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OPTIMIZATION OF AN INVESTMENT PORTFOLIO USING ANALYTICAL AND FINANCIAL MONITORING TOOLS

Sh. R. Abzhalelova^{1*}, S. A. Svyatov², L. A. Baibulekova¹

¹ University of International Business named after K. Sagadiyev,
Almaty, Kazakhstan

² Narxoz University, Almaty, Kazakhstan

ABSTRACT

Purpose of the research - To examine modern methods of investment portfolio optimization with an emphasis on risk and volatility management, and to explore the integration of financial monitoring tools in ensuring regulatory compliance and operational resilience.

Methodology - The study is based on the modeling and analysis of a diversified hypothetical investment portfolio containing stocks, bonds, and ETFs. It combines classical optimization theories—such as the Markowitz model and Sharpe ratio—with advanced tools including Value-at-Risk (VaR), Conditional Value-at-Risk (CVaR), stress testing, and machine learning algorithms for volatility forecasting and asset allocation.

Originality/value - This research provides a synthesis of traditional financial models and modern data-driven techniques. A notable contribution is the applied use of financial monitoring systems—used by second-tier banks—to assess portfolio stability and regulatory risk under the frameworks of AML/CFT and Basel III.

Findings - The results show that implementing innovative risk management and optimization strategies significantly enhances portfolio performance and resilience. Empirical analysis demonstrates that financial monitoring, when combined with CVaR-based modeling and stress scenarios, contributes to better decision-making, reduced exposure to extreme losses, and improved compliance.

Keywords: investment portfolio, financial monitoring, second-tier banks, AML/CFT compliance, Value-at-Risk (VaR), Conditional Value-at-Risk (CVaR), portfolio optimization, volatility, risk management, diversification, regulatory risk, risk analytics

INTRODUCTION

Optimization of investment portfolios in the context of growing financial market volatility requires integrated approaches that combine quantitative risk analytics and financial monitoring mechanisms. In modern economic conditions characterized by uncertainty, instability, and tightening regulatory oversight, effective portfolio construction must ensure not only a balanced risk–return profile but also full compliance with institutional standards and financial transparency.

Classical optimization models, such as Markowitz’s portfolio theory and the Sharpe ratio, remain essential tools for constructing diversified strategies. However, the limitations of these approaches in rapidly changing macroeconomic environments necessitate the incorporation of advanced techniques — including Value-at-Risk (VaR), Conditional Value-at-Risk (CVaR), stress testing, and machine learning algorithms designed for volatility forecasting and asset reallocation.

An additional layer of portfolio resilience is provided using financial monitoring instruments, particularly those employed by second-tier banks. These include systems for liquidity control, risk threshold assessment, AML/CFT compliance, and integration of digital risk dashboards. Financial monitoring is inseparable from the investment decision-making process, ensuring timely reactions to emerging systemic threats and improving transparency and governance across portfolio operations.

This study aims to present a structured analysis of investment portfolio optimization methods that integrate risk analytics and financial oversight. A hypothetical diversified portfolio composed of equities, bonds, and ETFs is constructed and assessed using a range of risk metrics. The outcome is a practical decision-making framework that reflects not only statistical risk characteristics and inter-asset correlations but also regulatory expectations and institutional standards of financial monitoring.

Literature review. There are many approaches to portfolio optimization that focus on detailed risk analysis and effective volatility management. These methods include identifying key risk factors, such as changing market conditions, interest rate movements, or asset price fluctuations, and developing strategies to reduce their impact on the overall portfolio. economic growth of the country. In this direction, the banking sector plays a key role. At present, the efficiency of a commercial bank is based on the strategy of attracting resources, their optimal allocation, considering the profitability and reliability of the asset, as well as its high liquidity. The overall efficiency of the bank's activities is determined by the skillful management of these resources, high margins, and profitability. This study is devoted to the assessment of the level of market risk and profitability of the bank's investment portfolio (real and conditional), the directions for improving the risk management system (diversification and hedging) and their impact on the expansion of banks' investment activities, which corresponds to the scale and nature of the bank's activities. In the study, it is especially important and important to be able to promptly and adequately assess uncertainties and risks, identify and use advanced methods and tools for managing them, as well as monitor market volatility and respond appropriately to minimize risks [1].

Investment portfolio management is critical for financial stability and value creation in enterprises, a mathematical model to optimize the portfolio taking into account expected returns, correlations and risk constraints, the use of machine learning (LSTM for time series) and genetic algorithms for optimal asset ratios, based on Markowitz theory, genetic algorithms and machine learning, genetic algorithms to optimize asset weights with forecasts Markowitz and machine learning, LSTM for processing and forecasting time-series data, an adaptive model with machine intelligence is used to improve accuracy [2]. Effective risk management implies diversification and optimal allocation of capital to minimize the overall risk of the portfolio; the article adopts the concept of effective portfolio risk management and capital allocation. By taking the risks associated with each activity, it is possible to minimize the overall risk portfolio by systematically diversifying financial capital. To achieve this, let us compare the valuation of value at risk (VaR) with other statistical metrics such as percentage ranking and empirical pattern. This combination can significantly reduce potential portfolio losses compared to a portfolio in which assets are evenly distributed. The results are based on the analysis of price assets using three different methods: historical (non-parametric), variance-covariance (parametric), and Monte Carlo [3].

There are various approaches to portfolio optimization, including the use of valuations at risk (VaR) and statistical indicators [3]. Markowitz's portfolio theory emphasizes the balance between risk and return, focusing on risk management at the portfolio level, optimizing the risk-potential return ratio, a mathematical approach to assessing the balance of risk and return - Emphasis on risk management at the portfolio level [4]. This article presents a theoretical and applied study of the Markowitz model for portfolio optimization. The basic assumption of the model is that the investor makes decisions solely based on expected returns and risk, while being risk averse. Thus, the model determines the minimum risk of the portfolio. To analyze the additional risk of the portfolio, the value at risk (VaR) is estimated. VaR is a measure of potential loss risk used to determine the risk that an investor will be exposed to in the future. Value at risk (VaR) is also used as an additional risk measure [5]. The Markowitz model remains a fundamental approach to building a portfolio [5], [6]. Innovative methods, such as the Sharpe and Markowitz methods, can be used to optimize the portfolio, the article discusses methods for optimizing the investment portfolio to achieve greater profitability and reduce risk, the methodology includes diversification and analysis of the portfolio using the methods of Sharp and Markowitz, the choice of the optimal strategy for choosing investment objects, the use of innovative methods for portfolio optimization [7].

