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International Portfolio Diversification

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Abstract

The current research investigates the benefits an investor will have if he diversifies his portfolio internationally by attaining high expected return, minimizing costs and maintaining a balance between the risk and the return, the portfolio diversification process comprises of selecting the optimal combination of portfolio out of a group of portfolios for achieving a specific objective. The purpose of portfolio diversification is to maximize the expected return or minimize the financial risks or it can be a mixture of both. Qualitative research methodology has been used by the researcher for gaining significant facts related to the study from the secondary sources. The current research has discussed the major portfolio optimization theories such as Modern Portfolio Theory (MPT), Efficient Frontier, Post-Modern Portfolio Theory (PMPT), Post-Modern Portfolio Theory, Mean Absolute Deviation (MAD) Optimization, Feinstein-Thapa Modification, Mansini-Speranza Optimization and Beta Model. Modern Portfolio Theory has proved that diversification reduces the portfolio's risk and international diversification provides greater benefits of diversification and relies on various economic factors.

Acknowledgement

First of all, I thank almighty God for granting me courage to conduct this research. I am deeply indebted to my supervisor Pr. Costas Giannopoulos for supporting me in my research work. I also thankful to my family for providing me necessary assistance for carrying out this research. I'm also respectful to the previous researchers whose work I have used to perform this analysis.

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Chapter 1: Introduction

1.1 Background of the Study

Diversification involves the process in which the capital is allocated in a manner that lessens the exposure to any specific risk or asset. The most common practice of diversification is to reduce risk by investing in a variety of assets (O'Sullivan & Sheffrin, 2003). The portfolio maximization or optimization process comprises of choosing the optimal combination of portfolio out of the group of portfolios for attaining a specific objective (Civitanic, Polimenis, & Zapatero, 2008). The portfolio might comprise of tangible as well as intangible assets, liabilities and earnings. Harry Markowitz's (1952) Modern Portfolio Theory centered on maximizing the expected returns of the portfolio by investors with any form of risk in view. In order for portfolios to achieve a higher return, investors need to take more risks. They have to trade-off between the expected return and the risk.Portfolio maximization can take place by means of either optimizing the weights of the assets for the purpose of holding (for example, selecting the proportion held in equity versus the bonds) or for the purpose of optimizing the weights of assets within the same asset group (for example, selecting the proportion of the sub portfolio stock that has been placed in the stocks) (Humphrey, Benson, Low, & Lee, 2015). These methods diversify the portfolios and eliminate the non-systematic risk.

In order to attain high expected returns in diversified portfolios, there is a need for more risk taking in way that the investors have to tackle the trade-off amid the risk and the expected return (Chua, Krizman, & Page, 2009). The expected return is represented by the curve which is known as the efficient frontier. The efficient portfolios are well diversified and are depicted by a point on the efficient frontier. The mathematical tools and techniques used for the portfolio maximization or optimization include quadratic programming, mixed inter programming, stochastic programming, deterministic global optimization, copula-based methods, meta heuristic methods, nonlinear programming, etc. (Low, Faff and Aas, 2016).

The present research will cover concepts related to portfolio diversification, reasons for portfolio diversification, methods used by the investors for achieving international portfolio diversification, constraints associated with portfolio diversification and advantages and limitations associated with international portfolio diversification by using qualitative research methodology and data analysis from data collected from Yahoo Finance for providing examples based on the secondary source of this research. The qualitative research methodology in this research involves secondary source of data collection. The secondary source includes review of journals, articles, books, magazines, newspapers, organizational reports, case studies and authentic websites related to portfolio diversification.

The first chapter reviews the background of the study, objectives of the study and the research methodology that is used.

The second chapter involves concepts related to Markowitz Diversification and Portfolio diversification, reasons for portfolio diversification, methods used by the investors for achieving international portfolio diversification, portfolio optimization theories, constraints associated with portfolio diversification and advantages and limitations associated with international portfolio diversification. In addition, we will mention about the Risk invoiced in investing Internationally, what is the Currency risk and finally, in that chapter, we will mention for the impact of currency in an internationally diversified portfolio

The third chapter will discuss the research approach, data gathering methods, originality and limitations of the data, reliability and validity of the data, ethical issues related to the research and philosophical approach.

The fourth chapter will comprise of the analysis of the data for the investigation of the benefits an investor will have if he diversifies his portfolio internationally that has been collected through literature review, cases of international portfolio diversification by multinational companies and then, the data from six companies with different currency and country origin.

The last chapter will include the overall conclusion of the research, suggestions for managing and improving portfolio diversification, future scope of the research and limitations of the research study.

Chapter 2: Literature Review

2.1 Portfolio Theory: Markowitz Diversification

It has been three decades since Markowitz provided the indication that the investment of less than perfectly correlated assets, you reduce the risk of portfolio without damaging any expected return (Markowitz 1959). Markowitz presumed the normal distribution of returns in a stock portfolio. Correspondingly, the mean and the variance of returns, can provide a full description of the portfolio tradeoff. The risk is calculated by the variance or scale of the distribution, while the potential for return is calculated by the mean of the distribution.
Markowitz also assumed that all investors are risk averse. This means if a rational investor with a given level of risk would choose the stocks with the maximum return, and given a level of return, he would choose the minimum risk.

Prior to Markowitz's theory, investment analysts talked about maximizing returns – subject to a risk. By measuring risk, Markowitz laid down the cornerstones of modern portfolio theory - MPT. The interrelationship between two securities is measured by the covariance σij. This is also a measure of the interactive risk between two securities and the correlation coefficient R ij can measure the covariance of two securities relative to the individual standard deviation.
The distinguish of the risk of each security can be made by its systematic component (related to the market or further economic factors) and unsystematic component (related to factors that affect the company).

Systematic and non-systematic components of each security's total risk are often known as undiversifiable and diversifiable because of their effect on risk reduction. For example, if the return on one asset is positive and the return on another is negative, the variability of the portfolio would be lower than the weighted total of the variability of its individual assets due to these movements. In a portfolio with two assets, risk reduction depends on the level of co-variation of the two assets. When the assets change values together in the same direction and

magnitude then the returns on the assets will be positively correlated. If the assets values change in opposite directions, the correlation is negative. If there is no relation between the two value changes, the correlation will be zero.

Hence, no potential benefits can be achieved with perfectly positive correlation on this diversification. If there is a decrease portfolio risk, then there will be a decrease in expected return. The potential benefits from diversification increase as the degree of uncorrelation to which the returns of the two assets are.

The portfolio's variance would be lower than the variance of either asset if the correlation coefficient is less than the ration of the smaller standard deviation to the largest standard deviation.

Once the returns and variance – covariance matrix are calculated for an array of securities, a set of efficient portfolios may be put together, and the investor can choose the unique portfolio, that suits his utility. No further diversification could reduce the portfolio's risk at any level of return. The remaining portfolio risk is that related to general macro-economic factors, such as money supply, interest rate changes, government spending, etc.

2.2 Portfolio Diversification

According to Dangi (2012), the portfolio diversification involves the determination of an optimal arrangement of weights linked with the financial assets that are held in a portfolio. Portfolio is regarded as a suitable compilation of investment that is held by the individuals or financial institutions. Rehnman (2018) considered portfolio diversification as the procedure of choosing asset weights for achieving an optimal portfolio, depending upon the objective. Usually, the objective is maximizing expected return or minimizing financial risk or it can be a mixture of both. The investment might comprise of mutual funds, government bonds, commodities, fixed income securities, derivatives or any other kind of financial instruments. The portfolio manager is responsible for taking decisions related to the investment held in the portfolio by the financial

institutions. Portfolio optimization involves choosing the investment portfolios comprising of the financial instruments, allocating the particular capital over the assets that are available, meeting the specific pre-defined goals, mitigating the financial risks and ensuring improved vigilance for the uncertain conditions, establishing the mathematical and computational methodologies on realistic limitations, handling profit and loss of the portfolio (in case of short and long positions), and providing constancy in cases of fluctuations in the inter and intraday markets (Dangi, 2012). The international investors focus on mitigating the foreign exchange risk (Papadamou & Tsopoglou, 2002). Currency hedging enhances the performance of the international diversified portfolio by decreasing the portfolio risk (Bekaert & Harvey, 2002). Hard (strong and reliable) currencies are considered as natural hedges against the negative returns in cases of international investments.

