**Introduction.**

A portfolio is a group of investments that are all owned by the same person or organization. A portfolio can be thought of as a collection of securities. different type of these investments includes; stocks, that are investments in particular businesses; bonds, which are viewed as debt instruments designed to earn interest; and mutual funds, which are pooled money from multiple participants that are invested professionally or according to market indexes(Zakamulin, 2016).

Portfolio analysis involves the study of examining or evaluating the components of a business's complete portfolio of assets or products to assess which combination of assets or products if placed together will yield more return to and manageable risk involved(Chatterjee et al., 2014). The review is conducted to perform a full analysis of risk and return. Portfolio analysis performed regularly enables the investor to adjust the portfolio holdings and adjust it in response to changing market conditions and situations. Additionally, the study aids in the right allocation of resources/assets to various components of the portfolio. Portfolio analysis is important for investors, with it they can make appropriate decisions on where to invest their resources for high levels of return. investors can also adjust the existing allocation of resources to different assets to cope with the current market conditions. For timely adjustment of allocation of resources to cope with the current market condition, portfolio management is a key aspect in monitoring the performance of the portfolio.

Portfolio management is the technique of selecting an asset mix, allocating assets according to the objectives of the organization, and managing risk and return. Portfolio management is the art of determining the optimal investment strategy for an entity in terms of minimum volatility and high-level return. Additionally, it refers to the management of securities in the form of stocks, cash, and mutual funds, and bonds to maximize profits within a specified time. Portfolio management involves the practice through which an investor's money is managed under the guidance of professional portfolio managers. It is accomplished by evaluating the SWOT analysis associated with various investment possibilities to arrive at a risk-reward trade-off.

Portfolio management is all about weighing the advantages and disadvantages of the securities, and a variety of other trade-offs experienced in the pursuit of maximum return with a given tolerance for risk. Portfolio management is defined by a knowledge of market dynamics to ensure all the time funds are located to the appropriate securities for return maximization (Clarke et al., 2010).

This study contains eight securities to be invested in, these investments are cash, bond, equity, direct property, listed property, hedging funds, commodity, and private equity. To achieve the investment objectives which is a key aspect of portfolio management, the return of the portfolio should not be less than 6% per year. The volatility of the portfolio should not be more than 12%, at least 60% of the funds should be invested in liquid assets (cash, bonds, equity, and listed property index), cash should hold at least 5% of the total allocation and at least 40 to 60% of the funds should be invested in traditional assets, that is bonds, equity, and cash. To achieve these portfolio objectives, the study will apply Markowitz's theory to come up with appropriate weight allocation for different securities.

The Markowitz technique identifies the most optimal portfolio for the investor by examining three critical variables: yield, volatility, and coefficient of correlation (Solanki, 2011). The investor can apply this model to determine the most effective portfolio by calculating the trade-off between volatility and return. As per this idea, the impacts of one fund purchase are weighed against the impacts of another fund purchase, and the outcomes are then assessed.

**Short-term return and standard deviation (yearly).**

|  |  |  |
| --- | --- | --- |
| fund | yearly return | yearly standard deviation |
| Cash (%) | -0.967 | 1.177 |
| Bond Index | 0.095 | 0.101 |
| Equity Index | 0.212 | 0.213 |
| Direct Property Index | 0.016 | 0.020 |
| Listed Property Index | -0.042 | 0.138 |
| Hedge Funds Index | 0.109 | 0.075 |
| Commodity Index | -0.008 | 0.466 |
| Private Equity Index | 0.115 | 0.245 |

From the above table, based on the short-term period (one year) the cash has a mean return of -0.967 and a standard deviation of 1.177. the high standard deviation indicates a high volatility in cash returns over the short-term period (2020). The bond index has a mean of 0.095 which is positive indicating that over the short period, investing in bonds was profitable. The standard deviation is 0.101 which is more than the return hence high volatility in bond returns. The equity index has a return of 0.212 and a standard deviation of 0.213. direct property index has a return of 0.016 and a standard deviation of 0.020 indicating a high level of volatility of the returns. The listed property index has a negative return of -0.042 and a standard deviation of 0.138 indicating the high level of volatility in the listed property index. The hedge funds index has a positive return of 0.109 and low volatility of 0.075. commodity index has the return of -0.008 and the highest volatility at 0.466 and finally the private equity index has a 0.115 return and 0.245 as volatility. In the short term, any rational investor will invest in equity since it has the highest return as compared to other funds.