MAIN PART OF THE STUDY

An investment portfolio is a set of financial instruments, including stocks, bonds, funds, and other assets, formed to achieve certain investment goals at a given level of risk. A key objective in portfolio building is to optimize the ratio between expected return and risk characteristics through strategic asset allocation.

According to the portfolio theory of Harry Markowitz, the effectiveness of an investment portfolio is determined by its ability to provide maximum return with the lowest possible level of risk. This goal can be achieved through diversification, which involves the inclusion of assets with different correlation characteristics in the portfolio [8].

The goals of portfolio formation vary depending on the investor's profile and may include:

Capital preservation: use of low-risk instruments such as government bonds.

Capital growth: inclusion of assets with high potential for capital appreciation in the portfolio.

Generating stable income: emphasis on instruments that provide regular dividend or interest payments.

Balanced approach: combining the use of diverse types of assets to achieve a moderate level of growth with a controlled level of risk.

Investment activities involve a wide range of risks that can have a significant impact on portfolio returns. For effective management of portfolio investments, a thorough analysis and classification of risks is necessary. Table 1 presents the main types of risks, as well as their sources.

Table 1 – Classification and sources of risks of an investment portfolio

№	Type of risk	Characteristic	Source of origin
1	Market Risk	It occurs when the market value of assets changes under the influence of demand, supply, indices, and investor expectations.	Stock markets, commodities, and currency exchanges
2	Credit risk	Threat of losses due to the borrower's failure to fulfill his debt obligations.	Banks, bond issuers, counterparties to transactions
3	Liquidity risk	The possibility of losses if the asset cannot be sold promptly at a fair price.	Secondary markets, illiquid instruments
4	Operational risk	Risk of losses due to IT system failures, staff errors, internal violations of procedures.	Human factors, internal organization, technological failures
5	Inflation risk	A decrease in real profitability due to the depreciation of money and rising consumer prices.	Macroeconomic instability, CPI growth
6	Currency risk	Losses due to changes in foreign exchange rates when there are assets or liabilities in another currency.	Currency fluctuations, forex volatility
7	Political and legal risk	It arises due to political instability, changes in legislation, sanctions, and nationalization of assets.	Geopolitics, state regulation
8	Interest rate risk	Probability of losses in case of changes in base interest rates affecting the cost of bonds and borrowed resources.	Decisions of central banks, macroeconomic policy
9	Systematic risk	Built-in risk in the market is associated with global factors — recessions, crises, and inflation. It is not eliminated by diversification.	Global economy, crisis cycles, systemic shocks
10	Unsystematic risk	Risks specific to a particular issuer, industry or region. It can be eliminated by competent diversification of assets in the portfolio.	Factors affecting an individual company or sector

Note – compiled by the authors based on the source [9].

Risk management in investment activities is a systematic process of identifying, assessing and controlling risks associated with investment decisions. Its goal is to minimize potential losses while maintaining or increasing the profitability of the portfolio. Basic principles of risk management: Conscious risk acceptance: An investor must understand and accept a level of risk that is appropriate for their investment objectives and risk tolerance. Diversification: The allocation of investments between different assets to reduce the impact of unsystematic risks. Monitoring and adaptation: Regularly reviewing and reviewing the portfolio in response to changes in market conditions and the investor's personal circumstances. Risk management tasks include Risk identification: identification of potential sources of risk in the portfolio. Risk assessment: a quantitative and qualitative assessment of the probability of risk events occurring and their potential impact. Development of management strategies: selection of methods for mitigating, transferring, or accepting risks. Implementation and control: implementation of the selected strategies in the practice of portfolio management and constant monitoring of their effectiveness [10].

In practice, both classical and modern methods are used to assess risks. One of the most common is the Value at Risk (VaR) indicator, which reflects the maximum losses that a portfolio can incur with a given probability over a certain period. For example, the VaR value of 5% = 1.2 million tenge means that with a 95% probability, losses will not exceed 1.2 million tenge for the specified period.

In addition, Conditional Value at Risk (CVaR) is actively used, which allows you to consider the "tail" of loss distribution, i.e. the average value of losses when they exceed VaR. This is especially important for assessing so-called "black swans" – rare but devastating events. Along with them, beta coefficients (β) are used - a measure of the sensitivity of the return of an asset to the profitability of the market as a whole; alpha (α) is an indicator of additional profitability above the market yield; Sharpe ratio is the return per unit of risk (volatility). Diversification is a key strategy for managing unsystematic risks. Its essence is to distribute assets in such a way that the decrease in the value of some components of the portfolio is compensated by the growth of others. The effectiveness of diversification depends not on the number of assets, but on the degree of their mutual correlation.

Correlation (ρ) is measured from -1 to +1. At $\rho = +1$, the assets move in perfect synchrony, at $\rho = -1$, they move in opposite directions, and at $\rho = 0$, there is no relationship between them. In practice, aiming for portfolios with low or negative correlations can reduce overall volatility.

A classic example is a combination of stocks and bonds. When the stock market falls, bonds tend to rise in value or remain stable. This can be seen in historical data: in 2008, the S&P 500 index fell by 38.5%, while long-term US government bonds rose by 25.9% (according to the U.S. Treasury). A portfolio containing 60% stocks and 40% bonds for 30 years (1993-2023) showed an average annual return of about 8.8% with a standard deviation of about 9.4% – significantly lower than that of "pure" stocks. This approach is the basis of the Markowitz model, which forms the so-called "efficient frontier", where each portfolio has the best return for a given level of risk. It is important to keep in mind that diversification works effectively only under certain conditions. During global crises, there can be a temporary synchronization of all assets, a phenomenon called correlation shift. At such moments, even previously uncorrelated assets begin to move in the same way. This requires the inclusion of alternative assets in the portfolio: real estate, gold, commodities, hedge funds, which allows for deep diversification. Models and methods for assessing the risks of an investment portfolio. Value-at-Risk (VaR) is a statistical measure that assesses the maximum potential loss of an investment portfolio at a given level of confidence and over a certain period. For example, a daily VaR of 95% in the amount of 1 million tenge means that with a 95% probability the loss will not exceed 1 million tenge within one day.

