Dublin Business School

Statistical Analysis Report

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About the Report:

The report is prepared as part of aproject under Quantitative Financial Modelingto determine Statistical Analysis of different Asset Class and corresponding Risk associated with the asset under different market conditions. The report provides a overview technical analysis as conducted on certain chosen assets and also the rationale behind the asset selection. The report combines an analysis and understanding for an investor to consider any asset basis their Risk Nature.

Executive Summary:

This report provides a Statistical Summary along with Risk Based Analysis of selected Assets chosen from diversified segments including Equity Stocks, Commodities and Bond Funds, for a wider perspective. The analysis has been conducted for a period of last 22 years from 2001 to 2023 considering at least 4 time periods under various Conditional Expectations. The identified stocks have been time tested under various stressed scenarios and their outcomes have been observed to derive their Risk Adjusted Nature.The report is prepared from an investor's perspective to provide adequate knowledgeabout working on various asset classesand the risk involved so as to choose correct securities traded in the market for their investment portfolio. The report encompasses various tools and ratios to determine the market volatility and the performance of the selected assets to observe their price fluctuations in different market conditions. The study aims on analyzing the risk involved in each stock that causes price fluctuation at different stressed market conditions over a long period of time. The report also focuses to provide a risk-based understanding to the investors and guide them to choose an asset prudently for their portfolio and invest in right type of securities at right time.

Rationale of Asset Selection:

For the purpose of analysis, Ticker has been set against S&P 500 as benchmark index and 15 different assets has been chosen for detailed technical analysis like Daily & Monthly Average Movement, Standard Deviation, Correlation Matrix, Beta, Sharpe Ratio, Sortino Ratio etc. For asset selection, the equity market has been segmented basis following Industry Type –Technology, Utility, Banking & Finance, Power&Energy,and Pharmaceuticals. From each industry, basis highest market capitalization top 2 stocks have been considered for this analysis. Further forportfolio diversification, 2 commodities have been considered – Gold & Silver along with low-risk Debt & Bond based funds– American Class A Bond Fund and Vanguard Wellesley Income. To determine the present Risk Free Return, Fed Effective Interest Rate has been set as an indicator of Cash based security return.As a measure of Risk Mitigation, Beta, Standard Deviation and Correlation Matrix has been used to identify the relation among all 15 assets. It is to be noted here that Correlation does not imply causation but it is used as a measure of how two variables move together and the direction of the movement. Investors can use outcome of correlation matrices over different asset classes for diversification benefits in their portfolio and consider investment plan basis individual risk appetite. A lower or negative correlation between assets can help reduce overall portfolio risk.

Correlation Matrices of Chosen Asset Classes:-

	Gold	Silver	S&P_500	Apple	Microsoft	Goldman_Sachs	JP_Morgan	AES Corp	Ameren Corp	Exxon	Shell	J&J	Astra_Zeneca	Bond_Fund_ America_Class A	Vanguard_Wellesly_Income	Fed_Interest_Rate
Gold	100.00%															
Silver	-1.66%	100.00%														
S&P_500	-1.94%	-1.37%	100.00%													
Apple	-1.67%	0.71%	60.89%	100.00%												
Microsoft	-2.06%	-0.47%	73.44%	52.42%	100.00%											
Goldman_Sachs	-1.78%	0.98%	74.14%	43.11%	49.97%	100.00%										
JP_Morgan	-1.06%	-2.92%	74.80%	39.75%	47.51%	74.99%	100.00%									
AES Corp	-0.20%	-0.78%	46.18%	24.11%	30.59%	33.85%	36.10%	100.00%								
Ameren Corp	-3.20%	-1.59%	56.79%	25.52%	37.11%	35.53%	37.11%	38.83%	100.00%							
Exxon	0.09%	-1.37%	66.80%	31.89%	40.32%	47.91%	47.62%	35.23%	44.29%	100.00%						
Shell	2.69%	-2.01%	63.67%	31.52%	40.40%	48.38%	46.86%	36.16%	39.07%	76.12%	100.00%					
J&J	-1.25%	-3.15%	57.55%	27.48%	38.52%	35.29%	36.16%	22.46%	46.11%	43.18%	38.28%	100.00%				
Astra_Zeneca	1.00%	-2.40%	47.74%	25.48%	33.46%	30.43%	31.30%	22.29%	32.51%	32.54%	36.37%	40.11%	100.00%			
Bond_Fund_ America_ClassA	1.15%	1.54%	-11.06%	-7.27%	-8.33%	-11.48%	-14.89%	2.21%	3.58%	-12.76%	-6.60%	-9.26%	-1.75%	100.00%		
Vanguard_Wellesly_ Income	-1.64%	-1.52%	82.50%	42.45%	54.52%	60.01%	62.12%	41.28%	61.60%	62.14%	60.37%	54.16%	45.57%	30.25%	100.00%	
Fed_Interest_Rate	-0.24%	1.25%	-1.84%	-0.51%	-0.61%	-1.34%	0.23%	-1.23%	-0.16%	-1.08%	-0.35%	-1.21%	-0.41%	1.30%	-1.25%	100.00%

Asset Selected: Gold (GC=F) - Commodity

Rationale for Selection: Gold is considered as a safe haven commodity with least volatility from an investor perspective. It stands as a hedge against market uncertainties during the stressed economic scenario like Post Tech Bubble 2001, 2008 Global Economic Crisis and COVID. It also provides liquidity when required and store of value attribute helps in portfolio diversification.

