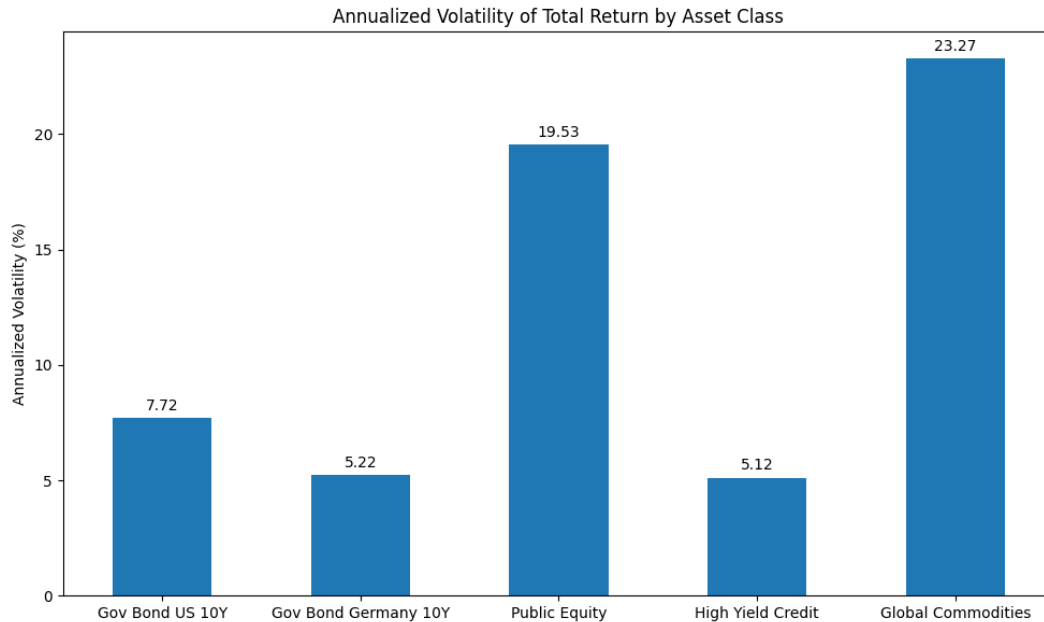


Macro Finance – Homework 1

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Macro Asset Returns

Question 2: Compute the annualized volatility of all 7 returns. What things do you notice?



1. Bonds have significantly lower volatility compared to equities

Government bonds (10Y US treasuries, German Bund) and High-Yield Corporate Bonds have significantly lower volatility than public equities. This makes sense because for the same geographical location, bonds are considered as a safer (less volatile) asset class compared to equities.

2. Commodities is the riskiest asset class observed (highest volatility)

The other asset classes being analyzed are coming from one geographical region:

- US government bond market
- US high yield corporate bond market
- US public equity market, and
- Germany's government bond market.

The S&P GSCI (used as the measure for global commodities) tracks a basket of commodities bought and sold all over the world. Since the sample size are much more diversified, there's a huge variance of returns and thus, higher overall volatility.

Question 3: *Why do you think I am not asking you to do this?*

Due to the overall market conditions, credit spreads (difference between risky and risk-free asset yields) can tighten or widen. If credit spreads tightened, the yield on HY corporate bonds can go down, meaning the prices of corporate bonds can increase. This can translate into higher price (capital return) for those bonds. However, the companies themselves might not do any significant changes in their underlying business operations. The corporate bond price movements are solely reflecting credit spread movements (investor sentiment).

Therefore, it is significantly harder to differentiate which parts of the total return is coming from the income return and capital return for HY credit, as compared to US public equity and government bond market.

Question 4: *Compute the volatility of both income and capital returns for US equity and bonds. What things do you notice?*

	Annualized Volatility (%)
Total Return for Public Equity Market	7.717764
Income Return for Public Equity Market	0.147762
Capital Return for Public Equity Market	19.531878

	Annualized Volatility (%)
Total Return for 10Y UST	7.717764
Income Return for 10Y UST	0.082110
Capital Return for 10Y UST	7.731066

It makes sense that the volatility of income return is low because the coupon rate of US government bonds doesn't vary much across different years. Similarly, for equities, the dividend payments made by the companies to investors don't change significantly across different years.