According to DiBartolomeo (1993), the optimization issues are generally considered by practitioners as consisting of two portfolios, firstly, the investor portfolio and secondly, the benchmark portfolio, whereas three portfolios, including the investor portfolio, the benchmark portfolio and the difference portfolio, are better created. The difference portfolio encompasses the set of securities given by the benchmark portfolio when applied to the investment portfolio. DiBartolomeo (1993) emphasized that this difference portfolio needs to be optimized. The optimal investor portfolio is just the portfolio that is a result of the subtraction of the optimal difference portfolio from that of the benchmark portfolio. There is a need to focus on the difference portfolio for getting better results for portfolio optimization.

Jothimani, Shankar and Yadav (2015) in their article *"A Big Data Analytical Framework for Portfolio Optimization"* presented a framework for incorporating structured as well as unstructured data for the purpose of portfolio optimization. The portfolio optimization process comprises of asset selection, asset weighting and asset management. The framework proposed by the researchers attained the first two processes by utilizing a methodology comprising of five stages, that is, short listing of the stocks by making use of \Data Envelopment Analysis (DEA), integration of the qualitative factors by making use of the text mining process, stock clustering

(the greater the clusters, the higher will be the diversification), stock ranking (usually done through Artificial Neural Network (ANN)) and optimizing the portfolio by making use of the optimization heuristics. The framework presented by these researchers can assist the investors in selecting the suitable assets for making a portfolio, investing in them for minimizing the risk and maximizing the returns and finally monitoring their performance.

Low, Faff and Aas (2016) mentioned in their article entitled *"Enhancing Mean Variance Portfolio Selection by Modeling Distributional Asymmetries"* that the mathematical tools and techniques used for the portfolio maximization or optimization include quadratic programming, mixed inter programming, stochastic programming, deterministic global optimization, copula-based methods, meta heuristic methods, nonlinear programming, etc.

2.3 International Diversification

2.3.1 Empirical evidence

Residential securities tend to move up and down together in so are as they are similarly affected by residential conditions such as money supply announcements, movements in interest rates, budget deficit, national growth, etc. Different countries may be at different phases in business cycles, with different socio-political situations, and this may be reflected in stock prices in that country.

Part of national systematic risk is diversifiable when measured on a worldwide basis and risk reduction may be facilitated by diversifying security portfolios intentionally.
By doing this, the investor avoids a large part of national systematic risk and should be left, hypothetically, with only the risk associated with worldwide economic conditions. Those conditions speak to undiversifiable risk.

2.4 Portfolio Optimization Theories

Portfolio theory is defined as the utilization of the decision-making tools for solving the issue of the management of the risky investment portfolio (Nawrocki, 1999).

2.4.1 The optimization criteria

To construct the efficient frontier of a risky -n- assets portfolio it is first necessary to generate a sufficiently large set of minimums – variance portfolios. Once we know how to measure risk and returns, we can start to investigate alternative risk / return trade – offs.

Our principal assumption is that investors are risk-averse. Accordingly, a portfolio diversification trading strategy may be set out in two different ways.

- Find that portfolio which gives the highest expected return subject to the variance of return not exceeding a specific level,
- Find that portfolio which gives the lowest variance of return subject to the expected return non-being below a specified level.

Both trading strategies are the same, and direct us toward the goal of a unique portfolio. It is necessary to note that there is not a feasible solution for all the objectives (target returns)

Modern Portfolio Theory (MPT), Efficient Frontier, Post-Modern Portfolio Theory (PMPT), Mean Absolute Deviation (MAD) Optimization and Beta Model form the main portfolio optimization theories. Below, these theories and models are explained briefly.

2.4.2 Capital Asset Pricing Model (CAMP)

Capital Asset pricing model is essential for financial economics. This model provides a higher level of accuracy between benchmark rate of return and the perspective investments. According to Bodie, et al, 2002, p.258, this is a model that is used by many, can provide a good scientific assumption about the forecast of the stock's expected return.

According to this theory, the case scenarios can be

• Investors value portfolios by estimating the expected return and the risk in a single time horizon, which is estimated to be the same for all of the investors.

• Between two identical portfolios, investors will choose the one with the higher yield and on the same time will prefer the one with the lowest risk (standard deviation).

• Assets are infinitely divisible, which means that every investor has the ability to buy and sell any quantity of assets.

• There is a risk-free rate in the market for all of the investors, which means that every investor can lend and borrow money.

• There is no transaction cost and taxation

• There is a free flow of information to all of the investors, at no cost

• No investor can influence the market in the direction that would like, buying or selling assets

Under this model, it is assumed that

- The investors are rational and prefer higher return/lower risk
- The possibility to set an optimal Portfolio – the best combination of return-risk for the investor
- The possibility to alter the optimal portfolio, as well as set the investment assets with a zero risk
- There is the security market line (linear relation between the return of stock and risk in the market

By comparing different time periods for the Market Rate Return and Beta, the graph is linear. Since all investors have the same expectations for returns, fluctuations and fluctuations as well as the same risk-free interest rate, will set the same set of effective portfolios. Which portfolio to choose in the end the investor from the set of efficient portfolios portfolios), depends directly on the map of its indifference curves (indifference curves), which represent investors' preferences for risk and return. The final choice of portfolio depends on the mood of each investor to take a greater or lesser risk, according to curves of his indifference.

2.4.3 Beta Model

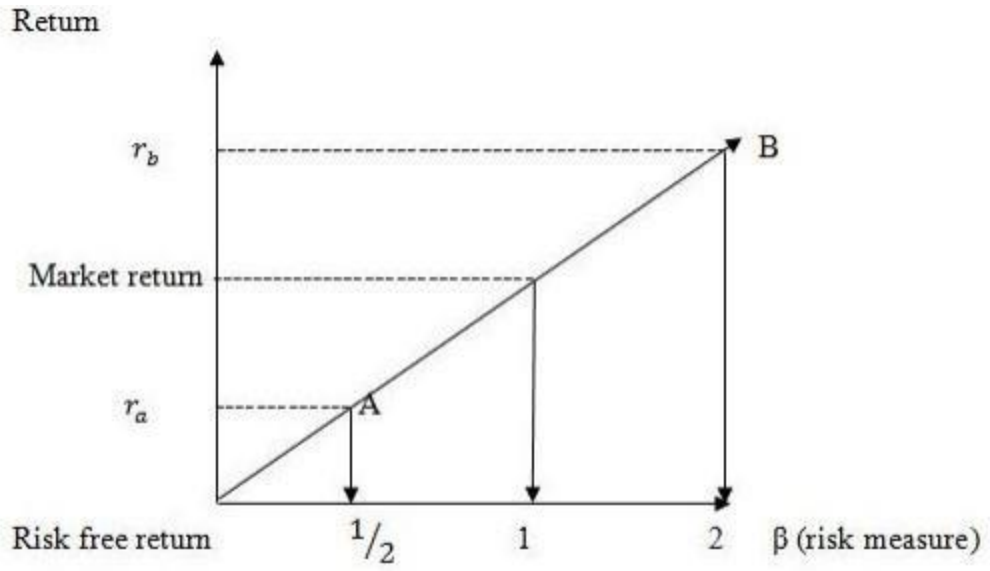
The Beta model, which is considered to be an extension of Mansini & Speranza's Mansini-Speranza Optimization model (2005), was proposed by Albuquerque (2009). The Beta model comprises of the factor of diversifiable and non-diversifiable risks in it. A diversifiable risk is considered by the inclusion of a minimum number of assets in the development of the optimal portfolio, while a non-diversifiable risk is considered by the use of the portfolio's beta coefficient.

$$\beta_s = \frac{E(r_s) - r_f}{E(r_m) - r_f}$$

β_s = Beta for your investment
$E(r_s)$ = Expected Return from your investment
$E(r_m)$ = Expected Return from the Market
r_f = Risk-Free Return

How to calculate the Beta?

Start by finding the risk-free rate, the stocks rate of returns, and the market rate of returns all expressed as percentage. Then subtract the risk-free rate from the stocks rate of return. Next subtract the risk-free rate from the markets rate return.



