

ARTIFICIAL INTELLIGENCE-DRIVEN DECISION SUPPORT SYSTEMS AND BEHAVIORAL BIAS MITIGATION IN MUTUAL FUND INVESTMENTS: A CONCEPTUAL REVIEW AND FRAMEWORK

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Abstract—Investor decision-making in mutual fund investments is frequently influenced by behavioral and psychological biases that lead to suboptimal financial outcomes. Traditional advisory mechanisms and investor education initiatives have achieved limited success in mitigating these biases due to scalability constraints and human susceptibility to emotional and cognitive distortions. Recent advances in Artificial Intelligence (AI) have introduced sophisticated Decision Support Systems (DSS) capable of delivering data-driven, predictive, and personalized investment guidance. This conceptual review synthesizes prior research from behavioral finance, financial data science, and decision support systems to examine how AI-driven DSS can mitigate investor biases in mutual fund investments. Drawing on insights from machine learning, predictive analytics, robo-advisory systems, and ethical AI literature, the study develops an integrated conceptual framework explaining the mechanisms through which AI-driven DSS influence investor behavior, decision quality, and market-level outcomes. The paper contributes to fintech and behavioral finance literature by offering a structured theoretical foundation, highlighting ethical and trust-related considerations, and identifying directions for future empirical research.

Keywords: Artificial Intelligence, Decision Support Systems, Behavioral Biases, Mutual Funds, Robo-Advisors, FinTech.

1. Introduction

Investor behavior plays a decisive role in determining outcomes in mutual fund investments. Despite the availability of extensive financial information and analytical tools, investors frequently deviate from rational decision-making due to psychological biases such as overconfidence, loss aversion, herd behavior, and anchoring. These biases manifest in practices such as return-chasing, panic selling during market downturns, and excessive conservatism, which ultimately impair long-term portfolio performance (Shefrin, 2000).

Conventional approaches aimed at addressing behavioral inefficiencies primarily rely on investor education initiatives and human financial advisors. While these mechanisms provide valuable guidance, their effectiveness is constrained by limited scalability, informational asymmetry, and the susceptibility of human advisors themselves to cognitive biases and conflicts of interest (Barber & Odean, 2001; Ackert & Deaves, 2010). As financial markets become increasingly complex and data-intensive, the need for more objective, consistent, and scalable decision-support mechanisms has become evident.

The rapid advancement of Artificial Intelligence (AI) has significantly transformed financial decision-making processes. AI-driven Decision Support Systems (DSS) leverage machine learning algorithms, predictive analytics, and large-scale data processing capabilities to deliver personalized, real-time, and evidence-based investment recommendations (Agrawal et al., 2019). In the context of mutual fund investments, these systems offer substantial potential to mitigate behavioral biases by enforcing disciplined decision rules, providing timely behavioral nudges, and aligning investment choices with long-term financial goals.

Despite their promise, the deployment of AI-driven DSS raises critical concerns related to algorithmic transparency, ethical accountability, data privacy, and investor trust (Binns, 2018). Moreover, existing research remains fragmented across behavioral finance, fintech, and decision-support literatures, with limited efforts to integrate these perspectives into a unified theoretical framework. Addressing this gap, the present study develops a comprehensive conceptual framework that explains how AI-driven DSS mitigate behavioral biases in mutual fund investments and influence both individual and market-level outcomes.

Contribution of the Study: This paper contributes to the literature in three ways. First, it integrates behavioral finance and AI-driven decision support research into a unified conceptual framework tailored to mutual fund investments. Second, it identifies behavioral intervention mechanisms as key mediators linking AI capabilities and investor decision outcomes. Third, it incorporates ethical and trust-related factors as moderating influences, thereby extending existing fintech and decision-support theories and offering a foundation for future empirical investigation.

2. Methodology of the Conceptual Review

This study adopts a theory-building conceptual review approach. Relevant literature was identified through a structured search of academic databases including Scopus, Web of Science, and Google Scholar. The review focused on peer-reviewed journal articles, books, and conference proceedings published primarily between 2000 and 2024. Keywords used in the search included behavioral finance, mutual fund investor behavior, artificial intelligence in finance, decision support systems, robo-advisors, and ethical AI.

