$$\frac{E(r_m) - r_f}{\sigma_m} = \frac{E(r_i) - E(r_m)}{\sigma_{im} - \sigma_m^2} \sigma_p \qquad \text{in } w_i = 0$$

$$\sigma_p = \sigma_m !$$

$$\frac{E(r_m) - r_f}{\sigma_m} = \frac{E(r_i) - E(r_m)}{\sigma_{im} - \sigma_m^2} \sigma_m$$

$$(\sigma_{im} - \sigma_m^2) \frac{E(r_m) - r_f}{\sigma_m^2} = E(r_i) - E(r_m)$$

$$\frac{\sigma_{im}}{\sigma_m^2} \left[E(r_m) - r_f\right] - \frac{\sigma_m^2}{\sigma_m^2} \left[E(r_m) - r_f\right] = E(r_i) - E(r_m)$$

$$\frac{\sigma_{im}}{\sigma_m^2} \left[E(r_m) - r_f\right] - \cancel{E(r_m)} + r_f = E(r_i) - \cancel{E(r_m)}$$

$$\Rightarrow \quad E(r_i) - r_f + \left[E(r_m) - r_f\right] \frac{\sigma_{im}}{\sigma_m^2}$$

$$= r_f + \left[E(r_m) - r_f\right] \beta_i$$