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ŞERİATA UYGUN HİSSE SENEDİ OPTİMİZASYONU İÇİN İSLAMİ META-UYARIM PORTFÖY TEORİSİ

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ÖZ

Metaverse, son yıllarda hızlı bir gelişme yaşadı. Metaverse belirsiz bir şekilde tanımlanmıştır, ancak tipik olarak, biri metaverse içinde oynamasa bile kalıcı bir dünya ve artırılmış gerçeklik biçimleri ile karakterize edilen bir sanal gerçeklik biçimi içerir. Bu hem fiziksel hem de dijital dünyaları kapsar. Birçok şirket metaverse'i iş planlarına ve stratejilerine dahil etmiş ve müşterilerine metaverse deneyimleri sunmaktadır. Metaverse ve gelir fırsatları için önemli büyüme fırsatları göz önüne alındığında, birkaç şirket, metaverse'nin sağladığı büyüme ve kar fırsatlarını aktif olarak desteklemiştir. Bu aynı zamanda Şeriat uyumlu yatırım fonlarını bu şirketlere maruz kalma ve onlara yatırım yapma konusunda cezbetti. Fon tahsisini optimize etmek, fonlardan elde edilen getirileri maksimize etmede kritik bir unsuru temsil eder. Bu makale, Şeriata uygun hisse senedi optimizasyonu için yeni bir İslami meta-uyarım portföy teorisi sunmaktadır. Teori, metaverse şirketlerine yapılan yatırımlar için İslami gerekliliklerin bu hisseleri içeren bir portföyün performansını nasıl teşvik edebileceğini özetlemektedir. Teori, metaverse Şeriat uyumlu portföylerin performansının uyarılması için derin bir öğrenme optimizasyon çerçevesini bütünleştirir. Teori, diğerlerine kıyasla Şeriat uyumlu metaverse şirketlerinin deneyimlediği performans gelişimini gösteren, NYSE ve NASDAQ'da listelenen büyük şirketlerin bir veri setinde özetlenmiştir.

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ISLAMIC META-STIMULATION PORTFOLIO THEORY FOR SHARIAH-COMPLIANT EQUITY OPTIMIZATION

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ABSTRACT

The metaverse has experienced rapid development in the last decades. The metaverse is vaguely defined, but typically includes a form of virtual reality, that is characterized by a persistent world even if one is not playing within the metaverse, and forms of augmented reality. This encompasses both the physical and digital worlds. Many companies have incorporated the metaverse in their business plan and strategies and provide metaverse experiences to their customers. Given the significant growth opportunities for the metaverse and revenue opportunities, several corporations have actively promoted the growth and profit opportunities the metaverse provides. This has also attracted Shariah-compliant investment funds to gain exposure to these corporations and invest in them. Optimizing the allocation of funds represents a critical element in maximizing returns from the funds. This paper presents a new Islamic meta-stimulation portfolio theory for Shariah-compliant equity optimization. The theory outlines how Islamic requirements for investments into metaverse companies may stimulate the performance of a portfolio containing these shares. The theory integrates a deep learning optimization framework for the stimulation of the performance of metaverse Shariah-compliant portfolios. The theory is outlined on a dataset of major NYSE and NASDAQ listed enterprises demonstrating the performance improvement experienced by Shariah-compliant metaverse corporations as compared to others.

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INTRODUCTION

The word "metaverse" has been encountered everywhere in recent years, with Facebook changing its name officially to Meta (Park & Kim, 2022). Non-fungible tokens (NFT) have become one of the major words of the year, where these tokens form a key part of the virtual universe. This has also led gamers and developers to move into this space, making it more and more attractive to conventional consumers. While there has been considerable attention around the virtual universe, understanding the environment behind the virtual universe and what value it creates is of critical importance. The land prices related to digital land have been on the rise, with Republic Real Estate launching a fund for investors to purchase virtual land (Narin, 2021). The fund will purchase virtual land across various online metaverses and transform them into hotels, stores, and other uses. This shall lead to an increase in the value of these properties amongst consumers.

