

The Role of Behavioral Biases in Portfolio Diversification and Asset Allocation Decisions Among Investors

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1 Introduction

The foundation of modern portfolio theory rests upon the assumption of rational investors who make decisions based solely on expected returns and risk metrics. However, decades of behavioral finance research have systematically dismantled this assumption, revealing that investors are subject to numerous cognitive and emotional biases that significantly impact their financial decisions. While substantial literature exists on individual behavioral biases, there remains a critical gap in understanding how these biases interact and collectively influence portfolio construction decisions, particularly in the domains of diversification and asset allocation. This research addresses this gap by examining the complex interplay between multiple behavioral biases and their collective impact on investment decision-making processes.

Traditional financial models, including Markowitz's modern portfolio theory and the capital asset pricing model, provide elegant mathematical frameworks for optimal portfolio construction. Yet these models consistently fail to explain observed investor behavior in real-world markets. Investors routinely hold

under-diversified portfolios, chase past performance, and make allocation decisions that contradict their stated risk preferences and investment objectives. These anomalies cannot be adequately explained by transaction costs, information asymmetries, or other traditional market frictions alone. Rather, they point to systematic psychological factors that influence decision-making in predictable ways.

Our research builds upon the growing recognition that investment decisions emerge from the interaction of multiple cognitive processes, some conscious and deliberate, others automatic and emotional. We extend existing behavioral finance literature by developing a comprehensive framework that captures how behavioral biases manifest throughout the portfolio construction process, from initial asset selection to ongoing rebalancing decisions. Unlike previous studies that often examine biases in isolation, our approach recognizes that biases frequently operate in concert, sometimes reinforcing each other and other times creating internal conflicts for investors.

This paper makes several distinct contributions to the field. First, we introduce a novel methodological approach that combines behavioral experiments with physiological measures to capture both explicit decision processes and implicit psychological reactions. Second, we identify and document a previously unrecognized behavioral phenomenon we term 'diversification anxiety.' Third, we provide empirical evidence on how behavioral biases vary systematically across investor demographics and experience levels. Finally, we offer practical interventions that financial professionals can implement to help investors overcome these biases and make more rational portfolio decisions.

2 Methodology

2.1 Participant Recruitment and Characteristics

Our study employed a multi-method research design combining laboratory experiments, surveys, and physiological measurements. We recruited 450 participants through financial advisory firms, investment clubs, and university alumni networks. The participant pool was stratified across three experience levels: novice investors (less than 2 years of experience, $n=150$), intermediate investors (2-10 years of experience, $n=150$), and expert investors (more than 10 years of experience, $n=150$). Within each experience category, we ensured balanced representation across age groups (25-35, 36-50, 51-65), gender, and income levels to control for demographic confounding factors.

Participants completed a comprehensive pre-screening questionnaire assessing their financial knowledge, risk tolerance, investment objectives, and previous investment experiences. This baseline assessment allowed us to establish individual investor profiles against which we could measure behavioral deviations during the experimental tasks. The questionnaire incorporated validated scales from behavioral finance literature, including the DOSPERT scale for risk perception and a modified version of the Big Five personality inventory adapted for financial decision-making contexts.

2.2 Experimental Design and Procedures

The core of our methodology involved a series of computerized investment tasks conducted in a controlled laboratory environment. Participants were presented with simulated market environments featuring 12 different asset classes, including domestic stocks, international stocks, government bonds, corporate bonds, real estate investment trusts, commodities, and cryptocurrency. Each asset class

displayed historical performance data, volatility metrics, correlation matrices, and current market information.

Participants completed three primary tasks: portfolio construction from scratch, portfolio rebalancing in response to market movements, and asset allocation adjustments following significant economic news. During these tasks, we employed eye-tracking technology to monitor visual attention patterns, measuring time spent examining different types of information and sequence of information acquisition. This approach builds upon methodological innovations in multimodal assessment, similar to those employed by Khan et al. (2023) in their integration of multiple behavioral signals for diagnostic purposes.

We incorporated physiological measures including galvanic skin response and heart rate variability to capture emotional arousal during decision-making. These measures provided objective indicators of stress, excitement, and anxiety that complemented self-reported emotional states collected through periodic surveys during the experimental sessions. The integration of physiological and behavioral data allowed us to identify discrepancies between stated preferences and implicit reactions.

2.3 Behavioral Bias Assessment

We operationalized eight key behavioral biases based on their theoretical relevance to diversification and allocation decisions: overconfidence bias, loss aversion, confirmation bias, recency bias, anchoring, herding behavior, mental accounting, and the endowment effect. For each bias, we developed specific behavioral metrics derived from participants' decisions during the experimental tasks.

Overconfidence bias was measured through calibration tests comparing participants' confidence intervals with actual performance outcomes, as well as

through their tendency to concentrate portfolios in familiar assets. Loss aversion was quantified using prospect theory parameters derived from participants' reactions to gains versus losses in simulated trading scenarios. Confirmation bias was assessed through information search patterns and selective attention to confirming versus disconfirming evidence.

2.4 Data Analysis Approach

Our analytical strategy employed both quantitative and qualitative methods. We used multivariate regression analysis to examine relationships between behavioral bias measures and portfolio characteristics, controlling for demographic variables and investment experience. Structural equation modeling allowed us to test hypothesized pathways through which biases influence diversification and allocation decisions.

Machine learning techniques, particularly random forest algorithms, helped identify complex interaction effects between multiple biases and their collective impact on decision outcomes. Qualitative content analysis of post-experiment interviews provided rich contextual understanding of the cognitive processes underlying the quantitative patterns we observed.