There are three main methods for calculating VaR:

Historical Modeling Method: Analyzes the actual historical changes in the value of a portfolio, assuming that past changes may be repeated in the future.

Variance-Covariance: Assumes a normal distribution of returns and uses averages and standard deviations to estimate risk.

Monte Carlo method: uses computer modeling to generate a variety of possible scenarios for changes in the value of a portfolio, which allows you to consider complex and nonlinear relationships between assets [11]. Each of the methods has its own advantages and limitations, and the choice of the appropriate method depends on the specifics of the portfolio and the available data.

Conditional Value at Risk (CVaR), also known as Expected Loss or Expected Shortfall, is the average value of losses that exceed a given level of VaR. Unlike VaR, which shows a loss threshold, CVaR provides information about the average size of losses in worst-case scenarios. CVaR is a coherent measure of risk that satisfies the properties of subadditivity and monotonicity, making it preferable in some aspects of risk management. It is particularly useful in assessing risks in conditions of high uncertainty and market volatility. The Markowitz model, or effective portfolio theory, assumes that investors seek to maximize expected returns at a given level of risk. The key concept is the efficient frontier – the set of portfolios that offer the best risk-return ratio.

The model assumes that investors can reduce the overall risk of the portfolio through diversification, that is, the inclusion of assets with a low correlation with each other. This allows you to achieve a more stable yield and minimize the impact of certain risk factors. Risk indicators: beta, volatility (standard deviation) and Sharpe

ratio. Beta (β): Shows the sensitivity of an asset's return to changes in market returns. A value of $\beta > 1$ indicates higher volatility compared to the market, $\beta < 1$ indicates lower volatility. Standard Deviation: Measures the volatility of an asset's or portfolio's returns. A high standard deviation indicates greater variability in returns and therefore higher risk. Sharpe Ratio: Evaluates the performance of a portfolio by measuring returns above the risk-free rate per unit of risk (volatility). A higher Sharpe Ratio value indicates a better risk-reward ratio.

Overview of modern programs and platforms (Excel, Python/NumPy, RiskMetrics) Excel: widely used for basic analysis and modeling, including the calculation of VaR and other risk indicators using built-in functions and macros. Python with NumPy and pandas's libraries provide powerful tools for data analysis, modeling, and visualization, making it a popular choice among analysts and risk managers. RiskMetrics: A platform developed by J.P. Morgan that offers comprehensive solutions for assessing and managing financial risks, including VaR calculations, stress testing, and other analysis methods. The use of these tools allows for a more accurate and effective assessment of the risks of an investment portfolio, adapting management strategies in accordance with current market conditions [12].

Formation of a conditional portfolio of 5-6 instruments (stocks, bonds, ETFs). Analysis of the risks of an investment portfolio requires initial data - the structure and parameters of a specific set of assets. The formed conditional portfolio presented in Table 2 includes five financial instruments diversified by type of assets and industries. It included: the SPY stock index (30%), long-term US government bonds through TLT (25%), shares of technology giant Apple (20%), GLD gold ETF (15%) and VNQ real estate fund (10%). The choice of these assets is due to several key factors: liquidity (all securities are traded daily in volumes from \$500 million to \$35 billion), a transparent history of yields, and different reactions to macroeconomic shocks. For example, the TLT asset shows negative beta sensitivity (-0.08), which makes it a countercyclical asset – especially valuable in recession phases. Asset beta ratios range from -0.08 (bonds) to 1.25 (Apple stock), which balances the volatility of the portfolio. SPY, which is the benchmark of the American market, maintains a neutral value of $\beta = 1.00$ and serves as a representative basis for the entire portfolio.

The choice of GLD, which correlates with stock indices only partially ($\beta = 0.20$), is also interesting, which allows you to hedge the risks of inflation and geopolitical instability. The average annual return on assets ranges from 3.2% (TLT) to 12.5% (AAPL), with standard deviations ranging from 8.2% to 21.4%. This configuration provides not only a balance between risk and return, but also a mechanism for natural volatility mitigation built into the structure. The statistical weight of bonds and gold together is 40%, which reflects a conservative strategy for protecting capital in the event of market turbulence.

Table 2 – Structure of a hypothetical investment portfolio

№	Asset Name	Asset Type	Share in the portfolio (%)	Average annual yield (%)	Standard Deviation (%)	Beta	Liquidity (USD/day)	Country/Market
1	SPY (ETF на S&P 500)	Stock Index	30	9.8	15.1	1.00	35 billion	United States
2	TLT (Long-Term Bonds)	Bonds	25	3.2	8.2	-0.08	2 billion	United States
3	AAPL (Apple Inc.)	Stock	20	12.5	21.4	1.25	10 billion	United States
4	GLD (Gold ETF)	Commodities (Gold)	15	6.5	12.3	0.20	1.5 billion	International
5	VNQ (REIT ETF)	Real Estate (REITs)	10	7.1	14.8	0.60	500 million	United States

Note – compiled by the authors

The calculation of key portfolio risk metrics includes the determination of the standard deviation, Value-at-Risk (VaR) and Conditional Value-at-Risk (CVaR), which serve as fundamental indicators for assessing the probability of losses and the level of volatility of the portfolio. The values given are presented in Table 3. The standard deviation of the portfolio was 11.2%, which was calculated because of a covariance matrix of assets, considering their weights presented in Table 2. This indicator considers interactive correlations, such as the negative relationship between SPY and TLT assets ($\rho = -0.29$), which helps to smooth out the final volatility value. The Value-at-Risk (VaR) metric was calculated at a 95% confidence interval level with a one-day horizon and amounted to -2.45% of the equity. This indicates that there is a 95% probability that portfolio losses in one trading day will not exceed this value if current conditions are maintained.

The calculation methodology is based on historical modeling: data on daily returns for the last 252 trading days (1 year) were used, while maintaining empirical distribution and tails. However, VaR, as is known, does not provide information about the nature and scale of losses in case of exceeding the confidence interval [13]. To do this, Conditional VaR (CVaR) is used, the value of which for the portfolio turned out to be -3.17%. This indicator reflects the average loss in the worst-case 5% of scenarios and, as a result, is more informative in stressful conditions. CVaR allows for a more adequate assessment of the potential depth of drawdown, especially during periods of high turbulence, like the events of March 2020.