The above diagram is made by using the below technical term

$$\boldsymbol{r_i = r_{RF} + \beta_i\,(r_M - r_{RF})}$$

Where

$\boldsymbol{r_i}$ **:** The return on asset i

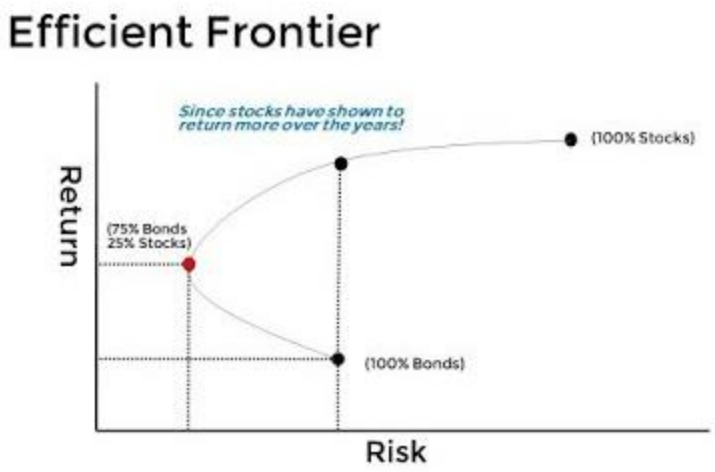
$\boldsymbol{r_{RF}}$: The returns on the Risk-Free Asset

$\boldsymbol{r_M}$: The returns on the Market Portfolio

$\boldsymbol{\beta_i}$**:** The beta on asset i

2.4.4 Efficient Frontier

The efficient frontier is a starting point in Modern Portfolio Theory and that was firstly of all mentioned by Markowitz (1952). The efficient frontier can be described as the optimal portfolio that gives a specific risk level over a certain level of expected return for the highest expected return. The portfolios that do not meet the criteria of the efficient frontiers are known as the sub optimal. As the rate of return on the Y-axis and a hyperbola with the risk on the X-axis, the efficient frontier is normally shielded.



2.4.5 Capital market line (CML)

According to the CAPM, it is easy to determine the relationship between risk (standard deviation) and expected performance of effective portfolios. This is exactly the relationship described by the line

E(RP) = Rf +[(E(Rm)-Rj) / σ2 μ]σρ

Where

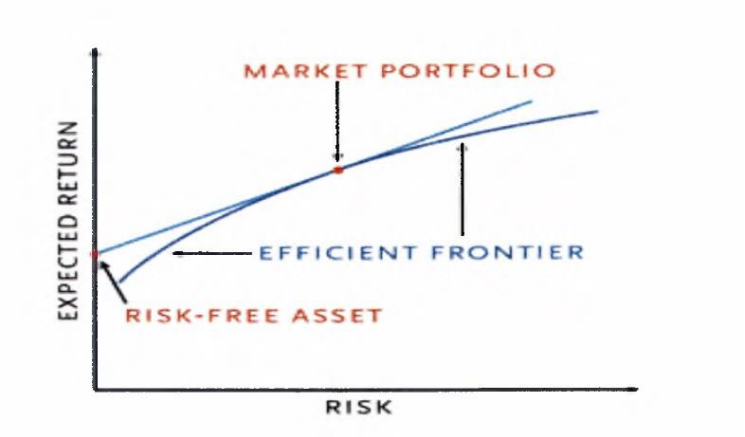
E (Rp) and sr the expected return and risk of our portfolio respectively,

Rf the risk-free return

E (Rm) the return of the portfolio of the market.

If the slope of this line is equal to the difference of the expected return on market portfolio from risk-free return, divided by the difference of their risks, respectively (essentially of market portfolio risk, since the risk of stable investment is equal to zero). Thus, the market equilibrium is characterized by two numbers- keys:

A. the constant term, which is the performance of the element risk free-asset and corresponds to the value of time and
B. the slope of the slope, which reflects the value of the risk (market price of risk).



The point where the efficient frontier curve (CML) intersects the market portfolio (market portfolio) which is the only portfolio on its optimal choice curve and the Sharpe ratio (performance per unit risk) has its highest value. As a market portfolio define the portfolio consisting of all market securities, weighted relative to market value. So, portfolio dominates all other portfolios below it, as all investors maximize their profitability by investing in this. In fact, any portfolio other than the market portfolio will is below the capital market line, although some portfolios will they are quite close. Consequently, and any other portfolio that consists from a single bond will be below this line, as it does not constitute an inefficient portfolio.

2.4.4 Modern Portfolio Theory (MPT)

Modern Portfolio Theory (MPT) also known as the Mean Variance Analysis is a theory that was presented by Harry Markowitz in the year 1952. According to this theory, the investors try to make rational and logical decisions and hence, they expect higher return even in case of increased risk. The theory emphasizes on the construction of a portfolio that supports the maximization of the expected return at a particular level of risk. This kind of portfolio has the ability to attain efficient frontier. An investor will not be willing to undertake extra risk if it does not yield higher returns. On the contrary, the investor must necessarily undertake risk if the objective is to attain higher returns. A major approach in this theory is considering the return and risk of the assets together and not separately, as both the factors together constitute the overall risk and return of the portfolios (Markowitz, 1952). Modern Portfolio Theory has proved that diversification reduces the portfolio's risk and international diversification provides greater benefits of diversification and relies on various economic factors (Mansourfar, Mohamad & Hassan, 2010). Modern Portfolio Theory (MPT) has been criticized by many theorists and practitioners. This theory needs the input of the expected returns, which demands the investor to forecasts the future output. Practically it is achieved by examining the historical data. The forecasts usually fail to consider the new situations which lead to flawed forecasts. Furthermore, the risk measure of Modern Portfolio Theory is variance. Thus, the optimization model also becomes quadratic, as variance is quadratic. In case of large portfolios, it makes the model incompetent in the computational way. Moreover, Modern Portfolio Theory considers that the asset returns follow the Gaussian distribution, which leads to two critical inferences. First of all, it underrates the probability of large and significant fluctuations in the prices of the assets. Secondly, it depends on on the correlation matrix which restricts its ability of capturing the related reliance structure among the assets (Rachev & Mittnik, 2006). These drawbacks restrict the practical usage of Modern Portfolio Theory.

2.4.5 Post-Modern Portfolio Theory (PMPT)

The Post-Modern Portfolio Theory (PMPT) was introduced in 1994 both Rom and Ferguson, which is based onto Markowitz's (1952) MMP, but offsets its limitations. The standard deviation of negative returns is used by P. M. Portfolio Theory as the total risk, while the standard deviation of returns is used by M. Portfolio Theory. The symmetric risk calculation involves the normal deviation of the total and the difference of asset returns as upside and indent side deviation are categorized equal.

There was an argument from the Rom and Ferguson in 1994 that it is contradictory instinctive for the buyers, as useful are the pansitive deviations. They thought that from a practical point of view, risk is sternly skewed, with the highest dumb side of crimincern. Moreover, the Post-Modern Portfolio Theory acknowledges that investment risk should be related to both the investor 's specific guests. As a Minimum Acceptable Return (MAR), they lied about the goal return. It shields the return that is important to accomplish the failure of the impermanent financial gathering. This calculation is specifically categorized in the categorization of efficient frontier of Post-Modern Portfolio Theory, which shows that for each of the Minimum Acceptable Return, there is a certain efficient frontier. This is in the Modern Portfolio Theory, in which the investor's absolute objectives are called oblivious.

In order to reveal the underlying uncertainty of asset forecast, optimization behavior in the Modern Portfolio Theory and the Post-Modern Portfolio Theory together involve a distribution of statistical return that is individually unique to each asset. Post Modern Portfolio Theory only allows normal distributors and two-meter parameters to be logged, whereas Post Modern Portfolio Theory allows a collection of distributors to be logged, comprising the asymmetrical distributes. Rom and Ferguson (1994) argued that Post Modern Portfolio Theory optimization typically produces precise results, since it allows the real asset to be interpreted correctly. It also suggests that the Post-Modern Portfolio Theory all falls on extremely biased investment strategies for optimization.

