

RISK OPTIMIZATION IN DIVERSIFICATION STRATEGY

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Abstract

Diversification is a strategy designed to optimize risk by combining a variety of investments such as real estate, stocks and bonds which are not likely to move in the same direction. The goal of diversification is to minimize the risk in a portfolio. There are many literatures on diversification; in addition, this paper attempts to add values to the existing literatures by empirically establishing the theory of diversification by combining two assets together. In view of this task, two assets; gold and silver are explored from S&P 500 between 2010 and 2015. Return and risk of each security was estimated, it was discovered that both securities have low returns and high risks. Estimating the risk of the combined securities in the portfolio, it was observed that the risk falls drastically which established the theory of diversification. Furthermore, comparing the returns of the two securities with the aid of charts, it was noticed vividly that the return of silver was higher than that of gold within the specified period.

Keywords: Diversification, Return, Risk, Portfolio, Security.

1. INTRODUCTION

For over five decades the subject of diversification is one of the significant modern investment theories that have been established. Anyway, it may not be the most vital theory developed, however, it is certain that investors holding diversified portfolio is the best generally accepted investment idea and one of the best practiced knowledge

The study of diversification has attracted the attention of some management scholars and is one of the common research areas of business. Among others, researchers have studied the antecedents of diversification and the financial performance [1]. Investors really would explore the benefit of diversification by investing on 10 to 15 securities as recommended by financial management.

Diversification is a strategy by which a firm expands from its core business into other product market [2]. Research reveals that corporate management actively employed diversification activities. Many researchers notice a rise in diversified firms. According to a survey, European Corporate managers not only favour it but intensely pursue diversification.

According to economic activity, there are costs and benefits related with diversification and definitely, a firm's performance must depend on the way managers maintain a balance between cost and benefits in each concrete case. Moreover, these costs and benefits may not be equal on investors and managers. Management researcher argues that diversification prolongs the life of a firm. Researchers in finance show that diversification benefits managers because it procures them insurance and shareholder normally bear all the costs of such insurance.

Diversification can develop debt capacity, reduce the chances of bankruptcy by diverge into new product/markets [3], and improve asset deployment and profitability. A diversified firm can shift funds from a cash surplus unit to a deficit unit without taxes or transaction costs. Diversified firms pool unsystematic risk and reduce the variability of operating cash flow adore comparative benefit in hiring because key employees may have a greater sense of job security [4].

Diversification, firm size and executive compensation are highly correlated which may imply that diversification provides benefits to managers that are unavailable to investors [5], and managers stand to lose if they become unemployed, either through poor firm or firm performance or bankruptcy. Diversification can lead to problem of moral hazard. Diversification can be costly [6] and place considerable stress on management. These are the costs of diversification.

Assets is diversifiable if it is not perfectly correlated with the market, and a hedge if it is uncorrelated or negatively correlated with other asset [7]. These features of assets could motivate investors to invest on diversifiable assets as a hedge in the period of stress.

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The objective of this paper is to add values to the conceptual literatures on diversification. The remaining parts of the paper is organized as follow: section two presents the literature review on diversification, section three describes the data used, section four shows the methodology adopted section five discusses research findings while section six concludes the paper.

2. LITERATURE REVIEW

Modern Portfolio theory is a finance theory that attempts to minimize risk of the portfolio and maximize portfolio expected return. Harry Markowitz was the first to discover the theory of modern portfolio. His discovery was filled with insights and ideas that anticipated many of the subsequent growth in the field. He originated a portfolio problem as a choice of the mean variance portfolio of assets. He cited out that the proper risk encountering by an investor was portfolio risk which leads to a basic and important point that the risk of a stock should not only be estimated just by the variance of the stock but also by the covariance. Moreover, he also observed that the best (optimal) portfolio should consist of assets that are perfectly negatively correlated. He noted that there are many perfectly positively correlated assets in circulation. This observation gives rise to the theory of diversification [8, 9].

The most important aspect of Markowitz model was his description of the effect on portfolio diversification by the number of securities within a portfolio and their covariance relationships [10]. They used data on sectoral level of employment and value added to generate new and robust evidence that economic growth through stages of diversification and that sectoral concentration follows a U-shaped pattern in relation to per capital income [11].