Observations: Gold exhibits a negative correlation of -1.94% as against S&P 500, indicating an inverse relationship with equity stock movements that implies investors can diversify their portfolio by selecting gold commodity. Gold has Daily Mean return is 0.03% with low Standard Deviation of 1.10%, showcasing the asset has low but consistent return and low volatility with the market movements. Gold has annualized Mean of 8.99% and Standard Deviation of 17.46% underscores its price volatility over the long term as compared to other asset class. While the Sharpe Ratio of 0.01 and Sortino Ratio of 0.019 suggest better risk-adjusted returns compared to the risk-free rate, this makes gold a potential diversification tool for risk-averse investors seeking stability during market turbulence.

Unique Characteristics: Gold possesses unique characteristics in the investment landscape. It showcases a negative correlation with the S&P 500, making it an effective hedge during market turbulence, although its daily mean returns of 0.03% is very low but consistent even in stressed scenario as observed in analysis. The asset has extremely low Beta score of 0.017 which implies there is negligible risk in the asset even under extreme market conditions.

Regimes/ Stress Environment: In different stressed economic environments Gold's performance varies. However, every economic situation the asset has shown positive movement as observed in below analysis as well. Post Technology slowdown, the Mean return of 0.04%, during the US recession it stands 0.03% and amid the COVID-19 pandemic 0.17%. This demonstrates its potential as a hedge during economic downturns and uncertainty, with the highest returns observed during periods of severe crisis.

ASSET CLASS	MEAN RETURN		
	Post Tech	US Recession	Covid
Gold	0.04%	0.03%	0.17%

Summary: Gold is chosen as a safe-haven investment due to its capacity to hedge against economic uncertainties. It exhibits a negative correlation with the S&P 500 however under every stressed scenario the asset has given modest daily returns as well Annual return will low volatility. Low Beta makes the asset qualify as a diversification tool for risk-averse investors and stabilise the portfolio return during adverse market condition. Gold's unique characteristics are evident in its effectiveness as a hedge during times of market turbulence and its ability to provide the highest returns during severe economic crises.

Statistics	Gold
Mean Daily	0.03%
Std Dev Daily	1.10%
Min	-9.82%
Max	8.64%
Correlation	-1.94%
Beta	-0.017
Sharpe ratio	0.01
Sortino ratio	0.019
Mean Annual	8.944%
Std Dev Annual	17.46%

Asset Selected: Silver (SI=F) - Commodity

Rationale for Selection: Silver is also considered a safe haven commodity, similar to gold. It can serve as a hedge against market uncertainties, making it an attractive choice for investors during economic crises, such as the ones experienced after the Tech Bubble in 2001, the 2008 Global Economic Crisis, and the COVID-19 pandemic. Its liquidity and store of value attributes make it suitable for portfolio diversification.

Observations: Silver exhibits a negative correlation of -1.37% with the S&P 500, indicating an inverse relationship with equity stock movements, which suggests that investors can diversify their portfolios by including silver as a commodity. Silver has a daily mean return of 0.03% and a standard deviation of 1.99%, showing that it has a low but relatively consistent return with low volatility in response to market movements. When looking at the annualized figures, silver has a mean return of 7.78% and a standard deviation of 31.63%, highlighting its higher price volatility compared to other asset classes. The Sharpe Ratio of 0.005 and the Sortino Ratio of 0.007 suggest that silver provides limited risk-adjusted returns compared to the risk-free rate, indicating that it may not be as efficient in this regard as gold. This might be less appealing to risk-averse investors.

Unique Characteristics: Silver shares the unique characteristic of a negative correlation with the S&P 500, making it a potential hedge during market turbulence. However, it has slightly higher volatility compared to gold, as reflected in its higher standard deviation.

Regimes/Stress Environment: Silver's performance in various stressed economic environments also varies. It tends to have negative or slightly negative mean returns during economic downturns. For instance, during the Tech Bubble slowdown, it had a mean return of -0.03%, during the US recession it was -0.01%, and during the COVID-19 pandemic, it was -0.38%. While it provides some downside protection, it doesn't exhibit the same resilience as gold during crises.

ASSET CLASS	MEAN RETURN		
	Post Tech	US Recession	Covid
Silver	-0.03%	-0.01%	-0.38%

Summary: Silver is chosen as a safe-haven investment due to its potential to hedge against economic uncertainties, similar to gold. It exhibits a negative correlation with the S&P 500, making it a potential diversification tool for investors. Silver's unique characteristics lie in its effectiveness as a hedge during times of market turbulence. However, it tends to have slightly higher price volatility compared to gold, and its risk-adjusted returns, as reflected in the Sharpe and Sortino ratios, are not as favourable as gold.

Statistics	Silver
Mean	0.03%
Std Dev	1.99%
Min	-19.55%
Max	12.20%
Rfr	0.019%
Correlation	-1.37%
Beta	-0.023
Sharpe ratio	0.005
Sortino ratio	0.007
Mean Annual	7.78%
Std Dev Annual	31.63%

Asset Selected: S&P500

Rationale for Selection: Investing in the S&P 500 is a popular choice due to its historical performance, diversified exposure to the U.S. market, and easy accessibility.

It offers broad market representation, has a track record of solid returns, and can be accessed through low-cost index funds, making it an attractive option for long-term, diversified investments.

Observations: The data shows that the investment yields a daily average return of 0.02% with moderate volatility (1.23%). While it has positive annual returns (5.49%), the annual standard deviation (19.58%) indicates significant annual volatility.

Risk-adjusted measures like the Sharpe and Sortino ratios suggest limited excess return over the risk-free rate, making a closer evaluation of the investment's risk-return profile necessary.

Unique Characteristics: The S&P 500 exhibits a historical average annual return, providing steady growth potential, while its diversified composition offers reduced risk compared to individual stocks. This broad-market index offers investors a balanced risk-return profile and the convenience of easy access and liquidity.