2.4.6 Mean Absolute Deviation (MAD) Optimization

Konno and Yamazaki (199) promoted Mean Absolute Deviation (MAD) as another alternative and efficient model for omni that presented the potential computational complexity and drawbacks of the Markowitz Quadratic Model (1952) and also its derivatives The Mean Absolute Deviation model centers on the linear programming model and has been shown to be equivalent to Markowitz 's model, but with the tractable characteristics of being comparatively more effective in computational time.

2.5 Factors Responsible for Attaining Portfolio Diversification

Chua, Krizman, & Page (2009) mentioned in their article entitled *"The Myth of Diversification"* that attaining high expected returns requires more risk taking in a way that the investors must tackle the trade-off amid the risk and the expected return. The expected return is represented by the curve which is known as the efficient frontier. The efficient portfolios are well diversified and are depicted by a point on the efficient frontier.

Kuutan (2007) examined the impact of risk measurement on the position size of a portfolio in his thesis entitled "Portfolio optimization using conditional value at risk and conditional drawdown at risk." To optimally assign the portfolio assets, the Conditional Value-At - Risk (CVaR) and Conditional Drawdown-At-Risk (CDaR) risk measures were used. The selected assets were the Goldman Sachs Commodity Indices' annual returns. For the optimization of asset allocation, he used a linear portfolio rebalancing algorithm. By making use of the linear programming method, risk assessments have been carried out. The method for evaluating the effectiveness of the use of risk assessments to assess asset allocation was presented in the ILOG OPL Development Studio IDE. By minimizing risk for both the risk controls, i.e. CDaR and CVaR, multiple portfolio allocations were generated by ensuring that the portfolio return was restricted to a minimum amount. Analysis was carried out after the allocation through means such as Conditional Value-At - Risk drawdown functions, sample portfolio series, effective frontier construction, Conditional Value-At - Risk loss functions and in-depth portfolio allocation graphs for both series, as well as

the risk and return comparative quantification of portfolio asset allocation. It was noted that the Conditional Drawdown-At-Risk risk measure was less accurate than that of the Conditional Value-At - Risk risk measure. It was a product of three variables. The first factor is that with 5 properties, the dataset consisted of only 20 periods per asset, which limited the amount of drawdown data that the algorithm might consider. The second factor is that the dataset contains highly volatile annual data, thus reducing the amount of risk that can be eradicated. The third factor is that, not only the extent of portfolio losses but also their order of placement, Conditional Drawdown-At-Risk is receptive. Conditional Drawdown-At-Risk was revealed to be a more conservative measure of risk relative to Conditional Value-At-Risk. Conditional Drawdown-At-Risk, in comparison, has a higher risk level than Conditional Value-At-Risk. In addition, CDaR was also found to be more cautious in nature as it considers the magnitude as well as the series of losses, but the magnitude of losses is a consideration only for CVaR.

2.6 Methods for Achieving Portfolio Diversification

Portfolio performance can be calculated through different ways. Different investors think differently about measuring the portfolio performance. Some of them consider the rate of return to be the most significant measure of portfolio performance, by giving low consideration to the riskiness of assets or portfolio volatility (Kuutan, 2007). Other investors regard risk adjusted return as a most suitable measure of portfolio performance. There are three methods for attaining portfolio diversification, which include attaining high expected return, minimizing costs and preserving a balance between the risk and the return. These are explained below:

2.6.1 Attaining High Expected Return

Investors with high risk returns should expect large lengths if they are unable to effectively manage their pledge. In their article entitled "Portfolio Optimization Using Mean Absolute Deviation (MAD) and Conditional Value at Risk (CVaR)," Silva, Alem and Carvalho (2017) discussed the effectiveness of optimization when the returns of financial assets are highly unstable, such

as in cases of financial crisis. A replacement for optimization models consisting of the mixture of CVaR and Mean Absolute Deviation (MAD) was also developed by the researchers to reduce the unsuccessful return of the high-risk portfolio. By using the three methodologies, they also tested the predictability of the historical returns of the assets. They examined the success of their prerogative strategies by using the Brazilian stock market in the years 2004 and 2013. Their ownership has shown that conventional models have offered high-yielding portfolios, but they have built their own risk portfolios, which can be deemed attractive in uncertain market categories. Likewise, they showed that models that do not use the equip ratable scenarios produce better risk and return outcomes.

In their article entitled "Dynamic Portfolio Optimization Through Hidden Market Regimes" Nystrup, Madsen and Lindstrom (2017) used the MPC dynamic optimization of a portfolio based on the calculation of the mean and variance of the financial returns of the Hidden Markov with the use of time varying limitations. It was discovered that there are computational advantages of using Model Predictive Control when the valuations of future returns are changed every time a novel observation becomes available, as the optimal activities of control are reevaluated. Model Predictive Control performs a static decision-making rule that changes everything and recognizes both a high return and a substantial low risk as a purchase and investment in main indices of the stock markets is classified. After recovering the transaction costs, it is classified by causing one day delay in the execution of allocation adjustments along with the zero-interest cash as the only replacement for the stock indices. The implementation of a trading penalty results in a decrease in the amount of trades that essentially increases the utility of this instruction.

In this thesis entitled "Mean Variance Portfolio Optimization: Eigen decomposition Based Models" Mayambala (2015) stated that modern portfolio the dairy is about to decide how to distribute capital of available securities such that the expected return is maximized, for a given level of risk, or for a given level of return, the as measured risk is minimized. Variance was used as measure of the risk in Markowitz's in 1952, which gave rise to the well-known portfolio optimization model of mean variance. In the literature, the mean-variance memorandum is the

backbone of modern portfolio theory and it is still commonly applied. The mean-variance memorandum is still the backbone of modern portfolio theory.

Pedersen (2014) in his report entitled *"Portfolio Optimization and Monte Carlo Simulation"* used Monte Carlo simulation of a simple equity growth model. It involved the resampling of the historical financial data for estimating the probability distributions of the earnings, future equity and payouts of some companies which include GDAXI, GSPC, IMOEX.ME, OMX, XCH.TO. The simulated equity was then utilized with the historical P or Book distribution for estimating the probability distributions of the future stock prices. The return distributions were then utilized for generating the optimal portfolios by making use of the Geometric Mean and Mean Variance (i.e; Markowitz) methodology. It was found that variance is an inaccurate measurement of the investment risk as mean variance optimal portfolios have not been found to assist in minimizing risk. This drawback is considered right for return distributions.

2.6.2 Maintaining a Balance between the Risk and the Return

There is a need to maintain a balance between the risk and the return in the portfolio management. The financial risks involved in a portfolio include high volatile movements in the asset's prices, economic imbalance, financial crisis and algorithmic trading (Balbs, 2007). Risk based allocation strategies are used for mitigating these financial risks.

Ban, Karoui and Lim (2016) in their research article entitled *"Machine Learning and Portfolio Optimization"* made use of the two machine learning methods, that is, cross validation and regularization for attaining portfolio optimization. Performance Based Regularization (PBR) was used by them for constraining the sample differences of the expected risk and return of the portfolio. This paves the resolution to the one that is associated with less estimation error in the portfolio performance. Performance Based Regularization was utilized for mean variance as well for mean Conditional Value-at-Risk (CVaR) issues. In case of the mean-variance issue, a "quartic polynomial constraint" was introduced by the Performance Based Regularization for which two

convex estimations were made, firstly, based on rank-1 estimation and secondly based upon convex quadratic estimation. The rank-1 approximation Performance Based Regularization added a biasness to the optimal allocation, whereas, the convex quadratic approximation Performance Based Regularization shrank the sample covariance matrix. In case of the mean Conditional Value-at-Risk problem, the Performance Based Regularization model is a combinatorial optimization issue, but the Quadratically Constrained Quadratic Program (QCQP) which is the convex relation is fundamentally strong. The researchers revealed that Performance Based Regularization models can be casted as robust optimization issues with new uncertainty sets and can set up asymptotic optimality of not only Sample Average Approximation (SAA) as well as Performance Based Regularization resolutions but also of the related efficient frontiers. For calibrating the right-hand sides of the Performance Based Regularization restraints, the researchers developed novel k-fold cross-validation algorithms. It was revealed that Performance Based Regularization had domination over all other benchmarks for 2 out of 3 of the data sets of Fama-French.

