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Executive Summary

The main purpose of this study is to compare an active and passive portfolio management strategy which involves studying the client's risk profile and macroeconomic environment for the purpose of asset allocation decisions.

Various asset valuation methods such as CAPM, GGM, P/E ratio as well as technical analysis are used to make decisions regarding equity portfolio management for the active portfolio. Bond maturity, credit rating, duration, convexity, and bond laddering approaches are used for the bond portfolio. The portfolio is evaluated using various risk-adjusted performance measures such as Sharpe ratio, Treynor ratio, Information Ratio and Jensen's Alpha along with a variety of other measures.

The main findings include the outperformance of the active portfolio against the benchmark (Dow Jones Industrial Average), thus proving the success of active management, after considering certain drawbacks such as transaction costs and management fees.

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PASSIVE PORTFOLIO

Introduction

This section involves demonstration of Passive Portfolio Management for Client X who invests £1,000,000 for a period of 5 years starting in Feb'2015.

Investment Philosophy

As a Portfolio Manager for Client X, my investment philosophy is based on Value investing and passive trading using a buy-and-hold approach.

Rationale for adopting the Philosophy

A buy-and-hold strategy works best when the overall market is expected to perform well. (Ling, Yat, & Muhamad, 2014). Value-based investing provides superior returns due to the higher risks associated, cognitive biases present in investors and lower costs such as trading and agency costs. (Chan & Lakonishok, 2004).

Asset Allocation

The portfolio constitutes of 30 moderate-to-low P/E UK stocks invested passively for 5 years, in-line with the philosophy, macro-economic analysis and investor profile (Appendix). A portfolio of value stocks outperforms the benchmark as the time-horizon of investment increases beyond 1 year. (Rousseau & Rensburg, 2004). As per the Fama-French model, Low P/E ratio stock tend to outperform high P/E stocks. According to Statman (1987), well-diversified portfolio must consist of a minimum of 30 stocks.

Benchmark Selection

Since all the constituent stocks are from UK, the most appropriate benchmark is the FTSE 100 index.

Results

Over the 5-year horizon, the portfolio value reached £1,531,725 and achieved an annualized pretax return of 8.90%, which is higher than the benchmark returns of 1.50%, thus achieving the client's return objective of beating the benchmark.

ACTIVE PORTFOLIO

Introduction

This section involves demonstration of Active Portfolio Management as Client X reinvests the capital along with the returns from Passive Portfolio (£ 1,531,725) for a period of 10-weeks starting 17 Feb'2020.

Portfolio Construction and Management

Portfolio Asset Allocation

Top-down approach is used for construction of the portfolio has better applicability in relation to bottom-up approach. (Alketbi & Gardiner, 2014). Macro-economic analysis is performed on the US Market since majority of the stocks and bonds in the portfolio are from the US.

Tactical Asset Allocation (TAA) strategy was used for the purpose of active management of equity portfolio. In case of TAA, the performance of the portfolio manager is measured against a benchmark with the goal of maximizing relative return and minimizing relative risk. (Lee W. , 2000). The success of TAA highly depends on the market timing skills and the level of innovation of the asset manager. (Weigel, 1991). US business cycle is partly predictable, which aids the process of TAA since the behavior of the stocks in the portfolio can be better predicted. (Dahlquist & Harvey, 2001).

The bond portfolio is more of a **Buy-and Hold** Portfolio, which involves buying the bond and holding it to maturity. (Fabozzi & Wickard, 1997). Since our investor's overall horizon is long-term (7-10 years), it is more appropriate to hold a portfolio of bonds at least for a period of 5years.

Rebalancing Strategy

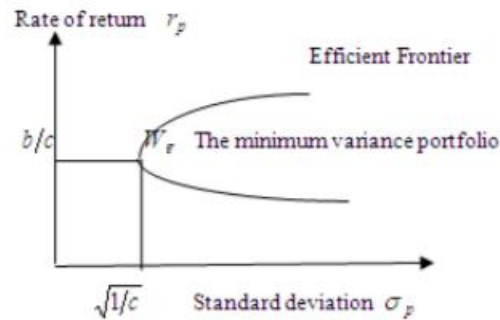
The portfolio is **Equally Weighted** across stocks and bonds and is rebalanced as and when the weights shift due to change in the market prices. An equally weighted portfolio outperforms a market-cap weighted portfolio as explained using the Carhart 4-factor model. (Urbán & Ormos, 2012).

Diversification

According to Markowitz (1952), a portfolio is efficient if it maximises return while minimising variance. He also states that diversification involves refraining from investing in stocks with high covarinace.

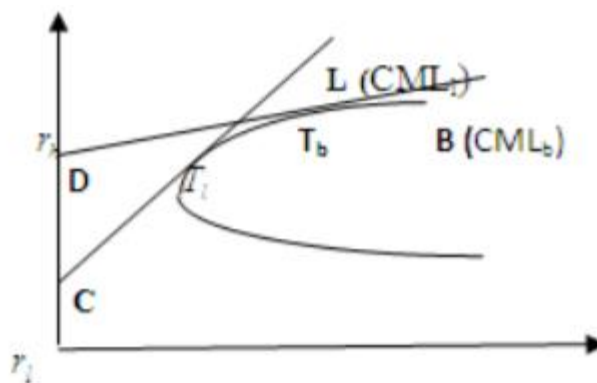
Correlation Matrix is a table showing correlation coefficient between multiple variables. Negative correlation within countries, asset classes and sectors would aid in the process of achieving a diversified portfolio.

Markowitz Efficient Frontier helps in determining the most efficient portfolio that maximizes return and minimizes risk.



(Lee & Su, 2014).

Capital Market Line is used to determine the most efficient set of portfolios with both risk-free and risky assets. It is used to determine the optimal weight for the efficient portfolio of risky and risk-free asset.



(Lee & Su, 2014).

- **Asset Class Diversification**

A well-diversified portfolio helps minimize negative impact of a single asset class from affecting the overall portfolio performance. (Cardona, 1998). There is low correlation between stocks and bonds, and thus, the overall portfolio may face lesser downward pressure when the any one asset class underperforms. (Baker & Filbeck, 2013).

- **International Diversification**

Application of cross-country diversification is more beneficial when spread across a combined portfolio of stocks and bonds. (Levy & Lerman, 1988). Industrial diversification works better as it is rather useful to invest in the same industry but in different international markets for the purpose of achieving maximum benefit from diversification. (Heston & Rouwenhorst, 1994).

Diversification involves reducing or eliminating the unsystematic or diversifiable risk of the portfolio. However, systematic risk can be reduced up to a certain level by diversifying globally as certain systematic factors of one country may be uncorrelated with other countries. (Reilly & Brown, 2012).

International diversification of US-bond portfolio into non-US bonds would provide benefits of increased returns and reduced risk. (Fabozzi, Bond Portfolio Management, 2001).

- **Exchange Rate Risk**

Fluctuations in the currency market may cause a reduction in the returns earned by investors and is an important consideration when making decisions about investment. Kaplanis & Schaefer (1991) conclude that the benefits of international diversification may erode when we take exchange risk into account. However, currency hedging may substantially reduce the currency risk. Active currency hedging using certain trading signals will improve the returns. (Levich & Thomas, 1993).

Equity Portfolio Management

Capital Asset Pricing Model (CAPM)

CAPM helps determine the return on an asset based on how it moves in relation to market (Beta). (Pilbeam, 2018).

CAPM helps active portfolio managers to determine how they expect to add value to their client's portfolio. (Grinold & Kahn, 2000). CAPM can be used as a valuation tool to determine the return based on fair or correct price of the security.

The CAPM is given by:

$$ER_i = R_f + \beta_i(ER_m - R_f)$$

where:

ER_i = expected return of investment

R_f = risk-free rate

β_i = beta of the investment

$(ER_m - R_f)$ = market risk premium

(Reilly & Brown, 2012)

Security Market Line determines the trade-off between risk and return of efficiently priced securities. (Bradfield, 2007). Undervalued securities lie above the SML, since the security has earned higher return than the one predicted by the CAPM model and vice-versa. (Khatri, 2010).

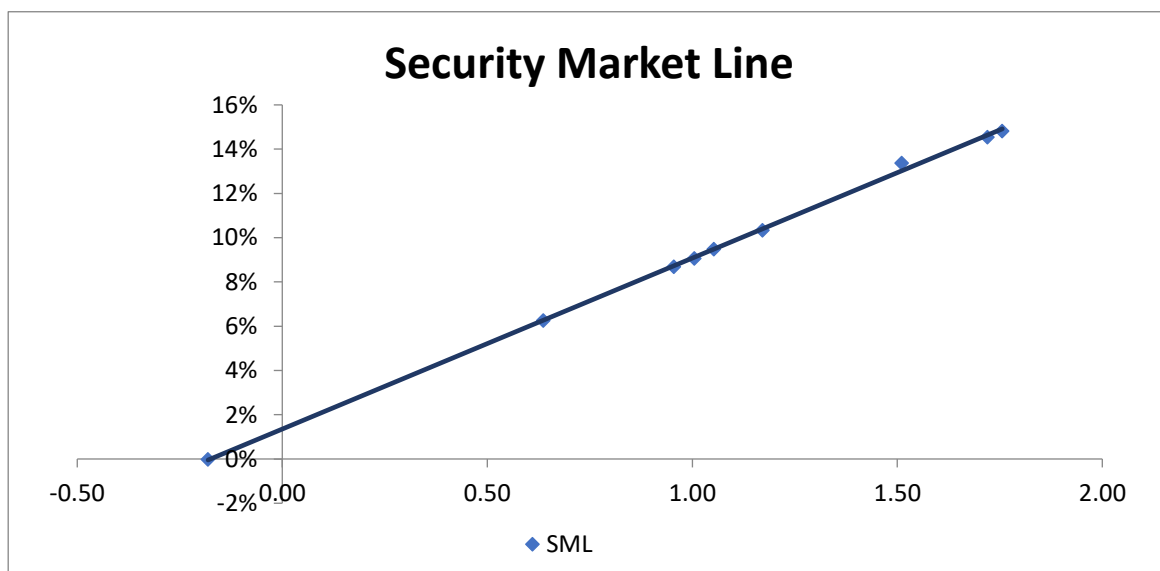


Figure 1: SML for some US stocks in the portfolio

Based on the above SML, the actual return of securities will be plotted, and buy/sell decisions would be made for the active portfolio.

Gordon Growth Model (GGM)

The Gordon Growth model is a discounting model which determines the fair price of a security based on dividends, long-term growth rate of dividends and required rate of return.

According to Mugoša & Popović (2017), the GGM model has proven to be useful for valuation of stock prices, even during periods of financial crisis. The GGM model helps assess the impact of interest rates and inflation on the stock returns.

The GGM is given by:

$$V_j = P_j = \frac{D_1}{k - g}$$

where:

P_j = the price of stock j

D_1 = dividend in Period 1, which is equal to $D_0(1 + g)$

k = the required rate of return for stock j

g = the constant growth rate of dividends

(Reilly & Brown, 2012)

Price-Multiple Approach

The portfolio selects undervalued and overvalued stocks by comparing them with the industry Price to earnings ratio. The variation in P/E is explained by the industry and thus, using P/E comparison as a valuation technique creates value for the portfolio. (Alford, 1992).

A P/E multiple approach for the purpose of valuation yields more accurate results as compared to other multiples such as P/B ratio. The effectiveness of P/E multiple approach depends on the selection of the list of comparable firms. (Cheng & McNamara, 2000).

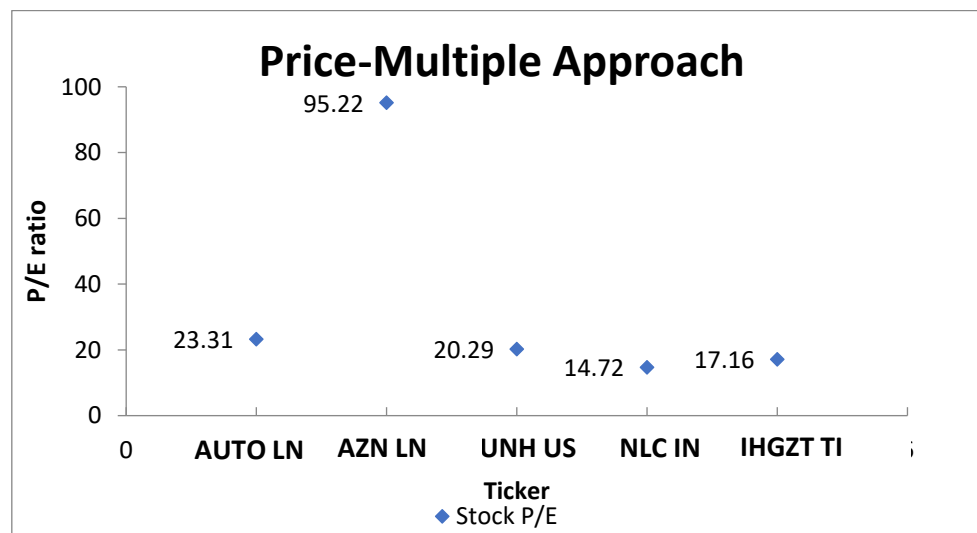


Figure 2: P/E multiple approach

The above figure shows the P/E ratios of a set of companies in the portfolio. The Relative valuation approach using industry P/E multiple is applied for the purpose of identifying undervalued and overvalued stocks.

Efficient Market Hypothesis

Jones & Wermers (2011) state that markets are inefficient and go on to say that active managers will always earn relatively higher returns with minimum addition to portfolio risk, however the associated costs must be considered. Certain trading rules can be applied that outperform the Dow Jones Industrial Average (US Index) and thus, rejects the EMH. (Cervelló-Royo, Guijarro, & Michniuk, 2015). The UK stock market (based on FTSE 30 index) is weak-form inefficient and does not follow a random walk. (Al-Loughani & Chappell, 1997). Mehla & Goyal (2012) conclude that Indian stock markets are inefficient and thus, investors can earn excess returns using superior market timing and stock-selection technique.

Since, no market is fully efficient, technical analysis tools can be used to make purchase and sell decisions. Momentum strategy involves buying past winners (good performers) and selling past losers. If any security performs well in the past 12 months, the same trend is expected to continue for the next 12 months period. (Jegadeesh & Titman, 2011)

Thus, technical analysis can be used to outperform the market in inefficient markets.

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Bond Portfolio Management

Bond Credit Rating

Investment grade (IG) bonds (S&P rating AAA – BBB) outperform the High-Yield (HY)/Non-investment grade bonds on a risk-adjusted basis. (Dietze & Entrop, 2009). IG bonds have higher liquidity than HY bonds, since they are issued in relatively large quantity. IG bonds are thus, subject to lower risk of default. (CFA Institute, 2018). Bonds issued by issuers who are socially active and conduct CSR activities are assigned higher credit ratings. (Ge & Liu, 2015). HY bonds tend to have high levels of speculative risk and thus riskier. (Altman & Nammacher, 1987).

Exhibit 17.3 Description of Bond Ratings				
	Fitch	Moody's	Standard & Poor's	Definition
High grade	AAA	Aaa	AAA	The highest rating assigned to a debt instrument, indicating an extremely strong capacity to pay principal and interest. Bonds in this category are often referred to as <i>gilt-edge securities</i> .
	AA	Aa	AA	High-quality bonds by all standards with a strong capacity to pay principal and interest. These bonds are rated lower primarily because the margins of protection are not as strong as those for Aaa and AAA bonds.
Medium grade	A	A	A	These bonds possess many favorable investment attributes, but elements may suggest a susceptibility to impairment given adverse economic changes.
	BBB	Baa	BBB	Bonds that are regarded as having adequate capacity to pay principal and interest, but they do not have certain protective elements, in the event of adverse economic conditions that could lead to a weakened capacity for payment.
Speculative	BB	Ba	BB	These bonds are considered to have only moderate protection of principal and interest payments during both good and bad times.
	B	B	B	Bonds that generally lack characteristics of other desirable investments. Assurance of interest and principal payments over any long period of time may be small.
Default	CCC	Caa	CCC	Poor-quality issues that may be in default or in danger of default.
	CC	Ca	CC	Highly speculative issues that are often in default or possess other marked shortcomings.
	C			The lowest-rated class of bonds. These issues can be regarded as extremely poor in investment quality.
		C	C	Rating given to income bonds on which no interest is being paid.
	DDD, DD, D		D	Issues in default with principal or interest payments in arrears. Such bonds are extremely speculative and should be valued only on the basis of their value in liquidation or reorganization.