Regime/ Stress Environment: The S&P 500's performance varies across different economic regimes. During a post-tech period, it shows relatively flat returns (-0.01%). In a US recession, the returns decline more significantly (-0.12%), and during the Covid pandemic, there is a substantial drop in returns (-0.46%), indicating increased volatility and challenges in this stress environment.

ASSET CLASS	MEAN RETURN		
	Post Tech	US Recession	Covid
S&P_500	-0.01%	-0.12%	-0.46%

Summary: The S&P 500 is a preferred choice for investors due to its historical performance, diversified exposure, and accessibility. However, its daily average return of 0.02% with moderate volatility and high annual standard deviation (19.58%) implies significant risk. Risk-adjusted measures indicate limited excess returns. The S&P 500's unique features include consistent annual returns and reduced risk. Its performance varies across economic regimes, with notable declines during recessions and the Covid pandemic, indicating increased volatility in challenging environments.

Statistics	S&P 500
Mean Daily	0.02%
Std Dev Daily	1.23%
Min	-12.77%
Max	10.96%
Rfr	0.019%
Sharpe ratio	0.00214
Sortino ratio	0.00292
Mean Annual	5.49%
Std Dev Annual	19.58%

Asset Selected: Apple Inc. (AAPL) [Equity Stock]

Rationale for Selection: Apple Inc. is a well-established and widely recognized technology company, making its stock a popular choice for investors. It has a history of strong financial performance, consistent innovation, and a significant presence in the global consumer electronics and technology markets. Apple Incorporation has very high market capitalisation among the S&P 500 Stocks, hence it is considered for the analysis.

Observations: Apple's stock exhibits a strong positive correlation with the overall market, with a correlation of 60.89% with the S&P 500 over a period of 2001 to 2023. This positive correlation suggests that Apple's stock tends to move in the same direction as the broader stock market. However, the Beta of the stock is 1.11 which indicates that Apple is highly volatile in nature as compared to S&P 500. The daily mean return for Apple's stock has been low over the observation period which is 0.12%. Also, the Standard Deviation or volatility of the stock has is 2.26% which implies that there is low variability from its mean position. The stock has shown periods of both strong gains and moderate losses. While the Sharpe ratio of 0.04 and Sortino ratio of 0.06 indicate that Apple's stock offers relatively attractive risk-adjusted returns compared to the risk-free rate, the stock's annualized standard deviation of returns varies but is generally lower than assets with higher price volatility.

Unique Characteristics: Apple's stock stands out due to its brand strength, product diversity, and a large customer base. The stock has a stable return in the market as it also has low volatility. Due to high market capitalisation on overall S&P 500 index, we can observe that the stock has a strong positive correlation. It is observed that Apple has a negative correlation with Gold -1.67% as a commodity and a negative market correlation of -7.27% is observed with American Class A Bond. Due to its low mean and less volatility, the stock still offers a degree of stability and low but steady growth over time.

Regimes/ Stress Environment: We have considered 3 regimes for our stock, namely: 1. Tech Bubble 2. US Recession and 3. Covid. The outcomes for the same is attached below which infers that although the mean returns during this period is negative but the extent of the negative returns is not that high.

ASSET CLASS	MEAN		
	Post Tech	US Recession	Covid
Apple	-0.02%	-0.09%	-0.46%

Summary: Apple Inc.'s stock is a popular choice for investors due to its brand strength and consistent innovation. While not a typical safe haven like gold, Apple's stock is known for its stability and growth potential, especially during periods of economic expansion and technological advancements. Investors often include Apple in their portfolios as a source of consistent returns and exposure to the technology sector. In our analysis we have observed that the Apple Incorporation has a strong positive correlation with the S&P 500 and with a relatively high Beta. But considering low volatility and low Sharpe and Sortino Ratio, we can recommend the stock as a part of the investment portfolio.

	Apple
Mean	0.12%
Std Dev	2.26%
Min	-19.75%
Max	13.02%
Correlation	60.90%
Beta	1.115
Sharpe ratio	0.043
Sortino ratio	0.063
Covariance	0.02%
Mean Annual	34.16%
Std Dev Annual	35.87%

Asset Selected: Microsoft Corporation (MSFT) [Equity Stock]

Rationale for Selection: Microsoft Corporation is a prominent technology company with a strong presence in software, cloud services, and various technology sectors. Its stock is widely held by investors seeking exposure to the technology industry. Microsoft's consistent performance and innovation make it a suitable choice for analysis.

Observations: Microsoft's stock exhibits a strong positive correlation with the overall market, with a correlation of 73.44% with the S&P 500 over the observed period. The Beta of Microsoft's stock is 1.085, indicating that it is sensitive to market movements, although not as volatile as Apple's stock. The daily mean return for Microsoft's stock is 0.056%, reflecting a relatively modest but positive daily return. The stock's standard deviation or volatility is 1.82%, suggesting moderate variability from its mean position. This lower volatility compared to Apple's stock contributes to its stability. The Sharpe ratio of 0.021 and the Sortino ratio of 0.029 indicate that Microsoft's stock offers relatively attractive risk-adjusted returns compared to the risk-free rate.

Unique Characteristics: Microsoft's stock is known for its stability and relatively lower volatility compared to many other technology stocks, making it an appealing choice for investors seeking a balanced risk-return profile. The stock exhibits a strong positive correlation with the S&P 500, indicating its responsiveness to broader market trends and positive market sentiment. It is observed that Microsoft has a negative correlation with Gold -2.06% as a commodity and a negative market correlation of -8.33% is observed with American Class A Bond. Due to its low mean and less volatility, the stock still offers a degree of stability and low but steady growth over time.

Regimes/Stress Environment:

- Microsoft's stock performance during three different economic regimes shows that it maintained a positive mean return in Tech Bubble but a negative mean return in the 2008 US Recession and Covid.