Studies were included if they examined behavioral biases in investment decision-making, AI-driven financial decision support, predictive analytics, or ethical considerations in fintech. The selected literature was systematically analyzed to identify dominant themes, theoretical perspectives, and research gaps. Insights from these streams were synthesized to develop the proposed conceptual framework.

3. Literature Review

3.1 Behavioral Biases in Mutual Fund Investment Decisions

Behavioral finance theory challenges the assumption of fully rational investors by demonstrating that financial decisions are systematically influenced by cognitive and emotional biases (Thaler, 1980). Overconfidence bias leads investors to overestimate their forecasting abilities, resulting in excessive trading and suboptimal diversification. Loss aversion causes investors to place greater weight on potential losses than equivalent gains, often leading to premature selling or excessive risk avoidance. Herd behavior encourages investors to mimic market trends rather than rely on fundamental analysis, thereby amplifying volatility. Anchoring bias leads investors to rely excessively on historical prices or past performance, even when such information is no longer relevant.

While prior studies consistently document the negative impact of these biases on portfolio performance, they also reveal persistent challenges in correcting such behavior through traditional advisory mechanisms alone (Shefrin, 2000). This highlights the need for more systematic and technology-enabled interventions.

3.2 AI-Driven Decision Support Systems in Financial Markets

AI-driven DSS have emerged as powerful tools capable of enhancing decision quality through data-driven insights. Machine learning models analyze historical financial data, investor behavior patterns, and macroeconomic indicators to forecast returns and assess investment risk (Chen et al., 2020). Robo-advisory platforms operationalize these insights by delivering automated portfolio construction and rebalancing services aligned with investor preferences and risk profiles.

Although existing studies acknowledge the efficiency and consistency of AI-driven systems, they differ in their assessment of the extent to which such systems can autonomously mitigate deeply rooted behavioral biases without reducing investor autonomy (Huang et al., 2020; Dixon et al., 2020). This divergence underscores the importance of understanding the behavioral mechanisms through which AI-driven DSS influence investor decisions.

3.3 Predictive Analytics and Behavioral Interventions

Predictive analytics constitutes a core capability of AI-driven DSS. By identifying behavioral anomalies such as excessive trading or panic selling, AI systems can generate timely alerts, personalized nudges, and automated portfolio adjustments (Bose & Mahapatra, 2021). Integrating behavioral finance principles into algorithmic design enables AI-driven DSS to promote long-term investment orientations rather than short-term speculative behavior (Jiang, 2021). However, existing interventions often rely on generic nudging strategies, indicating a need for more context-sensitive and individualized approaches.

3.4 Ethical and Trust-Related Challenges

The adoption of AI in financial decision-making is constrained by ethical and governance concerns. Algorithmic opacity, commonly referred to as the “black-box” problem, limits explainability and accountability (Binns, 2018). Furthermore, biased training data may lead AI systems to reinforce existing inequalities in financial markets (Gomber et al., 2018). Addressing these concerns through transparent model design and ethical governance is essential for sustaining investor trust and regulatory compliance.

4. Theoretical Foundations

4.1 Behavioral Finance Theory

Behavioral finance theory provides the primary foundation for understanding how cognitive and emotional biases influence investor decisions and lead to suboptimal outcomes (Thaler, 1980).

4.2 Decision Support Systems Theory

Decision Support Systems theory emphasizes the role of information systems in improving decision quality by providing timely, relevant, and accurate information. AI-driven DSS extend this framework by incorporating learning and predictive capabilities.

