liaudinskas (2019) examined passive investment strategies and algorithmic impacts on behavioural biases without considering investor intervention. Braeuer et al. (2017) explored the influence of external anchors and guidance on investment decisions in an experimental setting, finding that financially capable investors tend to contribute more, even when presented with default values by Robo-advisors. In contrast, D'Acunto et al. (2019) allowed investors to make active choices, revealing that Robo-advisors had different impacts depending on the investors' level of diversification prior to adoption.

Jung and Weinhardt (2018) investigated whether Robo-advisors could address decision inertia, finding that default nudges were more effective than warning messages in overcoming inertia.

A better understanding of how different Robo-advisor designs—whether passive or active—affect specific behavioural biases, investor performance, and outcomes could enhance the effectiveness of Robo-advisors and increase participation in the stock market.

OPPORTUNITIES

1. Pervasiveness of Digital Services:

India is undergoing rapid digitalization, driven by several factors such as increased broadband access, technological innovations, lower data costs, and strong government support for digital infrastructure development. This digital shift is particularly significant for India's large population, with over 60% residing in rural areas. Enhancing connectivity helps extend the advantages of a modern economy to a broader segment of the population, helping to narrow the economic gap.

The growth in broadband usage in India has been remarkable, with mobile broadband (MBB) subscribers rising from 345 million to 765 million in the past five years. Data traffic per user has surged by 31% over the same period, reaching 17 GB by December 2021. Consequently, India has experienced some of the highest data traffic growth rates globally, with a compound annual growth rate (CAGR) of 53% from 2017 to 2021. Additionally, India's Gen Z spends an average of 8 hours online each day, and the next phase of smartphone adoption is occurring in rural areas. By 2030, India is projected to have the second-largest population of online shoppers, estimated at between 500 million and 600 million (EY India, 2023).

The widespread use of smartphones, tablets, and other devices means people are constantly connected. Younger generations, in particular, are growing up immersed in technology (Sironi, 2016). This pervasive digital environment creates a strong foundation for the establishment of Robo-advisors in a market traditionally dominated by conventional wealth and asset management firms.

2. Goal Based Investment:

In goal-based investing, the focus is on individual investors, each with their unique set of values, investment objectives, priorities, time horizons, and risk profiles (Sironi, 2016). Since each person's combination of these attributes is distinct, a more personalized model is necessary to effectively address individual needs. While some Robo-advisors have begun incorporating basic elements of advanced personalization, there is still a significant gap in achieving high levels of customization.

3. Integration And Standardization:

Robo-advisors currently offer services such as portfolio rebalancing and automated asset allocation, but the wealth management industry encompasses a broader range of complex services. These include specialized areas like cross-border tax advice, which involves navigating different national and international tax laws and individual arrangements across countries which are difficult to standardize and mass-customize by Robo-advisors. The full integration of financial, legal, and tax considerations on an international scale is highly complex, presenting numerous variables (Cocca, 2016). However, the ability to standardize and integrate more sophisticated services is a crucial factor in attracting customers who currently depend on traditional personal advisors. Established traditional advisors who introduce individual advisors or acquire stand-alone Robo-advisors may have an edge, as they bring decades of experience in wealth and asset management practices and expertise.

4. Collaboration:

Stand-alone Robo-advisors face challenges due to their limited assets under management (AUM), which suggests they struggle to

attract high-net-worth clients. Despite experiencing high growth rates, Robo-advisors accounted for less than 1% of the wealth management market in 2016 (Cocca, 2016). This issue is compounded by the significant marketing costs required to expand their customer base and enhance their reach (Sironi, 2016). According to Burnmark (2017), the average cost for a US Robo-advisor to acquire a customer is $389, while the average account size of $27,000 generates only $90 in revenue. One potential solution to this challenge is for traditional wealth management firms and Robo-advisors to collaborate or merge. Vincent et al. (2015) explored scenarios where Robo-advisors partner with traditional advisors or banks, which could be mutually beneficial. Such partnerships would allow wealth managers to offer Robo-advised portfolios, while Robo-advisors could leverage the existing expertise and client base of traditional financial institutions.

Table 1: Opportunities and Challenges of Robo-Advisors.

