1.3 Performance Evaluation

Naturally, the performance as well as the risk profiles of the aforementioned strategies may be (relatively) sensitive to the *target Beta* and the (current) market environment.

For example, a '**low Beta**' (essentially) means that a strategy is created with the objective or aim to be '**decorrelated**' (no linear relationship between entites) with the 'Global Market,' which, in our case, is represented by the **S&P 500** (i.e., no *systematic relationship*).

A '**high Beta**' is simply the antithesis, or opposite, of what we just discussed. In layman's terms, we have a (higher) appetite for '*risk*' (in this case, let's keep it simple and define our premise as σ or **standard deviation**) and desire to ride or 'scale up' the *market risk* (**systematic risk**).

Moreover, it's imperative that one acknowledges that such a (described) strategy is more probable to be (quite) sensitive to the *estimators* used for the **Risk Model** and the **Alpha Model** (e.g., the length of the *look-back period* utilized); therefore, it is necessary to understand and, most importantly, *comprehend* the impact of said estimators on the **Portfolio's** characteristics:

- (Realized) Return : μ_h
- (Historical) Volatility) : σ_h
- Skewness : $(\mathbb{E}[(\frac{x-\mu}{\sigma})^3]) = \frac{\mu_3}{\sigma_3} = \frac{\kappa_3}{\kappa_2^{3/2}}$
- VaR / Expected Shortfall
- Sharpe Ratio : $S_a = \frac{\mathbb{E}[R_a - R_b]}{\sigma_a} = \frac{\mathbb{E}[R_a - R_b]}{\sqrt{\mathbb{V}(R_a - R_b)}}$

1.4 Simplification

To make it easier, we assume that once the **Factor Model** (FM) has been constructed, we will use trend following estimators for the **Expected Returns**. Since the quality of the estimators depend on the **look-back period**, we define three cases:

- ***Long-Term Estimator (LTE)*** : $\text{LT} \Rightarrow \text{LB} \in \{180 \text{ Days}\}$.
- ***Mid-Term Estimator (MTE)*** : $\text{MT} \Rightarrow \text{LB} \in \{90 \text{ Days}\}$.
- ***Short-Term Estimator (STE)*** : $\text{ST} \Rightarrow \text{LB} \in \{40 \text{ Days}, 60 \text{ Days}\}$.

Specifically, we define a **Term-Structure** for the $\text{Covariance } \boldsymbol{\Sigma}$ and $\text{Expected Return } \boldsymbol{\mu}$.

1.5 Synthesis

To (briefly) summarize, the behavior of a (potential) '*optimal*' portfolio built from a melting pot of *estimators* for **Covariance** and **Expected Return** may vary according to the cadence

of the '**Market**' (environment/regime) or an aforementioned strategy.

For example, the (mathematical) notation S_{40}^{90} is just fancy jargon to visually illustrate that we are using **40 days** for the covariance estimation and **90 days** for the expected returns estimations—it's not that deep.

Overall, the goal of this fun, entertaining project is to conceptualize, visualize, understand, analyze, and compare the behavior of our ideas; we want to *see* if we can (actually) make some **$$$**, especially during momentous, historical (time) periods such as the **Subprime Mortgage Crisis** of *2008*, the horrendous commencement of **Coronavirus SARS-CoV-2 Disease** of *2019*, et cetera.