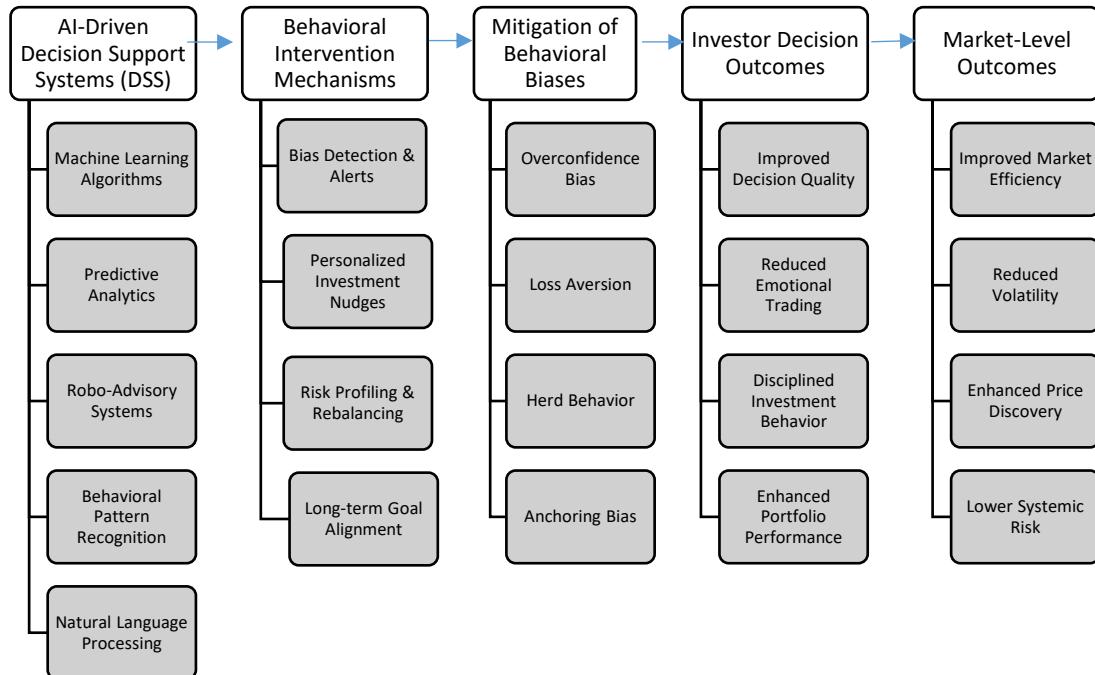
4.3 Ethical AI and Market Dynamics

Ethical AI frameworks address transparency, accountability, and data privacy, while market dynamics theories explain how individual investment behaviors aggregate into market-level outcomes.

5. Conceptual Framework

5.1 Conceptual Framework Diagram

Conceptual framework illustrating the role of AI-driven decision support systems in mitigating behavioral biases and enhancing mutual fund investment outcomes.



5.2 Framework Description

The proposed conceptual framework explains how AI-driven Decision Support Systems influence investor behavior and decision outcomes in mutual fund investments. AI-driven DSS—comprising machine learning algorithms, predictive

analytics, robo-advisory platforms, and behavioral pattern recognition—serve as the foundational input. These capabilities operate through behavioral intervention mechanisms such as bias detection alerts, personalized investment nudges, automated portfolio rebalancing, and long-term goal alignment.

These interventions mitigate key behavioral biases including overconfidence, loss aversion, herd behavior, and anchoring bias, thereby improving investor decision outcomes such as decision quality, emotional discipline, and portfolio performance. At the aggregate level, improved investor behavior contributes to enhanced market efficiency, reduced volatility, improved price discovery, and lower systemic risk. The effectiveness of this process is moderated by factors such as algorithm transparency, explainability, data quality, investor trust, and market volatility.

6. Research Gaps and Future Research Directions

Despite growing scholarly attention, several gaps remain. First, limited research examines the long-term behavioral implications of sustained AI-DSS usage, particularly its impact on investor autonomy and financial literacy. Second, empirical validation of AI-based behavioral interventions in mutual fund contexts remains scarce. Future studies should employ longitudinal designs and advanced analytical techniques such as Structural Equation Modeling (SEM) or PLS-SEM to empirically test the proposed framework.

7. Ethical Considerations and Controversies

Key ethical concerns include algorithmic bias, accountability for AI-driven recommendations, and unequal access to advanced decision-support technologies. Addressing these issues requires transparent model design, ethical governance frameworks, and regulatory oversight to ensure responsible AI adoption in financial markets.

8. Conclusion

AI-driven Decision Support Systems represent a transformative innovation in mutual fund investment decision-making. By systematically mitigating behavioral biases and promoting disciplined investment behavior, these systems enhance both individual and market-level outcomes. However, their long-term effectiveness depends on transparency, ethical governance, and sustained investor trust. This conceptual review provides a comprehensive theoretical framework that advances understanding of AI-driven behavioral interventions in mutual fund investments and offers a foundation for future empirical research.

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