Sources: *Bond Guide* (New York: Standard & Poor's, monthly); *Bond Record* (New York: Moody's Investors Services, Inc., monthly); and *Rating Register* (New York: Fitch Investors Service, Inc., monthly).

Figure 3: List of Credit ratings

The portfolio invests in bonds with higher credit rating (between AAA to A+) to reap the benefits of high-quality bonds.

Interest Rate Sensitivity (Duration)

Active managers who invest in investment grade bonds tend to focus more on interest rate sensitivity of their portfolio bonds to control the duration and yield curve exposure of their bonds. (CFA Institute, 2018). The duration of a portfolio of bonds is calculated as:

$$D_W = \sum_{i=1}^n w_i D_i$$

(Veronesi, 2010)

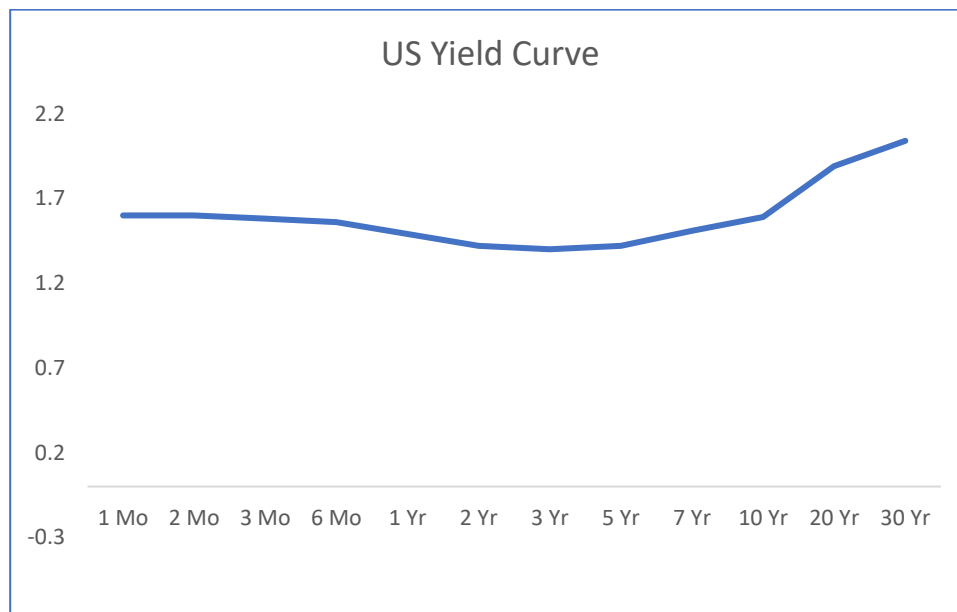


Figure 4: US Yield Curve as on 16.02.2020

Source: (U.S. Department of the Treasury, 2020)

The US yield curve is flat, which indicates a narrow spread between the short and long-term rates. This may point towards the fact that bond investors expect a slowdown in the economy and stagnant growth.

The duration of the bond portfolio needs to be adjusted to reduce interest rate risk. One approach for doing this is to adopt the bond laddering strategy for reducing interest rate sensitivity.

Bond Laddering

Bond laddering is an approach to reduce interest rate risk by spreading investment across bonds with different maturities. Longer maturity bonds tend to have higher risk and vice-versa. A combination of the maturities would protect the portfolio against major declines in bond markets. (Appel & Appel, 2008). The return of principal at frequent intervals provides investment flexibility. (Chovancova & Gvozdjak, 2016). Bond laddering approach increases convexity as the cash flows are spread across different maturities. (Smith, 2014).

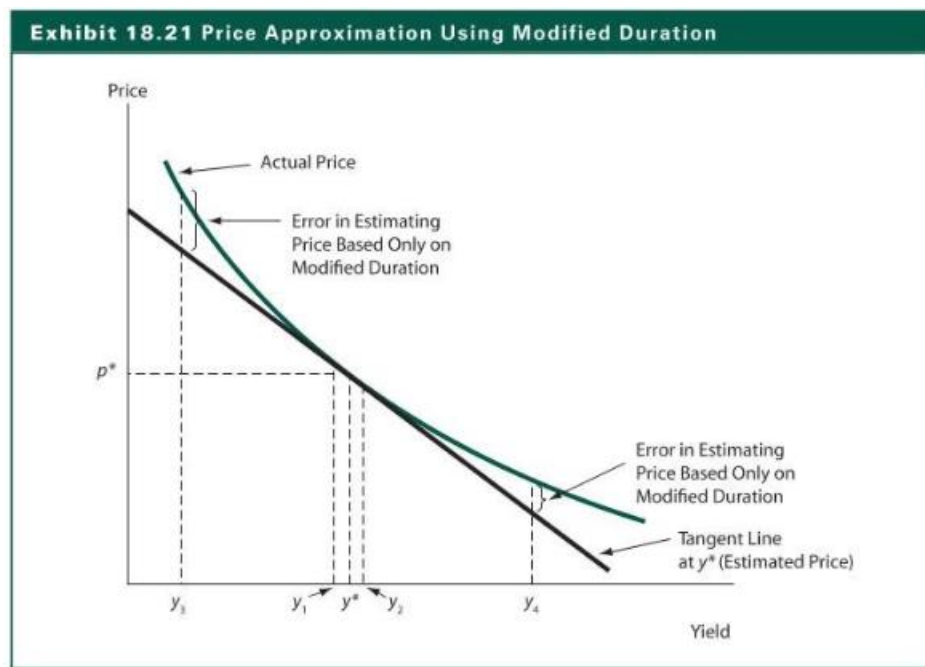
Convexity

Convexity is the curvature in the non-linear relationship between interest rates and bond prices.

$$\text{Convexity} = C = \frac{1}{P} \frac{d^2 P}{dr^2}$$

(Veronesi, 2010)

Convexity helps in better performance of the process of interest rate risk management as it can be used for the purpose of hedging a high duration portfolio. (Veronesi, 2010). Higher convexity is a desirable trait as increase in interest rate would lead to less decline in bond price and if yields fall, the bond price increases by a higher rate. (Reilly & Brown, 2012).



Source: Frank J. Fabozzi, Gerald Buetow, and Robert R. Johnson, "Measuring Interest Rate Risk," in *Handbook of Fixed-Income Securities*, 7th ed. (New York: McGraw-Hill, 2005). Reproduced with permission from The McGraw-Hill Companies.

The above figure shows the error in estimating price based on modified duration. That error is the rectified using convexity.

There exists an inverse relationship between coupon rates and convexity, and thus, lower coupon rates lead to higher convexity. Secondly, higher maturity bonds have higher convexity. (Reilly & Brown, 2012).

Thus, higher convexity has a positive impact on the portfolio. Since our portfolio is based on bond laddering strategy, has longer maturity bonds and low coupon bonds, which leads to an increased convexity, the portfolio is likely to perform better.

Performance Evaluation

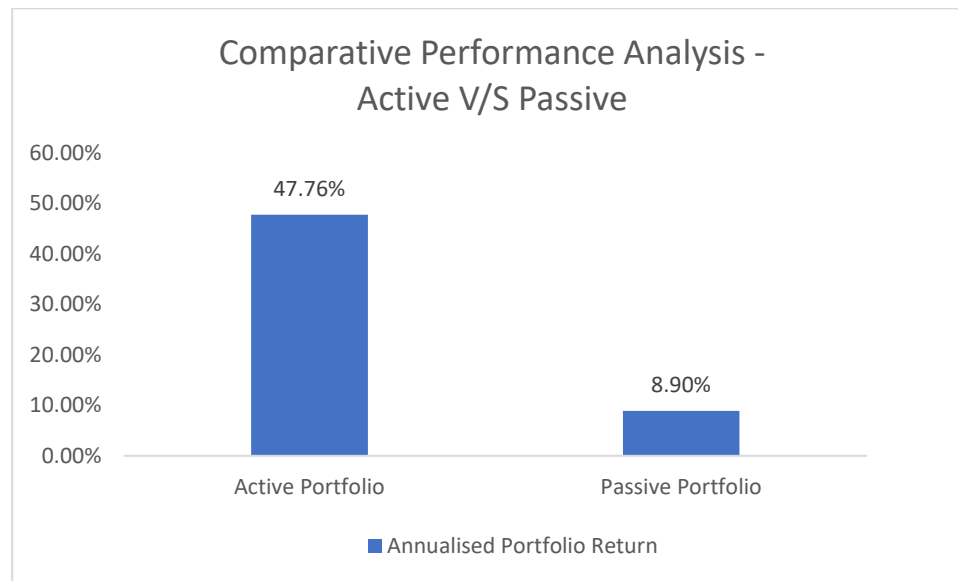


Figure 5: Comparative Portfolio Analysis

The annualized return for the active portfolio is 47.76% as compared to the return on passive portfolio of 8.90%, pre-tax. In theory, the active management strategy outperforms the passive strategy and thus, should be an attractive investment for investors.

However, one of the major drawbacks of active strategy is the high levels of transaction costs associated with rebalancing and active buying and selling, which may erode the profits earned from the active strategy. (Jensen, 1968). However, it is of prime importance to determine if the benefits of international diversification outweigh the transaction costs associated with international diversification. (Rowland, 1999). Apart from the monetary costs of active investing, there is another cost of reduced diversification as the active portfolio might not be as diversified as market portfolio. (French, 2008).

On the other hand, there might be numerous benefits to active investing. Active portfolio managers exploit market inefficiencies and trade based on information, in-depth analysis and judgements. Regarding the argument about costs, transaction costs are a relatively lower number if the active manager has the required skills to outperform the market. Nowadays, active managers fees are charged as incremental fees on incremental returns after the base fee. (Ellis, 2015). Active investment strategy performs exceedingly well in the U.S. small and mid-capitalization stocks. (Sharpe, 1991).

In our case, the portfolio return on active portfolio is significantly higher than passive portfolio return. Even after accounting for transaction costs, the active portfolio might still outperform the passive portfolio. Thus, we can conclude that active portfolio management may be an attractive investment strategy depending on the skills of the active portfolio manager.

Value at Risk (VaR)

An internationally diversified portfolio of stocks and bonds may be exposed to a variety of risk factors such as equity risk (financial risk involved in holding an equity investment), interest rate risk (risk of rise or fall in future interest rates), yield-curve risk (risk due to change in the shape of the yield curve), and foreign exchange risk (risk due to fluctuations in the currency market). (Bychuk & Haughey, 2011).

VaR gives a single aggregate number to quantify the risks faced by the investment portfolio and thus, is an important measure for determining risk of the portfolio.

VaR has become a useful measure for estimating and managing risk of the portfolio. (Jorian, 1997). Traditional risk measures do not quantify the diversification within the portfolio. VaR can solve this issue as it considers the risk of the entire portfolio. VaR is used as an important statistical tool for the purpose of managing risk in the portfolio. (Best, 1998).

One of the most important features of VaR is that it is “forward-looking” because it provides a measure of the portfolio risk over the next measurement period. Thus, the VaR helps in decomposing the total risk into various components such as risk measures to allocate assets, setting limits and monitoring those limits. In other words, it is called risk budgeting. (Pearson, 2002).

Calculating VaR using historical simulation involves generating risk factor scenarios using historical data and prices to estimate future profits and losses. (Pearson, 2002). Historical simulation is best suited for calculating shorter period VaR such as daily or weekly since large number of data points are required when using historical simulation and their availability might be an issue. Historical simulation does not require any assumptions regarding the distribution of returns. (Pearson, 2002).

Monte-Carlo simulation heavily relies on probability theory for the purpose of simulation. It involves repetitive trials of values of uncertain inputs and it is based on a known set of probability distribution, whereby the distribution of the output would be the same as the input. (Reilly & Brown, 2012). Monte-Carlo simulation works best where the portfolio constitutes options. (Pearson, 2002).

As a result of this, VaR estimates using different methods may yield slightly different results depending upon inputs including assumptions, parameters and methodology. (Johansson, Seiler, & Tjarnberg, 1999).

For historical simulation the entire historical performance of returns is arranged in ascending order and then, depending on the confidence interval chosen (e.g. 95%), the lowest 5% returns are taken and the highest value among them is the VaR using historical simulation.

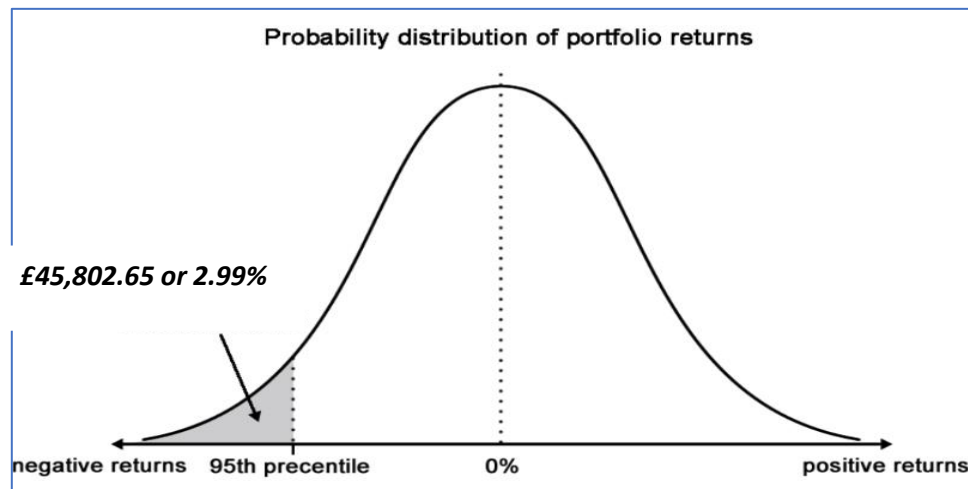


Figure 6: Historical Simulation given VaR at 95%

For Monte-Carlo simulation, the following formula is used to calculate the VaR. Various excel functions such as Normsinv(), rand() etc were used to perform this calculation.

$$S_{t+\Delta t} = S_t e^{(k\Delta t + \sigma \varepsilon_t \sqrt{\Delta t})}$$

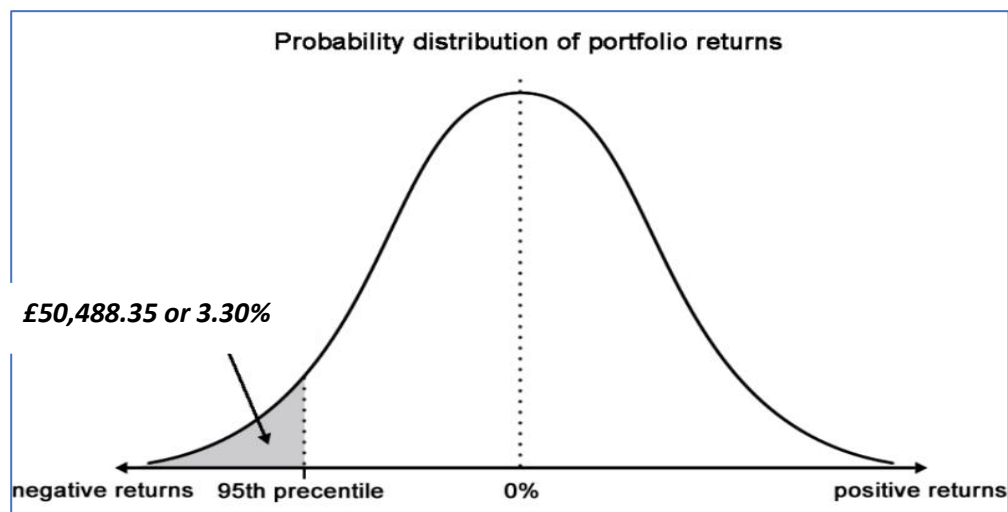


Figure 7: Monte-Carlo Simulation given VaR at 95%

Particulars	90% C.I	95% C.I	99% C.I
HS given Portfolio VaR (£)	-£ 26,347.36	-£ 45,802.65	-£ 63,369.05
MCS given Portfolio VaR (£)	-£ 35,683.22	-£ 50,488.35	-£ 77,466.45
HS given Portfolio VaR (%)	-1.72%	-2.99%	-4.14%
MCS given Portfolio VaR (%)	-2.33%	-3.30%	-5.06%

Table 1: Portfolio Value at risk

The weekly VaR for the portfolio using Historical Simulation method at 95% confidence level is £45,802.65 and using the Monte-Carlo simulation is £50,488.35. This indicates that there is a 5% chance that the portfolio value will fall by more than these values over any given week. In other words, we can say with 95% confidence that the decline in portfolio value will be lesser than 2.99% (using Historical Simulation) or 3.30% (using Monte-Carlo Simulation). Similarly, for the 90% and 99% Confidence levels, the VaR values indicate 10% and 1% chances of a greater fall in value respectively.