Rahnama (2016) mentioned in his thesis entitled *"A Portfolio Optimization Model"* that a diversified portfolio has less risky behavior and also yields less difference in the expected return. A properly diversified pledge tends to minimize the vaporization of the portfolio 's results as the price of the entire assets does not change in similar directions and at the same rate.

Blomgren (2016) in his thesis *"A Mean Variance Portfolio Optimizing Trading Algorithm Using Regime Switching Economic Parameters"* presented a model of algorithmic trading. The purpose of that model was the creation of an optimal investment portfolio comprising of both a risk-free asset and a risky asset. The risky asset was in the shape of a stock created by using the constraints of the regime switch with a Markov chain depicting the economy's situation. Portfolio optimization was carried out on the basis of clear assumptions and fair constraints on the cost of the deal, the risk and the amount traded. The financial risk restriction was implemented by balancing the expected value of the portfolio against the portfolio difference after a given time period through the recognized mean variance condition. By using the quadratic methods of

programming in Matlab, the algorithm was implemented. A sensitivity analysis was carried out with the use of various parameters of the model. In graphs, simulated scenarios and the algorithm 's actions were depicted. The algorithm was found to be logical and, in each case, worked better than a static portfolio.

2.8 The Risk involved in investing Internationally

There is the possibility that the advantage of International diversification may be decreased by the commonness of certain risks, which must be confronted with the worldwide investment.

2.9 Currency Risk

The first risk which the international investor must approach is the exposure to the change of foreign exchange. International monetary system is characterized by a combination of freely floating, managed floating and fixed exchange rates, and most of the times, day-to-day changes at the exchange rate prices.

There is no existing theory which can be identical to forecast the exchange rates movements, but the Purchasing Power Parity (P.P.P) can be a very useful economic theory, which helps to acknowledge the behavior of the currency in one country. Purchasing Power Parity (P.P.P) is calculated by the amount of goods and services that can be purchased with a single unit of a currency. If the exchange rate between two currencies show that the purchased goods in either currency will cost the same, then the P.P.P between those two currencies is violated and the exchange rate must be adjusted until the P.P.P prevails.

In order to understand the co-movement of the stock prices with the domestic currency changes, you need to investigate the behavior of the stocks prices against the inflation rate movement. When inflation rate is zero then the one period yield on the stock is calculated by

$$\boldsymbol{Y = \frac{D_e + S_{t+1}}{S_t}}$$

Where

S_t = the price of the stocks at the beginning of the period.

D_e = the expected dividend to be received at the end of the period.

In this model, inflation rate will cause an increase to the nominal stock prices at the same rate as the general price index, which will affect the real stock prices by being invariant (excepted if the inflation rate causes changes at the expected real earnings or the required rate of returns).

When the inflation rate is p, and is fully predicted, the equation for the nominal price of stock will be:

$$\boldsymbol{Y = \frac{D_e + (1+p)^t}{r}}$$

Where

r = the real rate of returns required by the stockholders.

For instance, if inflation rate is 10% per year, nominal dividends would be expected to be \$5.50 at the end of the first year, \$6.05 at the end of the second year, and so on the opening stock price, S_o would still be \$100, but the price at the beginning of the next year, S_1 , would be (\$5.50/0.05), or \$110, and S_2 would be (\$6.05/0.05), or \$121. as a result, "the real price of the stock would not change since the nominal stock price's increase just match the increases in the general price level",

Therefore, there is a direct relationship between the inflation and stock prices. According to the P.P.P theorem, there is a contrary relationship between the commodity price and the exchange rate. For this reason, the assumption is that there will be a negative correlation between the nominal stock returns and exchange rate changes.

Investors identify the risk of a currency as the probability of it underrated. However, “if the devaluation was certain as to magnitude and timing there would be no risk at all” (Adler & Dummas 1984).

Then, investors would have predicted the future exchange rate and they would hedge against a devaluation by selling forward – for their own currency – the foreign exchange stocks. Returns will consist of foreign security’s returns/ loses plus or minus a previously known forward exchange premium.

Commonly, where there are higher interest rates in the domestic currency, this will lead to a sell at a forward discount against another currency in whose market lower interest rates are prevailing. Then, if Interest Rate Parity remains then the differences in exchange rates between the two currencies should be equal to the forward discount or premium. When this parity exists, foreign and domestic securities with the same risk must offer the same return.

As a result, any additional earning obtained internationally rather than domestically, should arise only because the diversification across a larger population of non-perfectly correlated securities offers higher opportunities for additional reduced risk.

The currency risk is calculated by using the linear regression analysis.

$$\boldsymbol{P_{t+1} = a + b_{t+1} + e_{t+1}}$$

Where

S_{t+1} : the uncertain exchange rate at time t+1

P_{t+1} : the random future value of the foreign asset denominated in he investors currency.

e_{t+1}: random error such that E (e)= 0= COV (e,s)

a: the regressions constant term

The coefficient b measures the sensitivity of the assets to exchange rate change, and the expressed in units of the foreign currency. When we calculate the domestic currency risk, then the coefficient b is a direct measure of the unexpected variations in the inflation rate.

For the optimal hedge ratio, this model may also be used for its calculation. Optimal hedge ration is the proportion of an assets spot value that should be hedge in the forward or future market. Attention must be given in such circumstances, by noticing the eventual multicollinearity that may exists, due to the high intercorrelations that characterize many groups of currencies.

2.10 The impact of currency risk in an internationally diversified portfolio

The investors utility is affected by the currency implications for international investment. That is concluded by reports and indications made by market professionals and various studies, when knowing the distribution of foreign currency rate.

The resulting outcomes of such risk, as measured by the portfolios trade-off, for investors along with presence of the risk and eventual management of it, are questions that arise for the internationally diversified portfolio.

Chapter 3: Research Methodology

The current chapter covers the research approach, data collection processes, data originality and constraints, data reliability and validity, research-related ethical issues, and the philosophical approach.

3.1 Research Approach

Two types of research methods exist, i.e.: the qualitative or deductive method and the method to quantitative or inductive research. The deductive method is regarded as the most important and common method used by researchers to perform their studies (Bell and Bryman, 2007). The inductive approach is regarded by many researchers as the method used in constructing theories via the results of the research carried out compared to the deductive approach (Anderson, 2004). Hackley (2003) emphasized that the inductive approach helps researchers in a community of multiple cases recognize specific factors and continue to identify what needs to be examined in the research. Qualitative research methodology (Deductive approach) has been used in the current research, which is discussed below:

3.1.1 Qualitative Research Methodology

Qualitative study requires an in-depth understanding of human actions and the factors that guide these behaviors. It is descriptive and utilizes methodologies for content analysis on the chosen levels of the content of communication. It is a systematic and comprehensive approach that examines the specifics of critical and complex problems. It gives a detailed explanation of attitudes, behavior, activities and motivation. In qualitative analysis, the reasoning method used consists of putting parts together perceptually in order to construct wholes. The meaning is extracted through this method. As interpretation varies with individuals, there is a potential for definitions to differ (Burns & Grove, 1993). This method has provided comprehensive study of

the current research topic and has helped in demonstrating portfolio diversification, reasons for portfolio diversification, methods used by the investors for achieving international portfolio diversification, constraints associated with portfolio diversification and advantages and limitations associated with international portfolio diversification. The research has also discussed the examples and case studies of the corporations that have achieved portfolio diversification. Keeping in consideration the aforementioned definitions and explanations, it can be concluded that the utilization of qualitative research methodology for this research is justified.

Keeping in view the aforementioned definitions and explanation relevant to the qualitative research methods, it can be concluded that the use of the qualitative methodology for the current research is justified. This methodology has provided in-depth analysis of the research topic.

3.2 Data Gathering Methods

There are two types of data gathering methods that are used in this research, i.e.; primary source and secondary source.

3.2.1 Primary Source

On this study, primary data was collected to examine and justified the theories of previous researchers. Monthly data was collected from GDAXI, GSPC, IMOEX.ME, OMX, XCH.TO. However, due to the fact that this data was not adequate to provide detailed information, thus, the secondary source is needed to attain in-depth information from the historical facts.