In addition, the Max Drawdown was calculated - it amounted to -19.6% over three years. This figure was recorded as part of a simulation based on 2020–2023 data and reflects the most significant decline in portfolio value from local high to low. Such scenarios are especially important in stress testing. Finally, the integral Sharpe Ratio was 0.68. This value indicates an acceptable level of efficiency in terms of return per unit of risk (assuming an average return of 7.1% and a risk-free rate of 1.5%). Despite the apparent moderation, this value is quite acceptable for a balanced portfolio.

Table 3 – Calculation of key portfolio risk metrics

№	Risk metric	Value (% of capital)	Calculation method
1	Portfolio standard deviation	11.20	Weighted standard deviation considering covariance between assets
2	Value-at-Risk (VaR), 95%, 1 день	-2.45	Historical Simulation for 252 trading days, 95% confidence level
3	Conditional VaR (CVaR), 95%, 1 день	-3.17	Average Loss Value Below VaR Level for the Same Data Set
4	3-year maximum drawdown (MaxDD)	-19.6	Calculation based on historical quotes from 2020 to 2023
5	Volatility of Sharpe Ratio	0.68	(Average Return – Risk-Free Rate) / Standard Deviation
6	Correlation SPY ↔ TLT	-0.29	Pearson correlation between stock and bond index returns
Note – compiled by the authors			

Let us analyze the impact of diversification on risk. One of the basic mechanisms for managing the risk of an investment portfolio is diversification, i.e. the distribution of capital between different, weakly or negatively correlated assets [14]. To empirically demonstrate its impact, a comparative analysis of four portfolio structures differing in the level of diversification was carried out (see Table 4. Impact of diversification on risk).

Table 4 – Impact of diversification on risk

№	Portfolio composition	Expected return (%)	Standard Deviation (%)	Sharpe Ratio
1	Stocks Only (AAPL)	12.5	21.4	0.51
2	AAPL + TLT	7.8	15.2	0.59
3	AAPL + TLT + GLD	8.1	13.1	0.62
4	Full portfolio (5 assets from Table 2)	8.7	11.2	0.68
Note – compiled by the authors				

In the initial configuration, the portfolio consists exclusively of one high-risk asset — Apple Inc. (AAPL) shares. The indicators for this combination serve as a "starting point": the average annual return was 12.5%, but at the same time there is an extremely high volatility of 21.4%. The Sharpe Ratio in this case is 0.51,

which indicates a relatively unfavorable risk-reward ratio. Adding long-term US government bonds (TLT) to the portfolio immediately leads to a sharp decrease in risk: the standard deviation decreases to 15.2%, and the Sharpe Ratio rises to 0.59. This dynamic is due to the weak (and often negative) correlation between stocks and bonds, especially during periods of market panic. With the inclusion of the third component, gold (GLD), as a safe-haven asset, there is a further decrease in volatility to 13.1% with a moderate increase in yields. This is accompanied by an improvement in the Sharpe Ratio to 0.62, which indicates the effective work of diversification in a multi-asset structure. The highest Sharpe Ratio is achieved when using a full portfolio that includes all five asset classes described earlier (see Table 2): stocks, bonds, gold, S&P 500 ETFs, and real estate. Its standard deviation is 11.2%, with an expected return of 8.7%. The increase in efficiency here is ensured by the widest possible combination of instruments with different sensitivity to macroeconomic factors. The dynamics of risk reduction with diversification is clearly illustrated in Figure 1 – Risk reduction with increased diversification, where each point corresponds to one of the four portfolio structures. A smooth decline in the volatility line confirms the basic postulate of Markowitz's theory: with a rational choice of assets, it is possible to reduce risk without a proportional decrease in returns.

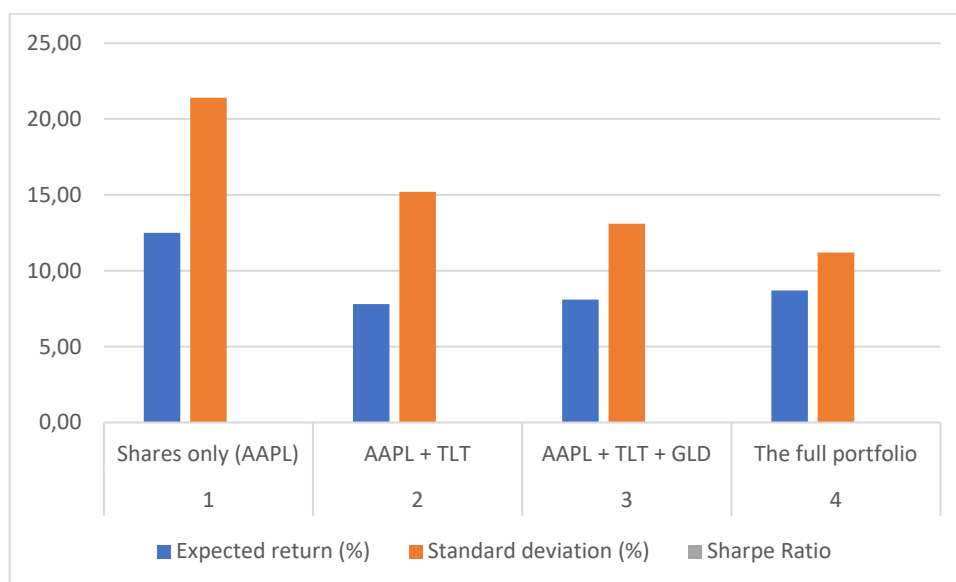


Figure 1 – Risk reduction with increased diversification

Note – compiled by the authors.

Scenario analysis and portfolio stress testing.

To assess the portfolio's resilience to extreme market conditions, scenario analysis was conducted using historical crises and hypothetical macroeconomic shocks. Detailed data are presented in Table 5. Scenario analysis and portfolio stress testing.