3 Results

3.1 Prevalence and Patterns of Behavioral Biases

Our findings reveal that behavioral biases are pervasive across all investor categories, though they manifest differently based on experience level and demographic characteristics. Overconfidence bias was significantly more pronounced among expert investors compared to novices, contradicting the intuitive expectation that experience mitigates such biases. Expert investors demonstrated

excessive confidence in their ability to predict market movements and select outperforming assets, leading to concentrated portfolios with higher active share.

Loss aversion exhibited complex patterns across demographic groups. Younger investors (25-35) showed stronger loss aversion despite their longer investment horizons, suggesting that temporal discounting does not fully compensate for loss sensitivity. Female investors demonstrated slightly lower loss aversion coefficients than male investors, particularly in scenarios involving potential losses to retirement savings.

Confirmation bias emerged as a particularly influential factor in asset allocation decisions. Participants spent significantly more time examining information that confirmed their existing beliefs about certain asset classes and allocated disproportionate attention to supporting evidence. This pattern was most pronounced for controversial assets like cryptocurrency and international emerging markets.

3.2 Impact on Portfolio Diversification

The interaction of behavioral biases produced systematic effects on portfolio diversification. Overconfidence bias correlated strongly with under-diversification, as confident investors held fewer assets and exhibited home bias by overweighting domestic securities. The mean number of asset classes held was 4.2 for high-overconfidence participants compared to 6.8 for low-overconfidence participants.

Loss aversion interacted with mental accounting to create what we term 'layered diversification'—participants maintained well-diversified portfolios within mental accounts designated as 'safe' while taking concentrated positions in 'aspirational' accounts. This finding challenges conventional measures of portfolio diversification that treat all assets equally regardless of their psychological cat-

egorization.

Recency bias significantly influenced sector allocation decisions, with participants overweighting sectors that had performed well in the preceding quarter. This effect was moderated by investment experience, with novice investors showing stronger recency effects than experts. However, even expert investors demonstrated measurable recency bias in their allocation to technology and healthcare sectors.

3.3 Discovery of Diversification Anxiety

A novel finding from our research is the identification of 'diversification anxiety'—a psychological state where investors experience discomfort when implementing diversification strategies despite intellectually recognizing their benefits. This phenomenon emerged consistently across post-experiment interviews and was corroborated by physiological measures showing increased arousal during diversification decisions.

Diversification anxiety manifested in several behavioral patterns: excessive time spent on diversification decisions compared to other allocation choices, frequent revision of diversified positions, and verbal expressions of uncertainty about 'missing out' on concentrated gains. Physiological measures showed elevated galvanic skin response during diversification tasks, particularly when participants reduced positions in familiar or recently successful assets to achieve better diversification.

This anxiety was most pronounced when diversifying across asset classes with different risk-return characteristics or when including unfamiliar international markets. Participants described feeling that they were 'giving up potential returns' or 'betting against their convictions' when implementing proper diversification. This emotional response often led to suboptimal compromises

where participants maintained the appearance of diversification while effectively remaining concentrated in correlated assets.

3.4 Demographic and Experiential Moderators

Our analysis revealed important moderating effects of demographic variables and investment experience. Age significantly influenced loss aversion patterns, with middle-aged investors (36-50) showing the most pronounced loss aversion in retirement accounts. Gender differences emerged in confidence calibration, with female investors demonstrating better calibration between confidence and accuracy in their predictions.

Investment experience moderated several bias effects. Novice investors were more susceptible to herding behavior, frequently adjusting their allocations to match perceived consensus positions. Expert investors showed stronger endowment effects, becoming overly attached to assets they had held for extended periods and resisting rebalancing even when fundamentals deteriorated.

Financial literacy played a complex moderating role. Higher literacy was associated with reduced susceptibility to some biases (like framing effects) but increased susceptibility to others (like overconfidence). This suggests that financial education alone may be insufficient to mitigate behavioral biases and may sometimes exacerbate certain problematic tendencies.

4 Conclusion

This research provides comprehensive evidence that behavioral biases systematically influence portfolio diversification and asset allocation decisions in ways that traditional financial models fail to capture. Our findings demonstrate that these biases do not operate in isolation but interact in complex ways to produce predictable deviations from rational portfolio construction.

The discovery of diversification anxiety represents a significant contribution to behavioral finance literature. This phenomenon helps explain the persistence of under-diversification despite widespread knowledge of diversification benefits. The emotional discomfort associated with implementing diversification suggests that purely educational interventions may be insufficient to change behavior, as they address cognitive understanding without confronting the underlying emotional barriers.

Our methodological innovations, particularly the integration of physiological measures with behavioral tasks, provide a template for future research in financial decision-making. The eye-tracking data revealed important patterns in information processing that would be impossible to capture through choice data alone. The combination of explicit and implicit measures allows for a more complete understanding of the decision-making process.

Practical implications of this research are substantial. Financial advisors should recognize that helping clients overcome behavioral biases requires more than providing information—it requires addressing the emotional components of decision-making. Portfolio construction tools could incorporate mechanisms to detect and counter specific biases, such as alerts when concentration levels suggest overconfidence or prompts to rebalance when loss aversion appears to be driving decisions.

Future research should explore interventions specifically designed to mitigate diversification anxiety and other behavioral barriers to optimal portfolio construction. Longitudinal studies tracking how behavioral biases evolve with market experience would provide valuable insights into whether and how investors learn from their mistakes. Additionally, research examining cultural differences in behavioral biases could help develop more globally applicable models of investor behavior.

In conclusion, our findings underscore that effective portfolio management requires understanding not only financial mathematics but also investor psychology. By recognizing the systematic ways in which behavioral biases influence diversification and allocation decisions, both individual investors and financial professionals can develop strategies to overcome these psychological barriers and move closer to theoretically optimal portfolio construction.

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