**Medium-term return and standard deviation(yearly)**

|  |  |  |
| --- | --- | --- |
| fund | yearly return | yearly standard deviation |
| Cash (%) | 0.364 | 0.7169 |
| Bond Index | 0.047 | 0.0707 |
| Equity Index | 0.145 | 0.1091 |
| Direct Property Index | 0.058 | 0.0137 |
| Listed Property Index | 0.074 | 0.1261 |
| Hedge Funds Index | 0.061 | 0.0457 |
| Commodity Index | 0.019 | 0.2683 |
| Private Equity Index | 0.141 | 0.1537 |

From the above table, based on the medium-term period (five years) the cash has a mean return of 0.364 and a standard deviation of 0.7169. The high standard deviation indicates a high volatility in cash returns over the medium-term period. The bond index has a mean of 0.047 which is positive indicating that over the medium-term period, investing in bonds was profitable. The standard deviation is 0.0707 which is less than the return hence low volatility in bond returns. The equity index has a return of 0.145 and a standard deviation of 0.1091. direct property index has a return of 0.058 and a standard deviation of 0.0137. The listed property index has a positive return of 0.074 and a standard deviation of 0.126 indicating the high level of volatility in the listed property index. The hedge funds index has a positive return of 0.061 and low volatility of 0.0457. commodity index has a return of 0.019 and volatility at 0.2683 and finally, the private equity index has a 0.141 return and 0.1537 as volatility. In the short term, any rational investor will invest in a cash fund since it has the highest return as compared to other funds.

When comparing the two periods (short and medium-term) it is clear the over the past five years (medium-term) funds generated positive returns as compared to the short term period (2020). This difference may be as a result of the Covid-19 pandemic which has led to more decreased economic activities around the world hence reduced purchasing power of individuals. With low purchasing power, the demand for goods and services reduces hence leading to a low production rate consequently leading to low returns for companies.

Impact of Covid-19

Figure 1: the quarterly return of different securities.

From the above graphs, there is a downward trend in quarterly returns from Q4 2019 to Q2 2020. The reduction is a result of Covid-19. The pandemic has led to more decreased economic activities around the world hence reduced purchasing power of individuals. With low purchasing power, the demand for goods and services reduces hence leading to a low production rate consequently leading to low returns for companies. The high unemployment rate may also be a reason for reduced purchasing power among individuals.

**Short term correlation matrix**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **Cash (%)** | | **Bond Index** | | **Equity Index** | | **Direct Property Index** | | **Listed Property Index** | | **Hedge Funds Index** | | **Commodity Index** | | **Private Equity Index** |  |
| **Cash (%)** | | 1 | | -0.0829055 | | 0.35317107 | | -0.7179738 | | -0.155233 | | 0.18108 | | -0.16658 | | -0.165459 |  |
| **Bond Index** | | -0.08291 | | 1 | | -0.6919779 | | -0.6340104 | | -0.971483 | | -0.9317 | | -0.96614 | | -0.967514 |  |
| **Equity Index** | | 0.353171 | | -0.6919779 | | 1 | | 0.2000312 | | 0.6123726 | | 0.44664 | | 0.547142 | | 0.6332305 |  |
| **Direct Property Index** | | -0.71797 | | -0.6340104 | | 0.20003123 | | 1 | | 0.7986404 | | 0.51499 | | 0.804949 | | 0.8032396 |  |
| **Listed Property Index** | | -0.15523 | | -0.9714825 | | 0.61237263 | | 0.7986404 | | 1 | | 0.87499 | | 0.996004 | | 0.9991288 |  |
| **Hedge Funds Index** | | 0.181081 | | -0.9316908 | | 0.44663613 | | 0.5149939 | | 0.8749945 | | 1 | | 0.899696 | | 0.8562217 |  |
| **Commodity Index** | | -0.16658 | | -0.9661383 | | 0.54714169 | | 0.8049492 | | 0.9960036 | | 0.8997 | | 1 | | 0.9916888 |  |
| **Private Equity Index** | | -0.16546 | | -0.9675139 | | 0.63323051 | | 0.8032396 | | 0.9991288 | | 0.85622 | | 0.991689 | | 1 |  |
|  |  | |  | |  | |  | |  | |  | |  | |

The correlation matrix is applied to assess the relationship between different funds, a positive correlation coefficient indicates a positive association that is increasing in one fund leads to a decrease in another fund. A negative correlation coefficient indicates an inverse relationship that is, an increase in one fund leads to a decrease in the other fund. From the above table, funds with the highest correlation are listed property index and commodity index with a correlation coefficient of 0.9960036 indicating a perfect positive relationship between these two variables, that is the increase in listed property index by one unit leads to an increase in commodity index by one unit. Funds such as; cash and bond index, cash and direct property index, bond index and equity index, etc. have a negative correlation coefficient indicating an increase in one variable leads to a decrease in another variable.