Hedging using Options

Hedging involves purchasing an offsetting position to protect against loss on an investment. A hedge needs to be managed in order to ensure enhanced return while reducing the exposure to the risk. (Bychuk & Haughey, 2011). Hedges are strategies that protect the portfolio from adverse movements, and thus, hedging is an important tool for the purpose of understanding risk management. (Peterson, 2012). Various derivative instruments such as options and futures can be used for the purpose of hedging to reduce the risk of a portfolio of stocks. (Reilly & Brown, 2012).

Option contracts gives the holder the right but not the obligation to buy or sell a security at a fixed date and fixed price. (Reilly & Brown, 2012).

Hedging using options involves use of various option strategies for the purpose of reducing or eliminating the exposure to risk from any security. If there is a stock in your portfolio that has a level of uncertainty attached regarding its future price movements, hedging using options such as call option, put option, straddle strategy, strangle strategy, naked call and naked put etc., can be used to reduce the exposure to the risk of that stock. Portfolio managers generally like to hedge their downside risk. (Peterson, 2012).

Straddle Purchase

A straddle purchase strategy is used for the purpose of hedging the portfolio when there is uncertainty regarding future movement of the stock. It involves simultaneous purchase of call and put option with the same strike price and expiration date. If the stock price moves by a level greater than the total amount of premium paid for purchasing the two options in either direction, the strategy is a success. (Chen & Leung, 2003).

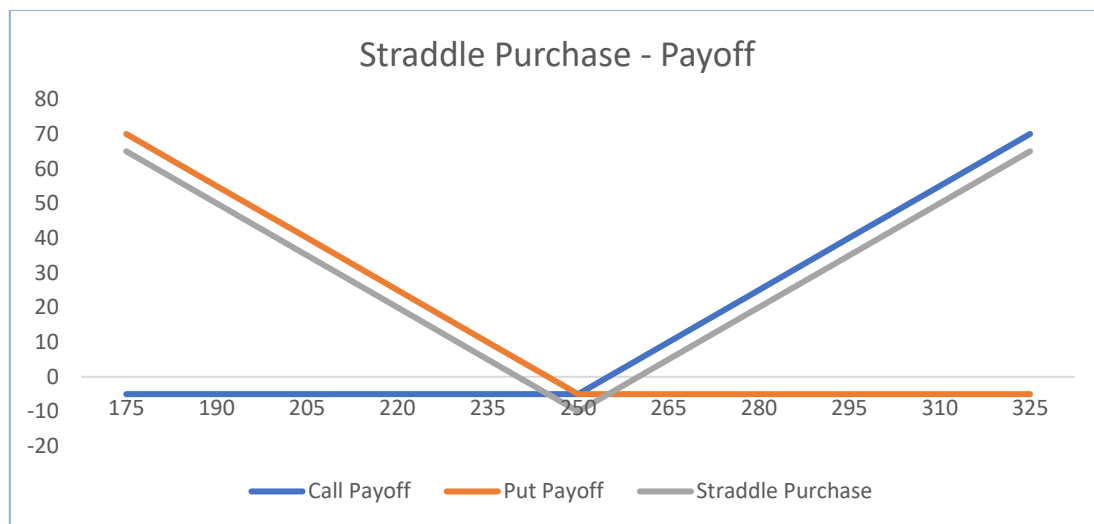


Figure 8: Straddle Purchase

Based on the assumption of call and put premium, the maximum loss that the option holder (straddle purchase) can incur is the sum of its premiums ($5+5 = \$10$), if the stock price does not make a significant move from the strike price. The maximum gain is unlimited in either direction after reducing the sum of both option premiums. E.g. if the stock price moves to \$500, the profit would be $(500-250-10 = \$240)$. The breakeven point would be \$240 and \$260. Any price beyond these values would yield successful results for the straddle purchase strategy.

Straddle Write

A straddle write strategy involves selling a call and put simultaneously with the same exercise price and expiration date. If the stock price is not expected to make any significant movement away from its strike price in either direction, the straddle write strategy is a success. (Chen & Leung, 2003).

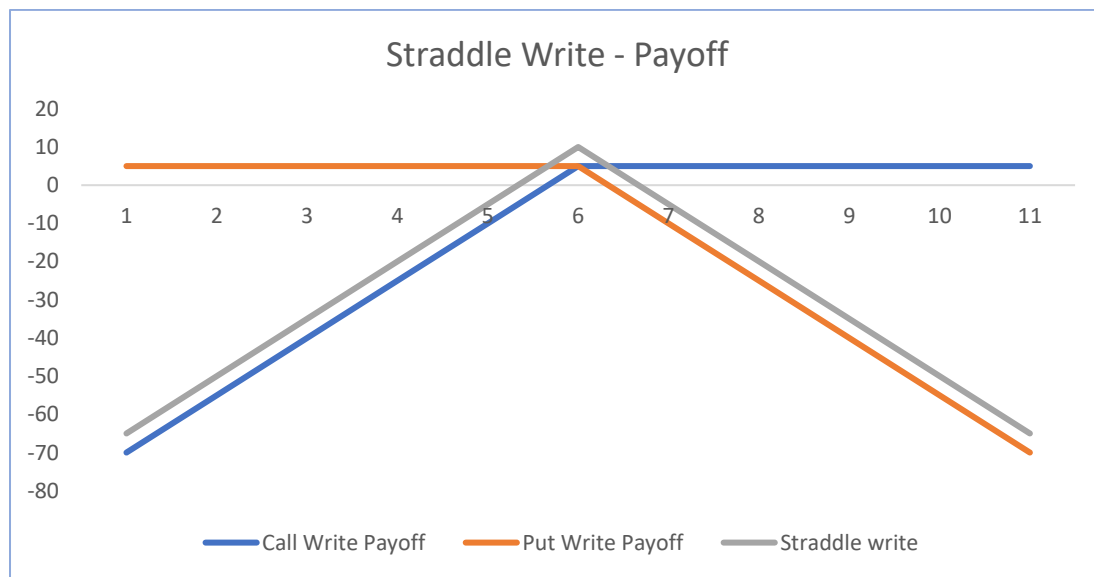


Figure 9: Straddle Write

In case of a straddle write, the maximum loss that the writer can incur is unlimited. E.g. if the stock price moves to \$500, then the option writer would lose $(500-250-10 = \$240)$. The maximum gain that the writer can earn is the premium charged on both the options ($5+5 = \$10$) if the stock price does not move significantly from the strike price. The breakeven point is similar to the straddle purchase whereby if the price stays between \$240 and \$260, the straddle write strategy is a success.

Investor Profiling

INVESTOR PROFILING - Passive Portfolio (as on 17.02.2015)	
Financial Goal	“I am willing to invest my excess savings and hold them for a 5-year period in equity with no emergency cash requirement.”
Investment Objectives:	
Risk Tolerance	<p>Willingness to take risk: The client has average willingness to take risk Ability to take risk: The client has substantial wealth and wants to invest excess money, thus has an ability to take on risk</p> <p>Overall, AVERAGE risk tolerance</p> <p><i>The risk aversion coefficient (θ) for the client is 3, which means the investor is a risk-taking investor.</i></p>
Return Objective	The client has a relative return goal of 5% above the benchmark return.
Investment Constraints:	
Liquidity Requirement	Liquidity requirement is none beyond a 6-month cash reserve.
Time Horizon	The investor has a long-term single-stage horizon of 5 years
Tax Concerns	The investor is in the 25% marginal tax bracket
Legal and Regulatory Factors	None
Unique Circumstances	The client requires only investment in stocks with companies domiciled in the UK.

Macro-economic Environment Analysis

Since the portfolio only consists of stocks from the UK as per the client requirement, a macroeconomic environment analysis is conducted on the UK market.

UK Macroeconomic Analysis – Forecast 2015			
Economic Variable	Current Level (as on 15.02.2015)	Forecast for 2015	Rationale for the Forecast (PWC, 2015)
GDP	2.6%	2.5%	The GDP is expected to stay steady around 2.5% levels due to the recent oil price declines.
Inflation	1.5%	0.3%	The CPI is expected to be closer to 0 in 2015 but is expected to return closer to target level of 2% by 2016.
Unemployment rate	5.7%	5.5%	There is positive outlook for employment in the economy as the fall in oil prices as increase productivity of UK businesses benefitting from this would lead to increase demand for labor, increased wages and reduced unemployment rate.
Net Exports (% of GDP)	-0.5%	0.2%	Net Exports are expected to remain stable without any major increase in exports due to sluggish growth in the Euro zone and UK is expected to benefit from domestic demand.
Interest rate	0.5%	2% (by 2017)	The interest rate will increase eventually, but it is unlikely that there will be any rate rise before the May Elections.

Sectoral Analysis

11) View ▾ 12) Actions ▾ 13) Settings ▾ 14) Trade Simulation ▾ Portfolio & Risk Analytics						
Intraday	Holdings	Characteristics	VaR	Scenarios	Tracking Error/Volatility	Performance
Main View	Total Return	Period Analysis	Seasonal Analysis	Statistical Summary	Attribution	
UKX	vs Default (None)	by GICS Sector	in GBP	As of 02/17/15		
Unit	Percentage					
Name	% End Wgt	Tot Rtn 1D	Tot Rtn MTD	Tot Rtn YTD		
FTSE 100 INDEX (UKX)		0.60	2.42	5.38		
Residuals		0.00	0.00	0.00		
Holdings	100.00	0.60	2.42	5.38		
Communication Services	8.34	0.59	1.09	6.91		
Consumer Discretionary	5.98	-0.11	0.20	3.71		
Consumer Staples	16.52	1.71	-1.46	6.77		
Energy	14.74	0.41	8.27	5.77		
Financials	20.68	0.40	2.18	3.38		
Health Care	9.90	1.21	1.95	7.44		
Industrials	7.69	-0.16	2.22	6.55		
Information Technology	1.56	0.45	1.84	5.92		
Materials	8.84	-0.07	9.72	6.28		
Real Estate	1.54	0.10	-0.55	9.35		
Utilities	4.21	0.57	-5.20	-1.88		

Figure 10: Historical Sectoral Analysis

The last one-year performance of IT, energy and communication services has been positive and shows good promise for further growth. Stocks which have performed well in the last 12 months are expected to continue to perform well in the next 12-months period. (Jegadeesh & Titman, 2011).

Periods of slow economic growth encourage investment in utilities sector, and it has negative correlation with other sectors. (Investments, Gilliland, & Teufel, 2011). Utility stocks are added to the portfolio for the purpose of diversification.

Portfolio Creation and Allocation

Criteria for Selection:

The investor's risk profile, macroeconomic environment analysis and sectoral analysis has motivated stock selection criteria for the passive portfolio.

Using the EQS function on Bloomberg Terminal, we create a portfolio of companies with low-to-moderate P/E ratio across UK.

Criteria Type	Value
Country of Domicile	United Kingdom
Sector	Communication Services, Energy, Technology, Utilities
P/E ratio	Between 100 to 159 (Lower is better)

Allocation:

The portfolio consists of 30 low P/E stocks from UK as follows:



Ticker	Short Name	P/E	Rank	Market Cap	Price	Total Return	Revenue
101 DOTD	LN DOTDIGITAL GROUP	30.24	129	106.95M	37.50	25.83	16.21M
102 GHM	LN GOOCH & HOUSEGO	30.16	128	161.95M	678.00	-1.42	70.06M
103 RMV	LN RIGHTMOVE	30.10	127	2.54B	2613.00	16.24	153.16M
104 HNG	LN HAWKWING PLC	29.58	126	53.29M	43.50	19.18	11.85M
105 TEP	LN TELECOM PLUS PLC	29.48	125	933.59M	1165.00	-7.69	680.24M
106 PNN	LN PENNON GRP PLC	29.47	124	3.40B	853.00	-6.21	1.35B
107 AN/	LN DAISY CORPORATE	29.42	123	240.53M	497.25	-5.33	137.77M
108 OMIP	LN ONE MEDIA IP GRO	29.37	122	8.31M	11.75	2.17	2.65M
109 ELA	LN ELAND OIL & GAS	28.66	121	83.84M	54.00	-23.94	0.00
110 SPT	LN SPIRENT COMM	27.91	120	527.63M	86.25	13.86	444.10M
111 QXT	LN QUIXANT PLC	27.85	119	94.37M	146.00	8.15	27.07M
112 SGE	LN SAGE GROUP	27.66	118	5.08B	471.60	2.97	1.31B
113 KBT	LN K3 BUSINESS TECH	27.13	117	70.73M	222.50	-0.67	71.95M
114 TRAK	LN TRAKMS HOLDINGS	26.86	116	31.35M	108.50	24.00	15.11M
115 NCC	LN NCC GROUP PLC	26.38	115	468.78M	224.50	9.76	118.99M
116 FEP	LN FORUM ENERGY LTD	26.16	114	9.42M	26.50	10.42	6.65M
117 EMIS	LN EMIS GROUP PLC	25.85	113	536.88M	848.00	-2.53	124.80M
118 BDI	LN BOND INTL SOFTWA	25.80	112	36.71M	97.00	12.79	36.46M
119 REL	LN RELX PLC	25.26	111	24.95B	1182.00	7.45	5.86B
120 SVT	LN SEVERN TRENT	24.88	110	4.91B	2049.00	2.14	1.88B
121 IOM	LN IOMART GROUP PLC	24.57	109	214.20M	200.50	17.94	62.59M
122 IDOX	LN IDOX PLC	24.55	108	144.13M	40.50	1.89	60.68M
123 ADT	LN ADEPT TECHNOLOGY	24.42	107	35.06M	157.00	9.41	22.01M
124 MAI	LN MAINTEL HLDG PLC	24.05	106	67.50M	630.00	-6.67	38.22M
125 CRW	LN CRANWARE PLC	24.02	105	133.49M	497.50	4.52	42.57M
126 ITV	LN ITV PLC	23.79	104	9.38B	233.10	8.32	2.47B
127 AVV	LN AVEVA GROUP PLC	23.62	103	991.80M	1551.00	18.54	214.76M
128 JEL	LN JERSEY ELECTRICI	23.62	102	116.43M	380.00	8.31	98.44M
129 INSE	LN INSPIRED ENERGY	23.55	101	42.90M	10.13	5.19	9.07M
130 RENT	NA RELX NV	23.06	100	33.73B	22.44	13.10	5.86B

Figure 11: List of stocks in Passive Portfolio

PORT Holdings Report: Holdings (02/17/2020 16:28:13)

Summary

User Name	JAHNAVI MEHTA
Portfolio	PASSIVE PORTFOLIO 5
As-of Date	2/17/2020
Currency	GBP