While virtual land has, due to its connotation with physical land, attracted considerable interest, the art sector related to NFTs has experienced an even more significant rise, and there is the expectation that equities and bonds will be hosted on a digital asset platform that is built around blockchain technology. Another key area of the metaverse is the gradual online-only shopping experience, which implies that individuals purchase entirely virtual assets. Several stores sell clothing and accessories entirely online, which only exist in the metaverse. Furthermore, there are virtual fashion shoes solely for the virtual world, which has attracted considerable investment amounts. The growing remote work operational model, in addition to the growing utilization of artificial intelligence and virtual technologies, has opened up new business models providing customers with different experiences in the virtual world. Another key change is the move towards remote work, where the metaverse can make remote work more permanent and immersive to maximize efficiency and interaction. This will enable stronger interaction and engagement of the employees (Wilson, Karg, & Ghaderi, 2021).

Given the growing importance of the metaverse, the financial industry has been looking into how to create value within the metaverse space and how fintech solutions can deliver financial services in this new environment. Furthermore, metaverse technology creates new business model opportunities that may strengthen the utilization of crypto-technology as an alternative financial system (Taghdiri, 2020; Yang, et al., 2022).

The technologies behind the metaverse combine technologies such as virtual reality (VR) and augmented reality (AR). This leads to an interactive, immersive

and collaborative virtual 3D universe. The idea is that these individual universes may be integrated with each other as well as allowed to connect across the world in various environments. This may be in the form of games but also in terms of real estate, commercial transactions, and other associated environments (Wohlgenannt, Simons, & Stieglitz, 2020).

As outlined by Facebook's transformation into Meta, financial data and transaction management will become key parts of the metaverse enabling individuals and corporations to transact and operate within these universes. For example, there are digital assets for purchase, such as the World of Warcraft and the Habbo Hotel, and these assets may be even moved from one universe to the other (Park & Kim, 2022).

The current metaverse is a composition of the capabilities of various social media and video game enterprises that build upon their user base and platform to connect these individuals. While this first glance may give the impression that the metaverse is solely about gaming, it has become more of another virtual world where individuals may be fully immersed and conduct most of their life within the metaverse. This may range from dating to having their social interactions within the metaverse, but also conducting business across it. This may be in the form of leading a real enterprise or a digital enterprise within the metaverse. Overall, this will lead to someone being completely immersed in the metaverse and living their daily lives within this universe (Vidal-Tomás, 2022).

The growing presence of metaverse corporations that are eyeing growing their revenues within these digital environments has led to significant investor interest. Islamic funds have been attracted as well to invest in these corporations to participate in these growth opportunities. Given the strong focus of Islamic finance on ethics and alignment with Shariah principles, this raises the question of whether Shariah-compliant metaverse stocks may perform better than those that are non-compliant.

Islamic finance encompasses forms of capital financing that are in agreement with Islamic law and provides guidelines on investment forms. Shariah law permits the investment into common shares of corporations provided that they do not engage in activities that are forbidden by Shariah law. This also includes excessive debt leveraging and speculative activities. The investments may be either in the form of shares or direct investment activities (Katterbauer, Syed, Cleenewerck, & Genc, 2022). There have been several concessions related to companies compliant with Islamic law, given that many of these corporations used debt to address liquidity shortages or invest their excess cash. There are different views on which corporations are permissible, where some scholars

consider companies that hold any form of interest-bearing debt, receive interest or any other impure income as impermissible. Furthermore, the trading of debt beyond its face value may also be Shariah non-compliant. Additionally, corporations whose debt to total asset ratio exceeds 33 %, or whose non-operating interest income exceeds 5 % of the revenue would also be excluded. Finally, those corporations with accounts receivable to total asset ratio greater than 45 % may also be non-compliant concerning Shariah (Hasan, Hassan, & Aliyu, 2020; Katterbauer & Moschetta, A deep learning approach to risk management modeling for Islamic microfinance, 2022).

