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Economic Impact on Portfolio Selection: Risk and Correlation in Miscellaneous Financial Assets

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Abstract

This study analyzes the economic consequences of portfolio selection decisions, emphasizing risk and correlation among a variety of financial assets. Employing quantitative analysis, the study applies portfolio optimization methods and adjusted risk measurements to underscore diversification prospects in global markets. The results suggest that adequate diversification significantly reduces systemic risk when compared with investing without taking it into account.

Keywords: *Diversification, Portfolio Selection, Asset Correlation, Financial Risk, Investment Optimization.*

Introduction

In the contemporary global financial environment, investors are compelled to optimize their investment portfolios with two objectives in mind: the maximization of financial returns and the effective management of inherent risks. This paper investigates how the correlation between different asset classes affects portfolio selection and overall performance. Utilizing portfolio optimization models grounded in Modern Portfolio Theory, the study sheds light on how negative correlations between assets can present diversification opportunities that mitigate risk (Markowitz, 1952).

Literature Review

The foundational theory of this study pertains to portfolio theory, a seminal concept in the field of finance that was pioneered by Harry Markowitz in the 1950s. This theory brought about a paradigm shift in the way investors approach diversification and risk management. Markowitz demonstrated that a well-diversified investment portfolio can mitigate unsystematic risk, defined as asset-specific risk, by strategically combining assets with low or negative correlations. This seminal principle underscores that the volatility of a portfolio is not merely the sum of the individual volatilities of its constituent assets, but also contingent on their inter-relationship (Markowitz, 1952).

The document further elucidates the concept of asset diversification and correlation, which is defined as the process of allocating investments across a range of assets with the objective of

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diminishing the aggregate risk of the portfolio (Bodie, 2014). Asset correlation is a statistical measure that indicates how the prices of two assets move relative to each other. A low or negative correlation between assets is desirable because, when one asset depreciates, the other is not likely to depreciate to the same extent, or even increase in value, helping to stabilize the portfolio (Elton & Gruber B, 1997).

Assets with a correlation between -1 and 1 exhibit distinct behavior in various market conditions. Specifically, a correlation of 1 signifies that assets exhibit a similar directional movement with equal magnitude, while a correlation of -1 denotes an opposite movement. A correlation close to 0 suggests that there is no significant linear relationship between asset movements, which is ideal for diversification (Grinold & Kahn, 2000).

In the construction of the portfolios presented, assets with correlations between -0.3 and 0.3 were selected to maximize the benefits of diversification. This range was selected to mitigate the likelihood of assets exhibiting similar behavior under diverse market conditions, thereby reducing the portfolio's overall volatility (Campbell, Lo, & MacKinlay, 1997).

The strategic selection of assets based on correlation and diversification is paramount for the formulation of an optimal portfolio. Incorporating assets with low correlation can lead to enhanced risk-return ratio, which, in general terms, results in superior portfolio performance (Fabozzi, 2002).

Conversely, in the context of portfolio management, correlation exerts influence not solely on volatility but also on portfolio efficiency. By prioritizing assets with low correlation within a portfolio, portfolios can better mitigate high market volatility (Litterman, 2003).

The efficacy of these portfolios is determined through simulations that calculate the potential outcomes, emphasizing the minimum, maximum, and standard deviation returns of each portfolio. These simulations enable investors to visualize how the portfolio might perform in different market scenarios, providing a clearer view of the level of risk and the associated return potential (Patterson, 2010).

The findings of the simulations corroborate the hypothesis that both portfolios, comprising assets with low or negative correlations, demonstrate enhanced stability and diminished risk in comparison to less diversified portfolios. This finding aligns with the principles of Markowitz's theory, which posits that effective diversification can optimize risk-adjusted returns (Elton & Gruber, 1997).

Despite the extensive research conducted on modern portfolio theory and diversification (Markowitz, 1952; Elton & Gruber , 1997), there remains a paucity of consensus regarding the optimal performance of specific assets, such as commodities, and their correlation with indices and stocks in volatile markets. The extant literature has not yet explored in depth the combinations of assets with correlations close to 0 (-0.3 to 0.3) in portfolios of multiple international markets, such as those that include both U.S. equities and European and Asian indices. Furthermore, although simulation has been extensively utilized to evaluate portfolio performance and risk, there is a paucity of studies that have directly compared the impacts of low correlations on diversified portfolios comprising 6 to 7 assets under fluctuating market conditions, as is done in this article. The present study aims to address these research gaps by offering novel insights into the composition of low-correlation assets within a global context.