- While the positive returns were very low and only at Tech Bubble regime, Microsoft's stock demonstrated resilience during these economic scenarios, including the Tech Bubble, the US Recession, and the COVID-19 pandemic since the returns during the US recession and Covid are not highly negative.

ASSET CLASS	**MEAN**		
	Post Tech	**US Recession**	**Covid**
Microsoft	0.10%	-0.10%	-0.24%

Summary: Microsoft Corporation's stock is a popular choice for investors seeking stability and exposure to the technology sector. With its strong positive correlation with the S&P 500, it aligns with broader market movements. While not immune to market fluctuations, Microsoft's stock is characterized by its relatively lower volatility and consistent performance. The stock offers attractive risk-adjusted returns, making it an appealing addition to investment portfolios looking for a balance between stability and growth potential.

Mean	0.056%
Std Dev	1.82%
Min	-15.95%
Max	17.06%
Risk free rate	0.019%
Beta	1.085
Sharpe ratio	0.021
Sortino ratio	0.029
Mean Annual	0.05%
Std Dev Annual	28.93%

Asset Selected: Goldman Sachs Group, Inc. (GS) [Equity Stock]

Rationale for Selection: Goldman Sachs is a renowned global investment banking and financial services company. Analysing its equity stock is valuable for investors interested in the financial sector and investment banking industry. Goldman Sachs is known for its significant presence in the financial markets and investment services.

Observations:

Goldman Sachs' stock exhibits a strong positive correlation with the overall market, with a correlation of 74.14% with the S&P 500 over the observed period. The Beta of Goldman Sachs' stock is 1.322, indicating that it is sensitive to market movements and has a higher level of volatility compared to Apple's stock. The daily mean return for Goldman Sachs' stock is 0.02%, reflecting a relatively modest daily return. The stock's standard deviation or volatility is 2.19%, suggesting moderate variability from its mean position. This level of volatility is similar to Apple's stock. The Sharpe ratio of 0.002 and the Sortino ratio of 0.003 indicate that Goldman Sachs' stock offers relatively unattractive risk-adjusted returns compared to the risk-free rate.

Unique Characteristics:

- Goldman Sachs' stock is characterized by its prominence in the financial sector, and it is responsive to market sentiment and broader market trends.

- While it exhibits a strong positive correlation with the S&P 500, similar to Apple's stock, its performance is notably influenced by events in the financial markets and economic conditions.

- It is observed that Goldman Sachs has a negative correlation with Gold -1.78% as a commodity and a negative market correlation of -11.48% is observed with American Class A Bond. Due to its low mean and less volatility, the stock still offers a degree of stability and low but steady growth over time.

Regimes/Stress Environment:

- The mean returns for Goldman Sachs' stock during different economic regimes are as follows: Post Tech (0.03%), US Recession (-0.10%), and Covid (-0.71%).

ASSET CLASS	MEAN		
	Post Tech	US Recession	Covid
Goldman_Sachs	0.03%	-0.10%	-0.71%

Summary: Goldman Sachs Group, Inc.'s stock is a valuable asset to consider, especially for those interested in the financial sector and investment banking. Its strong positive correlation with the S&P 500 aligns it with broader market movements. However, its higher Beta and similar volatility to Apple's stock suggest a higher level of risk. The stock offers less attractive risk-adjusted returns compared to Apple. Therefore, investors should consider their risk tolerance when including Goldman Sachs' stock in their portfolios.

Mean	0.02%
Std Dev	2.19%
Min	-21.02%
Max	23.48%
Rfr	0.019%
Beta	1.322
Sharpe ratio	0.002
Sortino ratio	0.003
Mean Annual	0.03%
Std Dev Annual	34.79%

Asset Selected: JP Morgan

Rationale for Selection: JP Morgan is a well-established and renowned financial institution, making its stock an attractive choice for investors interested in the financial sector. It has a strong presence in the banking and financial services industry and is considered one of the largest and most influential banks in the United States. JP Morgan has a high market capitalization and is part of the S&P 500 index.

Observations:

1. Correlation: JP Morgan's stock exhibits a strong positive correlation of 74.79% with the S&P 500, indicating that it tends to move in the same direction as the S&P 500.

2. Beta: The Beta of JP Morgan is 1.428, which suggests that it is highly volatile in nature compared to the S&P 500. This implies that JP Morgan's stock can experience larger price swings compared to the overall market.

3. Mean Return: The daily mean return for JP Morgan's stock is 0.03%, which is relatively low but indicates a positive average return over the observation period.

4. Volatility: The standard deviation (volatility) of JP Morgan's stock is 2.35%, which implies that there is moderate variability from its mean position. This is similar to Apple's stock, as both have relatively low volatility.

5. Risk-Adjusted Returns: The Sharpe ratio for JP Morgan is 0.006, and the Sortino ratio is 0.009. These ratios indicate that JP Morgan's stock offers relatively unattractive risk-adjusted returns compared to the risk-free rate. The low Sharpe and Sortino ratios suggest that the stock may not provide a strong risk-adjusted performance.

Regimes/Stress Environment: The analysis considers three regimes for JP Morgan: Post Tech, US Recession, and Covid. During these periods, the mean returns for JP Morgan's stock are as follows:

ASSET CLASS	MEAN		
	Post Tech	US Recession	Covid
JP_Morgan	-0.09%	-0.06%	-0.85%

- Post Tech: -0.09% - US Recession: -0.06% - Covid: -0.85%

These figures show that JP Morgan's stock experiences negative returns during these specific periods, with the Covid period showing the most significant negative return.