Given these constraints, the question arises of how Islamic funds can invest reliably into metaverse enterprises and whether those Sharia-compliant metaverse corporations perform better than those that are non-compliant.

METHODOLOGY

A new Islamic meta-stimulation portfolio theory is presented in this article (Figure 1). The meta-stimulation portfolio theory provides a theory behind the stimulation of performance of an Islamic portfolio consisting of solely Shariah compliant metaverse stocks as compared to a general portfolio of multiple compliant and non-compliant stocks. The Islamic meta-stimulation portfolio theory outlines the core factors for the improved performance being primarily due to a more sustainable nature of the business models, real-value generation of these enterprises and the limited speculative behavior of these corporations. Specifically, several new metaverse enterprises have business models that incorporate a highly speculative element, which makes these enterprises uninvestable for Islamic investment funds. The theory incorporates an artificial intelligence framework for determining the most important parameters affecting the meta-stimulation of the Islamic portfolio based on the metaverse.

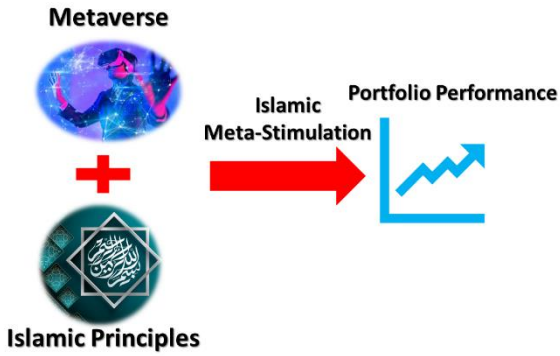

***Figure 1**: Graphical outline of the Islamic meta-stimulation theory for portfolio optimization.*

To validate the theory, several portfolio optimization routines are compared to the data to support and validate the theory.

The first routine is the mean-variance optimization which outlines that the investors aim to maximize the returns subject to the constraints in the variation of the individual investments. The main assumption is that the investors are risk averse, which implies that when investors are offered two portfolios with the same returns, these investors will prefer the less risky one. This implies that the investor only accepts a higher risk if they are compensated with higher expected returns. The trade-off that is encountered by the investors is different for the individual risk aversion characteristics. The model assumes that investors can invest any degree of fraction into the various stocks without any restrictions. A key part of the portfolio theory is that investors can reduce their exposure to individual risks of a stock by investing in a diversified portfolio of assets. This enables them to have the same portfolio expected to return with reduced risk (Björk, Murgoci, & Zhou, 2014).

A critical part of the analysis of the optimal portfolio is the determination of the efficient frontier. The efficient frontier is the boundary at which there is no better portfolio allocation with a higher return and the same risk. This represents the optimal portfolios for the given returns and standard deviations of the assets and enables the determination of the best possible allocations (Cai, Teo, Yang, & Zhou, 2000).

A different approach is the hierarchical risk parity (HRP) approach which addresses some of the issues with the mean-variance optimization. Specifically, the mean-variance estimation may lead to unstable and highly concentrated solutions, and the traditional risk parity ignores in many instances rather useful covariance information. The HRP focuses primarily on covariance data and

clusters the assets based on the correlation and allocate less weight to similar assets (Burggraf, 2021).

The next optimization approach is the conditional value at risk (CVaR). The conditional value at risk is known as an expected shortfall and quantifies the degree of tail risk that an investment portfolio has. The CVaR quantifies the tail risk of an investment portfolio and is taking the weighted average of the extreme losses arising in the distribution of the possible returns. These extreme losses are taken beyond the value at risk (VaR) cutoff point (Krokhmal, Palmquist, & Uryasev, 2002).

The CVaR can be mathematically expressed as

$$CVaR = \frac{1}{1-\alpha}\int_{-1}^{VaR} x\, u(x)dx \qquad (1)$$

where $u(x)$ is the probability density function for the return x, α is the cut-off point for the distribution based on the evaluation of the VaR breakpoint, and VaR is the value at risk. The objective is then to minimize the CVaR to minimize the risk of a potential bankruptcy or illiquidity of the fund due to an adverse event caused by inadequate investment decisions. While the conventional CVaR assumes that all parameters are certain and known, this is not the case in real-case scenarios, and there is uncertainty in the parameters (Ahmadi-Javid & Fallah-Tafti, 2019; Martins-Filho, Yao, & Torero, 2018).