Opportunities	Challenges
Pervasiveness of Digital Services	Competitive Environment
Goal Based Investment	Non-Acceptance
Integration And Standardization	Regulations
Collaboration	Market Crisis

Source: Jung et al., 2018

CHALLENGES
1. Competitive Environment:
As noted by Burnmark (2017), there are currently over 70 Robo-advisors in Europe, each adhering to similar investment principles. In the U.S., the number exceeds 200, with each Robo-advisor vying for customer attention. This competition is mostly confined to domestic markets for now, but if regulations, investment practices, and other barriers to international entry are relaxed, global competition will increase. U.S. firms, with their larger assets under management (AUM), may pose a significant challenge to smaller, international competitors (CB Insights, 2017). Additionally, stand-alone Robo-advisors are facing increasing competition from Robo-advisors launched by traditional advisory firms. The market is becoming more competitive as new entrants, acquisitions, and surging account openings contribute to the growth. Notable developments include Goldman Sachs' Marcus Invest and Stash's Smart Portfolios entering the market, and Betterment's acquisition of Wealthsimple Inc.'s U.S. operations. Vanguard Personal Advisor Services leads the market, with an AUM of $212 billion as of the end of 2020, and offers planning services with a live adviser for a 0.30% annual management fee (Casperson, 2021). Traditional advisors' existing large customer bases give them a significant advantage, posing a potential threat to stand-alone Robo-advisors, which need time to build a competitive client base and achieve profitability.

2. Non-Acceptance:
Despite the growing appeal of technology among millennials, which makes them an attractive target for Robo-advisors (Vincent et al., 2015), a significant portion of potential users may not view Robo-advisors as a viable alternative to traditional retail investing or personal advisory services. A survey by Ludden et al. (2015), revealed that 77% of wealth management clients trust their financial advisors, and 81% value face-to-face interaction, highlighting the continued preference for personal advisory services. Additionally, some investors feel that current Robo-advisors do not adequately address the needs of those with complex financial situations, citing overly simplistic risk assessment methods. Reher and Sun (2016) found that mutual fund investors often remain committed to their investments even when a Robo-advisor offers superior performance. In response, many Robo-

advisors are introducing hybrid models that combine Robo-advisory services with personal advisor support. For example, Betterment has recently launched a call center staffed with certified financial planners to oversee accounts and offer advice. Cocca (2016) also notes that the acceptance of Robo-advisors may ultimately depend on individual preferences for algorithm-based versus personal advice. The future widespread acceptance of Robo-advisors remains uncertain, posing a potential challenge for the industry.

3. Regulations:

There is growing concern about the regulation of digital investment advisory services for several reasons. Fein (2015) raises issues related to potential conflicts of interest, the absence of personalized advice, and fiduciary responsibilities. Novick et al. (2016) provide a comprehensive review of recent regulatory concerns surrounding Robo-advisors. Institutions like FINRA (2016) and the SEC and FINRA (2015) have expressed concerns about algorithm supervision, conflicts of interest, customer profiling practices, and automatic rebalancing, indicating a need for more sophisticated regulatory frameworks for Robo-advisors. Under the 2016 fiduciary rule by the Department of Labor, U.S. digital advisors must assess whether their programs comply with ERISA fiduciary requirements. Baker and Dellaert (2017) argue that regulators, including lawyers, economists, and behavioural scientists, need to enhance their understanding of computer and data science to develop and enforce new regulatory strategies. They also emphasize the need for regulation due to the unique risks associated with Robo-advisors, as all clients use similar algorithms (Baker & Dellaert, 2017). These emerging regulatory challenges and concerns represent a potential threat to the Robo-advisory industry, as stricter regulations could lead to increased compliance costs and impact profitability. SEBI has proposed that registered Investment Advisers and Research Analysts using artificial intelligence (AI) tools disclose the extent of their use to clients. This measure aims to ensure transparency, allowing clients to understand how AI contributes to their investment decisions and to make more informed choices about the advisory services they receive. Emphasizing robust security measures is also essential to prevent unintended data exposure (Investment Advisers, Research Analysts should disclose AI tool usage to clients: SEBI, 2024).

4. Market Crisis:

A significant concern among investors is that established Robo-advisors have not yet been tested during a market crisis or downturn. Fein (2015) expresses concern about how Robo-advisors would perform during such times. Traff (2016) suggests that Robo-advisors might have an advantage over retail investors and traditional financial advisors during market downturns because they avoid emotionally-driven decisions. For instance, during the Brexit referendum in 2016, many investors reacted impulsively, selling their holdings and missing subsequent gains as stock prices recovered. Robo-advisors, however, adhere to predefined risk parameters and asset allocation strategies, thereby avoiding panic-driven decisions. This could potentially be a strength of Robo-advisors. However, how these systems will fare in extreme market conditions, such as those experienced during the 2008 financial crisis, remains an unresolved question.