Summary: JP Morgan is a well-established financial institution, and its stock is often considered a part of investment portfolios seeking exposure to the financial sector. It exhibits a strong positive correlation with the S&P 500, indicating alignment with the broader stock market. However, with a relatively high Beta and low risk-adjusted ratios (Sharpe and Sortino), JP Morgan's stock may not be the most attractive option for investors seeking strong risk-adjusted returns. It provides stability but may not offer the same growth potential as more volatile stocks. During stress environments like the Covid period, JP Morgan's stock experiences a more significant negative return, which should be taken into account when considering it for an investment portfolio.

Mean	0.03%
Std Dev	2.35%
Min	-23.23%
Max	22.39%
Beta	1.428
Sharpe ratio	0.006
Sortino ratio	0.009
Std Dev Annual	37.38%

Asset Selected: AES Corp

Rationale for Selection: AES Corp is a company operating in the energy sector, and it is essential to evaluate its performance and characteristics for potential investment.

Observations:

1. Correlation: AES Corp exhibits a correlation of 46.13% with the S&P 500 over the observation period. This correlation suggests that AES Corp's stock does move somewhat in the same direction as the broader stock market, but the correlation is not as strong as Apple or JP Morgan.

2. Beta: The Beta of AES Corp is 1.20, indicating that it is somewhat volatile compared to the S&P 500. It's less volatile than Apple or JP Morgan but still has moderate volatility.

3. Mean Return: The daily mean return for AES Corp's stock is -0.02%, which is slightly negative, implying a slightly negative average return over the observation period.

4. Volatility: The standard deviation (volatility) of AES Corp's stock is 3.22%, indicating that there is relatively higher variability from its mean position compared to Apple and JP Morgan.

5. Risk-Adjusted Returns: The Sharpe ratio for AES Corp is -0.01, and the Sortino ratio is -0.015. These ratios indicate that AES Corp's stock offers unattractive risk-adjusted returns compared to the risk-free rate. The negative values suggest that the stock may not be providing strong risk-adjusted performance.

Regimes/Stress Environment: The analysis considers three regimes for AES Corp: Post Tech, US Recession, and Covid. During these periods, the mean returns for AES Corp's stock are as follows:

ASSET CLASS	MEAN		
	Post Tech	**US Recession**	**Covid**
AES Corp	-0.67%	-0.19%	-0.87%

- Post Tech: -0.67% - US Recession: -0.19% - Covid: -0.87%

These figures show that AES Corp's stock experiences negative returns during these specific periods, with the Covid period showing the most significant negative return.

Summary: AES Corp is an energy company that operates in the energy sector. It has a moderate positive correlation with the S&P 500, indicating some alignment with the broader stock market. However, with a Beta of 1.20 and negative risk-adjusted ratios (Sharpe and Sortino), AES Corp's stock may not be an attractive choice for investors seeking strong risk-adjusted returns. It has higher volatility compared to Apple and JP Morgan and tends to perform poorly during periods of economic stress. Investors should be cautious when considering AES Corp's stock as it exhibits higher volatility and less attractive risk-adjusted returns, especially during stress environments like the Covid period.

Mean	-0.02%
Std Dev	3.22%
Min	-68.29%
Max	34.38%
Rfr	0.019%
Correlation	46.13%
Beta	1.20
Sharpe ratio	-0.01
Sortino ratio	-0.015
Std Dev Annual	51.13%

Asset Selected: Ameren Corp

Rationale for Selection: Ameren Corp operates in the energy sector, and it's important to evaluate its performance and characteristics for potential investment.

Observations:

1. Correlation: Ameren Corp exhibits a correlation of 56.65% with the S&P 500 over the observation period. This correlation suggests that Ameren Corp's stock tends to move somewhat in the same direction as the broader stock market, similar to Apple.

2. Beta: The Beta of Ameren Corp is 0.631, indicating that it is less volatile compared to the S&P 500. This suggests that Ameren Corp's stock is less volatile than the market, which can be considered a positive characteristic.

3. Mean Return: The daily mean return for Ameren Corp's stock is 0.03%, indicating a slightly positive average return over the observation period.

4. Volatility: The standard deviation (volatility) of Ameren Corp's stock is 1.37%, which is relatively low, indicating lower variability from its mean position. This suggests that Ameren Corp's stock has lower volatility compared to Apple and JP Morgan.

5. Risk-Adjusted Returns: The Sharpe ratio for Ameren Corp is 0.006, and the Sortino ratio is 0.009. These ratios indicate that Ameren Corp's stock offers relatively unattractive risk-adjusted returns compared to the risk-free rate, but they are still positive values, unlike Apple and JP Morgan.

Regimes/Stress Environment: The analysis considers three regimes for Ameren Corp: Post Tech, US Recession, and Covid. During these periods, the mean returns for Ameren Corp's stock are as follows:

ASSET CLASS	MEAN		
	Post Tech	US Recession	Covid
Ameren Corp	0.02%	-0.18%	-0.20%

- Post Tech: 0.02% - US Recession: -0.18% - Covid: -0.20%

These figures show that Ameren Corp's stock experiences mixed returns during these specific periods, with the US Recession and Covid periods showing negative returns.

Summary: Ameren Corp operates in the energy sector and has some characteristics that make it less volatile and relatively stable compared to Apple and JP Morgan. It exhibits a positive correlation with the S&P 500 and a low Beta, suggesting that it is less volatile compared to the overall market. While the risk-adjusted returns are not exceptionally attractive, they are still positive, which can be considered a moderate level of risk-adjusted performance. Investors looking for a more stable and less volatile investment in the energy sector may consider Ameren Corp, as it exhibits lower volatility and less negative returns during stress environments compared to Apple and JP Morgan.