Another optimization approach is the conditional drawdown at risk (CDaR). The CDaR is a measure of the tail risk that aims to alleviate the challenges arising with the efficient semivariance and efficient CVaR and takes into account the time of the decreases in the value of the stocks. This implies that the CDaR may be assumed to be a measure of the average losses that may occur during challenging periods for the stocks. The variation parameter for the CDaR is chosen between zero and one and specifies the expected severity of the drawdown. If the parameter is equal to 1, then this represents the maximum drawdown of the portfolio. The drawdown is defined as the difference in the non-compounded return to the previous peak (Chekhlov, Uryasev, & Zabarankin, 2005).

Another optimization approach is the critical line algorithm (CLA) which is a robust alternative to solve for the optimal portfolio. The critical line algorithm is a dedicated robust algorithm to solve the mean-variance optimization problem and converges very fast. This enables us to derive the entire efficient frontier of the portfolio and the feasible solutions (Markowitz, Todd, Xu, & Yamane, 1993).

The outlined portfolio optimization routines encompass the majority of portfolio optimization routines utilized for the optimization of funds allocation

in portfolios and are widely utilized by investors. Furthermore, these models are the most comprehensive and represent the overwhelming majority of models in portfolio optimization environments. Hence, the performance evaluation on these algorithms can be considered representative of the generality of models for portfolio optimization and provides a solid basis for validating the Islamic meta-stimulation theory.

RESULTS

For validating the Islamic meta-stimulation theory, the metaverse stocks on the New York Stock Exchange and NASDAQ are compared against each other. Specifically, the iShares MSCI USA Islamic ETF (ISUS) was utilized to select Shariah-compliant stocks on these stock exchanges that have been widely accepted to be compliant (S&P Global, 2022). For the determination of metaverse enterprises, the ProShares VERS Metaverse ETF constituents were taken. The ETF tracks the performance of the Solactive Metaverse Theme Index and represents a representative outline of the major metaverse exchange-listed enterprises in the United States. The Shariah-compliant stocks were then taken to be the stocks that are encountered in both of the funds, and include corporations such as Adobe, Cisco, Intel, etc. For comparison, the metaverse enterprises ex those deemed as Islamic, were allocated into a separate category. The two lists are mutually exclusive enabling us to determine the performance differences between metaverse corporations that are Shariah compliant and those that are non-compliant.

The stocks were first analyzed in terms of their EBITDA margins, profit margins and return on equity. As outlined in Figure 2, the Islamic metaverse enterprises exhibit a strong correlation between profit margins and return on equity, as well as EBITDA margins. The plots are classified according to the sector, where most of the corporations are in the technology sector.

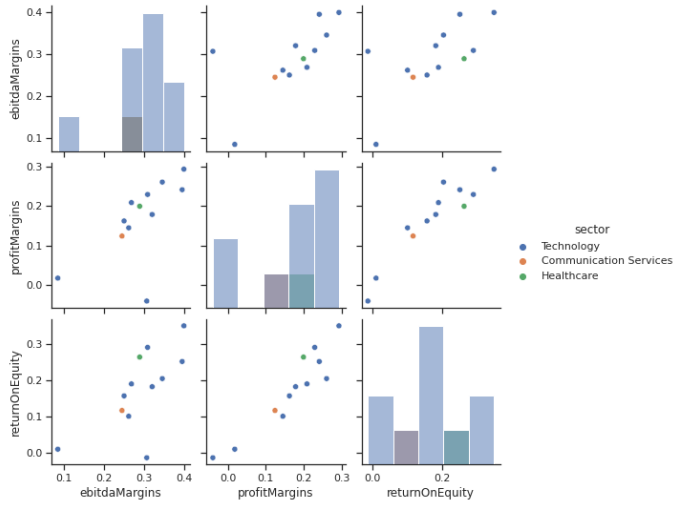

Figure 2: *Comparison of EBITDA margins, profit margins and return on Equity for the Islamic metaverse enterprises categorized by sector.*