CONCLUSION

This research paper underscores the growing relevance of Robo-advisors in addressing behavioural biases within investment decision-making. The study reveals that while Robo-advisors are effective in mitigating certain biases—such as the disposition effect, home bias, and rank effect - they are not a panacea, and some biases persist. Robo-advisors enhance portfolio diversification, cost efficiency, and accessibility, democratizing investment management. However, they face challenges

including competitive pressures, profitability concerns, and regulatory scrutiny. As the financial landscape continues to evolve, the integration of Robo-advisors with traditional advisory services could offer a more comprehensive and effective solution, bridging the gap between technological innovation and personalized financial advice. The paper highlights the need for ongoing research into the design and impact of Robo-advisors, particularly in how they can better cater to diverse investor profiles and withstand market fluctuations.

REFERENCES

1. Alt, R., & Puschmann, T. (2016). Digitalisierung der Finanzindustrie. In *Springer eBooks*. https://doi.org/10.1007/978-3-662-50542-7
2. Baker, T., & Dellaert, B. G. C. (2017). Regulating robo advice across the financial services industry. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.2932189
3. Bhandari, G., Hassanein, K., & Deaves, R. (2008). Debiasing investors with decision support systems: An experimental investigation. Decision Support Systems, 46(1), 399–410.https://doi.org/10.1016/j.dss.2008.07.010
4. Bhatia, A., Chandani, A., & Chhateja, J. (2020). Robo advisory and its potential in addressing the behavioral biases of investors — A qualitative study in Indian context. Journal of Behavioral and Experimental Finance, 25, 100281. https://doi.org/10.1016/j.jbef.2020.100281
5. Bhattacharya, U., Hackethal, A., Kaesler, S., Loos, B., & Meyer, S. (2012). Is Unbiased Financial Advice to Retail Investors Sufficient? Answers from a Large Field Study. Review of Financial Studies, 25(4), 975–1032. https://doi.org/10.1093/rfs/hhr127
6. Capponi, A., Olafsson, S., & Zariphopoulou, T. (2022). Personalized robo-advising: Enhancing investment through client interaction. *Management Science*, 68(4), 2377-3174, iv-v. https://doi.org/10.1287/mnsc.2021.4014
7. Cocca, T. (2016). Potential and limitations of virtual advice in wealth management. Journal of Financial Transformation, 44, 45–57. https://EconPapers.repec.org/RePEc:ris:jofitr:1581
8. Cooper, M. J., Dimitrov, O., & Rau, P. R. (2001). A rose.com by any other name. *The Journal of Finance*, *56*(6), 2371–2388. https://doi.org/10.1111/0022-1082.00408
9. D'Acunto, F., Prabhala, N., & Rossi, A. G. (2019). The promises and pitfalls of Robo-Advising. Review of Financial Studies, 32(5), 1983–2020. https://doi.org/10.1093/rfs/hhz014
10. D'Acunto, F., & Rossi, A. G. (2021). Robo-Advising. In Springer eBooks (pp. 725–749). https://doi.org/10.1007/978-3-030-65117-6_26
11. Fein, M. L. (2015). Robo-Advisors: A closer look. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.2658701
12. Feng, L., & Seasholes, M. S. (2005). Do investor sophistication and trading experience eliminate behavioral biases in financial markets? European Finance Review, 9(3), 305–351. https://doi.org/10.1007/s10679-005-2262-0
13. Hildebrand, C., & Bergner, A. (2021). Conversational robo advisors as surrogates of trust: onboarding experience, firm perception, and consumer financial decision making. *Journal of the Academy of Marketing Science*, 49, 659–676. https://doi.org/10.1007/s11747-020-00753-z
14. Hirshleifer, D. (2015). Behavioral finance. Annual Review of Financial Economics, 7, 133–159. https://doi.org/10.1146/annurev-financial-092214-043752
15. Hodge, F. D., Mendoza, K. I., & Sinha, R. K. (2020). The effect of humanizing Robo-Advisors on investor judgments. *Contemporary Accounting Research*, *38*(1), 770–792. https://doi.org/10.1111/1911-3846.12641
16. Jung, D., Glaser, F., & Köpplin, W. (2018). Robo-Advisory: Opportunities and Risks for the future of Financial advisory. In *Contributions to management science* (pp. 405–427). https://doi.org/10.1007/978-3-319-95999-3_20