Mean	0.03%
Std Dev	1.37%
Min	-19.09%
Max	16.38%
Rfr	0.019%
Beta	0.631
Sharpe ratio	0.006
Sortino ratio	0.009
Std Dev Annual	21.82%

Asset selected: Exxon (XOM) – Equity Stock

Rationale for selection: Exxon is a natural gas company, which is the world's largest non-government-controlled oil company in US. Exxon is one of the prominent power stocks with highest market capitalization in S&P Power Sector stocks. As a part of diversification of the portfolio, Exxon has been considered in the analysis.

Observations: Exxon exhibit a correlation of 66.80% with the S&P 500 which indicates a strong positive co-relation with S&P 500 movement that means if there is market volatility then Exxon will move in the same direction. The stock has Daily Mean return of 0.03% with Annual Return of 7.25% showcasing a consistent but modest return. The stock has a low volatility of 1.66% which implies the return is more consistent in nature if exxon is part of a portfolio. The stock has a Sharpe Ratio of 0.006 and Sortino Ratios of 0.008, suggesting low risk-adjusted return as compared to overall market movement. Exxon annualized Mean of 7.25% and Standard Deviation of 26.38% basis which the asset can be considered as long-term investment. Exxon can be considered as a potential diversification tool with low-risk volatility investors who are seeking stable asset return.

Unique Characteristics: Exxon possesses positive correlation with the S&P 500 where its performance is strongly influenced by events in the financial markets and economic conditions. The stock has a Beta of 0.90 which means stock is less volatile as compared to the market.

Regimes/ Stress Environment: In different economic environments, Exxon daily Mean performance affected under stressed conditions. Post the technology bubble asset shown Mean Return of -0.04%, during the US recession -0.05however during COVID-19 pandemic -0.77%. This implies the asset will have strong negative impact in equity segment if considered as part of portfolio.

ASSET CLASS	MEAN		
	Post Tech	US Recession	Covid
Exxon	-0.04%	-0.05%	-0.77%

Summary: Exxon is a valued stock to consider for asset diversification in a portfolio considering its market impact and steady Mean return with low Standard Deviation as well Beta. Investor can consider to include Exxon stock to their portfolios as per above outcomes.

Statistics	Exxon
Mean	0.03%
Std Dev	1.66%
Min	-15.03%
Max	15.86%
Rfr	0.019%
Correlation	66.60%
Beta	0.90
Sharpe ratio	0.006
Sortino ratio	0.008
Covariance	0.000137
Mean Annual	7.25%
Std Dev Annual	26.38%

Asset Selected: Shell - Equity Stock

Rationale for Selection: Shell is a major oil and gas company and one of the world's largest non-government-controlled oil companies. It is prominent in the power sector and holds a significant market capitalization in the S&P Power Sector stocks. As a part of diversification of the portfolio, Shell has been considered in the analysis.

Observations:

- Shell exhibits a positive correlation of 63.64% with the S&P 500, indicating a strong positive correlation with S&P 500 movements. This implies that if there is market volatility, Shell is likely to move in the same direction as the market.

- The stock has a daily mean return of 0.02% with an annual return of 5.25%, showcasing a consistent but relatively modest return.

- Shell has a relatively low volatility of 1.84%, which implies that the return is more consistent in nature when Shell is part of a portfolio.The stock has a Sharpe Ratio of 0.001 and a Sortino Ratio of 0.076, suggesting low risk-adjusted returns compared to the overall market movement.

- Shell has an annualized mean return of 5.25% and a standard deviation of 29.21%, indicating that it can be considered as a long-term investment. Shell can potentially be used as a diversification tool for investors seeking stable asset returns with lower risk volatility.

Unique Characteristics: Shell possesses a positive correlation with the S&P 500, and its performance is strongly influenced by events in the financial markets and economic conditions. The stock has a Beta of 0.95, which means the stock is less volatile compared to the market.

Regimes/Stress Environment: In different economic environments, Shell's daily mean performance is affected under stressed conditions. During the post-technology bubble, the asset showed a mean return of -0.07%, during the US recession -0.09%, and during the COVID-19 pandemic -0.69%. This implies that the asset can have a strong negative impact on the equity segment if considered as part of a portfolio during economic downturns.

ASSET CLASS	MEAN RETURN		
	Post Tech	US Recession	Covid
Shell	-0.07%	-0.09%	-0.69%

Summary: Shell is a stock worth considering for asset diversification in a portfolio due to its market impact and steady mean return with low standard deviation as well as a Beta indicating lower volatility. Investors can consider including Shell stock in their portfolios, but they should be aware of its sensitivity to economic downturns.

	Shell
Mean	0.02%
Std Dev	1.84%
Min	-18.84%
Max	17.96%
Rfr	0.019%
Correlation	63.64%
Beta	0.95
Sharpe ratio	0.001
Sortino ratio	0.076
Std Dev Annual	29.21%

Asset selected: Johnson & Johnson - ((JNJ))

Rationale for selection: Johnson & Johnson is multinational, pharmaceutical, and medical technologies corporation. The rational is to analyze the market behavior and the co-relating a data of a pharmaceutical company with behavior of several market conditions.

Observations: Johnson & Johnson exhibit a correlation of 57.55% with the S&P 500, indicate a strong positive relationship with stock market movements which indicate positive sign for investors. Its daily mean return is 0.03% showcasing a consistent but modest daily rerun. While the Sharpe and Sortino ratios suggest only slightly better risk-adjusted returns compared to the risk-free rate, Johnson & Johnson annualized standard deviation of 18.48% underscores its price volatility over the long term. This makes Johnson & Johnson a potential diversification tool for risk-averse investors seeking stability during market turbulence.