Detail

		# of Instruments	% Wgt	Market Value	Position	Closing Price	Currency
PASSIVE PORTFOLIO 5		32	100.00	15,31,725			
Equity		32	100.00	15,31,725			
Communication Services		8	25.00	3,82,931			
	ADEPT TECHNOLOGY GROUP PLC		3.13	47,866	14,911.65	321.00	GBp
	EUROMONEY INSTL INVESTOR PLC		3.13	47,866	4,423.88	1,082.00	GBp
	ITV PLC		3.13	47,866	38,963.28	122.85	GBp
	ITV PLC-UNSPON ADR		3.12	47,866	3,950.73	15.65	USD
	KIN AND CARTA PLC		3.13	47,866	46,247.72	103.50	GBp
	SYSTEM1 GROUP		3.13	47,866	22,793.52	210.00	GBp
	WPP PLC		3.13	47,866	5,269.31	908.40	GBp
	WPP PLC-SPONSORED ADR		3.12	47,866	1,071.56	57.70	USD
Energy		1	3.13	47,866			
	PHAROS ENERGY PLC		3.13	47,866	1,47,964.13	32.35	GBp
Information Technology		18	56.25	8,61,595			
	ACCESSO TECHNOLOGY GROUP PLC		3.13	47,866	9,516.18	503.00	GBp
	AMINO TECHNOLOGIES PLC		3.13	47,866	35,721.19	134.00	GBp
	APTITUDE SOFTWARE GROUP PLC		3.13	47,866	10,077.14	475.00	GBp
	AVEVA GROUP PLC		3.13	47,866	1,042.84	4,590.00	GBp
	CML MICROSYSTEMS PLC		3.13	47,866	14,037.07	341.00	GBp
	COMPUTACENTER PLC		3.13	47,866	2,707.38	1,768.00	GBp
	CROMA SECURITY SOLUTIONS GRO		3.13	47,866	51,469.24	93.00	GBp
	DIALOG SEMICONDUCTOR PLC		3.13	47,866	1,594.84	35.68	EUR
	DILLISTONE GROUP PLC		3.13	47,866	1,47,281.21	32.50	GBp
	GRESHAM TECHNOLOGIES PLC		3.13	47,866	33,240.55	144.00	GBp
	HALMA PLC		3.13	47,866	2,270.70	2,108.00	GBp
	IDOX PLC		3.12	47,866	1,15,619.30	41.40	GBp
	IOMART GROUP PLC		3.13	47,866	13,007.17	368.00	GBp
	MICRO FOCUS INTERNATIONAL		3.13	47,866	6,200.31	772.00	GBp
	SOLID STATE PLC		3.13	47,866	8,663.60	552.50	GBp
	SPECTRIS PLC		3.13	47,866	1,645.46	2,909.00	GBp
	SPECTRIS PLC-UNSP ADR		3.13	47,866	3,342.11	18.50	USD
	UNIVERSE GROUP PLC		3.12	47,866	7,59,783.99	6.30	GBp
Utilities		5	15.63	2,39,332			
	JERSEY ELECTRICITY PLC		3.13	47,866	10,566.53	453.00	GBp
	SEVERN TRENT PL-SPON ADR		3.13	47,866	1,796.83	34.41	USD
	SEVERN TRENT PLC		3.13	47,866	1,848.84	2,589.00	GBp
	UNITED UTILITIES GROUP PLC		3.13	47,866	4,781.86	1,001.00	GBp
	UNITED UTILITIES GROUP-ADR		3.13	47,866	2,410.96	25.64	USD

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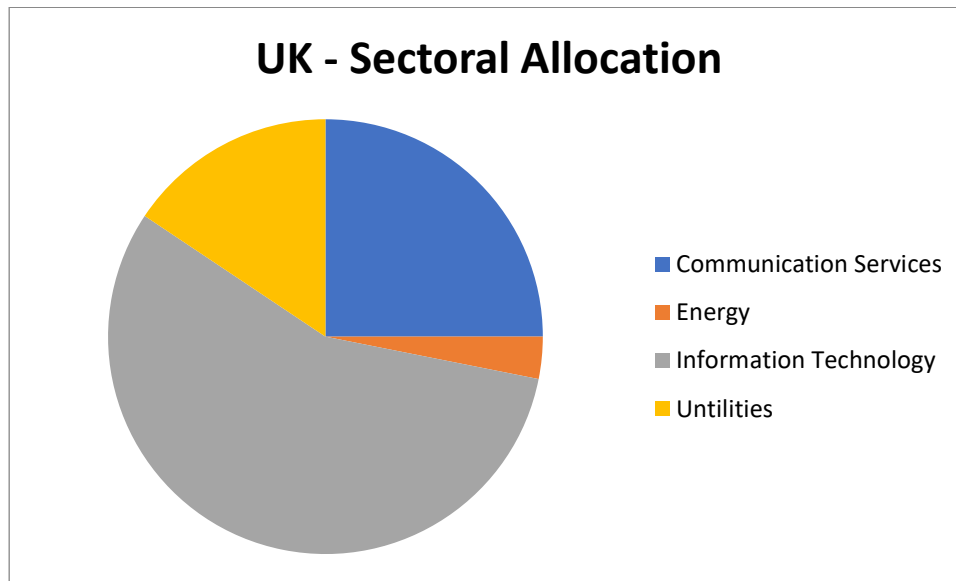


Figure 12: UK Sectoral Allocation

Performance Analysis

Particulars	Beginning value (£) (as on 17.02.2015)	End value (£) (as on 17.02.2020)	Pre-tax Return (%)	Post-tax Return (%)
Portfolio	1,000,000	1,531,725	8.90	6.68
Benchmark (FTSE 100)	6898.10	7433.30	1.50	1.125

Table 2: Passive Portfolio Performance Analysis

Investor Profiling

INVESTOR PROFILING – Active Portfolio (as on 17.02.2020)	
Financial Goal	“I am willing to reinvest my proceeds from passive investment in an active portfolio of stocks and corporate bonds for a 10-week period and stay invested for at least 7-10 years.”
Investment Objective:	
Risk Tolerance	<p>Willingness to take risk: The client has above average willingness to take risk</p> <p>Ability to take risk: The client has reinvested the capital along with the return earned, thus has average ability to take on risk</p> <p>Overall, AVERAGE risk tolerance</p> <p><i>The risk aversion coefficient (0) for the client is 3, which means the investor is risk-taking investor.</i></p>
Return Objective	The client has a relative return goal of outperforming the benchmark by at least 7% in absolute terms.
Investment Constraints:	
Liquidity Requirement	Liquidity requirement is none beyond a 6-month cash reserve.
Time Horizon	The investor has a long-term single-stage horizon of 7-10 years.
Tax Concerns	The investor is in the 25% marginal tax bracket
Legal and Regulatory Factors	None
Unique Circumstances	None

Macro-economic Environment Analysis

Since majority of the stocks and bonds in the active portfolio are from U.S., a macroeconomic environment analysis is conducted on the U.S. economy.

U.S. Macroeconomic Analysis – Forecast 2020			
Economic Variable	Current Level (as on 16.02.2020)	Forecast for 2020	Rationale for the Forecast (Sanabria & Dye, 2020)
GDP	2.3%	2.1%	As compared to 2019, there is reduced risk of recession on grounds of reduced trade-policy risk with China.
Inflation	1.8%	2.3%	The Fed expects to achieve its target inflation rate of 2% or more by 2020 based on its superior economic performance expectations.
Unemployment rate	3.7%	3.4%	Based on unemployment insurance claims, hiring rates and layoff announcements, the overall unemployment rate is expected to fall.
Net Exports	-\$974bn	-\$980bn	No major change in net exports is expected.
Interest rate	1.6%	1.6%	At the end of 2019, Fed Chairman Jay Powell and other Fed officials reinforced the idea that the Fed is in “pause” mode until any “material changes” in the outlook. However, the interest rates might be expected to increase over the long-term.

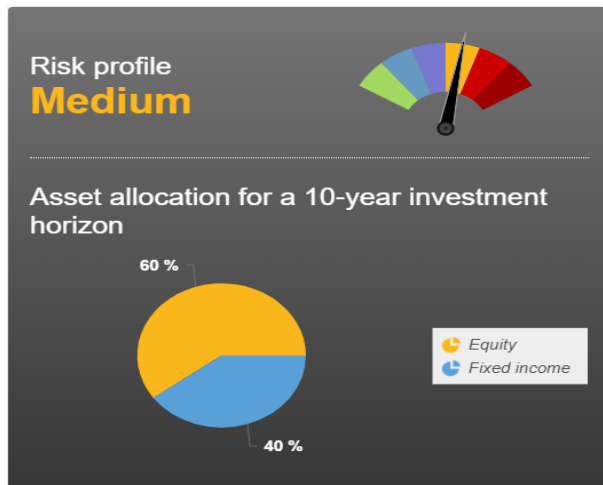
Asset Allocation

Based on the client's answers to the risk-profiling questionnaire on Vanguard, HSBC and Standard life, the appropriate asset allocation is 70% stocks and 30% bonds. However, the client has allowed the discretion to vary the % allocation in a range of 50-70% stocks and 30-50% bonds.

VANGUARD

	
Current Allocation	Suggested Allocation ("30% Bonds & 70% Stocks")

HSBC



Medium

You are prepared to accept medium financial risk in exchange for the prospect of higher potential returns. The investment products that suit you are subject to stock market risks. They may go down as well as up and are subject to capital losses. Under normal market conditions, these changes should be moderate.

How do I invest ?

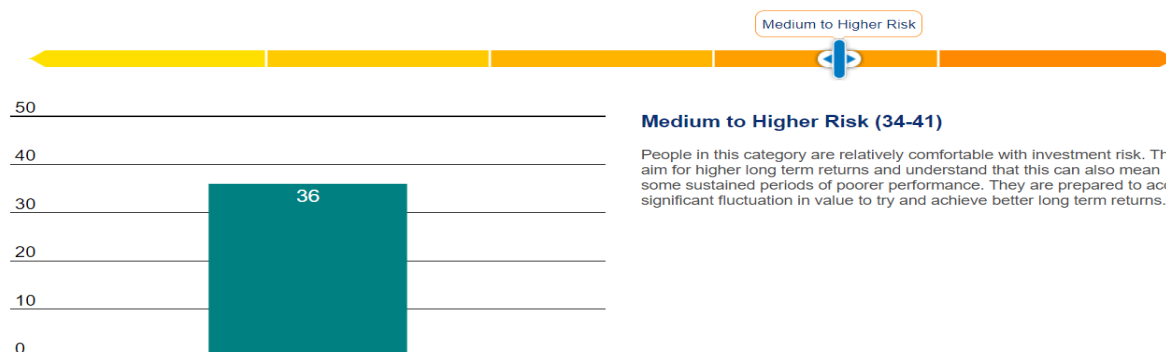
Based on this profile, you can invest in a diversified fund that matches your risk profile and is managed by an expert, or you can put together your portfolio yourself by allocating your assets to different funds (equity, fixed income, money market) offered by your company.

Don't forget to review your investor profile to ensure that it still meets your objectives.

STANDARD LIFE

Investment risk appetite

A risk score of 36 would put you in the medium to higher risk category.



Medium to Higher Risk (34-41)

People in this category are relatively comfortable with investment risk. They aim for higher long term returns and understand that this can also mean some sustained periods of poorer performance. They are prepared to accept significant fluctuation in value to try and achieve better long term returns.

Benchmark Selection

Since the portfolio consists of U.S. stocks and corporate bonds (a total of 60%), the most suitable benchmark would be S&P 500 Index. However, Bloomberg Terminal does not show constituent stocks of the S&P 500 Index. As a result, the Dow Jones Industrial Average (INDU) is chosen as an alternative benchmark for the portfolio.

Utility Score



Figure 13: Period Analysis

The probability for up and down movements is taken from Bloomberg Terminal for Dow Jones Index for a 5-Year quarterly period starting Feb'2015 to Feb'2020.

Expected Return			
Scenario	Probability of return (P_i)	Rate of return (R_i)	$P_i * R_i$
Bull	78.95%	5.56%	4.39%
Bear	21.05%	-5.14%	-1.08%
		Expected Return ($E(R_i) = \sum P_i * R_i$)	3.308%

Standard Deviation				
Scenario	Probability of return (P_i)	Rate of return (R_i)	$P_i * [R_i - E(R_i)]^2$	$\sqrt{P_i * [R_i - E(R_i)]^2}$
Bull	78.95%	5.56%	0.04005%	2.0013%
Bear	21.05%	-5.14%	0.15022%	3.8758%
			Standard Deviation ($\sigma = \sqrt{\sum P_i * [R_i - E(R_i)]^2}$)	5.8871%

$$E(U) = E(R) - \frac{\theta}{2} \sigma^2$$

$$E(R) = 3.308\%$$

$$\sigma^2 = 0.345\%$$

$$\text{Risk aversion coefficient } (\theta) = 3$$

$$\therefore \text{Expected Utility } [E(U)] = 3.308\%$$

The 10-Y US Government Bond Yield (rf): 1.59%

Utility score helps in determining the attractiveness of a portfolio for the purpose of investment. Higher utility scores indicate higher expected return or lower volatility and lower scores reflect lower expected returns or higher volatility. Investors with the same risk aversion coefficient may have different utility scores for different levels of risky portfolios. An investor with lower risk-aversion would be attracted to high-risk portfolios and derive positive utility by investing in that portfolio. (Bodie, Kane, Marcus, & Mohanty, 2009)

Since the risk of the portfolio is higher than the 10-Y Government bond yield of 1.59%, the utility derived from the portfolio is higher and it is attractive to invest in a portfolio with higher weight to risky assets.

The Utility score measures can also be used to determine the optimal weight of risky asset in the portfolio. This is calculated as follows:

Optimal Weight of Risky asset in the portfolio

$$\omega = \frac{E(R_M) - rf}{\theta \sigma_M^2}$$

$$\therefore \omega = 1.65\%$$

Based on the values mentioned for the utility score, the weight of risky asset is 1.65%. Since this is a highly unreasonable number and it does not match the investor profile and risk tolerance requirements, it is not a useful tool for determining the asset allocation weights. We thus make use of the information obtained from the client's risk profiling questionnaire to determine the appropriate allocation.

Diversification

Capital Market Line (CML)

The return on risky asset refers to the return on the benchmark index (INDU) and the risk-free refers to the return on 10-Y US government bond yield. Multiple combination of weights is allocated to risky and risk-free assets to form the CML.

Return on Risky Asset	Return on Risk-Free Asset	SD Risk-free Asset	SD Risky Asset	Weight in Risky Asset	Weight in Risk-free Asset	Portfolio Risk	Portfolio Return
5.56%	1.59%	0.00%	5.72%	0.00	1.00	0.00%	1.00%
5.56%	1.59%	0.00%	5.72%	0.10	0.90	0.57%	1.15%
5.56%	1.59%	0.00%	5.72%	0.20	0.80	1.14%	1.29%
5.56%	1.59%	0.00%	5.72%	0.30	0.70	1.72%	1.44%
5.56%	1.59%	0.00%	5.72%	0.40	0.60	2.29%	1.58%
5.56%	1.59%	0.00%	5.72%	0.50	0.50	2.86%	1.73%
5.56%	1.59%	0.00%	5.72%	0.60	0.40	3.43%	1.88%
5.56%	1.59%	0.00%	5.72%	0.70	0.30	4.00%	2.02%
5.56%	1.59%	0.00%	5.72%	0.80	0.20	4.58%	2.17%
5.56%	1.59%	0.00%	5.72%	0.90	0.10	5.15%	2.31%
5.56%	1.59%	0.00%	5.72%	1.00	0.00	5.72%	2.46%
5.56%	1.59%	0.00%	5.72%	1.60	-0.60	9.15%	3.34%

Table 3: CML calculation

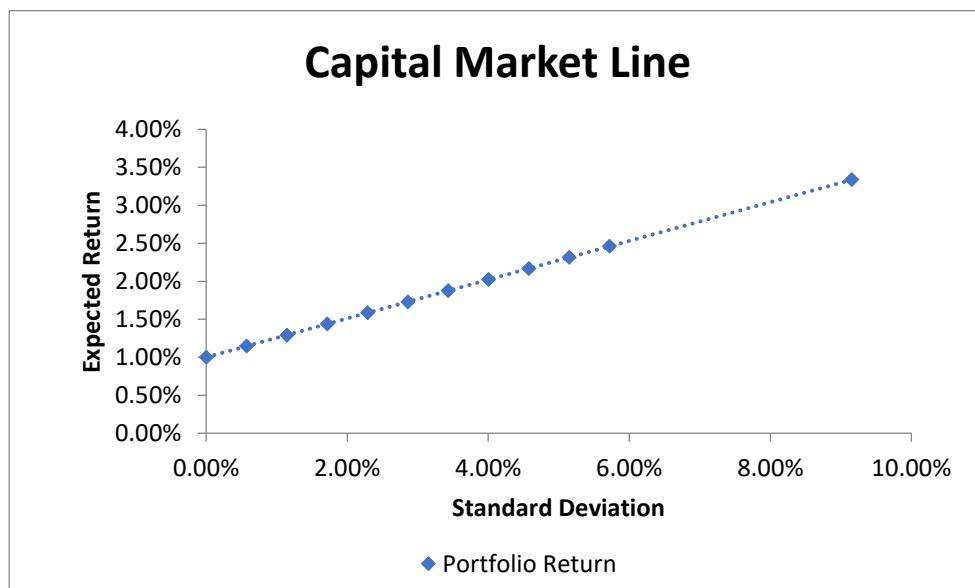


Figure 14: Capital Market Line

The point at which the CML is tangent to the Efficient frontier is the most efficient portfolio.