A comparison of the non-Shariah compliant metaverse enterprises in Figure 3 exhibits a different picture, where the return on equity for several of these enterprises is significantly above 2, which arises from the limited equity that several of these enterprises possess. While this represents a great opportunity for strong returns on equity as compared to those of the Islamic metaverse compliant stocks, the risks arising from non-compliant activities as well as high leverage may incur significant risks.

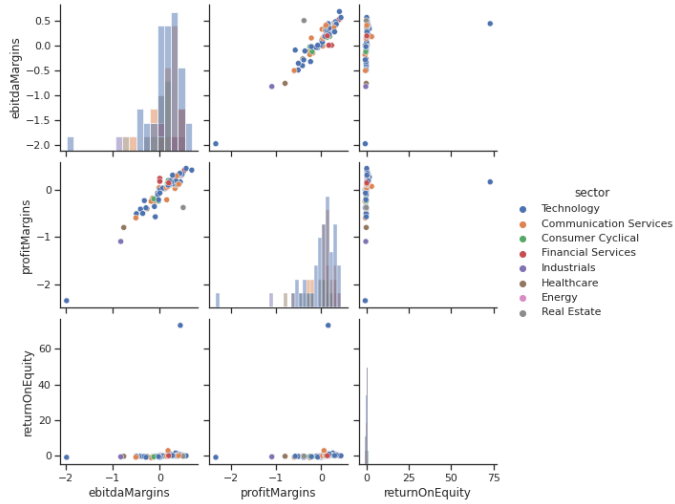

Figure 3: *Comparison plot for non-compliant metaverse corporations in terms of EBITDA margins, profit margins and return on Equity categorized by sector.*

To compare the effect of compliance and non-compliance on the parameters, Figure 4 provides an overview of the various parameters where outliers for the metaverse enterprises were removed. The visualization indicates that there is a connection between EBITDA margins and return on equity, however, this correlation is relatively limited. The quick ratio states how well a company can pay its short-term debts using the most liquid of its assets.

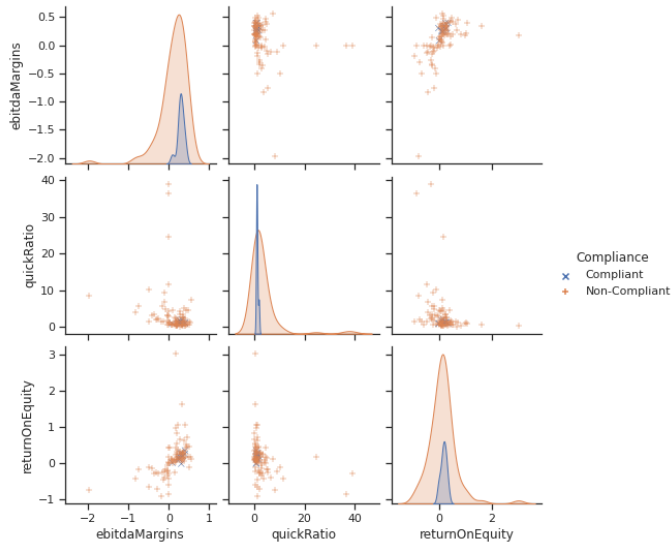

Figure 4: *Comparison of EBITDA margins, quick Ratio and return on equity for the Shariah-compliant and non-compliant metaverse enterprises.*

To compare the performance of the two portfolios, the expected annual returns for the Islamic metaverse and the non-compliant metaverse portfolio are displayed in Table 1. A comparison indicates that the various portfolio optimization routines, such as the determination of optimal solutions for the mean-variance optimization, hierarchy risk parity and others deliver far better performance for the Islamic compliant companies as compared to those that are non-compliant. While for the mean-variance optimization, the results are relatively similar with 61.7 % and 73.9 %, the difference is more significant for the hierarchical risk parity and critical line algorithm optimization results. The results for the CVaR and CDaR are even more significant with the difference being considerable. While the performance of the conditional value at risk on the expected return for the Islamic meta portfolio is rather strong, the same cannot be stated for the meta-enterprise that predicts a negative expected annual return for the optimized portfolio for CVaR and CDaR algorithms.