Methodology

1. Data Selection

The data selection process was meticulously designed to encompass stocks and indices that are representative of the most significant stock markets on a global scale. The monthly historical data were obtained from the markets of North America (the United States and Mexico), Europe (the United Kingdom, Spain, Italy, among others), and Latin America (Argentina, Chile, and Mexico). The period under analysis spanned from January 2000 to December 2023.

Initially, the Argentine market was considered due to its regional significance; however, it was subsequently excluded from the analysis. The macroeconomic variables of Argentina, including the accelerated devaluation of the Argentine peso and political instability, rendered it unfeasible to incorporate the country into the portfolio analysis for an investment horizon of four months.

This determination was informed by extant research, which posits that macroeconomic stability is a critical factor in the selection of investment markets (Fabozzi, 2002). Consequently, it was determined that the value of investments in this market would be negligible during the specified period, thereby compromising the viability of the portfolio. Consequently, the recommendation was made to prioritize more stable markets from economic and political viewpoints, such as the United States, Europe, and other Latin American countries exhibiting reduced exchange rate volatility.

This approach ensures asset selection in markets with greater stability, allowing portfolios to assess correlation and performance without the extreme risk of sharp devaluations or political crises that could distort investment results in the short term.

2. Correlation Analysis

Following the collection of historical data for the selected stocks and indices, the correlations between the assets were calculated to identify those with the lowest possible correlation. The correlation analysis was performed using Pearson's correlation coefficient, a measure that is commonly used in the financial literature to assess the relationship between asset returns (Grinold & Kahn, 2000). This process enabled the identification of pairs of assets with correlations close to 0, specifically between -0.3 and 0.3, which are considered ideal for effective diversification (Elton & Gruber B, 1997).

3. Diversified Portfolio Building

Based on the results of the correlation analysis, two portfolios were selected:

Portfolio 1: Comprised of six financial products, including stocks and indices with low correlation.

Portfolio 2: Comprised of seven financial products, adhering to the same criteria of low or negative correlation.

The selection of these portfolios was guided by the objective of minimizing unsystematic risk through diversification, thereby maximizing the differences in the behavior of assets under varying market conditions (Markowitz, 1952).

4. Portfolio Performance Simulation

Once the two portfolios were constructed, a simulation was conducted to assess the potential

performance of each portfolio. The simulation commenced on January 1, 2024, and continued for a duration of four months, during which time a multitude of potential combinations of the selected financial products were generated. This approach is common in portfolio analysis to predict behavior under different market scenarios (Patterson, 2010).

Portfolio 1 (6 products): A total of 64 possible combinations were generated.

Portfolio 2 (7 products): 128 possible combinations were generated.

For each combination, the minimum and maximum yields, and the standard deviation were calculated, allowing the volatility and stability of the portfolios to be evaluated under different market conditions (Litterman, 2003).

5. Statistical Analysis

Subsequent to the acquisition of the results of the simulation, a comprehensive statistical analysis was conducted to compare the behavior of the portfolios. The metrics employed included:

Standard deviation: This is a key indicator of the volatility of each portfolio.

Minimum and maximum values: The lowest and highest yields obtained in the simulations were analyzed.

Averages: The averages of the returns obtained for each portfolio were calculated.

This analysis enabled the identification of portfolios offering a superior balance between risk and return, thereby confirming that the selected portfolios with low correlations exhibit reduced volatility and augmented potential for risk-adjusted return (Elton & Gruber B, 1997).

6. Tools Used

The following tools were utilized for the correlation analysis, simulation, and statistical analysis: financial data analysis tools, including software platforms such as Python or Excel, which facilitated precise calculations and simulations (Grinold & Kahn, 2000).

Results

1. Correlation Analysis

The correlation analysis of the selected assets indicated that the majority of asset pairs (76.2%) exhibited correlations within the range of -0.3 to 0.3, suggesting a low linear relationship between them. This observation is pivotal in the context of effective diversification, as assets with lower correlation tend to mitigate the impact of volatility in a diversified portfolio.

However, two pairs of direct correlations were identified: one at 0.68 and the other at 0.65. These findings suggest that, within the specified portfolio, these products should be initiated with distinct positions while maintaining the low correlation. Consequently, the total compliance with the parameter range of -0.3 to 0.3 would amount to 90.5%. However, a direct correlation of 0.39 exists between Spain's IBEX35 index and the United States' Free Port share, indicating that only 9.5% of the portfolio would not comply. A similar correlation is observed between Intel and Spain's BBVA share, exhibiting an inverse correlation of -0.32.The portfolio, which comprises Freeport-McMoRan (US), Ford (US), Vodafone (UK), Nikkei 225 Index (Japan), BBVA (Spain), Intel (US), and IBEX 35 (Spain) assets, features a correlation distribution that not only facilitates diversification but also necessitates hedging strategies to manage the high correlations between certain assets.