Correlation Matrix

The overall correlation matrix among the stocks selected at the beginning of the period (as on 17.02.2020) shows negative or no correlation among the stocks. It is shown as follows:

Column1	ASM IN	CFP IN	NES IN	TCO IN	BAG LN	CNA LN	GOCO LN	EKIZ TI	IHGZT TI	4991 TT	CTSH US	GTMM US	HDIH US	PPC US	UNFI US	XXII US	ABBY US	ADI US	PI US	PIHN US	USM US
ASM IN	1																				
CFP IN	0.070	1																			
NES IN	0.023	0.004	1																		
TCO IN	0.078	0.109	0.108	1																	
BAG LN	0.034	0.134	0.017	0.071	1																
CNA LN	-0.046	0.033	-0.058	0.047	0.053	1															
GOCO LN	0.004	0.018	-0.109	0.035	0.037	0.185	1														
EKIZ TI	-0.033	0.067	0.091	-0.054	0.066	-0.042	-0.135	1													
IHGZT TI	0.054	0.002	-0.061	-0.005	-0.064	-0.049	0.037	-0.001	1												
4991 TT	-0.065	0.011	0.036	0.005	-0.095	-0.025	0.046	0.023	0.043	1											
CTSH US	0.023	-0.011	-0.006	0.069	0.026	0.063	0.037	0.010	0.023	0.055	1										
GTMM US	-0.066	0.010	0.086	-0.041	0.029	0.100	0.028	-0.012	0.008	0.068	0.174	1									
HDIH US	-0.087	-0.013	-0.048	-0.071	0.016	-0.080	0.044	0.011	-0.076	-0.006	-0.020	-0.040	1								
PPC US	-0.001	-0.083	-0.039	-0.006	0.027	-0.090	-0.070	-0.070	-0.016	-0.061	0.046	0.342	0.029	1							
UNFI US	-0.130	-0.009	0.033	-0.017	0.006	0.168	0.047	-0.057	-0.007	0.006	0.014	0.353	-0.010	0.089	1						
XXII US	-0.057	-0.003	0.035	-0.025	-0.048	0.169	0.018	0.001	-0.021	0.044	0.078	0.119	-0.039	-0.116	0.071	1					
ABBY US	-0.089	-0.023	0.003	-0.004	0.054	0.012	0.003	0.064	-0.084	-0.137	0.049	0.049	-0.062	0.107	0.041	-0.080	1				
ADI US	-0.009	-0.018	0.055	-0.064	-0.039	0.075	0.037	0.043	0.030	0.081	0.029	0.686	-0.038	0.244	0.266	0.165	0.026	1			
PI US	-0.025	-0.039	0.192	-0.138	0.028	-0.094	-0.027	0.099	0.030	0.106	0.009	0.333	-0.014	0.195	0.198	0.048	0.048	0.367	1		
PIHN US	-0.018	-0.055	-0.064	-0.042	-0.017	0.059	0.087	-0.111	-0.085	-0.005	0.034	-0.032	0.052	-0.002	0.039	-0.073	0.026	0.003	-0.044	1	
USM US	-0.076	-0.001	0.016	0.012	-0.090	0.209	0.133	-0.119	-0.052	-0.034	-0.041	0.309	-0.019	0.029	0.334	0.023	0.011	0.251	0.077	-0.015	1

Table 4: Correlation Matrix for diversification

Asset-class wise diversification

Thus, the asset allocation at the time of creation of the portfolio (17.02.2020) is given as follows:



Figure 15: Asset-class wise allocation as on 17.02.2020

International Diversification

The portfolio is diversified across multiple countries to ensure international diversification. The country-wise allocation at the beginning (17.02.2020) is given as follows:



Figure 16: Country-wise allocation as on 17.02.2020

Initial Portfolio (as on 17.02.2020)

IBRD 0 7/8 05/14/2030 Corp PRTU Related Functions Menu										
NEWS ALERT										
back to Return										
Save Actions Settings Analyze Portfolio Administration: Portfolio Display										
Portfolio Name		ACTIVE_PORTFOLIO		ID		U14258148-8		Currency		GBP
Date		02/17/20						Display Currency		GBP
Unbalanced		02/17/20		Short Margin		0		Futures Margin		0
Security	ID	Position	Price	PCS	FX Rate	Current	Principal	Market Val	Price	Cost
<Search>										
Totals						1,529,539.78	1,531,664.59			1,529,539.78
Cash		2,836.4881				2,836.49	2,836.49			2,836.49
4991 TT	4991	31,256.0000	63.80	EXCH	0.02560	51,040.22	51,040.22	63.80	0.02560	51,039.78
ABBY US	ABBY	26,592.4477		EXCH	0.76852	51,092.16	51,092.16		0.76852	51,092.16
ADI US	ADI	564.0000	117.65	EXCH	0.76852	50,994.93	50,994.93	117.65	0.76852	50,994.93
ASM IN	INE867C...	58,686.0000	80.70	EXCH	0.01077	51,016.37	51,016.37	80.70	0.01077	51,015.84
BAG LN	GB00B6X...	8,833.0000	578.00	EXCH	1.00000	51,054.74	51,054.74	578.00	1.00000	51,054.74
CFP IN	INE975C...	39,420.0000	120.00	EXCH	0.01077	50,956.48	50,956.48	120.00	0.01077	50,955.84
CNA LN	GB00B03...	70,288.0000	72.64	EXCH	1.00000	51,057.20	51,057.20	72.64	1.00000	51,057.20
CTSH US	CTSH	971.0000	68.42	EXCH	0.76852	51,057.35	51,057.35	68.42	0.76852	51,057.35
EKIZ TI	TREEKIZ...	334,793.0000	1.20	EXCH	0.12709	51,057.46	51,057.46	1.20	0.12709	51,057.46
GOCO LN	GB00BZ0...	57,367.0000	89.00	EXCH	1.00000	51,056.63	51,056.63	89.00	1.00000	51,056.63
GTMM US	GTMM	12,303.0127	0.01	EXCH	0.76852	51,057.69	51,057.69	0.01	0.76852	51,057.69
HDIH US	HDIH	2,127,395.00	0.03	EXCH	0.76852	50,846.90	50,846.90	0.03	0.76852	50,846.90
IHGZ TI	TREIHGZ...	92,783.0000	4.33	EXCH	0.12709	51,057.31	51,057.31	4.33	0.12709	51,057.31
NES IN	INE027D...	170,191.0000	27.70	EXCH	0.01077	50,782.95	50,782.95	27.70	0.01077	50,782.95
PI US	PI	2,108.0000	31.51	EXCH	0.76852	51,047.56	51,047.56	31.51	0.76852	51,047.56
PIHN US	PIHN	531,488.4047		EXCH	0.76852	51,057.52	51,057.52		0.76852	51,057.52
PPC US	PPC	2,533.0000	26.22	EXCH	0.76852	51,041.55	51,041.55	26.22	0.76852	51,041.55
TCO IN	INE493A...	51,660.0000	91.75	EXCH	0.01077	51,057.79	51,057.79	91.75	0.01077	51,057.79
UNFI US	UNFI	8,818.0000	7.54	EXCH	0.76852	51,097.23	51,097.23	7.54	0.76852	51,097.23
USM US	USM	1,912.0000	34.74	EXCH	0.76852	51,047.40	51,047.40	34.74	0.76852	51,047.40
XXII US	XXII	59,315.0000	1.12	EXCH	0.76852	51,055.03	51,055.03	1.12	0.76852	51,055.03
AAPL 3.05 07/31/29	XS12691...	43.0000	116.86	BGN	1.00000	50,248.51	50,309.76	116.86	1.00000	50,248.51
AMZN 3.15 08/22/27	023135BC	60.0000	108.23	BMRK	0.76852	49,903.93	50,610.01	108.23	0.76852	49,903.93
BRK 0.44 09/13/29	XS20494...	7,275.0000	100.16	BVAL	0.00699	50,946.60	51,042.34	100.16	0.00699	50,949.99
JNJ 2.9 01/15/28	478160CK	62.0000	106.58	BMRK	0.76852	50,784.06	50,906.89	106.58	0.76852	50,784.06
MOYLE 2.9376 03/31/3	XS01666...	69.0000	195.54	BVAL	1.00000	50,513.99	50,990.39	195.54	1.00000	50,513.99
MSFT 3.3 02/06/27	594918BY	60.0000	109.23	BMRK	0.76852	50,365.97	50,412.47	109.23	0.76852	50,365.97
NIPDES 0.315 03/17/2	0P35515...	7,225.0000	100.91	BGN	0.00699	50,972.28	51,037.66	100.91	0.00699	50,974.44
RILIN 9 01/21/25	INE110L...	4,364.0000	107.92	BCOP	0.01077	50,730.94	51,043.91	107.92	0.01077	50,728.88
WMT 3.7 06/26/28	931142EE	59.0000	111.83	BMRK	0.76852	50,704.54	50,942.21	111.83	0.76852	50,704.54

Rebalancing Strategy

Rebalancing refers to the process of buying and selling securities in order to maintain the weights of the assets in the portfolio. (Dayanandan & Lam, 2015). Since the portfolio is equally weighted, all the constituent stocks and bonds are rebalanced to maintain equal weighting of each. If a security's market value increases, a portion of it is sold to bring its weight back to an equal level with the other constituents. Similarly, if a security's market value falls, more of the security is purchased to make the overall portfolio allocation equal among all.

Equity Portfolio Creation and Management

Week 1:

Capital Asset Pricing Model (CAPM)

The CAPM valuation model and Security Market Line (SML) was applied to identify undervalued and overvalued stocks in the existing portfolio (Table 5). If the actual return is greater than the CAPM return, the alpha will be positive, and the stock is said to be *Undervalued* and vice-versa.

TICKER	Rf	Beta	RM	CAPM Return	Actual Return	Alpha	Over/Undervalued
4991 TT	0.83%	147.40%	11.29%	16.25%	-9.32%	-25.57%	<i>Overvalued</i>
ASM IN	6.37%	87.70%	14.44%	13.44%	-24.22%	-37.67%	<i>Overvalued</i>
BAG LN	0.54%	48.00%	10.43%	5.29%	-3.00%	-8.29%	<i>Overvalued</i>
CFP IN	6.37%	66.50%	14.44%	11.73%	-9.64%	-21.37%	<i>Overvalued</i>
CNA LN	0.54%	110.60%	10.43%	11.48%	-25.07%	-36.55%	<i>Overvalued</i>
CTSH US	1.37%	100.50%	9.03%	9.07%	-7.17%	-16.24%	<i>Overvalued</i>
GOCO LN	0.54%	73.60%	10.43%	7.82%	-8.75%	-16.57%	<i>Overvalued</i>
GTMM US	1.37%	63.70%	9.03%	6.25%	-41.69%	-47.94%	<i>Overvalued</i>
HDIH US	1.37%	52.00%	9.03%	5.35%	-87.48%	-92.83%	<i>Overvalued</i>
NES IN	6.37%	17.50%	14.44%	7.78%	-40.85%	-48.63%	<i>Overvalued</i>
PPC US	1.37%	95.50%	9.03%	8.68%	-1.55%	-10.24%	<i>Overvalued</i>
TCO IN	6.37%	108.30%	14.44%	15.10%	-16.62%	-31.72%	<i>Overvalued</i>
UNFI US	0.54%	158.40%	9.03%	13.99%	-58.13%	-72.11%	<i>Overvalued</i>
XXII US	0.54%	151.10%	9.03%	13.37%	-35.11%	-48.48%	<i>Overvalued</i>
ABBY US	1.37%	-18.10%	9.03%	-0.02%	4.26%	4.27%	<i>Undervalued</i>
ADI US	1.37%	117.10%	9.03%	10.34%	17.10%	6.76%	<i>Undervalued</i>
EKIZ TI	12.42%	84.10%	21.08%	19.70%	43.49%	23.78%	<i>Undervalued</i>
IHGZT TI	12.42%	73.20%	21.08%	18.76%	97.56%	78.80%	<i>Undervalued</i>
PI US	1.37%	175.60%	9.03%	14.82%	17.98%	3.16%	<i>Undervalued</i>
PIHN US	1.37%	172.00%	9.03%	14.54%	17.85%	3.31%	<i>Undervalued</i>
USM US	0.54%	105.30%	9.03%	9.48%	11.20%	1.72%	<i>Undervalued</i>

Table 5: CAPM calculation

In the case of SML, if the stock lies above the SML, it is said to be *Undervalued* and vice-versa. Figure 17 shows a demonstration of SML and actual return on certain US stocks from the portfolio above.

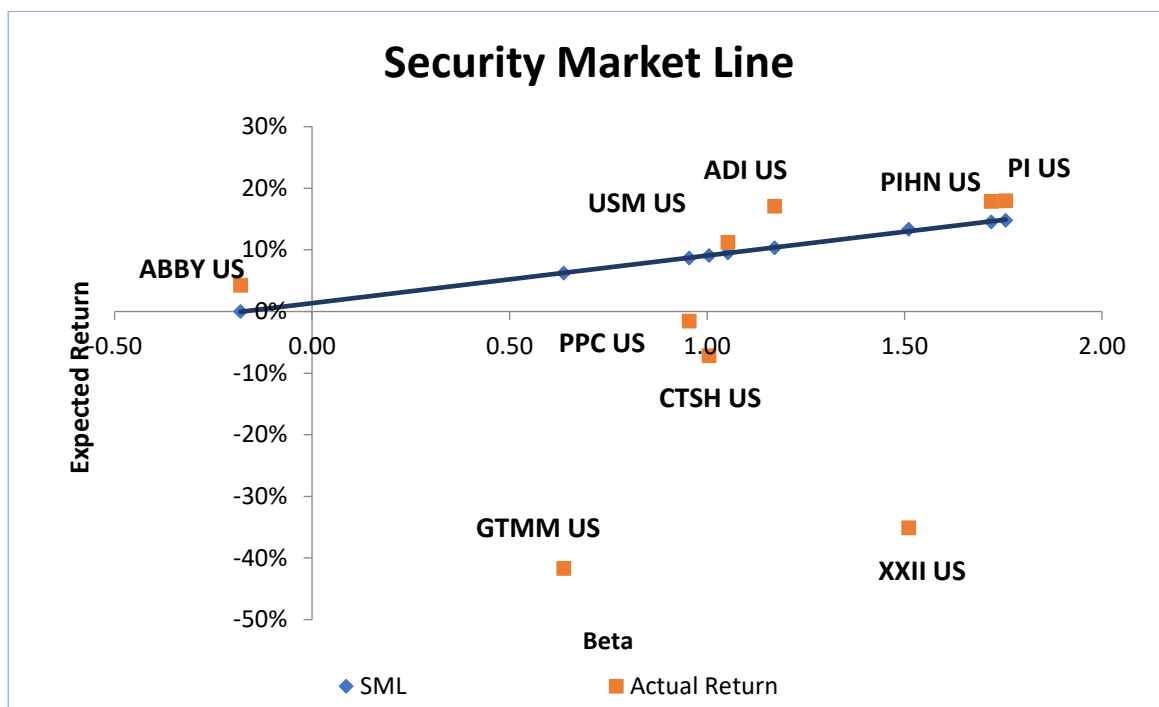


Figure 17: SML of some US stocks in the portfolio

New Buying in Week 1:

Equity	Corporate Bonds
WPRO IN	CSCO 2.2 02/28/21
SUNP IN	XOM 2.222 03/01/21
PNN LN	
PGHL IN	
STE US	
NG/ LN	
NLC IN	

Rationale for buying:

Equity: Since the Global Pandemic COVID-19 started affecting multiple countries, the health care sector seemed an attractive investment choice along with the utilities and IT sector.

