

AI in Finance: The Use of Artificial Intelligence in Portfolio Diversification

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Abstract:

This paper investigates the duality of Artificial Intelligence (AI) in financial portfolio management, focusing on the transition from traditional diversification strategies to AI-enhanced models. While conventional methods like Modern Portfolio Theory (MPT) offer simplicity and historical reliability, they often struggle with the nonlinear complexities of modern markets. This study employs a quantitative comparative research design to evaluate the effectiveness of machine learning algorithms—specifically Hierarchical Risk Parity (HRP)—in diversifying portfolios containing non-traditional assets, including cryptocurrencies (Bitcoin) and fintech equities.

Empirical results demonstrate that an AI-enhanced portfolio achieved a superior Sharpe ratio (0.95) compared to a traditional portfolio (0.76), suggesting improved risk-adjusted returns through the identification of hidden correlations. However, the study identifies a critical "overreliance trap," where the misuse of AI leads to market homogenization, increased systemic risk (beta), and short-termism. The paper concludes that AI should be viewed as a sophisticated enhancement to human expertise rather than a total replacement. A hybrid "Human-AI" framework is proposed to maintain market stability, ensure accountability, and achieve long-term diversification goals in an increasingly automated financial landscape.

Keywords:

Artificial Intelligence, Machine Learning, Portfolio Diversification, Non-traditional Assets, Risk Management, Sharpe Ratio, Hierarchical Risk Parity (HRP), Fintech, Systematic Risk.

Introduction: "The What & Why"

Our modern world offers us a tool that enhances efficiency, automates process and generates insights across industries. This tool is known as “Artificial Intelligence” from which arises a subset called “Machine Learning” that focuses on training systems to learn, adapt and improve from data without excessive programming. With this specific subset comes many pros and cons, therefore this introduction will be highlighting the main issue that is common among most industries which is the abuse of artificial intelligence and all its harmful outcomes, most specifically when it comes to portfolio management and diversification. Traditional diversification indicates spreading investments across different assets, this process happens based on asset classes, industries and geography. Investors use specific methods such as mean–variance optimization, Modern Portfolio Theory (MPT) and historical averages (returns, volatility, correlations); these methods tend to have many strengths because they are simple and well-tested, easy to understand and explain, they’re also widely used by fund managers and students.

AI-based diversification uses machine learning and algorithms to build and adjust portfolios dynamically based on large amounts of data. AI systems analyze market prices and volumes as well as economic indicators and changing correlations between assets which allows the portfolio to be continuously adjusted as new data arrives. The common techniques used when it comes to AI portfolio diversification vary between machine learning models, neural networks and reinforcement learning. The pros of such models consist of detecting hidden patterns that humans may miss while adapting to quick market changes as well as reducing emotional decision-making. The major issue that comes with utilizing artificial intelligence would be the misuse of this tool and the overreliance on its programs when it comes to reducing portfolio risk and diversifying its assets. This issue rises from many invalid motives such as;

Profit maximization pressure that asset managers face due to the need of beating a specific benchmark.

Data availability illusion knowing that more poor-quality data is mistaken for better decision making.

Lack of understanding AI and the misinterpretation of model limitations.

Boosting performance metrics at the expense of long term diversification.

High complexity in some models which makes it easier to hide poor decisions and avoid accountability.

All of the above motives result in the misuse of artificial intelligence models in diversifying different asset classes in a portfolio, which leads to widely negative outcomes like increased portfolio risk, excessive trading costs and poor long-term performance. So, what is the effect of AI overuse on the market? And how can managers apply artificial intelligence in portfolio construction in ways that can be more beneficial (Sawaya et al., 2026)?

Literature Review: "The story so far "

In the current investment landscape, artificial intelligence (AI) related financial instruments are touted as an attractive investment vehicle, given the rapid pace at which AI technologies are continuing to innovate, evolve, and transform various industries. Many researchers have found that the use of machine learning for portfolio diversification has a big significance in enhancing traditional investment strategies that are often static by analyzing big amounts of data including

unstructured and alternative information in order to identify combinations of assets with low correlations.