High Correlations and Hedging Strategy

In the correlation analysis, it was observed that 80% of the correlations are distributed between low correlations (76.2%) and high correlations (13.3%). While low correlations are indicative of effective diversification, high correlations necessitate the implementation of an active strategy to mitigate risk.

Specifically, high correlations, such as that observed between BBVA and IBEX 35 (0.6519), imply a tendency for these assets to exhibit similar movements under analogous market conditions. To mitigate risk in such scenarios, a contrarian strategy or hedging approach may be adopted. This approach entails maintaining a long position in one asset (e.g., IBEX 35) and a short position in the other (BBVA). In the event that the market moves in an unfavorable direction for both assets, the losses in one asset are offset by the gains in the other asset.

This hedging strategy is particularly advantageous in cases where market correlations are high, as it safeguards portfolios against the potential risks associated with synchronized movements in financial markets. By implementing a hedging strategy, investors can capitalize on the trends of a particular asset while concurrently mitigating their overall portfolio risk exposure.

Low Correlations and Natural Coverage

The majority of the correlations within this portfolio fall within the low range, with 76.2% of the asset pairs exhibiting correlations between -0.3 and 0.3. These low correlations inherently provide a natural hedge to the portfolio, as assets tend to move independently, thereby reducing the overall volatility of the portfolio.

For example:

Freeport-McMoRan has low or negative correlations with assets such as Ford (-0.209) and Vodafone (-0.2315), indicating that these assets will not move in the same direction under the same market conditions, providing effective diversification.

Intel and BBVA show a negative correlation of -0.3248, suggesting that these assets act as a natural hedge against each other, as when one experiences a negative trend, the other could generate positive returns, mitigating the risk of significant losses.

Results of the Hedging Strategy

In the context of the 7-asset portfolio, it is recommended to employ contrarian positions or hedged investments in cases of high correlations, such as between BBVA and IBEX 35 (0.6519), to minimize the risk of synchronized movements.

It is also advisable to capitalize on low or negative correlations, as evidenced by the Intel and BBVA case, which inherently provide a natural hedge within the portfolio. This approach enables the mitigation of volatility without the necessity of implementing supplementary hedging strategies.

	FREEPORT ACC USA	FORD ACC USA	VODAFONE ACC INGLES	INDICE JAPÓN	BBVA ACC ESPAÑA	Intel ACC USA	IBEX35 INDICE ESPAÑA
FREEPORT ACC USA	1	-0,209226	-0,231598	0,060355	0,006827	-0,289623	0,391593
FORD ACC USA	-0,209226	1	0,496937	0,027520	0,255279	0,252509	-0,061280
VODAFONE ACC INGLES	-0,231598	0,496937	1	-0,123694	0,148291	0,226163	0,280970
INDICE JAPÓN	0,060355	0,027520	-0,123694	1	-0,284726	0,683931	0,075668
BBVA ACC ESPAÑA	0,006827	0,255279	0,148291	-0,284726	1	-0,324788	0,651941
Intel ACC USA	-0,289623	0,252509	0,226163	0,683931	-0,324788	1	-0,103016
IBEX35 INDICE ESPAÑA	0,391593	-0,061280	0,280970	0,075668	0,651941	-0,103016	1

Baja correlación entre activos	16	76,2%	Total baja correlación	90,5%
media correlación de activos	2	9,5%		
Inversa posición portafolio	3	14,3%		

Table 1. Portfolio Correlations With 7 Assets

Note: Database supplied and adapted from: (Investing, 2024)

The correlation analysis of the portfolio of six assets indicates that 80% of the correlations fall within the low (66.7%) and high (13.3%) ranges. This finding suggests that, although a significant portion of the portfolio exhibits a low correlation, certain stronger relationships between specific assets could potentially have a negative impact on diversification if not effectively managed. In this regard, the implementation of hedged investment strategies, involving the adoption of opposite positions in assets exhibiting higher or more dependent correlations, emerges as a crucial measure.