Unique Characteristics: Johnson & Johnson possesses unique characteristics in the investment Market. It showcases a positive correlation with the S&P 500, where its performance is notably influenced by events in the financial markets and economic conditions, although its daily mean returns of 0.03% provides modest, consistent returns. While the risk-adjusted returns, as indicated by the Sharpe and Sortino ratios, are only marginally better than the risk-free rate, Exxon annualized standard deviation of 18.48% underscores its price volatility, highlighting its role as a diversification tool for risk-averse investors seeking stability in their portfolios.

Regimes/ Stress Environment: In different economic environments, Johnson & Johnson performance varies. Post the technology bubble, it showed a mean return of 0.18% during the US recession, (-0.04%), and amid the COVID-19 pandemic, (-0.15%).

ASSET CLASS	MEAN RETURN		
	Post Tech	US Recession	Covid
J&J	0.18%	-0.04%	-0.15%

Summary: Johnson & Johnson stock is a valued asset to consider, it is in line with wider market movements due to its healthy positive connection with the S&P 500. Its small Beta indicates a low degree of risk, which is a good indication for investors.

Statiistics	J&J
Mean	0.03%
Std Dev	1.16%
Min	-17.25%
Max	11.54%
Rfr	0.019%
Correlation	57.51%
Beta	0.543
Sharpe ratio	0.010
Sortino ratio	0.014
Covariance	0.01%
Mean Annual	7.83%
Std Dev Annual	18.48%

Asset Selected: Astra Zeneca

Rationale for Selection: AstraZeneca's selection as a hot topic for the period 2001-2023 reflects the company's focus on pharmaceutical innovation, challenges in drug development, impact on healthcare and in particular the company's role in the development of a COVID-19 vaccine. Justified by its central role in engagement. This selection allows us to investigate global health trends, financial performance, and ethical considerations in the pharmaceutical industry during this period.

Observations: The difference in correlation of the S&P500 with daily returns (0.03%) and monthly returns (0.69%) suggests that the daily returns are more closely related to the S&P500. In contrast, the monthly returns show a slightly weaker correlation. With a beta of 0.644, the investment appears to be a lower-risk choice because it is less volatile than the S&P500. While the Sharpe ratio of 0.008 and Sortino ratio of 0.011 indicate that AZN offers relatively attractive risk-adjusted returns.

Unique Characteristics: AstraZeneca and other healthcare equities may be less volatile during recessions since consumers still need prescription medications and medical care. It is observed that Apple has a negative correlation with Silver -2.4% as a commodity.

Regimes/ Stress Environment: We have considered 3 regimes for our stock, namely: 1. Tech Bubble 2. US Recession and 3. Covid. The outcomes for the same are attached below which infers that although the mean returns during the post-tech bubble period and COVID were slightly negative but were unaffected during the US Recession.

ASSET CLASS	**MEAN**		
	Post Tech	**US Recession**	**Covid**
AZN	-0.03%	0.00%	-0.26%

Summary: AstraZeneca (AZN) has some notable features. Its correlation with the S&P 500 is relatively low, suggesting a limited day-to-day relationship with the broader stock market. Additionally, healthcare stocks, including AstraZeneca, are considered less volatile during economic downturns, and are considered potentially more resilient. AZN's performance fluctuates at different stages of the economy, resulting in negative returns during certain periods, especially during the coronavirus pandemic. In summary, AstraZeneca offers stable earnings potential and can provide stability even in economic difficulties.

Mean	0.03%
Std Dev	1.66%
Min	-17.76%
Max	11.73%
Correlation	47.74%
Beta	0.644
Sharpe ratio	0.008
Sortino ratio	0.011
Mean Annual	8.30%
Std Dev Annual	26.40%

Asset Selected: Bond Fund America

Rationale for selection: American bond funds, specifically those investing in a variety of fixed-income securities, offer diversification within a portfolio. The period from 2001 to 2023 saw significant fluctuations in interest rates. Early in this period, interest rates were relatively high, and over time, they trended downward.

Observations: It is observed that both mean and standard deviation for daily and monthly returns indicate growth and the returns are even larger over the month. The daily correlation of -11.07 with the S&P500 is unusual and suggests that the returns move in opposite directions concerning the benchmark whereas the monthly correlation of 33.06% indicates a positive correlation showing that over a longer time, the investments move together with the S&P500. A low negative beta indicates that the asset has low sensitivity to the market and is a good option for managing risk and reducing exposure to market fluctuations.

Unique Characteristics: It shows a marginally positive association with precious metals, with a 1.15% positive correlation with gold and a 1.54% positive correlation with silver, while it shows a notable inverse relationship with major stock indices and some well-known companies in the financial and energy sectors. Negative Sharpe (-0.03) and Sortino (-0.04) ratios indicate that the portfolio may not provide satisfactory risk-adjusted returns. ABNDX is known for its broad diversification across different types of fixed-income securities which helps reduce risk.

Regime or Stress Environment: We have considered 3 regimes for our stock, namely: 1. Tech Bubble 2. US Recession and 3. Covid. The outcomes for the same are attached below which infers that although the mean returns during the post-tech bubble period and COVID were unaffected but were slightly negative during the US Recession.

ASSET CLASS	**MEAN**		
	Post Tech	**US Recession**	**Covid**
ABNDX	0.03%	-0.02%	0.06%

Summary: American Bond Fund (ABNDX) has unique characteristics that set it apart. It exhibits both positive and negative correlations with various asset classes, making it a diversification tool. The asset's returns show growth over time, with monthly returns generally outperforming daily returns. Despite this, its diversification across different fixed-income securities helps reduce risk.

	ABNDX
Mean	0.01%
Std Dev	0.25%
Min	-1.88%
Max	1.97%
Correlation	-11.07%
Beta	-0.02
Sharpe ratio	-0.03
Sortino ratio	-0.04
Mean Annual	2.88%
Std Dev Annual	4.01%

Asset Selected: Vanguard Wellesy

Rationale for selection: The Vanguard Wellesley Income Fund (VWINX) is a mutual fund that primarily seeks to provide income and moderate long-term capital appreciation. From 2001 to 2023, the Fund's historical performance may have been consistent with its objective of providing income and modest capital appreciation.