Table 5 – Scenario analysis and stress testing of the portfolio

№	Scenario	Expected losses (%)	Assets with the highest drawdown	Stabilizer segment
1	Global Crisis (2008)	–28.5	SPY, AAPL	GLD
2	Covid shock (March 2020)	–19.6	SPY, VNQ	TLT
3	Fed Interest Rate Hikes	–6.4	TLT	VNQ
4	Inflation shock	–9.8	GLD, VNQ	TLT
5	Mild recession	–4.3	AAPL	GLD

Note – compiled by the authors

Scenario No1 — the global financial crisis of 2008 — shows the largest potential drawdown of the portfolio: -28.5%. During this period, the leading risky assets — SPY and AAPL — lost more than 45% of their value. The only stabilizing component of the portfolio in this case was gold (GLD), which showed growth against the backdrop of capital flight to safe-haven assets. In the March 2020 covid shock scenario, the total losses were -19.6%. Note that along with the fall in the SPY index and the real estate sector (VNQ), TLT bonds, which worked as a protective asset, showed amazing stability. This confirms the idea of including conservative tools even in aggressive strategies. Scenario No3 — a sharp increase in Fed rates — caused losses of -6.4%, concentrated mainly in the bond segment (TLT), which is sensitive to yield growth. However, real estate ETFs (VNQ) and equities (AAPL) showed moderate resilience. In the case of an inflationary shock associated with rising consumer prices and a decrease in real asset returns, the drawdown was -9.8%. GLD and VNQ showed the maximum drop, but at the same time, bonds played the role of a stabilizer, especially if the coupon yield is adjusted. Finally, in the mild recession scenario, losses were limited to -4.3%, with AAPL being the most sensitive element. Unlike deeper crises, in this situation, against the backdrop of stabilization of expectations, gold worked perfectly. A comparative analysis of the scenarios shows that different asset classes show a multidirectional reaction depending on the nature of the crisis. This once again emphasizes the value of a balanced portfolio with the presence of both risky and protective assets [15].

In modern banking practice, financial monitoring plays a key role not only in overseeing investment activities but also in ensuring compliance with anti-money laundering (AML) and anti-fraud regulations. An effective monitoring system within second-tier banks (STBs) enables timely identification of risks, assessment of portfolio resilience, and adaptive responses to volatile market conditions.

The main objectives of financial monitoring include:

- Controlling the volatility and liquidity of investment instruments.
- Ensuring compliance with credit and market risk standards (in line with Basel III and the requirements of the Agency for Regulation and Development of the Financial Market — ARDFM).
- Minimizing reputational and legal risks in investment operations.
- Ensuring transparency of funding sources and transactions (KYC, AML procedures).

Table 6 – Financial Monitoring Tools in Second Tier Banks and Their Practical Applications

Tool	Purpose	Example of Implementation
Power BI, RiskMetrics	Visualization of risk metrics, calculation of VaR and CVaR	Kaspi Bank — heat maps of volatility
SAP, 1C Finance	ALM management and risk reporting on portfolios	Halyk Bank — asset structure control
XGBoost, Bayesian methods	Default forecasting, risk detection	Jýsan Bank — intelligent credit scoring
Stress testing	Assessment of resilience to economic shocks	Under ARDFM supervision

Financial monitoring enables:

- Identification and exclusion of toxic assets linked to illicit capital.
- Adherence to the client's risk profile in portfolio management.
- Justification of asset rebalancing based on objective risk evaluations.
- Increased trust from regulators and investors through procedural transparency.

Thus, financial monitoring in STBs is inseparable from comprehensive investment risk management. Its integration with digital analytical platforms enhances banks' capacity to adapt to an increasingly volatile financial environment.

RESULTS (CONCLUSIONS)

Based on the modeling of a diversified hypothetical investment portfolio, analysis of quantitative risk indicators, and stress testing under various macroeconomic scenarios, the study formulates a set of practical measures aimed at enhancing the portfolio's resilience and efficiency. Key results and recommendations include:

Increase the share of countercyclical assets to 40–45%. Assets such as long-term bonds (TLT) and gold (GLD) demonstrated robust defensive behavior during crises (e.g., 2020 COVID shock). Elevating their combined weight from 40% to 45% may increase stability while preserving profitability, as reflected in improved Sharpe ratios.

Implement quarterly dynamic portfolio rebalancing. Replacing static allocation with volatility-adjusted quarterly rebalancing increases adaptability during turbulent market phases. Empirical evidence (e.g., Vanguard, 2022) suggests an average Sharpe Ratio improvement of 0.09 per quarter across multi-asset strategies.

Reduce excessive inter-asset correlation. High correlation between risk-concentrated assets (e.g., SPY and AAPL, $\rho \approx 0.85$) amplifies portfolio volatility. Integrating low-correlated instruments such as emerging market ETFs or ESG-based funds could reduce the standard deviation to ~10.3% while sustaining yields in the 8.2–8.5% range.

Integrate hedging through protective options. To mitigate tail risks, especially under extreme market conditions, long-term protective puts (e.g., LEAPs on SPY) are recommended. With a hedging cost of 1–1.5% annually, CVaR can be reduced by approximately 2.2%, according to Risk Metrics (2023).

Adopt a multi-factor strategy for portfolio formation. Incorporating Fama-French factors — such as value, size, and quality — has shown to improve long-term return stability. Value-oriented assets like VTV can reduce recession-phase drawdowns by 3–5% without compromising returns.

Reassess CVaR and stress metrics monthly. Given the sensitivity of CVaR to market volatility, monthly recalculation using a 252-day rolling window and updated return simulations allows for proactive risk management in dynamically evolving conditions.

Set a portfolio-level maximum drawdown threshold of –15%. Simulated max drawdown (–19.6%) exceeds most investor risk appetites. Establishing an automated capital-preserving mechanism (e.g., dynamic stop-loss with reallocation to conservative assets) aligns with investor tolerance and institutional capital protection strategies (e.g., BlackRock Defensive Allocation).

Synthesis of Study Outcomes. The research successfully achieved its primary objective: developing a quantitative and applied framework for investment portfolio optimization using risk analytics and financial monitoring mechanisms. The multi-phase structure of the study allowed for:

Classification of key risk categories (market, credit, interest, legal, currency) and clarification of their origins and impact vectors.

Systematic justification of diversification principles based on the Markowitz model and extensions.

Comparative assessment of risk modeling approaches using standard deviation, beta coefficients, VaR, CVaR, and the Sharpe ratio.

Application of statistical methods (Variance-Covariance, Historical Simulation, Monte Carlo) supported by analytics platforms (Python, Excel, RiskMetrics).