Bonds: Shorter maturity fixed coupon bonds were attractive to reduce the Duration of the bond portfolio due to increased interest rate risk.

Portfolio after changes in Week 1 (as on 24.02.2020):

HDFCIN 6.99 02/13/2023 Corp PRTU Related Functions Menu MSG: +17										
<Back> to Return										
1) Save 2) Actions 3) Settings 4) Analyze Portfolio Administration: Portfolio Dis										
Portfolio Name ACTIVE_PORTFOLIO ID U14258148-8 Currency										
Date 02/24/20 Short Margin 0 Futures Margin 0 Display Currency Gb										
Rebalanced 02/24/20										
	Security	ID	Position	Price	PCS	FX Rate	Current Principal	Accrued	Market Val	Cos Pri
	<Search>									
	Totals						1,499,911.10	3,181.15	1,503,092.2	
	Cash		10,733.857				10,733.86		10,733.86	
11)	ABBY US	ABBY	31,143.868		EXCH	0.77298	60,183.71		60,183.71	
12)	ADI US	ADI	663.0000	117.36	EXCH	0.77298	60,145.07		60,145.07	117.
13)	CFP UI	CFP			EXCH	0.77298				
14)	CNA LN	GB00B0...		76.78	EXCH	1.00000				
15)	CTSH US	CTSH		67.42	EXCH	0.77298				
16)	EKIZ TI	TREEKI...	453,610.00	1.05	EXCH	0.12636	60,183.66		60,183.66	1.
17)	GOCO LN	GB00BZ...		91.20	EXCH	1.00000				
18)	GTMM US	GTMM		0.01	EXCH	0.77298				
19)	HDIH US	HDIH		0.03	EXCH	0.77298				
20)	IHGZT TI	TREIHG...	116,452.00	4.09	EXCH	0.12636	60,183.43		60,183.43	4.
21)	NES IN	INE027...		25.50	EXCH	0.01072				
22)	NG/ LN	GB00BD...	5,761.0000	1044.60	EXCH	1.00000	60,179.41		60,179.41	1044.
23)	NLC IN	INE589...	105,459.00	53.25	EXCH	0.01072	60,182.30		60,182.30	53.
24)	PGHL IN	INE199...	1,367.0000	4107.35	EXCH	0.01072	60,172.18		60,172.18	4107.
25)	PI US	PI	2,308.0000	33.73	EXCH	0.77298	60,175.34		60,175.34	31.
26)	PIHN US	PIHN	778,596.66		EXCH	0.77298	60,183.71		60,183.71	
27)	PNN LN	GB00B1...	5,122.0000	1175.00	EXCH	1.00000	60,183.50		60,183.50	1175.
28)	PPC US	PPC		22.98	EXCH	0.77298				
29)	STE US	STE	464.0000	167.46	EXCH	0.77298	60,061.41		60,061.41	167.
30)	SUNP IN	INE044...	14,115.000	397.85	EXCH	0.01072	60,181.89		60,181.89	397.
31)	USM US	USM	2,463.0000	31.61	EXCH	0.77298	60,180.44		60,180.44	34.
32)	WPRO IN	INE075...	22,996.000	244.20	EXCH	0.01072	60,181.57		60,181.57	244.
33)	AAPL 3.05 07/31/29	XS1269...	43.0000	117.42	BGN	1.00000	50,490.17	86.47	50,576.64	116.
34)	AMZN 3.15 08/22/27	023135BC	71.0000	108.98	BM...	0.77298	59,809.69	9.61	59,819.30	108.
35)	BRK 0.44 09/13/29	XS2049...	8,540.0000	100.57	BVAL	0.00700	60,152.04	117.69	60,269.73	100.
36)	CSCO 2.2 02/28/21	17275RBD	76.0000	100.67	BM...	0.77298	59,141.59	631.85	59,773.44	100.
37)	JNJ 2.9 01/15/28	478160CK	72.0000	107.66	BM...	0.77298	59,918.56	174.85	60,093.41	106.
38)	MOYLE 2.9376 03/31	XS0166...	81.0000	196.29	BVAL	1.00000	59,527.08	587.21	60,114.29	195.
39)	MSFT 3.3 02/06/27	594918BY	70.0000	109.96	BM...	0.77298	59,499.19	89.28	59,588.47	109.
40)	NIPDES 0.315 03/17	JP3551...	8,485.0000	101.09	BGN	0.00700	60,071.27	80.51	60,151.78	100.
41)	RILIN 9 01/21/25	INE110...	5,154.0000	108.08	BC...	0.01072	59,699.43	463.06	60,162.49	107.
42)	WMT 3.7 06/26/28	931142EE	68.0000	112.94	BM...	0.77298	59,361.37	313.33	59,674.70	111.
43)	XOM 2.222 03/01/21	30231GAV	76.0000	100.65	BM...	0.77298	59,129.26	627.29	59,756.54	100.
44)										

Week 2:

Gordon Growth Model (GGM)

The GGM model was used to identify underpriced and overpriced securities based on the dividend, cost of equity capital and sustainable growth rate. (Bloomberg Terminal, 2020). If the GGM price is higher than the Actual price, then the security is *Undervalued* and vice-versa (Table 6).

Ticker	D ₀	g	D ₁	K _e	GGM Price	Actual Price	Over/Undervalued
WPRO IN	1.0	15.29%	1.2	10.90%	-26.24	223.65	N/A
SUNP IN	3.0	5.03%	3.2	10.20%	61.00	393.35	Overvalued
PNN LN	13.7	3.84%	14.2	7.90%	349.56	1140.50	Overvalued
NG/ LN	16.6	-0.32%	16.5	9.00%	177.30	1013.40	Overvalued
PGHL IN	416.0	9.47%	455.4	10.70%	36924.30	4002.80	Undervalued
STE US	0.4	8.65%	0.4	8.70%	747.08	161.03	Undervalued
NLC IN	4.5	6.63%	4.8	9.30%	181.00	71.88	Undervalued

Table 6: DDM calculation

One of the key assumptions of the GGM is that the Cost of Equity (K_e) must be higher than the growth rate (g), otherwise the model is not applicable. (Ryan, 2007). Since for security WPRO IN, the sustainable growth rate is higher than the K_e , the model cannot be applied.

New Buying in Week 2:

Equity
AUTO LN
AZN LN
UNH US

Rationale for buying:

Equity: The new stocks are bought with the same rationale as above in Week 1.

Portfolio after changes in Week 2 (as on 02.03.2020):

<div> <div> <div>PEP 1 1/8 03/18/2031 Corp</div> <div>PRTU</div> <div>Related Functions Menu</div> </div> <div>MSG: +21</div> </div>									
<Back> to Return									
<div> <div>1 Save</div> <div>2 Actions</div> <div>3 Settings</div> <div>4 Analyze</div> <div>Portfolio Administration: Portfolio Di</div> </div>									
<div> <div>Portfolio Name</div> <div>ACTIVE_PORTFOLIO</div> <div>ID</div> <div>U14258148-8</div> <div>Currency</div> </div>									
<div> <div>Date</div> <div>03/02/20</div> <div>Rebalanced</div> <div>03/02/20</div> <div>Short Margin</div> <div>0</div> <div>Futures Margin</div> <div>0</div> <div>Display Currency</div> </div>									
	Security	ID	Position	Price PCS	FX Rate	Current Principal	Accrued	Market Val	Co
	<Search>								
	Totals					1,503,758.6	2,368.50	1,506,127.1	
	Cash		1,012.0000			1,012.00		1,012.00	
11)	ABBY US	ABBY	33,583.680		EXCH 0.78070	65,547.04		65,547.04	
12)	ADI US	ADI	754.0000	111.27	EXCH 0.78070	65,498.93		65,498.93	11
13)	AUTO LN	GB00BV...	12,624.000	519.20	EXCH 1.00000	65,543.81		65,543.81	51
14)	AZN LN	GB0009...	935.0000	7010.00	EXCH 1.00000	65,543.50		65,543.50	701
15)	EKIZ TI	TREEKI...	427,360.00	1.22	EXCH 0.12572	65,547.16		65,547.16	
16)	IHGZT TI	TREIHG...	130,671.00	3.99	EXCH 0.12572	65,546.92		65,546.92	
17)	NG/ LN	GB00BD...		1006.20	EXCH 1.00000				
18)	NLC IN	INE589...	101,407.00	60.15	EXCH 0.01075	65,547.44		65,547.44	5
19)	PGHL IN	INE199...	1,516.0000	4021.00	EXCH 0.01075	65,506.65		65,506.65	409
20)	PI US	PI	2,958.0000	28.38	EXCH 0.78070	65,538.32		65,538.32	3
21)	PIHN US	PIHN	839,592.10		EXCH 0.78070	65,547.05		65,547.05	
22)	PNN LN	GB00B1...		1110.00	EXCH 1.00000				
23)	PPC US	PPC		21.49	EXCH 0.78070				
24)	STE US	STE	513.0000	163.40	EXCH 0.78070	65,441.64		65,441.64	16
25)	SUNP IN	INE044...		369.50	EXCH 0.01075				
26)	TCO IN	INE493...		78.60	EXCH 0.01075				
27)	UNH US	UNH	307.0000	273.11	EXCH 0.78070	65,457.70		65,457.70	
28)	USM US	USM	2,684.0000	31.70	EXCH 0.78070	66,424.23		66,424.23	3
29)	AAPL 3.05 07/31/29	XS1269...	56.0000	116.76	BGN 1.00000	65,386.16	145.46	65,531.62	11
30)	AMZN 3.15 08/22/27	023135BC	76.0000	109.61	BM... 0.78070	65,036.40	51.92	65,088.31	10
31)	BRK 0.44 09/13/29	XS2049...	8,911.0000	101.32	BVAL 0.00724	65,413.29	133.35	65,546.64	10
32)	CSCO 2.2 02/28/21	17275RBD	83.0000	100.76	BM... 0.78070	65,288.06	15.84	65,303.90	10
33)	JNJ 2.9 01/15/28	478160CK	76.0000	109.22	BM... 0.78070	64,806.18	224.64	65,030.82	10
34)	MOYLE 2.9376 03/31	XS0166...	87.0000	197.14	BVAL 1.00000	64,212.39	660.74	64,873.13	19
35)	MSFT 3.3 02/06/27	594918BY	75.0000	110.78	BM... 0.78070	64,862.79	139.55	65,002.34	10
36)	RILIN 9 01/21/25	INE110...	5,582.0000	108.23	BC... 0.01075	64,924.24	606.42	65,530.67	10
37)	WMT 3.7 06/26/28	931142EE	73.0000	113.81	BM... 0.78070	64,863.94	386.59	65,250.53	11
38)	XOM 2.222 03/01/21	30231GAV	83.0000	100.72	BM... 0.78070	65,262.79	4.00	65,266.79	10
39)									

Week 3:

Price-Multiple Approach

The P/E ratios of a list of companies were compared against the industry average P/E ratio, whereby the industrial classification was done based on Global Industrial Classification Standards (GICS). If the Stock P/E was lesser than the industrial P/E, the stock would be considered *Undervalued* or vice-versa (Table).

TICKER	Stock P/E	Industry P/E	Over/Undervalued
AZN LN	95.22	46.03	<i>Overvalued</i>
AUTO LN	23.31	87.77	<i>Undervalued</i>
UNH US	20.29	20.92	<i>Undervalued</i>
NLC IN	14.72	51.18	<i>Undervalued</i>
IHGZT TI	17.16	27.86	<i>Undervalued</i>

Table 7: Price-Multiple Calculation

It can be graphically represented as follows:

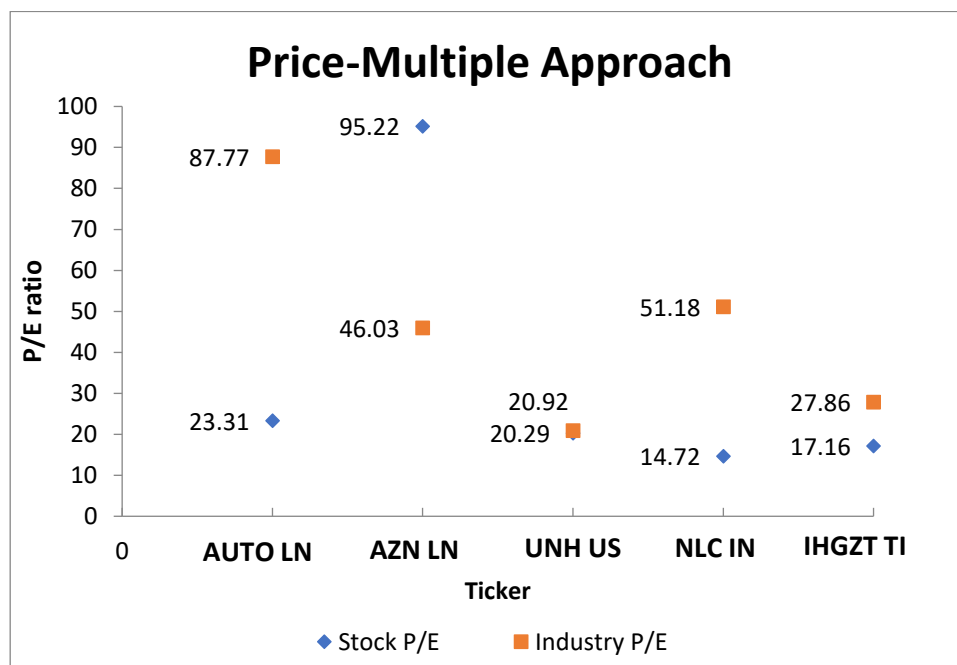


Figure 18: Price Multiple Approach

[illegible]

Week 4:

Efficient Market Hypothesis (Technical Analysis)

Historical Price trend for the past 12 months was analyzed on a bunch of stocks to make buy/sell decisions. If the stock performance was positive over the period, we would buy and if the performance was negative, sell.

Ticker	Price as on 17-02-19	Price as on 17-02-20	Return (%)	Decision
AAPL US (USD)	167.76	324.07	93.17%	Buy
AHT LN (GBp)	1980.5	2719.00	37.29%	Buy
ICICIBC IN (INR)	337.1	541.60	60.66%	Buy
ABBY US (USD)	0.005	0.003	-40.00%	Sell

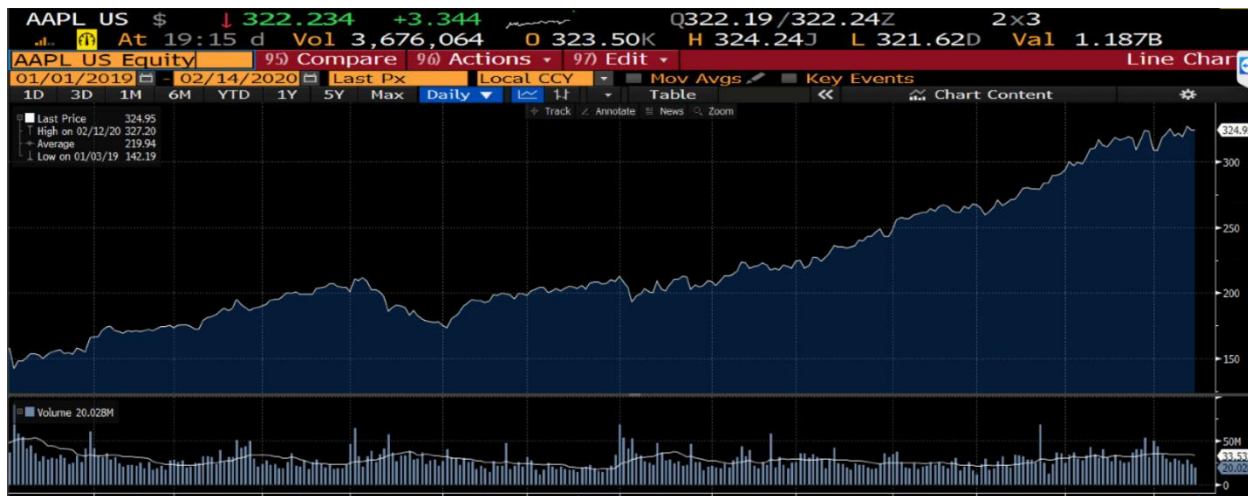


Figure 19: Historical Price for AAPL US



Figure 20: Historical Price for AHT LN



Figure 21: Historical Price for ICICIBC IN



Figure 22: Historical Price for ABBY US

New Buying in Week 4:

Equity	Corporate Bonds
AAPL US	AAPL 2.85 05/06/21
AHT LN	
ICICIBC IN	

Rationale for Buying:

Equity: Technical analysis as mentioned above.