A comparative analysis between Phenotypic and Species diversification among animal Clades was carried out. The purpose of the analysis is to investigate the evolutionary and ecological correlation of these rate differences. Their analysis suggested that speciation and phenotypic diversification rates may be related to factors such as invasion of novel habitats and habitat complexity [12].

The result of average return of a portfolio is just a linear function of the arithmetic average returns of portfolio constituents; the advantage of diversification is not only in return improvement but majorly in risk reduction. Thus, the real benefits of diversification are sensitive to the choice of risk measure. There are many other options, such as expected drawdown and value at risk (VaR), many researches and financial theories apt to rely on standard deviation or beta as measure of risk [13].

Cambodia's economy has experienced vital growth during the last two decades despite the global financial instability. The growth has successfully raised living standards of the people with a significant reduction in the poverty rate and rising employment. Nevertheless, the economy still based on a few sectors which mainly rely on external demand. Consequently, it is generally, noticed that there is need to further diversify its economic in order to achieve reasonable economic growth and employment creation [14].

In conclusion, it has been noticed right from on-set (1952) that investor would not be successful in investing if he/she fails to apply the theory of diversification. This has made the theory to be very significant and popular in the world of investment.

3. DATA

Data for this analysis is extracted from DataStream international S&P 500. The data set consists of monthly closing values, for gold and silver, We shall use US\$/Troy ounce.

4. RESEARCH METHODOLOGY

The methodology adopted is Mean-Variance Model.

Consider the following minimization constraint:

$$\begin{aligned} \min \frac{1}{2} \sigma_p^2 &= \frac{1}{2} \sum_{i=1}^n \sum_{j=1}^n w_i w_j \sigma_{ij} \\ &= \frac{1}{2} (w' \Omega w) \end{aligned} \quad (1)$$

Where $w' = (w_1, w_2, \dots, w_n)$ and Ω is the $(n \times n)$ covariance matrix $\{\sigma_{ij}\}$. The constraints are

$$E(r_p) = \sum_{i=1}^n w_i E(r_i) \quad (2)$$

$$\sum_{i=1}^n w_i = 1 \quad (3)$$

For short selling, we use two Langrange multipliers; λ_1 and λ_2 for the two constraints

$$\text{Min } L = (1/2) \sum_{i=1}^n \sum_{j=1}^n w_i w_j \sigma_{ij} - \lambda_1 \left(\sum_{i=1}^n w_i E R_i - E R_p \right) - \lambda_2 \left(\sum_{i=1}^n w_i - 1 \right) \quad (4)$$

$$\begin{aligned} L &= (1/2) \left[w_1^2 \sigma_{11} + 2w_1 w_2 \sigma_{12} + w_2^2 \sigma_{22} \right] - \lambda_1 \left[w_1 E R_1 + w_2 E R_2 - E R_p \right] - \\ &\lambda_2 \left[w_1 + w_2 - 1 \right] \end{aligned} \quad (5)$$

Differentiating equation (5) with respect to w_i, λ_i gives the following first order conditions (FOC)

$$\frac{\partial L}{\partial w_1} = (2w_1\sigma_{11} + 2w_2\sigma_{12}) - \lambda_1 ER_1 - \lambda_2 = 0 \quad (6)$$

$$\frac{\partial L}{\partial w_2} = (2w_1\sigma_{12} + 2w_2\sigma_{22}) - \lambda_1 ER_2 - \lambda_2 = 0 \quad (7)$$

$$\frac{\partial L}{\partial \lambda_1} = \sum_{i=1}^2 w_i ER_i - ER_p = 0 \quad (8)$$

$$\frac{\partial L}{\partial \lambda_2} = \sum_{i=1}^2 w_i - 1 = 0 \quad (9)$$

For minimum variance portfolio

From equations (8) and (9) and generalized to n -assets case can be written as

$$\sum_{i=1}^n w_i ER_i = ER_p \quad (10)$$

$$\sum_{i=1}^n w_i = 1 \quad (11)$$

where $\Omega = \sigma_{ij} = (n \times n)$ covariance matrix, ER is $(n \times 1)$, λ_i are scalars, w_i are weights of assets, σ_{ii} are variances, and σ_{ij} equation (10) arbitrarily set ER_p to any fixed value, we have $(n + 2)$ linear equation and $(n + 2)$ unknowns, the w_i and λ_i . These linear equations are easily solved using Microsoft Excel (spread sheet) to give the optimal weights for one point on the minimum variance portfolio. We estimate expected returns ER_i , standard deviations and covariances σ_{ij} . Having obtained the optimal weight w_i ($i = 1, 2, \dots, n$) these substituted in $\sigma_p^2 = w' \Omega w$ and $ER_p = w' ER$ to give one point on the efficient frontier.