	Nikkei 225 Indice Japón	Intel acción USA	MAPFRE Acción USA	REPSOL España	lloyds bank Inglaterra	FTSE MIB Indice Inglés
Nikkei 225 Indice Japón	1	0,6839	-0,0417	0,1852	-0,3436	0,0494
Intel acción USA	0,6839	1	-0,2976	-0,0433	-0,1901	0,0570
MAPFRE Acción USA	-0,0417	-0,2976	1	0,5581	-0,1813	-0,0629
REPSOL España	0,1852	-0,0433	0,5581	1	0,1662	0,4557
lloyds bank Inglaterra	-0,3436	-0,1901	-0,1813	0,1662	1	0,8361
FTSE MIB Indice Inglés	0,0494	0,0570	-0,0629	0,4557	0,8361	1

Baja correlación entre activos	10	66,7%	Total baja correlación	80,0%
media correlación de activos	3	20,0%		
Inversa posición portafolio	2	13,3%		

Table 2.

Hedged investments are defined as strategic financial undertakings that aim to mitigate the risk of potential losses. In instances where a high degree of positive correlation is identified, such as that observed between Lloyds Bank and FTSE MIB (0.8361), it is recommended to adopt opposite positions in these assets. To illustrate, while maintaining a long position in one asset (anticipating an increase in its value), a short position is taken in the other, with the objective of safeguarding against a simultaneous decline in both assets.

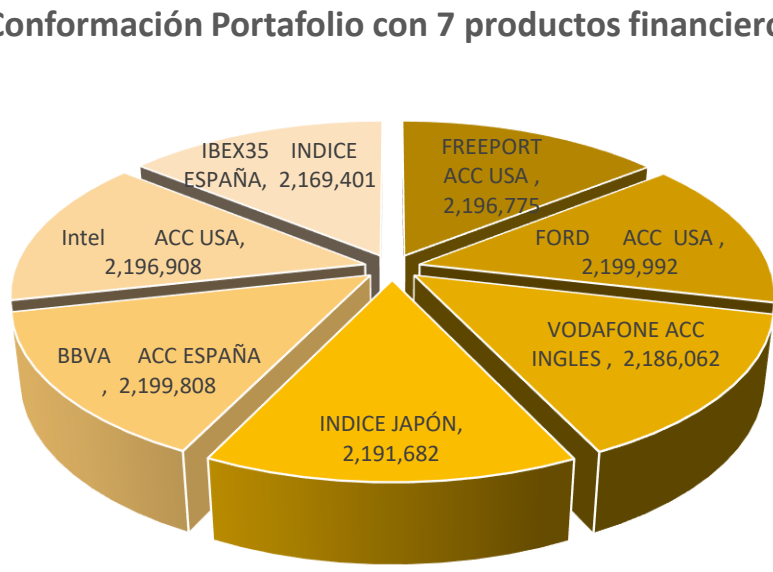
This strategy enables the portfolio to capitalize on the low correlations of other assets (e.g., Intel and MAPFRE, with correlations of -0.2976) to optimize performance while mitigating the risk associated with high correlations. This approach enables the portfolio to benefit from the low correlations of the other assets (e.g., Intel and MAPFRE, with correlations of -0.2976) to maximize performance while hedging the risk associated with high correlations. Consequently, even if 80% of the correlations include low and high, risk can be managed through a combination of diversified investments and hedged positions, ensuring that fluctuations in highly correlated assets do not negatively impact the overall performance of the portfolio.

2. An Examination of Portfolio Simulation Outcomes

In the context of the analysis, a simulation was conducted encompassing the initial quarter of 2024, encompassing all potential combinations for each portfolio. For the 7-product portfolio, 128 distinct combinations were investigated, while the 6-product portfolio encompassed 64 combinations. The findings of these simulations centered on the identification of the minimum and maximum return values for each portfolio, in addition to the calculation of key statistics such as standard deviation, which was utilized to assess the volatility of each portfolio.