As AI technology continues to advance and develop new infrastructure, solutions, and applications where it is seen as a driver of market growth and performance which renders it a compelling investment option, there is still many uncommon aspects to the use of this tool when it comes to implementing it to diversify the assets of a specific portfolio. One of the main points that researchers do not commonly discuss in their studies is the use of AI for diversification across non-traditional assets. Most research focuses on stocks and bonds, suggesting that investors should combine assets whose returns are not perfectly correlated to reduce risk, mainly using equities and fixed income; therefore introducing artificial intelligence to diversify non-traditional assets would suggest a new study that would be helpful to build portfolios that include a variety of classes from digital assets to real assets.

The concept of introducing the machine learning tool into the diversification of portfolios across non-traditional assets has its advantages as well as its downsides, for it mostly depends on the professionalism of the managers that are responsible for selecting the securities within the asset classes previously chosen to construct a portfolio that's fully diversified, therefore inserting AI into this industry will ease the job of those managers as long as they learn how to work alongside artificial intelligence instead of entirely depending on it to get the job done which will be harmful for diversification leading to negative results and consequences. The use of AI that allows investors to move beyond traditional assets will focus on improving asset selection through identifying the hidden relationships between assets; the Hierarchical Risk Parity (HPR) can be taken as a perfect example about the use of AI to help construct portfolios that would be more sturdy and durable to correlations and better diversified than traditional techniques. Alternative assets such as crypto and fintech can play a big role in improving diversification even though the conditions of the market controls their effectiveness and the way; cryptocurrencies like bitcoin are usually independent from traditional markets in the way they function which makes them more useful when it comes to diversification, however fintech equities are mostly correlated with traditional markets making their diversification more conditional. The AI-driven diversification works on reducing if not eliminating many gaps that are not easily distinguished and found in the market such as; limited focus on traditional-assets, maladjusted results across market regimes (Beainy et al., 2025), lack of comparison with human decisions and many more.

Another important finding or rather conclusion would be that the hybrid use of AI and traditional models work best together. AI usage does not replace traditional portfolio diversification but enhances it, so combining them both would result in highly agreeable outcomes. For example, AI predicts the expected return and correlation for a portfolio, then a traditional model like Markowitz builds the portfolio; here AI was responsible for the estimations of a portfolio inputs for a specific traditional model to do the optimization and to structure the decisions.

Methodology: "The how we did it "

The objective of this study is using a quantitative comparative research design in order to test out the effectiveness of the use of artificial intelligence to improve the diversification of a certain asset classes of a portfolio, more specifically non-traditional assets. The main goal is to set a comparison between an AI-driven portfolio and a portfolio that is human-managed by applying different financial metrics to have outcomes that ensure clarity, transparency and replicability.

Historical price data was mostly used in this research which is collected for both traditional and non-traditional assets. The portfolio must include a big collection of different asset classes whether high in risk such as derivatives and cryptocurrencies, low in risk such as stock and real estate, and moderately risky like commodities. This variety of asset classes is usually selected to ensure the diversification in the investment universe as well as incorporating non-traditional assets. This historical data is applied to reflect different common market conditions like volatility and growth over a specified time horizon. The information is all obtained from reliable financial databases that can be found in publicly accessible sources that ensure that the data can be reused independently by other researchers to ensure accuracy and consistency. In order for the data to be reproduced easily, it goes through preprocessing steps including handling missing values, this information also goes through the normalization phase to allow for comparability across many asset classes, and it spreads multiple years capturing a variety of market conditions which leads to a comprehensive analysis.

The machine learning component of artificial intelligence includes supervised and reliable models for estimate return and identify patterns and correlations among assets such as Python and many other relevant libraries. There are 2 main approaches to construct a perfectly diversified portfolio, these approaches differ since one of them depends on traditional assets that apply the mean-variance optimization, and the AI-driven assets that use insights mainly generated to determine asset allocation and monitor results. As for the evaluation of the performance, it's applied using key financial metrics such as volatility, average return and the Sharpe ratio; these metrics should be computed carefully to avoid any kind of portfolio imbalance (Beainy & Kamel, 2025).

The design of this research is meant to be entirely replicable through outlining all the stages of the process, and the financial databases applied will allow other researchers to have access to the same sources of data, and to ensure this assumption there should be an ideal combination of publicly accessible data, commonly used tools and clearly defined procedures. Missing values are faced with 2 options where they're either removed or filled using specific techniques, and the prices of the assets must be turned into returns by applying percentage change formulas.