**Middle term correlation matrix.**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Cash (%)** | **Bond Index** | **Equity Index** | **Direct Property Index** | **Listed Property Index** | **Hedge Funds Index** | **Commodity Index** | **Private Equity Index** |  |
| **Cash (%)** | 1 | -0.3826161 | 0.06273476 | 0.1813964 | -0.137788 | -0.3191 | -0.06018 | -0.099546 |  |
| **Bond Index** | -0.38262 | 1 | -0.3781453 | -0.3166338 | 0.0274147 | 0.04254 | -0.56154 | -0.413137 |  |
| **Equity Index** | 0.062735 | -0.3781453 | 1 | -0.0756769 | 0.4451 | 0.61314 | 0.603926 | 0.7400321 |  |
| **Direct Property Index** | 0.181396 | -0.3166338 | -0.0756769 | 1 | 0.3887281 | -0.2707 | 0.400505 | 0.3089034 |  |
| **Listed Property Index** | -0.13779 | 0.02741474 | 0.44509999 | 0.3887281 | 1 | 0.28468 | 0.60173 | 0.6640988 |  |
| **Hedge Funds Index** | -0.3191 | 0.04253931 | 0.61313643 | -0.2707216 | 0.2846815 | 1 | 0.399053 | 0.6460285 |  |
| **Commodity Index** | -0.06018 | -0.5615375 | 0.60392629 | 0.4005053 | 0.6017303 | 0.39905 | 1 | 0.8571276 |  |
| **Private Equity Index** | -0.09955 | -0.4131372 | 0.74003208 | 0.3089034 | 0.6640988 | 0.64603 | 0.857128 | 1 |  |

The correlation matrix is applied to assess the relationship between different funds, a positive correlation coefficient indicates a positive association that is increasing in one fund leads to a decrease in another fund. A negative correlation coefficient indicates an inverse relationship that is, an increase in one fund leads to a decrease in the other fund. From the above table, funds with the highest correlation are listed property index and commodity index with a correlation coefficient of 0.857128 indicating a positive relationship between these two variables, that is an increase in listed property index leads to an increase in a commodity index. Funds such as; cash and bond index, cash and listed property index, bond index and equity index, etc. have negative correlation coefficients indicating increase in one variable leads to a decrease in another variable.

**Markowitz portfolio theory.**

The Markowitz technique identifies the most optimal portfolio for the investor by examining three critical variables: yield, volatility, and coefficient of correlation(Solanki, 2011). The investor can apply this model to determine the most effective portfolio by calculating the trade-off between volatility and return. As per this idea, the impacts of one fund purchase are weighed against the impacts of another fund purchase, and the outcomes are then assessed.

Under Markowitz portfolio theory return and standard deviation are calculated as follows;

Return = E (rp) =

Standard deviation (σp) = ij

The portfolio objective is the return of the portfolio should not be less than 6% per year. The volatility of the portfolio should not be more than 12%, at least 60% of the funds should be invested in liquid assets (cash, bonds, equity, and listed property index), cash should hold at least 5% of the total allocation and at least 40 to 60% of the funds should be invested in traditional assets, that is bonds, equity, and cash.

**Weight**

|  |  |
| --- | --- |
| **weights for optimization** | weights |
| **Cash (%)** | 0.120743 |
| **Bond Index** | 0 |
| **Equity Index** | 0.879257 |
| **Listed Property Index** | 0 |
| **Direct Property Index** | 0 |
| **Hedge Funds Index** | 0 |
| **Commodity Index** | 0 |
| **Private Equity Index** | 0 |
| **total** | 1 |
|  |  |
| **portfolio return** | 0.171828 |
| **portfolio standard deviation** | 0.12 |

Based on the above table, to achieve the objectives of the study one should only invest in cash and equity index since they yield a maximum portfolio return of 0.171828 and a standard deviation of 0.12 which is still within our objective. To achieve these, the weights of the cash and equity index should be 0.879257 and 0.120743 respectively.

In conclusion for us to achieve the main portfolio objectives; the return of the portfolio should not be less than 6% per year. The volatility of the portfolio should not be more than 12%, at least 60% of the funds should be invested in liquid assets (cash, bonds, equity, and listed property index), cash should hold at least 5% of the total allocation and at least 40 to 60% of the funds should be invested in traditional assets, that is bonds, equity and cash one should only invest in cash and equity index.

**References.**

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