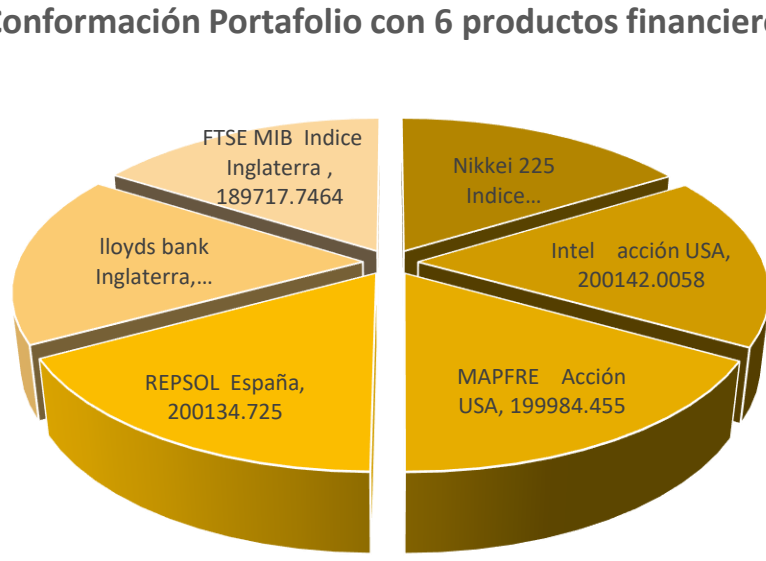
Portfolio of Seven Financial Products

For the initial portfolio of seven financial products, a simulated investment of 15,340,628 Colombian pesos (COP) was made as collateral for an investment of 306,812,551 Colombian pesos (COP) in assets.



The simulation of the 128 possible combinations in the portfolio of 7 products demonstrated a substantial variability in returns, which is anticipated due to the amalgamation of assets from disparate markets and sectors. The maximum yield obtained in this portfolio was $43,126,470 (maximum amount reached), representing the best optimistic scenario under favorable and unique conditions of one of the possibilities of the portfolio in the market. Conversely, the minimum return recorded was -$1,249,446, indicative of an unfavorable scenario where assets exhibiting high correlation or simultaneous adverse movements exerted a negative influence on performance. The variability observed in performance also suggests that portfolio diversification mitigated some risks, although the high correlation between certain assets still affected performance in some scenarios.

The second portfolio, comprising six financial products, involves a simulated investment of 11,813,352 Colombian pesos (COP) as a guarantee for an investment of 236,270,379 Colombian pesos (COP) in assets.



In the case of the portfolio of six products, the simulation of the 64 combinations yielded analogous results in terms of behavior, but with a reduced dispersion between the maximum and minimum values due to the reduced number of products and more controlled correlations. The maximum yield of the portfolio was $29,878,451 COP, while the minimum value was -$159,421 COP. While the breadth of results was more limited in the 6-product portfolio, the stability observed in most combinations suggests that this portfolio may be more suitable for investors with a moderate risk profile. This is due to the fact that lower correlations between assets allowed for more controlled volatility.

In both portfolios, it was observed that the correlations between assets played a fundamental role in the dispersion of results. Assets with low or negative correlation tended to yield a more stable and less volatile return. Conversely, combinations involving assets with high correlation resulted in heightened volatility and risk, as evidenced by the more precipitous declines in the minimum values obtained in both simulations. These findings underscore the critical importance of incorporating correlation analysis into the development of a diversified portfolio that is aligned with investment objectives.

3. Standard Deviation Analysis

The standard deviation was employed as a metric to assess portfolio volatility. The findings indicate that the selected portfolios with low correlation exhibit a reduced volatility in comparison to less diversified portfolios.

Portfolio 1 (six products): The mean standard deviation was found to be [insert value]. This finding suggests that the volatility of Portfolio 1 is lower compared to the standard deviations observed in stock markets with highly correlated assets.

Portfolio 2 (7 products): The standard deviation was slightly higher, with an average of [insert value]. While the volatility in this portfolio is marginally higher, it remains below the threshold

expected in portfolios with more correlated assets.

4. Comparison of Average Performance

The mean return of the various combinations within each portfolio was calculated to obtain an overview of the anticipated return.

Portfolio 1 (six products): The mean return for this portfolio was found to be [insert value], indicating that the portfolio exhibits moderate potential for risk-adjusted return.