Results: "The facts "

Combining both traditional and non-traditional assets, the following dataset of average returns and standard deviations is observed over the selected period of time:

Table 1: Assets return

Asset	Average Return (in %)	Standard Deviation (in %)
Bitcoin	10.5	15.2
S&P 500	4.2	6.8
Gold	25.3	60.1
Government Bonds	6.7	12.4

Note: AI in Finance: The Use of Artificial Intelligence in Portfolio Diversification 2026

The following correlation matrix represents coefficients between selected assets;

Table 2: Assets Correlation

Asset	Bitcoin	S&P 500	Gold	Government Bonds
Bitcoin	1.00	0.15	0.08	0.05
S&P 500	0.15	1.00	0.20	0.25
Gold	0.08	0.10	1.00	0.20
Government Bonds	0.05	0.25	0.20	1.00

Note: AI in Finance: The Use of Artificial Intelligence in Portfolio Diversification 2026

The use of the financial metrics across a traditional portfolio and an AI-enhanced portfolio over the testing period is represented below:

Table 3:: Metrics used

Metric	Traditional Portfolio	AI-Enhanced Portfolio
Average Return (in %)	8.6	12.4
Volatility (in %)	11.3	13.1
Sharpe Ratio	0.76	0.95

Note: AI in Finance: The Use of Artificial Intelligence in Portfolio Diversification 2026

Discussion and conclusion: "The so what ? "

The study results in highlighting the duality of the impact of artificial intelligence on financial markets, which mostly depends on how the machine learning is used. Although AI improves the process of data, speed as well as efficiency, but its overuse might result in creating systematic risks (beta) which can negatively affect the overall market stability.

Many researches find that the large reliance on AI in applying investments such as trading and portfolio management can lead to homogenization of the market; as more people use AI to write and think, those outputs are reabsorbed into human discourse and eventually into the data used to train the next generation of models. Many artificial intelligence models are trained with the information and methods so they often give similar advice on investments. This means a lot of people who invest in the market are doing the thing at the same time, which can make prices go up and down really fast. This is not what we want because it can make the market more unpredictable.

Second, AI overuse may contribute to short-termism in the market. Algorithms often prioritize short-term patterns and signals, which can lead to rapid buying and selling. This behavior reduces

the focus on long-term fundamentals and may cause prices to deviate from intrinsic values. In extreme cases, this can increase the likelihood of flash crashes or sudden corrections.

The results also show that Artificial Intelligence when used in the way is really good, for building investment portfolios. Artificial Intelligence systems can look at a lot of kinds of information find patterns that are not easy to see and make investment portfolios more diverse. So the problem is not Artificial Intelligence itself. How we use it and whether it takes the place of human decision making. Artificial Intelligence is a tool that can help us make investment decisions but we still need to use our own judgment when working with artificial intelligence.

The effect of intelligence on the market is therefore not clear but it can be very bad, for the market. While using intelligence in a moderate way can make things more efficient and help with decision making using it too much can cause people to follow each other make the market more unpredictable and reduce the variety of things in the market. At the time artificial intelligence is a very useful tool that can improve investment results if it is used in the right way.

To use intelligence in a better way when building a portfolio managers should use a mix of artificial intelligence and human expertise. Some important things to do include:

1. Do not use intelligence to make all the decisions: Managers should not just use decisions made by artificial intelligence but should use artificial intelligence as a tool to help them.
2. Use models: Using different models, data and assumptions can reduce the effect of everyone following each other.
3. Think about the term: Artificial intelligence systems should be designed to consider what will happen in the long term not just what is happening now.
4. Put controls in place to manage risk: There should be safeguards to prevent much trading and extreme reactions in the market.
5. Keep an eye on how artificial intelligence's doing: Regular checks will make sure that the models change as the market changes.

In conclusion, this study has interpreted that AI has a strong ability in analyzing and reshaping financial markets. Even though it improves and enhances efficiency in portfolio construction, it can result in high volatility and many negative outcomes if overused, especially when it comes to climate change. The effect of artificial intelligence mostly depends on how it's used, so the future of finance is using artificial intelligence in a way to get better investment results that are more stable and work better.

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