The present study comprises mainly of the use of secondary source for data collection. The secondary source used in this research is briefly discussed below:

3.2.2 Secondary Source

Critical examination of the literature in depth helps to obtain authentic information relevant to the research. The secondary data is classified as available and previously collected data that is useful for the investigator (Saunders et al., 2009). There are a number of hidden areas where the researcher cannot get sufficient to receive sufficient direct data. The secondary data will allow the researcher to understand the methods used by other researchers, according to Wrenn (2006), and decide the best method that can allow address the research questions. The secondary source of this analysis is the review of journal articles, books, organizational studies, reliable websites, etc.

3.3 Originality and Limitations of the Data

The originality of the thesis includes using and applying a particular research methodology to some novel field of research that has not been studied before. It involves bringing novel evidences to an old problem. Originality also includes presenting context that is based on the researcher's own research and explained in his/her own words. The current study focused on collecting data related to portfolio diversification, reasons for portfolio diversification, methods used by investors to achieve international portfolio diversification, constraints associated with portfolio diversification, and advantages and disadvantages associated with international portfolio diversification to ensure the originality of the analysis. This research also used data to examine past researchers' findings. Data is limited to the above subjects. Limitations are occurrences or problems that arise in a study and are out of the investigator's control. They affect the degree to which a study can continue. They usually influence the ending outcomes of the research study. The limitation of the existing research is that it used current data which was highly affected by this century pandemic and most of the assets are devaluated. Hence, the findings may be not as reliable as it could be.

3.4 Reliability and Validity of the Data

Reliability of the research involves the degree to which the outcome of the research can be replicated or can be utilized in another study by making use of the similar research methodologies and approaches in a distinct field. Marshall and Rossman (1999) argued that replicating the outcomes of a qualitative study is very hard as the data of the study was gathered at the time, when the study was carried out and so the changes might have resulted due to the alteration in the circumstances. The reliability of the research also depends on how the outcomes of the results are analyzed and interpreted so that meaningful results are derived, and original study is reflected through them. In this research, the results of the study can be replicated and applied to other researches on the portfolio optimization.

According to Bell and Bryman (2007), the validity of a research relies on the integrity of the results that are obtained after a specific research process. It is the capability of finding the cause and effect. It is a verification of the appropriateness of the research design. In this study, the researcher has carefully analyzed the secondary sources for deriving the useful findings and compared those findings with the existing primary sources.

3.5 Ethical Issues Related to the Research

Blumber, Cooper and Schindler (2005) defined ethical issues as the norms, moral principles or the standards of behavior that guide moral selection about the human behavior and relation with the others. The researcher will not publish any information that can harm the reputation of any individual or financial firm. The researcher has properly cited all the sources in order to avoid plagiarism.

3.6 Philosophical Approach

According to Stiles (2003), social research comprises of various philosophies. These include symbolic interactionism, positivism, ethnomethodology, idealism, realism and phenomenology. The Interpretivism philosophy has been used in this research which focuses on explaining the specific contexts and the subjective value of the research study rather than searching for generalizations (Levers, 2013). The Interpretivism technique combines human interest in a sample. Therefore, this type of methodology uses the process of qualitative research to collect essential information related to the research. The relationship between the researcher and the subject relies on this approach. The Interpretivists argue that in order to attain knowledge, there is no single or particular method necessary. They believe in the fact that social constructions such as shared opinions and opinions will achieve fact. In the Interpretivism approach, hypotheses are not considered to be either accurate or incorrect, but the research participants' subjective experiences are given importance.

Chapter 4: Data Analysis and Findings

The current chapter has analyzed the objectives of the portfolio diversification, comparison of the portfolio theories, advantages of portfolio diversification and cases studies of portfolio diversification, and data from Yahoo finance of price indices for the period 03 Aug 2015 until 27 July 2020 in a weekly basis with a sample of 260 observations. This data is presented in detail of each indicator for the six companies from different countries which are GDAXI (Dax Performance, Germany), GSPC (S&P 5050, USA), IMOEX.ME (MOEX, Russian), OMX Stockholm 30 Index (^OMX), iShares China Index ETF (XCH.TO, China) and NASDAQ 100 (^NDX).

4.1 Objectives of this Research

By using the method of Capital Asset Pricing Model (CAPM) which will show the relationship between the systematic risk and expected return for the above-mentioned data will help us to examine the benefits of an investor if he diversifies his portfolio internationally. CAPM method will help to examine VaR, ES, maximized risk adjusted return through Modified Sharpe Ratio and the Efficient Frontier which depicts the highest expected return for a specific level of risk.

4.2 CAPM Method

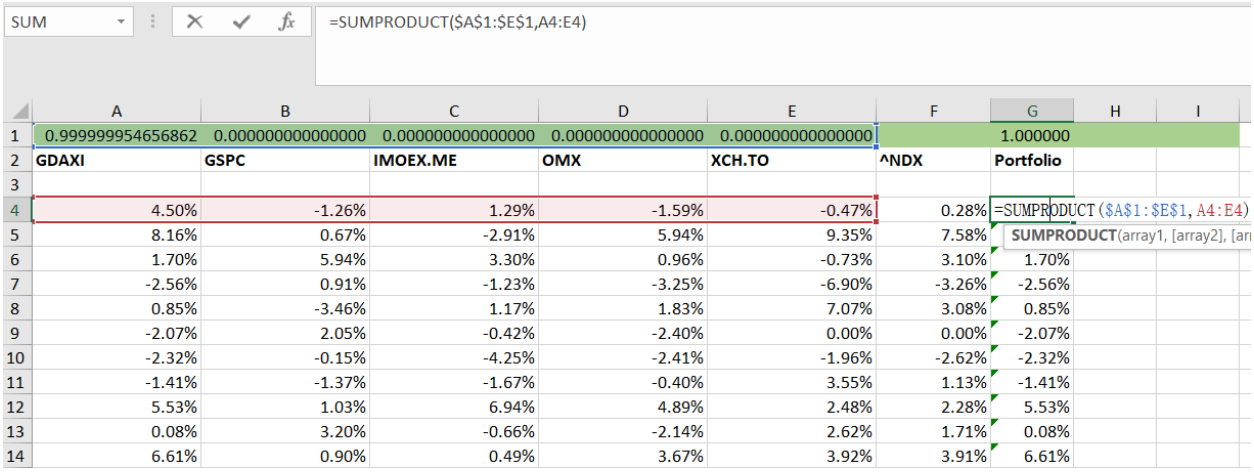
Firstly, we used the LN formula and gathered the returns data for each company.

$$\boldsymbol{LN = \frac{X2}{X1}}$$

Then, having in mind that the sum of weights must always equal to 1

$$\boldsymbol{w_1 + \cdots + w_n = 1}$$

We used our findings to create the portfolio by using the formula of SUMPRODUCT as shown below



	A	B	C	D	E	F	G	H	I
1	0.999999954656862	0.000000000000000	0.000000000000000	0.000000000000000	0.000000000000000		1.000000		
2	GDAXI	GSPC	IMOEX.ME	OMX	XCH.TO	^NDX	Portfolio		
3									
4	4.50%	-1.26%	1.29%	-1.59%	-0.47%	0.28%	=SUMPRODUCT($A$1:$E$1, A4:E4)		
5	8.16%	0.67%	-2.91%	5.94%	9.35%	7.58%			
6	1.70%	5.94%	3.30%	0.96%	-0.73%	3.10%	1.70%		
7	-2.56%	0.91%	-1.23%	-3.25%	-6.90%	-3.26%	-2.56%		
8	0.85%	-3.46%	1.17%	1.83%	7.07%	3.08%	0.85%		
9	-2.07%	2.05%	-0.42%	-2.40%	0.00%	0.00%	-2.07%		
10	-2.32%	-0.15%	-4.25%	-2.41%	-1.96%	-2.62%	-2.32%		
11	-1.41%	-1.37%	-1.67%	-0.40%	3.55%	1.13%	-1.41%		
12	5.53%	1.03%	6.94%	4.89%	2.48%	2.28%	5.53%		
13	0.08%	3.20%	-0.66%	-2.14%	2.62%	1.71%	0.08%		
14	6.61%	0.90%	0.49%	3.67%	3.92%	3.91%	6.61%		

After the creation of portfolio by using the CAPM method and Excel, the formulas of Er(p), Var(p), StDev(p) was easier to be calculated.