Bonds: Buying shorter maturity bonds in line with the barbell strategy to reduce the overall duration of the bond portfolio.

Portfolio after changes in Week 4 (as on 16.03.2020):

ICICI BANK LTD Equity PRTU Related Functions Menu MSG: +55									
<Back> to Return									
Portfolio Administration: Portfolio Display									
Portfolio Name ACTIVE_PORTFOLIO ID U14258148-8 Currency GBP									
Date 03/16/20 Short Margin 0 Futures Margin 0 Display Currency GB									
Rebalanced 03/16/20									
Security	ID	Position	Price	PCS	FX Rate	Current Principal	Accrued	Market Val	Price
<Search>									
Totals						1,462,511.94	3,661.46	1,466,173.40	
Cash		35,063.258				35,063.26		35,063.26	
11) AAPL US	AAPL	328.0000	242.21	EXCH	0.81733	64,932.47		64,932.47	242.21
12) ADI US	ADI	955.0000	83.21	EXCH	0.81733	64,949.37		64,949.37	112.55
13) AHT LN	GB000005...	3,655.0000	1778.00	EXCH	1.00000	64,985.90		64,985.90	1778.00
14) AUTO LN	GB00BVY...	15,780.000	411.90	EXCH	1.00000	64,997.82		64,997.82	506.13
15) ICICIBC IN	INE090A...	14,627.000	402.90	EXCH	0.01103	64,993.33		64,993.33	402.90
16) IHGZT TI	TREIHGZ...	128,077.00	4.00	EXCH	0.12694	65,030.26		65,030.26	4.23
17) PGHL IN	INE199A...	1,650.0000	3572.60	EXCH	0.01103	65,010.67		65,010.67	4075.00
18) PIHN US	PIHN	795,275.02		EXCH	0.81733	65,000.00		65,000.00	
19) STE US	STE	659.0000	120.50	EXCH	0.81733	64,903.56		64,903.56	159.84
20) UNH US	UNH	353.0000	225.04	EXCH	0.81733	64,927.76		64,927.76	33.16
21) USM US	USM	2,948.0000	26.98	EXCH	0.81733	65,007.80		65,007.80	32.56
22) AAPL 2.85 05/06/21	037833AR	77.0000	101.32	BM...	0.81733	63,764.94	647.70	64,412.64	101.32
23) AAPL 3.05 07/31/29	XS12691...	59.0000	110.56	BGN	1.00000	65,232.76	222.47	65,455.23	116.82
24) AMZN 3.15 08/22/27	023135BC	74.0000	107.79	BM...	0.81733	65,192.58	127.01	65,319.59	108.66
25) BRK 0.44 09/13/29	XS20494...	8,470.0000	99.50	BVAL	0.00771	65,005.11	2.40	65,007.51	100.32
26) CSCO 2.2 02/28/21	17275RBD	79.0000	100.69	BM...	0.81733	65,015.68	71.03	65,086.70	100.72
27) JNJ 2.9 01/15/28	478160CK	73.0000	108.74	BM...	0.81733	64,881.99	293.18	65,175.18	107.15
28) MOYLE 2.9376 03/31/	XS01666...	88.0000	195.19	BVAL	1.00000	64,309.97	729.09	65,039.06	195.77
29) MSFT 3.3 02/06/27	594918BY	72.0000	110.15	BM...	0.81733	64,818.24	215.77	65,034.02	109.67
30) RILIN 9 01/21/25	INE110L...	5,450.0000	106.90	BC...	0.01103	64,249.68	815.13	65,064.81	108.08
31) WMT 3.7 06/26/28	931142EE	71.0000	112.19	BM...	0.81733	65,102.39	477.14	65,579.53	112.39
32) XOM 2.222 03/01/21	30231GAV	80.0000	99.62	BM...	0.81733	65,136.41	60.54	65,196.95	100.66
33)									

Bond Portfolio Creation and Management

Bond Credit Rating

High yield bonds are highly risky and thus were not included as a part of the portfolio. The portfolio mostly consists of investment grade bonds (At least A+ rated), reducing the speculative risk of the bond.

11) View ▾ 12) Actions ▾ 13) Settings ▾ 14) Trade Simulation ▾ Portfolio & Risk Analytics						
Characteristics ▾ Holdings ▾ Tracking Error/Volatility ▾ VaR ▾ Scenarios ▾ Performance ▾ Attribution ▾ Intraday ▾						
Main View ▾ Summary ▾ Cash Flows ▾ Liquidity Risk ▾ Key Rates ▾						
ACTIVE_PORTFOLIO ▾ vs Default (None ▾ by Asset Type ▾ in GBP ▾ As of 02/17/20 ▾						
Date ▾ Trend ▾						
Name	Mkt Val	Principal	Price (Inflated)	OADBB	Comp	Market Value (%)
ACTIVE_PORTFOLIO	1,531,434	541,922.24	82.22	6.84	AA+/AA	100.00
Equity	1,071,747		67.45			69.98
Cash	2,836	2,836.49	1.00	0.00		0.19
Fixed Income	456,850	539,085.75	117.37	6.88	AA+/AA	29.83
Corporate Debt	456,850	539,085.75	117.37	6.88	AA+/AA	29.83
AAPL 3.05 07/31/29	50,191	50,126.13	116.57	8.35	AA+	3.28
AMZN 3.15 08/22/27	50,581	49,870.43	108.12	6.49	A+	3.30
BRK 0.44 09/13/29	50,848	50,751.87	99.78	9.37	AA	3.32
JNJ 2.9 01/15/28	50,871	50,744.15	106.47	6.95	AAA	3.32
MOYLE 2.9376 03/31/33	50,989	134,905.94	195.52	5.52	A+	3.33
MSFT 3.3 02/06/27	50,382	50,331.57	109.12	6.11	AAA	3.29
NIPDES 0.315 03/17/28	50,998	50,932.18	100.83	7.97	NR	3.33
RILIN 9 01/21/25	51,052	50,727.11	107.86	4.08	NR	3.33
WMT 3.7 06/26/28	50,939	50,696.37	111.78	7.10	AA	3.33

Figure 23: Bond ratings as on 17.02.2020

11) View ▾ 12) Actions ▾ 13) Settings ▾ 14) Trade Simulation ▾ Portfolio & Risk Analytics						
Characteristics ▾ Holdings ▾ Tracking Error/Volatility ▾ VaR ▾ Scenarios ▾ Performance ▾ Attribution ▾ Intraday ▾						
Main View ▾ Summary ▾ Cash Flows ▾ Liquidity Risk ▾ Key Rates ▾						
ACTIVE_PORTFOLIO ▾ vs Default (None ▾ by Asset Type ▾ in GBP ▾ As of 03/16/20 ▾						
Date ▾ Trend ▾						
Name	Mkt Val	Principal	Price (Inflated)	OADBB	Comp	Market Value (%)
ACTIVE_PORTFOLIO	1,462,787	853,902.79	359.70	4.90	AA+/AA	100.00
Equity	712,369		624.06			48.70
Cash	35,063	35,063.26	1.00	0.00		2.40
Fixed Income	715,354	818,839.53	114.03	5.14	AA+/AA	48.90
Corporate Debt	715,354	818,839.53	114.03	5.14	AA+/AA	48.90
AAPL 2.85 05/06/21	64,329	63,678.45	101.57	1.11	AA+	4.40
AAPL 3.05 07/31/29	65,226	64,998.95	110.17	8.21	AA+	4.46
AMZN 3.15 08/22/27	65,948	65,816.44	109.24	6.54	A+	4.51
BRK 0.44 09/13/29	64,974	64,970.67	99.59	9.33	AA	4.44
CSCO 2.2 02/28/21	64,735	64,660.55	100.53	0.94	A+	4.43
JNJ 2.9 01/15/28	64,809	64,512.29	108.54	6.90	AAA	4.43
MOYLE 2.9376 03/31/33	64,885	171,345.24	194.71	5.44	A+	4.44
MSFT 3.3 02/06/27	64,717	64,496.44	110.02	6.06	AAA	4.42
RILIN 9 01/21/25	65,363	64,538.15	108.05	4.02	NR	4.47
WMT 3.7 06/26/28	65,367	64,885.31	112.24	7.05	AA	4.47
XOM 2.222 03/01/21	65,001	64,937.03	99.69	0.91	AA+	4.44

Figure 24: Bond ratings as on 16.03.2020

Bond Laddering

The portfolio adopted a bond laddering approach for managing the bond portfolio for the purpose of reducing duration as compared to the barbell strategy and increasing the convexity of the portfolio. Bonds of various maturities were selected and included in the portfolio. (Table 8)

Ticker	Purchase Date	Maturity	Years to Maturity
AAPL 2.85 05/06/21	16/03/2020	2021	1
XOM 2.222 03/01/21	24/02/2020	2021	1
CSCO 2.2 02/28/21	24/02/2020	2021	1
RILIN 9 01/21/25	17/02/2020	2025	5
AMZN 3.15 08/22/27	17/02/2020	2027	7
MSFT 3.3 02/06/27	17/02/2020	2027	7
WMT 3.7 06/26/28	17/02/2020	2028	8
JNJ 2.9 01/15/28	17/02/2020	2028	8
AAPL 3.05 07/31/29	17/02/2020	2029	9
BRK 0.44 09/13/29	17/02/2020	2029	9
MOYLE 2.9376 03/31/33	17/02/2020	2033	13

Table 8: Constituent Corporate Bonds – as on 16/03/2020

Duration

Macauley Duration is a measure of effective life of the bond, however, Modified duration measures sensitivity of bond prices to changes in yield to maturity. Modified duration may overestimate price declines and underestimate price increases. (Kritzman, 1992).

Using the bond laddering approach lead to a reduced modified duration of the bond from 6.90 at the beginning of the period to 4.97 at the end of the 4th week. Initially only a group of longer maturity bonds were included in the portfolio. However, this resulted in higher interest rate sensitivity and hence, higher duration. Thus, multiple shorter maturity bonds were selected to reduce the overall duration of the bond portfolio. As a result, the interest rate risk of the portfolio is reduced, and the portfolio is immune to rise or fall in interest rates in the future.

11) View ▾ 12) Actions ▾ 13) Settings ▾ 14) Trade Simulation ▾ Portfolio & Risk Analytics										
Characteristics Holdings Tracking Error/Volatility VaR Scenarios Performance Attribution Intraday										
Main View Summary Cash Flows Liquidity Risk Key Rates										
ACTIVE_PORTFOLIO ▾ vs None ▾ by Duration ▾ in GBP ▾ As of 02/17/20 ▾										
Date ▾ Trend ▾										
Name	#	Mkt Val	Market Value (%)	OAD to Worst	Yield Mod	ISMA Dur	ISMA Yld	OAS	L-OAS	
ACTIVE_PORTFOLIO	31	1,531,434	100.00	6.84	2.16	6.90	2.20	67.30	74.30	
0 - 1 yrs	1	2,836	0.19	0.00	0.71	0.00	0.00	0.00	0.00	
BRITISH POUND	1	2,836	0.19	0.00	0.71	0.00	0.00	0.00	0.00	
3 - 5 yrs	1	51,052	3.33	4.08	6.93	4.20	7.05	77.08	172.25	
RILIN 9 01/21/25	1	51,052	3.33	4.08	6.93	4.20	7.05	77.08	172.25	
5 - 7 yrs	4	202,822	13.24	6.27	2.14	6.32	2.18	83.99	83.91	
AMZN 3.15 08/22/27	1	50,581	3.30	6.49	1.95	6.69	1.99	41.60	47.54	
JNJ 2.9 01/15/28	1	50,871	3.32	6.95	1.99	7.14	2.02	44.04	50.41	
MOYLE 2.9376 03/31/33	1	50,989	3.33	5.52	2.77	5.17	2.79	215.27	197.47	
MSFT 3.3 02/06/27	1	50,382	3.29	6.11	1.85	6.31	1.90	34.04	39.31	
7 - 10 yrs	4	202,976	13.25	8.20	0.99	8.25	1.01	49.11	41.10	
AAPL 3.05 07/31/29	1	50,191	3.28	8.35	1.19	8.38	1.19	57.41	38.68	
BRK 0.44 09/13/29	1	50,848	3.32	9.37	0.46	9.36	0.46	51.16	42.67	
NIPDES 0.315 03/17/28	1	50,998	3.33	7.97	0.21	7.97	0.21	32.14	20.58	
WMT 3.7 06/26/28	1	50,939	3.33	7.10	2.11	7.30	2.16	55.88	62.46	

Figure 25: Bond portfolio modified duration – as on 17/02/2020

11) View ▾ 12) Actions ▾ 13) Settings ▾ 14) Trade Simulation ▾ Portfolio & Risk Analytics										
Characteristics Holdings Tracking Error/Volatility VaR Scenarios Performance Attribution Intraday										
Main View Summary Cash Flows Liquidity Risk Key Rates										
ACTIVE_PORTFOLIO ▾ vs None ▾ by Duration ▾ in GBP ▾ As of 03/16/20 ▾										
Date ▾ Trend ▾										
Name	#	Mkt Val	Market Value (%)	OAD to Worst	Yield Mod	ISMA Dur	ISMA Yld	OAS	L-OAS	
ACTIVE_PORTFOLIO	23	1,462,787	100.00	4.90	2.15	4.97	2.29	113.35	123.33	
0 - 1 yrs	3	164,800	11.27	0.73	1.68	0.74	2.10	118.93	124.24	
BRITISH POUND	1	35,063	2.40	0.00	0.15	0.00	0.00	0.00	0.00	
CSCO 2.2 02/28/21	1	64,735	4.43	0.94	1.64	0.94	1.64	105.67	112.57	
XOM 2.222 03/01/21	1	65,001	4.44	0.91	2.55	0.95	2.56	196.29	202.87	
1 - 3 yrs	1	64,329	4.40	1.11	1.45	1.12	1.45	89.65	97.20	
AAPL 2.85 05/06/21	1	64,329	4.40	1.11	1.45	1.12	1.45	89.65	97.20	
3 - 5 yrs	1	65,363	4.47	4.02	6.86	4.12	6.98	74.14	201.84	
RILIN 9 01/21/25	1	65,363	4.47	4.02	6.86	4.12	6.98	74.14	201.84	
5 - 7 yrs	4	260,359	17.80	6.24	1.96	6.35	2.01	130.69	126.70	
AMZN 3.15 08/22/27	1	65,948	4.51	6.54	1.77	6.71	1.82	104.18	107.20	
JNJ 2.9 01/15/28	1	64,809	4.43	6.90	1.69	7.07	1.74	94.44	98.05	
MOYLE 2.9376 03/31/33	1	64,885	4.44	5.44	2.69	5.39	2.71	225.48	200.60	
MSFT 3.3 02/06/27	1	64,717	4.42	6.06	1.70	6.23	1.76	98.97	101.18	
7 - 10 yrs	3	195,567	13.37	8.20	1.46	8.26	1.48	106.46	100.43	
AAPL 3.05 07/31/29	1	65,226	4.46	8.21	1.86	8.27	1.87	142.39	114.14	
BRK 0.44 09/13/29	1	64,974	4.44	9.33	0.48	9.30	0.49	49.04	55.13	
WMT 3.7 06/26/28	1	65,367	4.47	7.05	2.04	7.22	2.09	127.69	131.80	

Figure 26: Bond portfolio modified duration – as on 16/03/2020

Convexity

Lower coupon bonds, higher maturity bonds and bond laddering approach lead to higher convexity. Portfolio convexity can be calculated as the weighted average convexity of individual bonds.