Scenario modeling of five macro shocks with empirical validation of asset class behavior under stress.

Practical Significance and Implementation Potential

The proposed optimization strategies — from CVaR-based modeling and dynamic asset weighting to the inclusion of financial monitoring protocols — meet international risk management standards (e.g., Basel III, CFA Institute). They offer scalable utility for both private and institutional investors seeking robust, rule-compliant, and adaptive investment frameworks. These methods foster more informed decision-making in volatile environments and support capital preservation without sacrificing long-term portfolio efficiency.

СПИСОК ИСТОЧНИКОВ

1. Байбулекова Л., Турысбекова Р., Касымбекова Г., Шиганбаева Н., Кужукеева К. Риски инвестиционных портфелей банков Казахстана: проблемы и пути их решения // Статистика, учет и аудит. – 2024. – №3(94). – С. 128–140. <https://doi.org/10.51579/1563-2415.2024.-3.10>

2. Коновалова М. Е., Абузов А. Ю. Математическая модель оптимизации портфеля инвестиций с учетом риска и финансовых ограничений в управлении предприятием // Фундаментальные исследования. – 2024. – №1. – С. 20–24. URL: <https://fundamental-research.ru/ru/article/view?id=43551> (дата обращения: 08.05.2025). DOI: <https://doi.org/10.17513/fr.43551>

3. Никулин М. В. Повышение эффективности управления портфельными рисками: сравнительное исследование различных подходов // Промышленная экономика. – 2024. – №4. URL: <https://cyberleninka.ru/article/n/povyshenie-effektivnosti-upravleniya-portfelnyimi-riskami-sravnitelnoe-issledovanie-razlichnyh-podkhodov> (дата обращения: 15.05.2025).
4. Смаглий Н. В., Тюрин Е. Е., Драгуленко В. В. Методы оптимизации портфельных инвестиций в условиях неопределенности // Экономика и предпринимательство. – 2024. – №1(162). – С. 804–808. – DOI: 10.34925/EIP.2024.162.1.154 <https://elibrary.ru/item.asp?id=60033934>
5. Игараси Д. М., Матиоли Л. К., Белло Т. Л. Теория портфеля Марковица и стоимость под риском применительно к портфелю акций BOVESPA // Материалы 50-го бразильского симпозиума по исследованиям операций. – 2018. – Рио-де-Жанейро. – URL: <https://proceedings.science/sbpo/sbpo-2018/trabalhos/teoria-de-portfolios-de-markowitz-e-value-at-risk-aplicados-a-um-portfolio-de-ac?lang=pt-br>
6. Сергеев А. В. Методы оптимизации инвестиционного портфеля и анализа активов // Международная конференция IEEE по системам, человеку и кибернетике. – 2021. – DOI:10.36871/2618-9976.2021.02.009. – URL: https://s-lib.com/en/issues/smc_2021_02_a9/
7. Кужельный Д. С., Матерова Е. С., Ружанская Н. В., Шарафуллина Р. Р. Организация и оптимизация инвестиционного портфеля акций российских компаний // Экономика и предпринимательство. – 2024. – DOI: 10.34925/EIP.2024.164.3.135
8. Кандауров Д. В. Эффективность международной диверсификации с точки зрения управляющего паевым инвестиционным фондом // Российское предпринимательство. – 2016. – Т. 17, №23. – С. 3463–3486. – DOI 10.18334/rp.17.23.37158, URL: <https://1economic.ru/lib/37158>
9. Бословяк С. В. Корпоративные облигации в системе инвестиционного банкинга // Вестник Полоцкого государственного университета. Серия Д. Экономические и юридические науки. – 2018. – №13. – URL: <https://cyberleninka.ru/article/n/korporativnye-obligatsii-v-sisteme-investitsionnogo-bankinga> (дата обращения: 08.05.2025).
10. Гужин А. А., Ежкова В. Г. Риск-менеджмент и методы управления рисками // Инновации и инвестиции. – 2017. – №2. – URL: <https://cyberleninka.ru/article/n/risk-menedzhment-i-metody-upravleniya-riskami> (дата обращения: 18.05.2025).
11. Metropolis N., Ulam S. The Monte Carlo Method // Journal of the American Statistical Association. – 2007. – 44(247). – P. 335–341. – URL: <http://links.jstor.org/sici?sici=0162-1459%28194909%2944%3A247%3C335%3ATMCM%3E2.0.CO%3B2-3>
12. Орлова Л. Н., Саяхетдинов А. Р. Методики количественной оценки рисков на основе VAR: сравнительный анализ // Интеллект. Инновации. Инвестиции. – 2023. – №2. – URL: <https://cyberleninka.ru/article/n/metodiki-kolichestvennoy-otsenki-riskov-na-osnove-var-sravnitelnyy-analiz> (дата обращения: 19.05.2025).
13. Бота М. Стоимость риска портфеля, скорректированная на ликвидность // Южноафриканский журнал экономических и управленческих наук. – 2011. – 11(2). – С. 203–216. – DOI: <https://doi.org/10.4102/sajems.v11i2.309>
14. Эриашвили Н. Д., Тепман Л. Н. Управление инвестиционными рисками // Вестник Московского университета МВД России. – 2014. – №12. – URL: <https://cyberleninka.ru/article/n/upravlenie-investitsionnymi-riskami-3>
15. Мясин А. В. Сценарное моделирование и стресс-тестирование розничного кредитного портфеля банка // Имущественные отношения в РФ. – 2013. – №6 (141). URL: <https://cyberleninka.ru/article/n/stsenarnoe-modelirovanie-i-stress-testirovanie-roznichnogo-kreditnogo-portfelya-banka>

REFERENCES

1. Baibulekova, L., Turysbekova, R., Kasymbekova, G., Shiganbaeva, N., & Kuzhukeeva, K. (2024). Riski investitsionnykh portfeley bankov Kazakhstana: problemy i puti ikh resheniya. Statistika, uchet i audit, 3(94), 128–140. <https://doi.org/10.51579/1563-2415.2024.-3.10>