Er(p)	0.056980652	**$J$25+$J$20*($J$22-$J$25)**	INDEX	5
Var(p)	0.000936869	**VAR(G4:G263)**		
StDev(p)	0.03060831	**SQRT(J18)**		
β(p)	0.808904155	**COVAR($G$4:$G$263,$F$4:$F$263)/J23**		
Er(m) monthly	0.38%	**AVERAGE(F4:F262)**		
Er(m) yearly	0.046817744	**(1+J21)^12-1**		
Var(m)	0.000795924	**VAR(F4:F262)**		
StDev (m)	0.028212126	**SQRT(J23)**		
Rf	10%			
Sharpe Ratio	6.71%	**(J17-J24)/J19/100**		

Asset	Avg	Var	St.Dev	Covariance	Beta	ER	GDAXI- w1	GSPC - w2	IMOEX.ME - w3	OMX - w4	XCH.TO -w5
MVP	1.709652394	0.00093834	1.701%	0.09%	0.808467597	5.11%	0.169069866159598	0.474295332447	0.356634801393616	0.0000000	0.0000000
Asset 1	0.039512059	0.000289427	2.402%	0.03%	0.23055929	10.00%	0.168269876946	0.473605344	0.358124779	0.0000000	0.0000000
Asset 2	0.039512059	0.00092935	2.501%	0.09%	0.251097462	15.00%	0.215413955	0.461353989	0.323232056	0.0000000	0.0000000
Asset 3	1.709241838	0.00072356	2.860%	0.07%	0.242097563	20.00%	0.200154682	0.575275796	0.2245695	0.0000000	0.0000000
M	0.6293864%	0.000936869	3.061%	0.09%	0.746018133	22.50%	0.999999954657	0.000000000	0.000000000	0.0000000	0.0000000
Formulas	0.1239669%	0.000936869	0.03060831	0.00064383	0.808904155	0.056980652					
GDAXI	0.001239669	0.000936869	0.030608311	0.000643826	0.808904192	0.05698065	1	0	0	0	0
GSPC	0.007166653	0.000586513	0.024218036	0.00011	0.134821938	0.092829865	0	1	0	0	0
IMOEX.ME	0.002091168	0.000597536	0.02444454	0.00031361	0.394019408	0.079045159	0	0	1	0	0
OMX	0.000677061	0.000693792	0.026339925	0.000533629	0.670451818	0.06434386	0	0	0	1	0
XCH.TO	0.001389431	0.000865518	0.029419685	0.000499989	0.628186204	0.066591641	0	0	0	0	1

4.2.1 Standard Deviation

$$St.Deviation = Var^2$$

From the above table, the smaller standard deviation shows that if the distribution is concentrated closed to the mean, then we can predict the final profit of the investment with greater certainty. On the other hand, if the standard deviation is large, it means that we cannot estimate the return on investment with great accuracy, so the risk is higher. For example, GDAXI's Standard Deviation which is 3.06% shows that has high risk and the prediction of the final profit of the investment might not be so accurate.

4.2.2 Covariance

$$\boldsymbol{Cov}\,(\boldsymbol{X},\boldsymbol{Y}) = \frac{\boldsymbol{\Sigma}(\boldsymbol{X_1} - \boldsymbol{X})(\boldsymbol{Y_1} - \boldsymbol{Y})}{\boldsymbol{n}}$$

The covariance takes values in the interval of -1 < X,Y <+1. When the value is equal to +1 shows a perfect positive linear relationship between the two variables. On the contrary, when the value of the covariance is -1 shows that there is a perfect negative linear relationship between the two variables. If the value is equal to 0 depicts that the two variables are unrelated.

According to Markowitz's theory, an investor has to find indicators that negatively correlated, so as to reduce the risk of the portfolio. The closer the covariance tends to -1, the greater the benefits of the differentiation. This means that an investor should diversifying its portfolio using shares from areas which are less related to each other (e.g. choose its portfolio which covariance value is closer to -1). From our data, GSPC has the smallest value of covariance which means the greatest benefits of the differentiation.

4.2.3 Sharpe Ratio

Sharpe Ratio is calculated with the below Formula

$$\boldsymbol{S_X} = \frac{\boldsymbol{E}\,[\boldsymbol{R_X} - \boldsymbol{R_Y}]}{\boldsymbol{\sigma_X}}$$

Sharpe Ratio depicts how much additional return an investor gets by making an adjustment to risk. In general, an investor should choose the portfolio with the higher Sharpe ratio. According to our data, our Sharpe Ratio is relatively high.

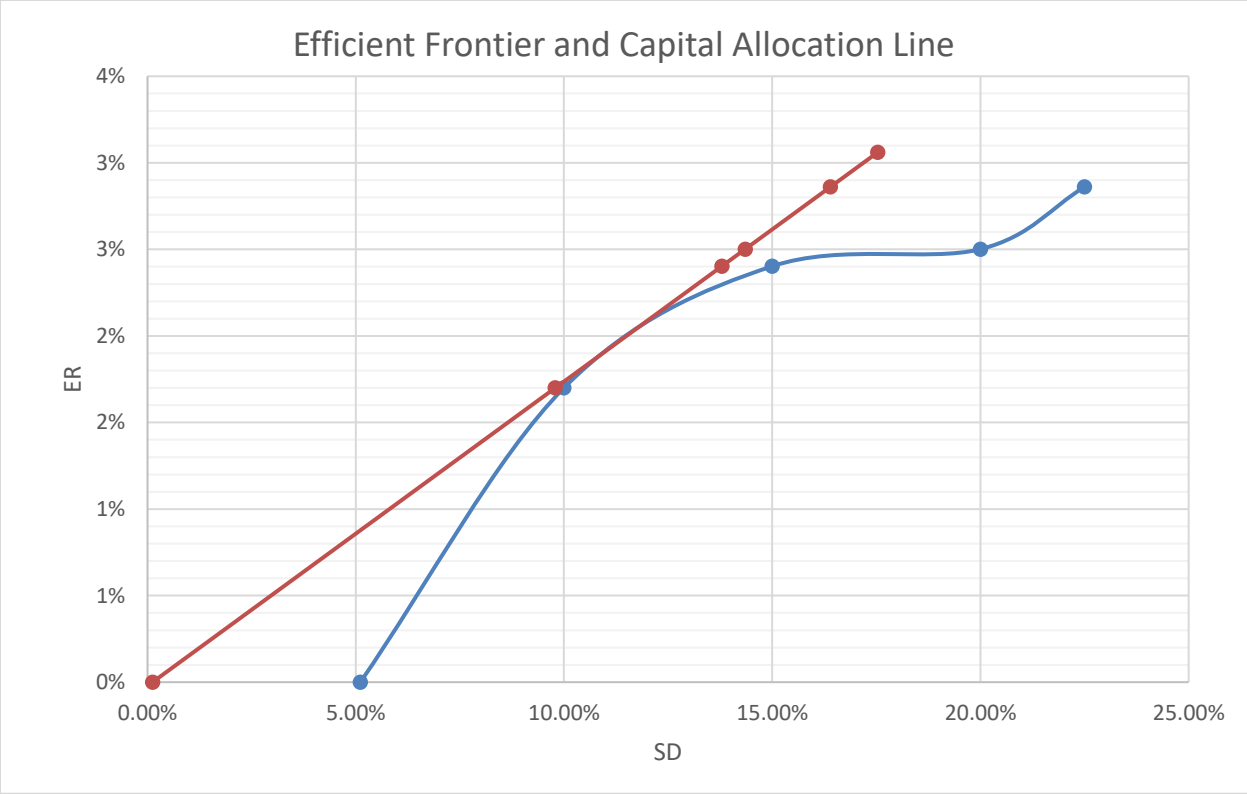
4.2.4 Capital Market Line

Using the above CAPM method, the Capital Market Line (CML) will shows the relationship between risk (St. deviation) and expected performance of the effective portfolio. Line's slope is equal to the difference of the expected return, divided by the difference of their risks, respectively.