17. Jung, D., & Weinhardt, C. (2018). Robo-Advisors and Financial Decision Inertia: How choice architecture helps to reduce inertia in financial planning tools. *International Conference on Information Systems*. https://aisel.aisnet.org/cgi/viewcontent.cgi?article=1114&context=icis2018

18. Liaudinskas, K. (2019). "Human vs. Machine: Disposition Effect Among Algorithmic and Human Day-traders," Working Papers 1133, Barcelona School of Economics. https://ideas.repec.org/p/bge/wpaper/1133.html

19. Lisauskiene, N., & Darskuviene, V. (2021). Linking the Robo-advisors phenomenon and Behavioural Biases in Investment Management: An interdisciplinary literature review and research agenda. *Organizations and Markets in Emerging Economies*, *12*(2), 459–477. https://doi.org/10.15388/omee.2021.12.65

20. Loos, B., Previtero, A., Scheurle, S., & Hackethal, A. (2020). Robo-advisers and Investor Behavior. https://www.semanticscholar.org/paper/Robo-advisers-and-Investor-Behavior%E2%88%97-Loos-Previtero/697e32b82a0c18e631a49c1a5e7992d5fdb1efeb#citing-papers

21. Ludden, C., Thompson, K., & Mohsin, I. (2015) The Rise of Robo-Advice: Changing the Concept of Wealth Management. *Accenture*.

22. Nguyen, T. P. L., Chew, L. W., Muthaiyah, S., Teh, B. H., & Ong, T. S. (2023). Factors influencing acceptance of Robo-Advisors for wealth management in Malaysia. *Cogent Engineering*, *10*(1). https://doi.org/10.1080/23311916.2023.2188992

23. Oehler, A., Horn, M., & Wendt, S. (2021). Investor Characteristics and their Impact on the Decision to use a Robo-advisor. *Journal of Financial Services Research*, *62*(1–2), 91–125. https://doi.org/10.1007/s10693-021-00367-8

24. Rao, P. R., & Lakshmi, K. S. (2024). A Review on the role of Robo-advisory service in transforming Personal Finance in the Digital- Era. *Journal of Informatics Education and Research*, *4*(2), 2405–2414. https://doi.org/10.52783/jier.v4i2.1077

25. Reher, M., & Sun, C. (2016). Robo Advisers and Mutual Fund Stickiness. https://scholar.harvard.edu/files/mreher/files/reher-sun.pdf

26. Shanmuganathan, M. (2020). Behavioural finance in an era of artificial intelligence: Longitudinal case study of robo-advisors in investment decisions. *Journal of Behavioral and Experimental Finance*, *27*, 100297. https://doi.org/10.1016/j.jbef.2020.100297

27. Sironi, P. (2016). FinTech Innovation: From Robo-Advisors to goal based investing and gamification. The Wiley Finance Series: John Wiley & Sons Ltd. http://doi.wiley.com/10.1002/9781119227205

28. Torno, A., Metzler, D. R., & Torno, V. (2021). Robo-What?, Robo-Why?, Robo-How? - A Systematic literature review of Robo-Advice. *Pacific Asia Conference on Information Systems*, 92. https://aisel.aisnet.org/cgi/viewcontent.cgi?article=1091&context=pacis2021

29. Traff, J. D. (2016). The future of the wealth management industry: evolution or revolution? MBA Submission, Massachusetts Institute of Technology. https://dspace.mit.edu/handle/1721.1/104548

30. Tversky, A., & Kahneman, D. (1974). Judgment under Uncertainty: Heuristics and Biases. Science, 185(4157), 1124–1131. https://doi.org/10.1126/science.185.4157.1124

31. Uhl, M. W., & Rohner, P. (2018). Robo-Advisors versus Traditional Investment Advisors: An Unequal Game. *The Journal of Wealth Management, 21*(1), 44–50. https://doi.org/10.3905/jwm.2018.21.1.044

32. Vincent, G., Laknidhi, V., Klein, P., & Gera, R. (2015). Robo-Advisors Capitalizing on a growing opportunity. Deliotte. https://www2.deloitte.com/content/dam/Deloitte/us/Documents/strategy/us-cons-robo-advisors.pdf

