- $\mathrm{TEV}(\omega) = \sigma(r_P(\omega) - r_{\mathrm{SPY}})$ is the '**Tracking Error Volatility**', which (if you're *really nerdy*) you can derive it as such:

$$\sigma(r_P(\omega) - r_{\mathrm{SPY}}) = \sqrt{\omega^\intercal \Sigma \omega - 2\omega^\intercal \mathrm{Cov}(r, r_{\mathrm{SPY}}) + \sigma_{\mathrm{SPY}}^2} \tag{3}$$

Oh yeah, I should probably define what '**FF3FM**' means; that would (probably) be helpful.

2.2 Fama–French Three-Factor Model

So, to echo the previous sentiment, we should (almost surely) explain what is this *funky* model we kept referencing:

$$r_i = r_f + \beta_i^3(r_M - r_f) + b_i^s r_{\mathrm{SMB}} + b_i^v r_{\mathrm{HML}} + \alpha_i + \epsilon_i \tag{4}$$

Sorry for writing (or, to be *really technical*, typesetting) more hieroglyphics. We gotta keep going for a bit—stay with me!

If we assume our white noise/error terms, on 'average', have a (numerical) value of 0 (i.e., $\mathbb{E}[\epsilon_i] = 0$), we can derive a new goofy equation:

$$\rho_i = r_f + \beta_i^3(\rho_M - r_f) + b_i^s \rho_{\mathrm{SMB}} + b_i^v \rho_{\mathrm{HML}} + \alpha_i \tag{5}$$

In the new cursive script defined above, the 3 coefficients β_i^3, b_i^s, and b_i^v are estimated by making a linear regression, or, in 'plain English', drawing a line of best fit of the time series $y_i = \rho_i - r_f$ against the other cool time series $\rho_M - r_f$ (**Momentum Factor**), r_{SMB} (**Size Factor**), and ρ_{HML} (**Value Factor**).

I feel like I'm forgetting something $\ldots$

Oh yeah! There's an extra (nerdy) thingy we gotta verify: (generally), $\beta_i^m \neq \beta_i^3$ and needs to be estimated by a separate regression or directly computed.