5. RESEARCH FINDINGS AND DISCUSSIONS

The results of returns for both gold and silver are tabulated in table 1 and the results of risks for gold, silver and combination of gold and silver are tabulated in table 2.

Gold	Silver
1.9%	7.8%

Table 1 presents the results of expected returns for gold and silver. Looking at the table the results of both securities are low and more especially the return of gold. This low in returns of the securities may be as a result of fall in dollar currency. Moreover, the low in return of gold is as a result of fall in the price of crude oil within this period. The return of crude oil presently is negative and gold is highly correlated with crude oil; this means whatever happens to crude oil would effect on gold and vice versa.

Gold	Silver	Portfolio
30.45%	30.32%	0.06%

Table 2 shows the results of risk for gold and silver. Gold has 30.45% risk and silver has 30.32% risk, but the risk of combined securities in portfolio falls drastically to 0.06%. This experiment proved the theory of diversification which states that, when investors invest in one security he/she is vulnerable to high risk but if he/she diversifies especially in negatively correlated securities that is, investing in more than one security that are not related in features, the risk falls.

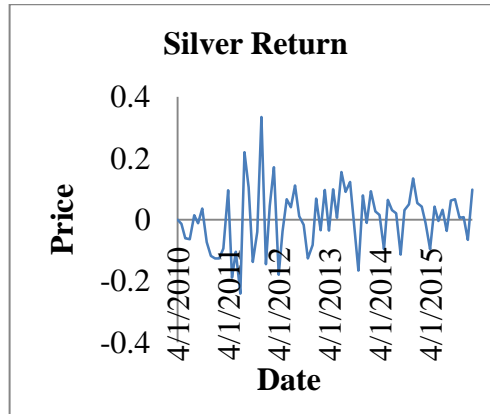
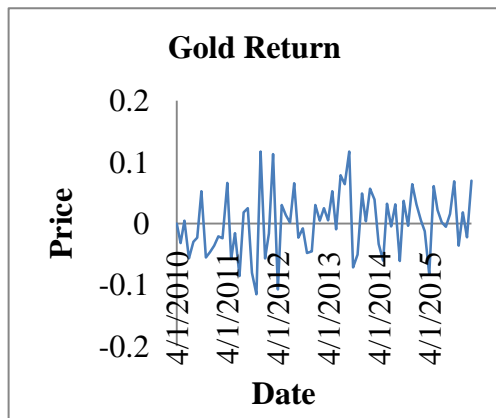


Figure1 (a) Showing result of GoldReturn**Figure1 (b)** Showing result of Silver Return

We use the charts above to compare the two securities used in this paper. The charts depict the characteristics of the returns of both securities. Looking at the returns of gold, in 2012 it rose above 10% but fell below zero in 2013, in 2014 it picked up to 5%, and rose again to 7% in 2015. For return of silver, it rose above 30% in 2012 and in 2013 it fell to 10%, in 2014 it fell again to 9%, in 2015 it rose above 10% but since then fell below 10%. These securities' returns portray fluctuations in the price of both securities within the periods. The observation here shows that return of silver is higher than return of gold within these periods.

6. CONCLUSION

As stated earlier that the paper attempts to add values to the existing literatures. The data used was extracted from DataStream international S&P 500. The data set consist of monthly closing values for gold and silver from 2010 to 2015.

We adopted Mean-Variance model methodology for the analysis carried out. Mean was used to estimate for returns while variance and standard deviation were used to estimate for risks of both securities. The results of risk for gold and silver are 30.45% and 30.32% respectively but when combined together in portfolio it was drastically fell to 0.06%. This experiment further proved the theory of diversification. This show that diversification is a powerful tool for investors to minimize risk of portfolio.

Lastly, we compared the returns of the two securities used with the aid of charts. It was observed that silver's return was higher compared to that of gold within the period of 2010 and 2015.

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