33. Waliszewski, K., & Zięba-Szklarska, M. (2020). Robo-advisors as Automated Personal Financial Planners – SWOT analysis. *Finanse I Prawo Finansowe*, *3*(27), 155–173. https://doi.org/10.18778/2391-6478.3.27.09

34. Woodyard, A.S., & Grable, J.E. (2018). Insights into the Users of Robo-Advisory Firms. *Journal of Financial Service Professionals*, 72(5), p56.

https://openurl.ebsco.com/EPDB%3Agcd%3A15%3A740031/detailv2?sid=ebsco%3Aplink%3Ascholar&id=ebsco%3Agcd%3A131378075&crl=f

35. Zhou, W., & Sornette, D. (2006). Fundamental factors versus herding in the 2000–2005 US stock market and prediction. Physica a Statistical Mechanics and Its Applications, 360(2), 459–482. https://doi.org/10.1016/j.physa.2005.06.084

36. Websites:

37. Braeuer, K., Hackethal, A., & Scheurle, S. (2017). Fund Savings Plan Choices with and without Robo-Advice. Observatoire de l'épargne européenne.https://www.oee.fr/download/fund-savings-plan-choices-with-and-without-robo-advice/?lang=en

38. Burnmark. (2017). Digital Wealth. https://www.burnmark.com/uploads/reports/Burnmark_Report_Apr17_Digital_Wealth.pdf

39. Cambridge Learner's Dictionary. (2024). Robot. In *Cambridge Learner's Dictionary.* https://dictionary.cambridge.org/dictionary/learner-english/robot

40. Cambridge Learner's Dictionary. (2024). Advice. In *Cambridge Learner's Dictionary.* https://dictionary.cambridge.org/dictionary/english/advice

41. Casperson, N. (2021, March 22). Top 5 largest robo-advisers by AUM. InvestmentNews. https://www.investmentnews.com/fintech/news/top-5-largest-robo-advisers-by-aum-204294

42. CB Insights. (2017). A Wealth Tech World: Mapping Robo-Advisors Around The Globe. https://www.cbinsights.com/research/robo-advisor-global-fintech-map/

43. Epperson, T., Hedges, B., Singh, U., & Gabel, M. (2015). Hype vs. reality: The coming waves of "Robo" adoption. from ATKearney. https://www.kearney.com/documents/10192/7132014/Hype%2Bvs.%2BReality_The%2BComing%2BWaves%2Bof%2BRobo%2BAdoption.pdf

44. EY India. (2023, February 7). *Digitalizing India: a force to reckon with.* https://www.ey.com/en_in/insights/india-at-100/digitalizing-india-a-force-to-reckon-with

45. Filipsson, F. (2024, July 27). The history of Robo-Advisors and Automated Investing. *Redress Compliance - Just another WordPress site*. Retrieved August 28, 2024, from https://redresscompliance.com/the-history-of-robo-advisors-and-automated-investing/

46. FINRA. (2016). FINRA Reports on Effective Practices for Digital Investment Advice. https://www.finra.org/media-center/news-releases/2016/finra-reports-effective-practices-digital-investment-advice

47. IFC (International Finance Corporation). 2017. "Digital Financial Services: Challenges and Opportunities for Emerging Market Banks." EMCompass, Note 42. https://documents1.worldbank.org/curated/en/750421502949470705/pdf/118736-BRI-EMCompass-Note-42-DFS-Challenges-and-Opportunities-PUBLIC.pdf

48. Investment Advisers, Research Analysts should disclose AI tool usage to clients: SEBI. (2024, August 15). The Hindu. https://www.thehindu.com/business/markets/investment-advisers-research-analysts-should-disclose-ai-tool-usage-to-clients-sebi/article68530221.ece

49. Market Data Forecast (2020). *Global Robo Advisory Market Research Report*. https://www.marketdataforecast.com/market-reports/robo-advisory-market

50. Novick, B., Lu, B., Fortin, T., Hafizi, S., Parkes, M., & Barry, R. (2016). Digital Investment Advice: Robo Advisors Come of Age. *Blackrock*. https://www.blackrock.com/corporate/literature/whitepaper/viewpoint-digital-investment-advice-september-2016.pdf

51. SEC & FINRA. (2015). Investor Alert: Automated Investment Tools. https://www.sec.gov/resources-for-investors/investor-alerts-bulletins/autolistingtoolshtm

******