2. Konovalova, M. E., & Abuzov, A. Yu. (2024). Matematicheskaya model' optimizatsii portfelya investitsiy s uchetom riska i finansovykh ogranicheniy v upravlenii predpriyatiem. *Fundamental'nye issledovaniya*, 1, 20-24. <https://fundamental-research.ru/ru/article/view?id=43551> (Data obrashcheniya: 08.05.2025). DOI: <https://doi.org/10.17513/fr.43551>
3. Nikulin, M. V. (2024). Povyshenie effektivnosti upravleniya portfel'nymi riskami: sravnitel'noe issledovanie razlichnykh podkhodov. *Promyshlennaya ekonomika*, 4. <https://cyberleninka.ru/article/n/povyshenie-effektivnosti-upravleniya-portfel'nymi-riskami-sravnitelnoe-issledovanie-razlichnyh-podkhodov> (Data obrashcheniya: 15.05.2025).
4. Smaglin, N. V., Tyurin, E. E., & Dragulenko, V. V. (2024). Metody optimizatsii portfel'nykh investitsiy v usloviyakh neopredelennosti. *Ekonomika i predprinimatel'stvo*, 1(162), 804-808. DOI: 10.34925/EIP.2024.162.1.154 <https://elibrary.ru/item.asp?id=60033934>
5. Igarashi, D. M., Matioli, L. C., & Bello, T. L. (2018). Teoriya portfelya Markovitsa i stoimost' pod riskom primenitel'no k portfelyu aktsiy BOVESPA. 50-y Brazil'skiy simpozium po issledovaniyam operatsiy, Rio-de-Zhaneiro. <https://proceedings.science/sbpo/sbpo-2018/trabalhos/teoria-de-portfolios-de-markowitz-e-value-at-risk-aplicados-a-um-portfolio-de-ac?lang=pt-br>
6. Sergeev, A. V. (2021). Metody optimizatsii investitsionnogo portfelya i analiza aktivov. Mezhdunarodnaya konferentsiya IEEE po sistemam, cheloveku i kibernetike. DOI:10.36871/2618-9976.2021.02.009, https://s-lib.com/en/issues/smc_2021_02_a9/
7. Kuzhelny, D. S., Materova, E. S., Ruzhanskaya, N. V., & Sharafullina, R. R. (2024). Organizatsiya i optimizatsiya investitsionnogo portfelya aktsiy rossiyskikh kompaniy. *Ekonomika i predprinimatel'stvo*. DOI: 10.34925/EIP.2024.164.3.135
8. Kandaurov, D. V. (2016). Effektivnost' mezhdunarodnoy diversifikatsii s tochki zreniya upravlyayushchego paevym investitsionnym fondom. *Rossiyskoe predprinimatel'stvo*, 17(23), 3463–3486. DOI: 10.18334/rp.17.23.37158 <https://1economic.ru/lib/37158>
9. Boslovyak, S. V. (2018). Korporativnye obligatsii v sisteme investitsionnogo banking. *Vestnik Polotskogo gosudarstvennogo universiteta. Seriya D. Ekonomicheskie i yuridicheskie nauki*, 13. <https://cyberleninka.ru/article/n/korporativnye-obligatsii-v-sisteme-investitsionnogo-bankinga> (Data obrashcheniya: 08.05.2025).
10. Guzhin, A. A., & Ezhkova, V. G. (2017). Risk-menedzhment i metody upravleniya riskami. *Innovatsii i investitsii*, 2. <https://cyberleninka.ru/article/n/risk-menedzhment-i-metody-upravleniya-riskami> (Data obrashcheniya: 18.05.2025).
11. Metropolis, N., & Ulam, S. (2007). The Monte Carlo Method. *Journal of the American Statistical Association*, 44(247), 335-341. Stable URL: <http://links.jstor.org/sici?sici=0162-1459%28194909%2944%3A247%3C335%3ATMCM%3E2.0.CO%3B2-3>
12. Orlova, L. N., & Sayakhetdinov, A. R. (2023). Metodiki kolichestvennoy otsenki riskov na osnove VAR: sravnitel'nyy analiz. *Intellekt. Innovatsii. Investitsii*, 2. <https://cyberleninka.ru/article/n/metodiki-kolichestvennoy-otsenki-riskov-na-osnove-var-sravnitelnyy-analiz> (Data obrashcheniya: 19.05.2025).
13. Bota, M. (2011). Stoimost' riska portfelya, skorrektirovannaya na likvidnost'. *Yuzhnoafrikan'skiy zhurnal ekonomicheskikh i upravlencheskikh nauk*, 11(2), 203-216. DOI: <https://doi.org/10.4102/sajems.v11i2.309>
14. Eriashvili, N. D., & Tepman, L. N. (2014). Upravlenie investitsionnymi riskami. *Vestnik Moskovskogo universiteta MVD Rossii*, 12. <https://cyberleninka.ru/article/n/upravlenie-investitsionnymi-riskami-3>
15. Myasin, A. V. (2013). Stsenarnoe modelirovanie i stress-testirovanie roznichnogo kreditnogo portfelya banka. *Imushchestvennye otnosheniya v RF*, 6(141). <https://cyberleninka.ru/article/n/stsenarnoe-modelirovanie-i-stress-testirovanie-roznichnogo-kreditnogo-portfelya-banka>

ТАЛДАУ ЖӘНЕ ҚАРЖЫЛЫҚ МОНИТОРИНГ ҚҰРАЛДАРЫ АРҚЫЛЫ ИНВЕСТИЦИЯЛЫҚ ПОРТФЕЛЬДІ ОҢТАЙЛАНДЫРУ

Ш. Р. Абжалелова^{1*}, С. А. Святков², Л. А. Байбулекова¹

¹Қ. Сағадиев атындағы Халықаралық бизнес университеті,
Алматы қ., Қазақстан Республикасы

²Нархоз Университеті, Алматы, Қазақстан Республикасы

АНДАТПА

Зерттеу мақсаты - Инвестициялық портфельді оңтайландырудың заманауи әдістерін, тәуекелдер мен құбылмалылықты басқару тәсілдерін, сондай-ақ қаржылық мониторинг құралдарын нормативтік талаптарға сәйкестік пен операциялық тұрақтылықты қамтамасыз етудегі рөлін зерттеу.

Әдіснама - Зерттеу акциялар, облигациялар және ETF құралдарын қамтитын әртараптандырылған шартты портфельдің модельдеуі мен талдауына негізделген. Жұмыста классикалық тәсілдер (Марковиц моделі, Шарп коэффициенті) мен заманауи әдістер (Value-at-Risk (VaR), шартты тәуекел мәні (CVaR), стресс-тестілеу, құбылмалылықты болжауға арналған машиналық оқыту алгоритмдері) біріктірілген.