Table 1: *Comparison of expected annual returns for the five different algorithms.*

	Islamic Meta	Meta
Efficient Frontier	73.9 %	61.7 %
HRP	40.9 %	18.4 %
Critical Line Algorithm	64.1 %	36.3 %
CVaR	76.6 %	-8.9 %
CDaR	25.4 %	- 5.7 %

The analysis outlines the impact on the performance of portfolios in terms of whether the constituents of the fund are Sharia-compliant metaverse companies or not. The results based on the expected annual returns demonstrate a strong stimulation of the performance of the constituents of the funds in contrast to those that are non-compliant. This Islamic meta-stimulation of the performance is clearly outlined in the data with far better performance as compared to the portfolio of non-compliant stocks. The main reason for Islamic meta-stimulation of the portfolio performance is the intense focus on the long-term and solid business foundations of any Shariah-compliant business. Gambling, excessive debt-utilization and other factors are forbidden under Shariah law and this requires these companies to have solid investments into real assets without engaging in excessive debt financing and leveraging.

Necessarily, over the long-term these corporations are better able to withstand market and economic turmoils, thereby providing more solid returns and limited downside risks. This has been illustrated within the last several years where the Islamic metaverse corporations experienced stronger performance as compared to those that are non-compliant and experienced significant volatility in their stock prices in addition to challenges to their business model.

CONCLUSION

Metaverse enterprises have attracted significant attention with the growing focus of investors on utilizing the massive growth opportunities in this sector. The metaverse represents a digital universe utilizing the internet that is supported by virtual and augmented reality and represents an unlimited growth opportunity. Challenges arise from the fact that several of these metaverse

enterprises have limited fundamental values and derive most of their value from speculative investors that are attracted by these growth expectations. Islamic finance has played a profound role in modern finance, focusing investment on companies that comply with Shariah law and have solid foundations of non-speculative nature. Given the focus on long-term solid investments and compliance with Shariah law, there are views that the performance of Sharia-compliant metaverse enterprise within a portfolio is better as compared to a portfolio of non-compliant enterprises. Specifically, there were views that Sharia compliance provides stimulation of the performance of metaverse companies as compared to those that are speculative. The article establishes and validates a new Islamic meta-stimulation theory that outlines that the focus on Islamic compliance stimulates the performance of funds investing into metaverse enterprises. The theory was validated on a large dataset of US-listed metaverse enterprises that exhibited considerably stronger performance as compared to portfolios with non-compliant metaverse enterprises. Based on several best-practice portfolio optimization routines, including CVaR, the Islamic metaverse portfolio performed considerably better in all instances as compared to the portfolio of non-compliant enterprises.

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AUTHORS' PERCENTAGE-BASED CONTRIBUTION

The contributions of each author to the study by percentages are as follows: The percentage-based contributions of the 1st author, 2nd author and 3rd author are 70%, 15% and 15%, respectively.

1st Author: Conceptualization, methodology, formal analysis, investigation, resources, writing-original draft, writing-review & editing, and visualization.

2nd Author: Conceptualization, writing-review & editing, and supervision

3rd Author: Resources, writing-review & editing, and supervision

DECLARATION OF CONFLICTING INTERESTS

There is no financial or individual relationship with a person or an institution in the context of the study. Also, conflicting interests do not exist.

ETHICAL APPROVAL OF THE STUDY

All rules within the scope of "Instruction on Research and Publication Ethics for the Higher Education Institutions" were observed through-out the study. No actions mentioned in the Instruction's second chapter titled "Actions Against to Scientific Research and Publication Ethics" were taken in the study.