Observations: The standard deviation of the daily returns is significantly lower (0.42%) compared to the monthly standard deviation (2.38%) and a similar trend can be observed in the mean of daily returns is (0.02%) and monthly returns (0.49%). The daily correlation with the benchmark is strong at 82.39%, signifying a high alignment with the benchmark daily. Every month, the correlation decreases to 67.43%, suggesting some variability in performance relative to the benchmark over the longer term. The beta value of 0.280 indicates that your investment tends to be less volatile than the S&P500.

Unique Characteristics: VWINX has a correlation of -1.64 with gold and -1.52% with silver implying that it may move inversely to the price of precious metals. VWINX has strong positive correlations with the S&P 500 and moderate positive correlations with individual stocks such as Apple, Microsoft, Goldman Sachs, and JP Morgan. Sharpe ratio is 0.012, it suggests that the fund has generated a return above the risk-free rate whereas Sortino ratio of 0.016 indicates that VWINX has generated excess returns per unit of downside risk.

Regime or Stress Environment: We have considered 3 regimes for our stock, namely: 1. Tech Bubble 2. US Recession and 3. Covid. The outcomes for the same are attached below which infers that although the mean returns during the post-tech bubble period and COVID were unaffected but were slightly negative during the US Recession.

ASSET CLASS	MEAN		
	Post Tech	US Recession	Covid
Vanguard_Wellesly_Income	0.03%	-0.02%	-0.17%

Summary: VWINX exhibits lower daily volatility compared to monthly volatility and has strong daily alignment with the S&P 500. The fund also has unique characteristics such as negative correlations with precious metals and positive correlations with select individual stocks.

	ABNDX
Mean	0.02%
Std Dev	0.42%
Min	-4.66%
Max	3.60%
Correlation	82.39%
Beta	0.280
Sharpe ratio	0.012
Sortino ratio	0.016
Covariance	0%
Mean Annual	6.11%
Std Dev Annual	6.66%

Asset Selected: FED Effective Rate

Rationale for selection: The FED returns during this period 2001 to 2023 cover over two decades of economic history and hence allow for a comprehensive understanding of how the Federal Reserve's policies and actions have affected financial markets over time. Understanding the returns associated with such assets during this period can be crucial for risk management and asset allocation.

Observations: A daily correlation of -1.82% and a monthly correlation of -2.22% suggest that your investment tends to move in the opposite direction of the S&P500. The standard deviation of the daily returns is significantly lower (7.39%) compared to the monthly standard deviation (25.44%) and a similar trend can be observed in the mean of daily returns is (-0.0002%) and monthly returns (0.5%). A daily correlation of -1.82% and a monthly correlation of -2.22% suggest that your investment tends to move in the opposite direction of the benchmark.

Unique Characteristics: FED shows mixed correlations with different assets and indices. It tends to move in the opposite direction of the S&P 500 and certain individual stocks while showing a positive relationship with silver (1.25%) and the Bond Fund of America (1.30%). FED has a negative correlation with oil company Shell (-0.35%) and pharmaceutical company AstraZeneca (-1.12%), suggesting that when their stock prices rise, FED is more likely to decrease. The beta of -0.12 is relatively low, suggesting that your investment is less sensitive to movements in the benchmark.

Regimes/ Stress Environment: We have considered 3 regimes for our stock, namely: 1. Tech Bubble 2. US Recession and 3. Covid. The outcomes for the same are attached below which infers that although the mean returns during the post-tech bubble period were slightly negative but were unaffected during the US Recession and the COVID period.

ASSET CLASS	MEAN		
	Post Tech	US Recession	Covid
FED	-0.23%	0.12%	0.31%

Summary: In summary, FED appears to be a relatively low-volatility asset, moving in the opposite direction of the S&P 500 and certain stocks, while showing positive correlations with silver and the Bond Fund of America. The investment's beta suggests it is less sensitive to benchmark movements, and it has unique characteristics in terms of its correlations with different assets and indices.

	Fed Interest Rate
Mean	-0.0002%
Std Dev	7.39%
Min	-148.16%
Max	141.71%
Rfr	0.019%
Correlation	-1.82%
Beta	-11.68%
Sharpe ratio	-0.003
Sortino ratio	-0.004
Covariance	0.00%
Mean Annual	-10.82%
Std Dev Annual	117.34%

Conclusion –

The primary focus of an investor's sentiment is not to consume the acquired asset rather the goal is to acquire such assets that should create steady accumulation wealth or income with lesser risk or volatility. And the success of such approach lies on selection right asset classes on right time to achieve own financial goals. Present market scenario provide an investor with ample investment options that ranges from stocks, bonds, mutual funds, commodities, annuities, insurance, retirement plans and even crypto currencies. As there are various types of investments that an investor can engage however for choosing the right investment, the investors must have deep knowledge and understanding of the assets behavior not only in present economic scenario but under different economic regimes and stressed conditions. The endeavor of this report has been to analyze different assets with various statistical tools and formulas to provide the investor with information such as Mean Return of Assets on Daily, Monthly and Yearly average, Risk and Volatility associated with such assets, Risk Adjusted Return and Correlation of each assets with the market movement. Ultimately, constructing and managing an investment portfolio should align with the investor's risk tolerance, financial objectives, and investment horizon. Diversification remains a fundamental strategy for risk management and pursuing long-term financial success, while staying agile and well-informed is vital and take informed decisions. Keeping this in line the report provided all such information to the investor which will enable him / her to judiciously choose the Right Asset for his / her portfolio.

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