Capital return volatility is the main driver for total return volatility. For US government bonds, it is because bond prices move relatively frequent, due to changing interest rates and economic conditions. For US equities, it is because stock prices fluctuate dynamically, due to changing interest rates, macroeconomic conditions, sector trends, and the company's underlying financial condition.

Question 5

	Mean	Vol	Sharpe
Tangent Weights	0.033662	0.047343	0.711034
The Sharpe Ratio for the Tangency Portfolio (using MV Optimization): 0.71			
	Mean	Vol	Sharpe
Excess_Return_UST	0.005114	0.076849	0.066540
Excess_Return_SPX	0.058664	0.194745	0.301233
Excess_Return_HY	0.031716	0.051039	0.621407
Excess_Return_Commodities	0.044656	0.233162	0.191521
The Average Sharpe Ratio for a Portfolio Consisting of One Asset Class: 0.30			

The tangency portfolio, constructed using Mean-Variance Optimization method, can provide a higher Sharpe Ratio of 0.71 compared to the average Sharpe Ratio obtained by investing fully in any single asset class (0.30). The MV Optimization method maximize the Sharpe Ratio and diversify risk, by determining the appropriate weights and consequently, capital, to be allocated for each asset class.

Rationale used:

- If the *Sharpe Ratio for the Tangency Portfolio* > *Average Sharpe Ratio of Each Asset Class*, it's better to be correct in the asset allocation across asset classes
 - Maximize risk-adjusted return by optimizing asset allocation across asset class and create a higher diversification
- If the *Sharpe Ratio for the Tangency Portfolio* < *Average Sharpe Ratio of Each Asset Class*, it's better to be correct in security selection within asset classes
 - Maximize risk-adjusted return by optimizing security selection in each asset class

From our results, it is better to be correct in the asset allocation across asset classes, for the entire time horizon (from 2000 until 2025).

Question 6

For a CIO, he should be investing more resources (time, effort, and human capital) towards the asset allocation part of his fund. Although selecting underpriced securities that can generate a high (potential) return (e.g., due to the good financial standing of the underlying company or a new product/service launch) is still the correct approach for investing, the evidence emphasizes the importance of diversifying risk across asset classes.

Securities in one asset class often move simultaneously in one direction (high correlation). For example, a tech bubble burst can push down the price of most US equities. A CIO should ensure that more people in the fund invest sufficient resources in cross-asset allocation in order to avoid being significantly exposed to a downturn in one asset class.

Investing in HY Credit



US HY Credit is indeed a desirable asset to hold. Whether we are looking at total returns or excess returns (total return – risk free rate), the risk-adjusted return for US HY Credit is evidently quite high. The reason for this is that HY credit has a high return but a low volatility (~5%). Investors are basically getting a higher return despite taking in lower risk as compared to other asset classes. This results in an extremely high Sharpe Ratio (0.62 for excess and 1.24 for total return), relative to other asset classes.

The Sharpe Ratio is an appropriate measure of risk and return because it subtracts the risk-free return from the portfolio's return and dividing it with the volatility (standard deviation) of that portfolio's excess return. The risk-free rate used here is the yield on 10-year US Treasuries (converted to daily rates).

Based on the *Sharpe Ratio for Excess Return*, we can see that being long HY credit outperforms being long 10Y UST, the US equities, and commodities.

- Being long HY credit implies that we are taking in default risk (the risk that companies fail to pay their contractual obligations).
- Being long 10Y UST means we are taking in interest rate risk and harvesting term premium (locking-in an investment for 10 years).
- Being long SPX means we are harvesting equity risk premium (and default risk).
- Being long commodities means that we are harvesting the risk premium related to geopolitical and supply/demand shocks.

Being long US HY Credit provides a better risk-adjusted return than harvesting risk premium related to geopolitical shocks, equity risk premium, and term premium.

For investors, they should expect a higher risk-adjusted return if they were to invest in US HY credit, compared to investing in equities, government bonds, and commodities. However, they still need to keep in mind that by doing so, they are subject to the default of various companies in the US.