4.2 Efficient Frontier

The next step is to identify our efficient frontier, the point on which our market portfolio has its highest value. This point is where the effective portfolio curve (Efficient frontier) touches the straight line (CML).

EFFICIENT FRONTIER AND CAPITAL ALLOCATION CURVES						
		MVP	Asset.1	Asset.2	Asset.3	M
SD	0%	1.700%	2.40%	2.5012%	2.860%	3.0611%
ER		5.11%	10.00%	15.00%	20.00%	22.50%
Sharpe ratio						5.69
rf/CML	0.12%	9.79%	13.79%	14.35%	16.40%	17.54%



According to our data, the optimal point for this portfolio is point (9.79%,2%). At this point, the portfolio offers the highest expected return and the lowest risk for the given level of expected return. Any other portfolio that lies below the efficient frontier, do not provide enough return for the level of risk.

4.4 Different Portfolio Optimization Methods and their Comparison

Methods for mean absolute deviation (MAD) and conditional value at risk (CVaR) can be used to achieve high expected return. Model Predictive Control (MPC) is applied to the dynamic optimization of a portfolio, based on the average and variance of the financial returns of the Hidden Markov model, along with the use of time limits that differ. Model Predictive Control has a static decision rule that changes the distribution and coprepresents a high return and a large risk as compared to a purchase and host investment in various key indices of the stock markets.

Trading penalty success decreases the efficiency of this apprenticeship. The solution of sparse portfolios is useful for the purpose of short-term portfolio optimization. It maximizes the categorical wealth of the total investment by first categorizing wealth in the prerogative of the small properties. The machine learning methods are also precise and eradicate the errors and biasness that are done by the individuals.

4.4 Advantages of Portfolio Diversification

Keeping in view the results from the literature review and the data above; the advantages of portfolio diversification can be

1. Diversification of the portfolio offers the advantage of carrying out a categorical, periodic and objective analysis of the portfolios of the organization.
2. The diversification of the portfolio assists in identifying the suitable benchmarks and developing a process for overcoming the internal biasness.
3. It helps to establish realistic scenarios for diversification and its relation to the metrics of value generation.
4. Portfolio diversification methods diversify the portfolios and eliminate the systematic risk.
5. Post-modern portfolio theory is all about the diversification of extremely distorted investment strategies.
6. The machine learning approaches for portfolio diversification are reliable and reduce human errors.

4.5 Case Studies of Portfolio Diversification

Oloko (2017) investigated the impact of portfolio diversification on UK and US investors who diversified their equity portfolio with the Nigerian stocks. He found that UK and US investors can minimize the impact of financial shocks from UK and US markets on their Nigeria UK (US) equity portfolio by holding approximately 10% (25%) and by taking short position of approximately 9.4% (16%) in the Nigerian stocks. Multinational companies have gained benefits from portfolio diversification such as improved growth, enhanced company's focus, best allocation of resources in different brands of businesses, enhanced alignment of the companies around various business activities, better shareholder's return and improved culture of the companies. According to our portfolio, we can minimize the impact of financial shocks by holding approximately 9.79% (efficient frontier optimal point) and holding most of our financial stocks of USA.

4.6 Overall Findings

The literature review and the data analysis have revealed that portfolio diversification involves maximizing the expected return or minimizing the financial risks or it can comprise of both the functions. Different portfolio theories have their own advantages and disadvantages and are undertaken by keeping in view the market situation/circumstances. Mean Absolute Deviation (MAD) and Conditional Value at Risk (CVaR) methods of portfolio optimization have been considered to yield high expected returns. The machine learning method has also been found to reduce the errors and can lead to better portfolio diversification.

Chapter 5: Conclusions, Recommendations and the Future Scope of the Study

5.1 Conclusion

The portfolio diversification process includes the selection of the optimal combination of portfolio out of a group of portfolios for achieving a particular goal. Diversification of asset collection, weighting of assets and management of assets. The objective of portfolio diversification is to optimize the expected return by minimizing the financial risks or to categorize the objectives. In current research, the main portfolio optimization theories have been briefly discussed, such as Modern Portfolio Theory (MPT), Efficient Frontier, Post-Modern Portfolio Theory (PMPT), Mean Absolute Deviation (MAD) Optimization, Feinstein-Thapa Adjustment, Mansini-Speranza Optimization and Beta Model. The three strategies discussed to achieve portfolio diversification include achieving high expected returns, reducing costs, and maintaining a balance between risk and return. It is easier to generate high returns for companies that select the right methods to keep in mind the market state. Future forecasting is important for the diversification of portfolios to be accomplished.

The above method of portfolio differentiation, according to its disposal investor for risk and return in the sample of 6 countries selected for the portfolios that we compiled in the specific time period, leads to the following conclusions:

- The benefits of international diversification are higher when we structure a diversified portfolio of developed markets (global portfolio), as well as with in this way we achieve the maximum additional return per risk unit (maximum Sharpe-ratio). This was also justified from the results of this research.

- However, in such a portfolio beyond a level of risk it is not particularly profitable to take further risk as well a small increase in yield implies a very large increase in it risk taken.

- At the same time, it is recommended to differentiate in a portfolio which consists exclusively of shares of developed markets since increasing risk yields per unit of risk are quite satisfactory, in contrast to their portfolio emerging capital markets, in which surplus yields increase proportionally less than the level of overall risk.

- Because for the international portfolio, some indicators are positive but have no statistical significance, this fact reinforces the Efficient Market Hypothesis (EMI).This means that product prices fully reflect both effectively any available information resulting in assets management strategies, do not lead to systematic profitability in one fully competitive environment (Elton, Gruber, Brown and Goetzmann,2003).

- Sharpe Ration rating scores gave a ranking for investors, when they are active internationally, suggesting good diversification of their portfolios.

- The systematic beta risk of a total of one worldwide diversified portfolio, formed by a conservative investor but also someone who accepts to take a middle level risk, is less than the global index, implying that These managers pursue a defense investment policy, in contrast with the venture capitalist who carries out an aggressive policy.

5.2 Recommendations

Keeping in view the facts that are observed through the literature review and from data analysis. Following recommendations have been advised:

1. The optimization of a portfolio using Mean Absolute Deviation (MAD) and Conditional value - at - risk (CVaR) is useful for generating low risks that can be seen as attractive in volatile markets.
2. In order to obtain a higher return for the portfolios, investors need to take more risk between the expected return and the risk that requires trade-off.

3. Models that do not use the equally likely scenarios have been found to show better risk and return outcomes.

4. The study has shown that the computational advantages of using Model Predictive Control have occurred when the estimates of future returns are updated each time a new observation becomes accessible.

5. It was discovered that variance is an imprecise indicator of the risk of investment as the mean variance was not found to assist in reducing risk.

6. Empirical evidence by the researchers have revealed that the cost of no short selling constraints enhances with the increase in the assets.

7. Through the machine learning techniques, the portfolio diversification can be used as they are accurate and eliminate the errors and biases made by the individuals.

8. A properly diversified portfolio helps to minimize the volatility of the portfolio 's results, as the overall asset price does not change in the same direction and at the same rate.

9. Beta should be dynamically modified by portfolio managers, i.e. to increase exposure when the market trend is projected to increase and to lower it when the market trend is expected to fall.

10. In order to achieve better results for portfolio diversification, the differential portfolio needs to be focused. The differential portfolio contains the set of securities given by the benchmark portfolio when applied to the investment portfolio.

11. Regulations and taxes should be well managed by corporations for taking away the hurdles in international portfolio diversification.

5.3 Limitations of the Study

The limitations of the current study are that it lacks primary source, that is, direct source of observation for collecting information related to portfolio diversification from the multinational corporations. The data in this research is limited to topics such as portfolio diversification; portfolio theories, methods used by the investors for achieving portfolio diversification, factors responsible for attaining the portfolio diversification; advantages and risks that are associated with portfolio diversification; and ways for attaining portfolio diversification.

5.4 Future Scope of the Study

The results of the present study can be useful to the future researchers as they can consider this research as a base research on portfolio diversification for further conducting research on this study. The current research can be useful to the teachers and students as they can grasp significant concepts relevant to portfolio diversification through this research study.

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