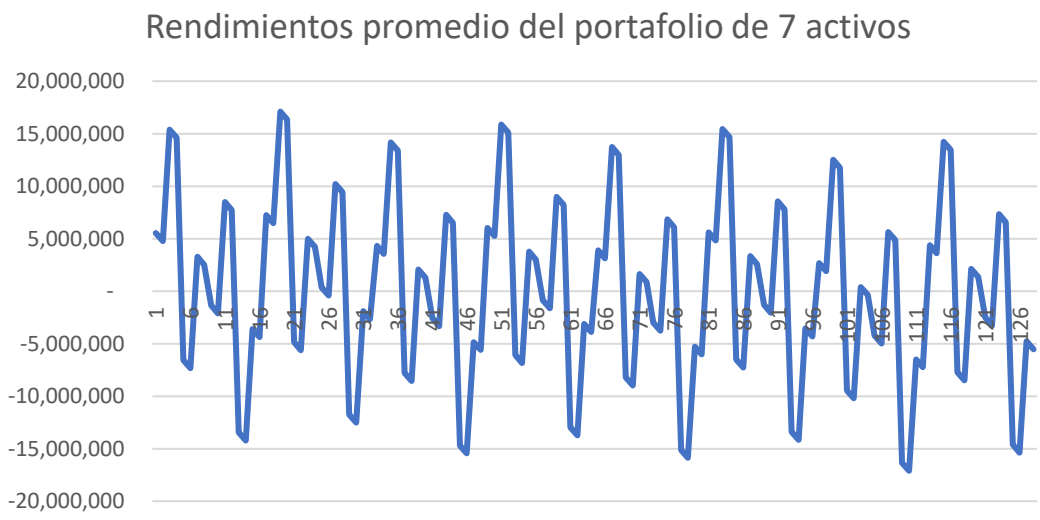


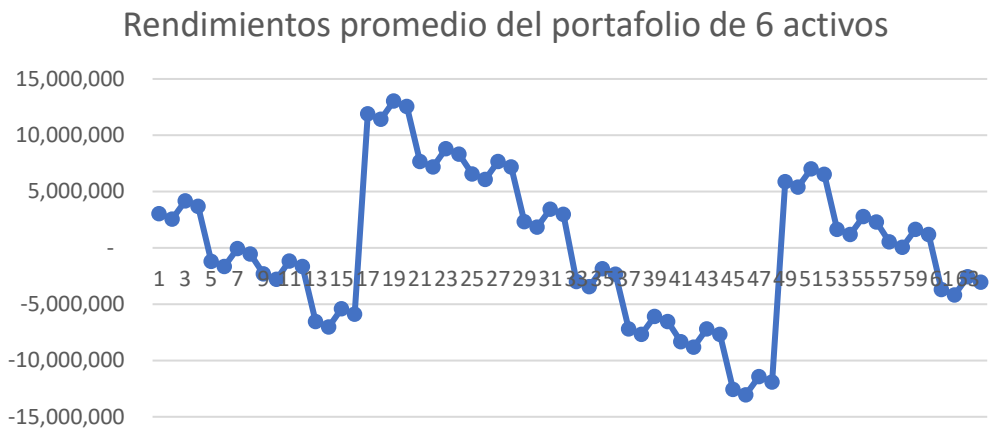
Figure 2.

The chart presents the mean return of the 128 possible combinations of the portfolio of 7 assets, evaluated during the first quarter of 2024. The line demonstrates high variability, with pronounced peaks representing combinations with significant positive returns and troughs indicating combinations with negative returns.

This fluctuation suggests a considerable dispersion in the results, which can be attributed to the diversity of the selected assets and their correlations within the portfolio. The presence of both positive and negative returns underscores the significance of portfolio composition, as certain combinations are capable of maximizing average returns, while others carry elevated risk.

Investors can optimize their portfolios by identifying combinations that achieve the most stable and positive returns, taking into account not only individual asset returns, but also how they interact with each other.

Portfolio 2 (7 products): The mean return for this portfolio was [insert value], indicating that while it exhibits higher volatility, it also offers a higher potential return.



The chart displays the mean performance of the 64 possible combinations of the portfolio of 6 assets during the initial quarter of 2024. The line indicates moderate variability, with combinations attaining maximum yields close to 15 million and minimums close to -13 million. The presence of sharp peaks and dips indicates that certain asset combinations can offer significant returns, while others may pose greater risk and lead to losses. However, the overall trend indicates that the volatility of the 6-asset portfolio is marginally lower compared to that of the 7-asset portfolio, suggesting enhanced stability in the possible combinations. This phenomenon can be attributed to the strategic selection of assets with lower correlations, which facilitates smooth transitions and mitigates risk. The findings underscore the criticality of meticulous asset selection to optimize average returns and mitigate exposure to unfavorable scenarios.

Discussion

This analysis demonstrates that diversification based on the correlation between assets is an effective strategy for mitigating risks. It is important to note that correlations tend to increase during periods of economic crisis. However, the findings of this study indicate that investors can still benefit from the inclusion of unconventional asset classes, such as commodities or assets from developing countries.

Conclusion

This paper underscores the significance of contemplating the correlation between assets when formulating an investment portfolio. Effective diversification has been shown to enhance risk-adjusted returns and to safeguard investors during periods of heightened market volatility.

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