Зерттеудің бірегейлігі / құндылығы - Бұл зерттеу дәстүрлі қаржылық модельдер мен деректерге негізделген заманауи технологияларды ұштастырады. Айрықша ерекшелігі - AML/CFT және Basel III шеңберінде инвестициялық қызметтің тұрақтылығын бағалауға бағытталған қаржылық мониторингтің, әсіресе екінші деңгейлі банктер тәжірибесінде, қолданылуы.

Нәтижелер - Инновациялық тәуекел менеджменті және портфельді оңтайландыру стратегияларын қолдану портфельдің тиімділігі мен тұрақтылығын едәуір арттыратынын көрсетті. Эмпирикалық талдау CVaR үлгілері мен стресс сценарийлері негізінде қаржылық мониторингтің инвестициялық шешімдерді қабылдау, шығындарға бейімділікті төмендету және нормативтік талаптарға сәйкестікті қамтамасыз етудегі маңызын дәлелдейді.

Түйін сөздер: инвестициялық портфель, қаржылық мониторинг, екінші деңгейлі банктер, AML/CFT, Value-at-Risk (VaR), шартты тәуекел мәні (CVaR), портфельді оңтайландыру, құбылмалылық, тәуекелдерді басқару, әртараптандыру, нормативтік тәуекел, тәуекелдік талдау

ОПТИМИЗАЦИЯ ИНВЕСТИЦИОННЫХ ПОРТФЕЛЕЙ НА ОСНОВЕ АНАЛИТИКИ И ФИНАНСОВОГО МОНИТОРИНГА

Ш. Р. Абжалелова^{1*}, С. А. Святков², Л. А. Байбулекова¹

^{1*} Университет международного бизнеса им. К. Сагдиева,
Алматы, Казахстан

² Университет Нархоз, Алматы, Казахстан

АННОТАЦИЯ

Цель исследования - анализ современных методов оптимизации инвестиционного портфеля с акцентом на управление рисками, волатильностью и применение инструментов финансового мониторинга для обеспечения нормативного соответствия и операционной устойчивости.

Методология - исследование основано на моделировании и анализе условного диверсифицированного инвестиционного портфеля, включающего акции, облигации и ETF. Применяются классические теоретические подходы (модель Марковица, коэффициент Шарпа) наряду с продвинутыми инструментами: Value-at-Risk (VaR), Conditional Value-at-Risk (CVaR), стресс-тестирование и алгоритмы машинного обучения для прогнозирования волатильности и распределения активов.

Научная новизна/ценность - работа объединяет традиционные финансовые модели и современные цифровые методы. Важным вкладом является прикладное использование инструментов финансового мониторинга, включая практики банков второго уровня, в целях оценки стабильности портфеля и нормативных рисков в рамках AML/CFT и Basel III.

Результаты - внедрение инновационных стратегий управления рисками и оптимизации позволяет существенно повысить эффективность и устойчивость инвестиционного портфеля. Эмпирический анализ показывает, что сочетание финансового мониторинга с моделированием на основе CVaR и стресс-сценариями способствует лучшему принятию решений, снижению вероятности экстренных потерь и соблюдению нормативных требований.

Ключевые слова: инвестиционный портфель, финансовый мониторинг, банки второго уровня, AML/CFT, Value-at-Risk (VaR), Conditional Value-at-Risk (CVaR), оптимизация портфеля, волатильность, риск-менеджмент, диверсификация, нормативный риск, риск-аналитика

ABOUT THE AUTHORS

Abzhalelova Sholpan – PhD student, University of International Business named after K.Sagadiyev Almaty, Kazakhstan, email: rasholpan@mail.ru, ORCID ID: <https://orcid.org/0000-0002-2188-6280>.*

Svyatov Serik – Professor of the Department of Doctoral Studies, Doctor of Economics, Narxoz University, Almaty, Republic of Kazakhstan, Almaty, Kazakhstan, email: ssvyatov@mail.ru, ORCID ID: <https://orcid.org/0000-0002-3320-1568>.

Baibulekova Leila – candidate of economic science, associate professor, University of International Business named after K. Sagadiyev Almaty, Kazakhstan, email: leila_abdibaevna@mail.ru, <https://orcid.org/0000-0002-6820-6035>.

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ҚАЗАҚСТАНДЫҚ СТАРТАПТАРДЫҢ ӨМІРЛІК ЦИКЛ КЕЗЕҢДЕРІНДЕГІ ҚАРЖЫ АҒЫНДАРЫН БАСҚАРУ: ЭМПИРИКАЛЫҚ ЗЕРТТЕУ

Т. Б. Бахытжанов^{1*}, Л. М. Байтенова¹, С. Ж. Интыкбаева¹

¹«Тұран» Университеті, Алматы қ., Қазақстан.

АНДАТПА

Бұл мақалада Қазақстандағы стартаптардың өмірлік циклінің әртүрлі кезеңдерінде қаржылық ағындарды басқару мәселелері зерттеледі. Эмпирикалық талдау әдістерін қолдана отырып, зерттеу кәсіпкерлердің идея сатысынан бастап масштабтау кезеңіне дейінгі аралықта қаржыны басқаруда кездесетін негізгі ерекшеліктері мен қиындықтарын айқындайды. Алматы, Астана және еліміздің басқа өңірлеріндегі стартаптар арасында жүргізілген сауалнама мен сұхбаттар негізінде қаржылық стратегияларды оңтайландыруға бағытталған ұсыныстар әзірленді.

Мақалада стартаптардың өмірлік циклінің әр кезеңіне тән қаржылық ағындарды басқару ерекшеліктері қарастырылады. Халықаралық және отандық ғылыми әдебиеттерге шолу жасалып, даму сатыларына сәйкес қаржыландыру көздерінің жіктелуі ұсынылады. Сонымен қатар, нақты қазақстандық стартаптар мысалында практикалық жағдайлар талданады. Зерттеу барысында стартап негізін қалаушылардың қаржылық сауаттылығының төмендігі мен венчурлік капиталға қолжетімділіктің шектеулілігі басты проблемалар ретінде анықталды.