The overall portfolio convexity marginally decreases from 0.501 at the beginning of the period to 0.371 at the end of 4th week. The main reason for the fall in convexity is due to the addition of shorter duration bonds for reducing duration but which also have low convexity.

Ticker	Price (P_i)	Convexity (C_i)	Weight (w_i) (P_i)/ $\sum P_i$	$C_i * w_i$
AAPL 3.05 07/31/29	116.86	0.746	0.111	0.082
AMZN 3.15 08/22/27	108.23	0.452	0.102	0.046
BRK 0.44 09/13/29	100.16	0.874	0.095	0.083
JNJ 2.9 01/15/28	106.58	0.503	0.101	0.051
MOYLE 2.9376 03/31/33	195.54	0.340	0.185	0.063
MSFT 3.3 02/06/27	109.23	0.389	0.103	0.040
NIPDES 0.315 03/17/28	100.91	0.632	0.095	0.060
RILIN 9 01/21/25	107.92	0.183	0.102	0.019
WMT 3.7 06/26/28	111.83	0.540	0.106	0.057
	$\sum P_i = 1057.26$		Portfolio Convexity	0.501

Table 8: Portfolio convexity as on 17.02.2020

Ticker	Price (P_i)	Convexity (C_i)	Weight(w_i) (P_i)/ $\sum P_i$	$C_i * w_i$
AAPL 2.85 05/06/21	101.32	0.013	0.081	0.001
AAPL 3.05 07/31/29	110.56	0.746	0.088	0.066
AMZN 3.15 08/22/27	107.79	0.452	0.086	0.039
BRK 0.44 09/13/29	99.50	0.874	0.079	0.069
CSCO 2.2 02/28/21	100.69	0.009	0.080	0.001
JNJ 2.9 01/15/28	108.74	0.503	0.087	0.044
MOYLE 2.9376 03/31/33	195.19	0.34	0.156	0.053
MSFT 3.3 02/06/27	110.15	0.389	0.088	0.034
RILIN 9 01/21/25	106.90	0.183	0.085	0.016
WMT 3.7 06/26/28	112.19	0.54	0.090	0.048
XOM 2.222 03/01/21	99.62	0.008	0.080	0.001
	$\sum P_i = 1252.65$		Portfolio Convexity	0.371

Table 9: Portfolio convexity as on 16.03.2020

End of Week 10 – Asset class wise and country wise diversification:

Overall, the portfolio shifted from a 70-30 stock-bond allocation to a nearly 50-50 allocation. The main purpose for doing so was the changes in the economic environment of the world due to the COVID-19 pandemic. Since the pandemic slowed down the economy, bonds started becoming more attractive (especially shorter maturity bonds) which would reduce the duration of the portfolio. Apart from that, healthcare stocks became more attractive as the development of a vaccine for the pandemic became more important. Thus, the portfolio shifted towards a 50-50 allocation.

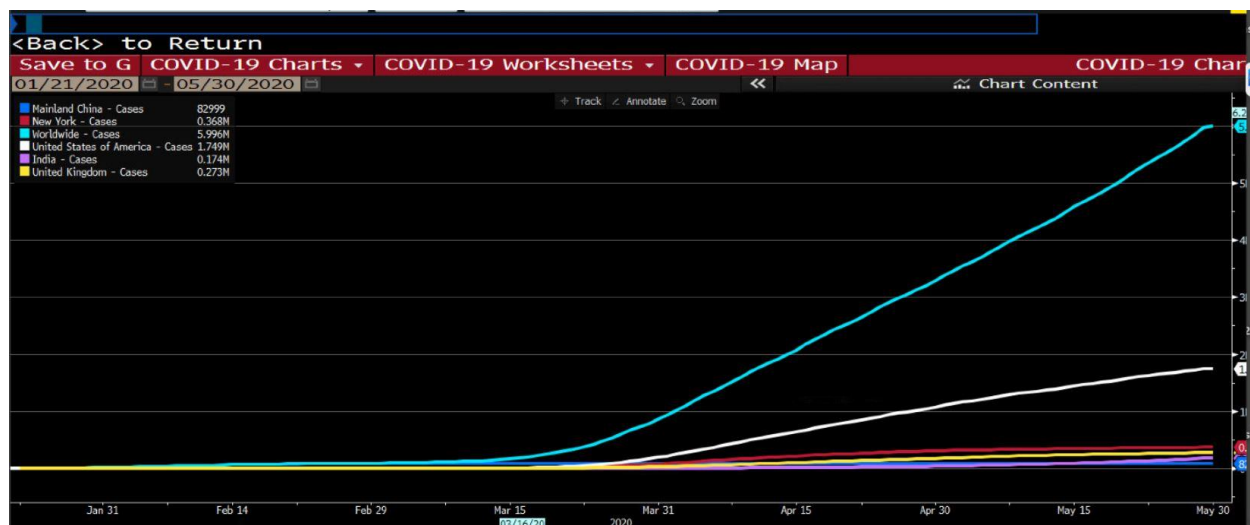


Figure 27: COVID-19 no. of cases



Figure 28: Asset class wise asset allocation as on 15.05.2020

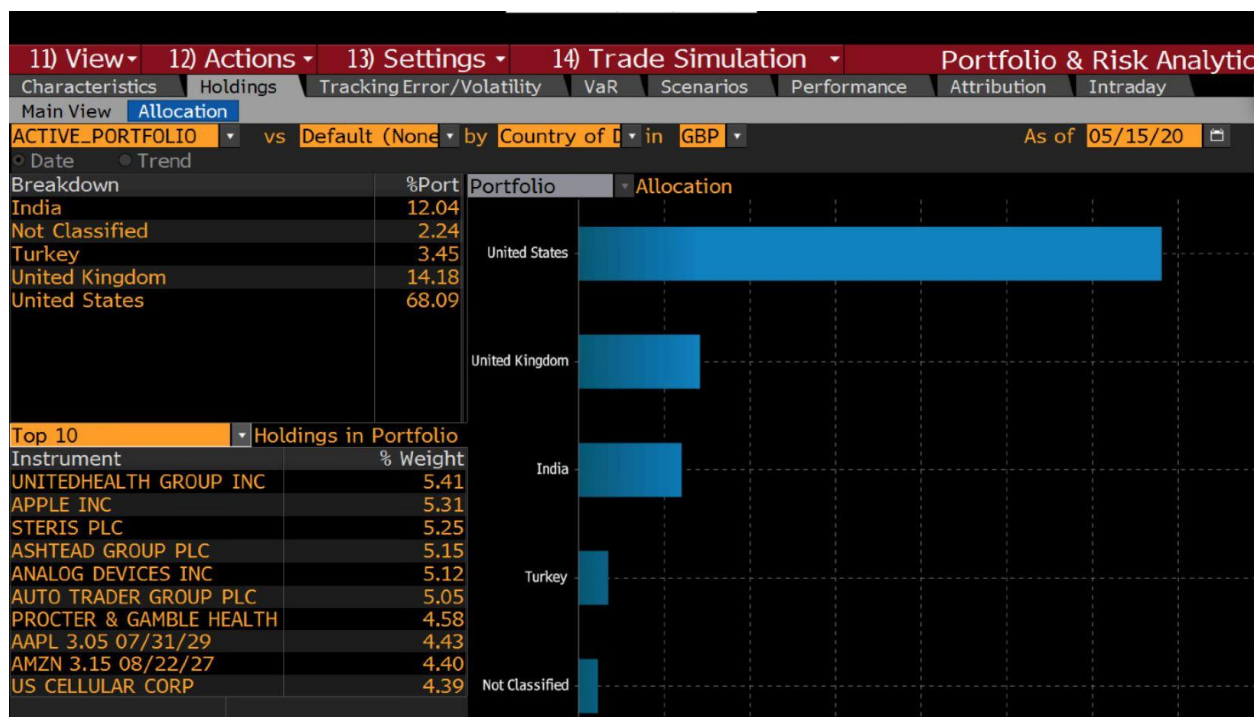


Figure 29: Country-wise asset allocation as on 15.05.2020

Portfolio Performance Evaluation

At the end of the 10-week period, the performance of the portfolio is evaluated in relation to the benchmark to determine the effectiveness or ineffectiveness of Active Portfolio Management.

The portfolio is evaluated using a range of measures such as Sharpe ratio, Treynor ratio, Jensen's Alpha, Information ratio and several other measures of performance evaluation.

Particulars	Portfolio Value	Portfolio Weekly Return
Week 1	1,531,725.00	-
Week 2	1,532,164.00	0.03%
Week 3	1,504,319.00	-1.82%
Week 4	1,509,128.00	0.32%
Week 5	1,442,367.00	-4.42%
Week 6	1,440,835.00	-0.11%
Easter	1,462,911.00	1.53%
Easter	1,450,552.00	-0.84%
Easter	1,530,974.00	5.54%
Week 7	1,592,498.00	4.02%
Week 8	1,613,318.00	1.31%
Week 9	1,657,376.00	2.73%
Week 10	1,712,058.00	3.30%

Table 10: Portfolio Weekly Returns

Sharpe, Treynor, Information and Jensen's Alpha	
Risk-free rate	1.59%
Return on Portfolio	11.77%
Return on Benchmark	-18.30%
Standard Deviation of Portfolio	2.73%
Standard Deviation of Benchmark	9.03%
Beta of Portfolio	0.08
Beta of Benchmark	1.00

Ratio	Portfolio	Benchmark
Sharpe Ratio	3.73	-2.20
Treynor Ratio	1.29	-0.20
Jensen's Alpha	11.75%	
Information Ratio	3.60	
Tracking Error	8.36%	

Table 11: Risk adjusted ratio calculations

Overall, Active Management has proven to achieve its objective of outperforming the benchmark. Several performance measures were used to conclude the same.

The Sharpe Ratio for the portfolio is 3.73, which indicates excess return of 3.73% above the risk-free rate for each additional unit of volatility (standard deviation – total risk). The portfolio's Sharpe Ratio is higher than the benchmark, which indicates that the portfolio earned a higher risk-adjusted excess return above the risk-free rate than the benchmark. (Aragon & Ferson, 2008). Treynor Ratio is similar to the Sharpe ratio and Treynor for the portfolio was 1.29 which means for each unit of systematic risk undertaken by the portfolio, it earns a return of 1.29% above the risk-free rate. As per Jensen's Alpha, the portfolio earns excess return of 11.75% above its theoretical intrinsic value as determined by CAPM.

Information ratio is 3.60 which indicates the active return of the portfolio above the benchmark return per unit of the tracking error or the standard deviation of active return.

The tracking error of 8.36% indicates the variation in active return and is slightly higher than deemed fit for active managers.

Other measures for Performance Evaluation

Particulars	Portfolio	Benchmark
Annualised Return	47.76%	-49.02%
Cumulative Return	11.59%	-12.79%
Annualised Volatility	19.66%	65.14%
Maximum Drawdown	-6.03%	-27.66%
% Winning trades	80.00%	50.00%
% Losing trades	20.00%	50.00%
Number of Up Periods	8	5
Number of Down Periods	4	7
Avg Gain in Up Periods	2.35%	6.41%
Avg Loss in Down Periods	-1.80%	-6.79%
Avg Gain/Loss Ratio	1.30	0.94

Table 12: Other performance evaluation measures

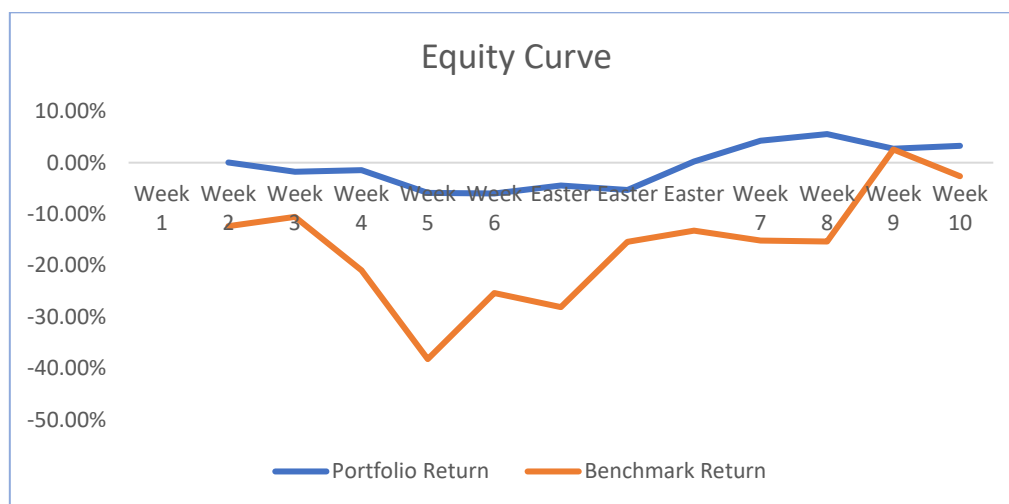


Figure 30: Equity Curve

The Equity Curve is upward sloping in the long run except for the period between Week 2 and Easter Week 3, post which the portfolio returns start trending above. In relation to the benchmark, the portfolio has consistently outperformed the benchmark. The avg gain/loss ratio is attractive at 1.30 which means the portfolio has gained higher than the % loss suffered. There is a higher % of winning trades at 80% for the portfolio which means the portfolio is earning positive returns for more than 50% of the times. However, the benchmark has 50-50% winning losing ratio. The portfolio's downside risk stands at -6.03% which is reflected in the maximum drawdown for the portfolio.

Based on this analysis, the portfolio has outperformed the benchmark and seems as an attractive investment. It also depicts the success of active portfolio management in relation to the benchmark.

Value at Risk (VaR)

The portfolio VaR is calculated using 2 methods – Historical Simulation and Monte-Carlo Simulation.

Monte-Carlo Simulation:

Particulars	Description	Value
Average Weekly Return	Average of portfolio weekly returns	0.966%
Average Weekly SD	Average of portfolio weekly SD	0.027
Annualised return	$(1 + \text{weekly return})^{52} - 1$	0.648
Annualised SD	Weekly SD * $\sqrt{52}$	0.197
S₀	Initial Portfolio Value	1,531,725.00
Time increment	1/52	1.92%
Expected return	$(\text{Annualised return} - \frac{1}{2} * \text{variance})$	0.629

Sr. No	rand()	Normsinv()	$K * T + SD * Et * \sqrt{T}$
1	0.919699436	1.403052687	0.050356457
2	0.272717918	-0.604613498	-0.004391068
3	0.038392376	-1.769654276	-0.036160841
4	0.25271122	-0.66598226	-0.006064548
.	.	.	.
.	.	.	.
.	.	.	.
.	.	.	.
1996	0.9418472	1.5704709	0.054921823
1997	0.685809141	0.484005848	0.025294751
1998	0.505067075	0.012701616	0.012442644
1999	0.17818521	-0.922303249	-0.013054225
2000	0.518321509	0.045941369	0.013349066

Table 13: Monte-Carlo Simulation calculation

Hedging using Option Strategies

Company Name: AAPL US Equity (Apple Inc.)		
Current Market Price	250	250
Exercise Price	250	250
Premium	5	5

Since the exercise price is equal to the assumed current market price, the option is At the Money. As a result of this, the option premium does not have any intrinsic value (Spot price – Exercise Price) and thus, the premium on both the call and put options are roughly the same. (Hence our assumption is they are the same).

Straddle Purchase:

Stock Price	Call Payoff	Put Payoff	Straddle Purchase
175	-5	70	65
190	-5	55	50
205	-5	40	35
220	-5	25	20
235	-5	10	5
250	-5	-5	-10
265	10	-5	5
280	25	-5	20
295	40	-5	35
310	55	-5	50
325	70	-5	65

Table 14: Straddle Purchase Calculation

Straddle Write:

Stock Price	Call Write Payoff	Put Write Payoff	Straddle write
175	-70	5	-65
190	-55	5	-50
205	-40	5	-35
220	-25	5	-20
235	-10	5	-5
250	5	5	10
265	5	-10	-5
280	5	-25	-20
295	5	-40	-35
310	5	-55	-50
325	5	-70	-65

Table 15: Straddle Write Calculation