Reading 6: Overview of the Global Investment Professional Standards

1. Total return (when no external cash flows)
   Total return = $r_t = \frac{V_1 - V_0 - CF}{V_0 + (CF \times w_i)}$

2. Time weighted return = $r_{twr} = (1 + r_{t,1}) \times (1 + r_{t,2}) \times \ldots \times (1 + r_{t,n}) - 1$

3. Original Dietz Method = $R_{Dietz} = \frac{V_1 - V_0 - CF}{V_0 + (CF \times 0.5)}$

4. Modified Dietz Method = $R_{ModDietz} = \frac{V_1 - V_0 - CF}{V_0 + (CF \times w_i)}$

5. Time weighted return using Modified Dietz = $r_{ModDietz} = \frac{V_1 - V_0 - CF}{V_0 + \sum_{i=1}^{n}(CF \times w_i)}$

   where,
   $w_i = \frac{CD - D_i}{CD}$
   CD = total calendar days,

   D_i = no. of calendar days from beginning of period to tie cash flow CF_i occurs.

$$V_1 = \sum_{i=1}^{n}[CF_i \times (1 + r)] + v_o(1 + r)$$

6. Sum of beginning assets and weighted external cash flows = $V_0 + \sum_{i=1}^{n}(CF \times w_i)$

7. composite return under the beginning of period value method =

$$r_c = \sum_{i=1}^{n}\left[r_{pi} \times \frac{V_{0,pi}}{\sum_{pi=1}^{n} V_{0,pi}}\right]$$

8. return for a portfolio under the beginning of period value and weighted cash flows (r_C) is R C =

9. $$\sum_{i=1}^{n}\left(r_{pi} \times \frac{V_{pi}}{\sum V_{pi}}\right)$$

10. Standard Deviation of Composite (in which constituents are equally weighted) =

$$S_c = \sqrt{\frac{\sum_{i=1}^{n}(r_i - \bar{r}_c)^2}{n - 1}}$$

11. Asset weighted Standard Deviation of individual portfolio returns within a composite =

$$S_c = \sqrt{\sum_{i=1}^{n}[(r_i - \bar{r}_{proxy})^2 \times w_i]}$$

where, $\bar{r}_{proxy} = \sum_{i=1}^{n}(w_i - r_i)$

12. Position of a percentile y in an array with n entries sorted in descending order =

$$L_y = (n + 1)\frac{y}{100}$$

13. Annualized Internal Rate of Return from Value of r =

$$V_0 = \frac{CF_1}{(1 + r)^1} + \frac{CF_2}{(1 + r)^2} + \cdots + \frac{V_N}{(1 + r)^N}$$

Reading 7: The Behavioral Finance Perspective

1. Expected utility (U) = Σ (U values of outcomes × Respective Prob)

2. Subjective expected U of an individual =Σ [u (xi) × Prob (xi)]

3. Bayes' formula = P (A|B) = [P (B|A) / P (B)]× P (A)

4. Risk premium = Diff. b/w Certainty Equivalent and Expected Value

5. Perceived value of each outcome =
   = U = w (p_1) v (x_1) + w (p_2) v (x_2) + … + w (p_n) v (x_n)

6. Abnormal return (R) = Actual R – Expected R

Reading 8: The Behavioral Biases of Individuals

Reading 9: Behavioral Finance & Investment Processes

1. After-tax (AT) *Real* required return (RR) % $= \frac{\text{Client's required expenditures in Year n}}{\text{Net Investable Assets}} = \frac{\text{Projected needs in Year n}}{\text{Net Investable Assets}}$

2. AT *Nominal* RR % $= \frac{\text{Projected needs in Year n}}{\text{Net Investable Assets}}$ + Current Annual (Ann) Inflation (Inf) % = AT real RR% + Current Ann Inf% *Or*
   AT *Nominal* RR% = (1 + AT Real RR%) × (1 + Current Ann Inf %) – 1

3. Total Investable assets = Current Portfolio -Current year cash outflows + Current year cash inflows

4. Pre-tax income needed = AT income needed / (1-tax rate)

5. Pre-tax Nominal RR = (Pre-tax income needed / Total investable assets) + Inf%

If Portfolio returns are tax-deferred:

6. Pre-tax projected expenditure $ = AT projected expenditure $ / (1 – tax rate)

7. Pre-tax real RR % = Pre-tax projected expenditures $ / Total investable assets

8. Pre-tax nominal RR = (1 + Pre-tax real RR %) × (1 + Inflation rate%) – 1

If Portfolio returns are NOT tax-deferred:

9. AT real RR% = AT projected expenditures $ / Total Investable assets

10. AT nominal RR% = (1 + AT real RR%) × (1 + Inf%) – 1

11. Procedure of converting nominal, pre-tax figures into real, after-tax return:
    - Real AT R = [Expected total R – (Expected total R of Tax-exempt Invst × wt of Tax-exempt Invst)] × (1 – tax rate) + (Expected total R of Tax-exempt Invst × wt of Tax-exempt Invst) – Inf rate

    Or

    - Real AT R =[(Taxable R of asset class 1 × wt of asset class 1) + (Taxable R of asset class 2 × wt of asset class 2) + …+ (Taxable return of asset class n × wt of asset class n)] × (1 – tax rate) + (Expected total R of Tax-exempt Invst × wt of Tax-exempt Invst) – Infrate

Reading 10: Capital market Expectations: Part 1

1. $i^* = r_{neutral} + \pi_e + 0.5 \times (\hat{Y}_e - \hat{Y}_{trend}) + 0.5 \times (\pi_e - \pi_{target})$

where,
i^*= target nominal policy rate
$r_{neutral}$ = real policy rate that would be targeted if GDP growth were on trend & inflation on target
π_e, π_{target} = respectively the expected and target inflation rates
$\hat{Y}_e$, $\hat{Y}_{trend}$ = respectively the expected and trend real GDP growth rates
By readjusting the above equation:

Real inflation adjusted target rate =
$i^* - \pi_e = r_{neutral} + 0.5 \times (\hat{Y}_e - \hat{Y}_{trend}) + 0.5 \times (\pi_e - \pi_{target})$

2. **Net exports =** Net Private Savings + Government Surplus
   (X–M) = (S–I) + (T-G)

3. Government Surplus = Taxes – Government spending

Reading 11: Capital market Expectations: Part 2

1. $E(R_e) \approx \frac{D}{P} + (\%\Delta S - \%\Delta E) + \Delta P/E$
   Where,
   - E (R_e) = Expected rate of return on equity

- D/P = Expected dividend yield
- %ΔS = Expected % change in number of shares outstanding

2. Under Basic CAPM model:
   - $RP_i = \beta_{i,M} RP_M$
   - $\beta_{i,M} = Cov(R_i, R_M)/\sigma_M^2 = \rho_{i,M}\ \sigma_i \left(\frac{\sigma_i}{\sigma_M}\right)$

Where,

$RP_i = [ER_i - R_F]$ risk premium on ith asset

$RP_M = [ER_M - R_F]$ risk premium on market portfolio

$\beta_{i,M}$ = ith asset sensitivity to market portfolio $= \frac{Cov(R_i,R_M)}{\sigma_M^2} = \rho_{iM}\ \sigma_i \left(\frac{\sigma_i}{\sigma_M}\right)$

σ is standard deviation and ρ is correlation

Expected Return using Singer-Terhaar Model

Model's 1st component (full integration assumption):

3. $RP_i^G = \beta_{i,GM} RP_{GM} = \rho_{i,GM}\ \sigma_i \left(\frac{RP_{GM}}{\sigma_{GM}}\right)$

Model's 2nd component (completely segmented market assumption):

4. $\mathrm{RP_i^S} = 1 \times \mathrm{RP_{GM}} = 1 \times \sigma_i \left(\frac{\mathrm{RP_i^S}}{\sigma_i}\right)$

5. $RP_i = \varphi RP_i^G + (1-\varphi) RP_i^S$

6. Cap rate $= \frac{\text{Current year's NOI}}{\text{Property value}}$, where NOI = net operating Income

7. $E(R_{re})$ = Expected return on real estate
   - ***long run*** (assuming constant growth rate for NOI) is:

     $E(R_{re})$ = Cap rate + NOI growth rate

   - for a ***finite horizon*** (to reflect expected rate of change in the cap rate) is:

     $E(R_{re})$ = Cap rate + NOI growth rate - %Δ Cap rate

8. Implication of capital mobility:
   $E(\%\Delta S_{d/f}) = (r^d - r^f) + (\text{Term}^d - \text{Term}^f) + (\text{Credit}^d - \text{Credit}^f) + (\text{Equity}^d - \text{Equity}^f) + (\text{Liquid}^d - \text{Liquid}^f)$

9. $r_i = \alpha_i + \sum_{k=1}^{K} \beta_{ik} F_k + \varepsilon_i$

r_i = *return on ith asset*

α_i = constant intercept

β_{ik} = asset's sensitivity to kth factor

F_k = kth common factor return

ε_i = error term

10. $Variance\ on\ ith\ asset = {\sigma_{ij}}^2 = \sum_{m=1}^{K}\sum_{n=1}^{K} \beta_{im}\ \beta_{jn}\ \rho_{mn} + v_i^2$

where,

ρ_{mn} = covariance between the mth and nth factor

v_i^2 = variance of ith asset return

11. Covariance between ith and jth $= \sigma_{ij} = \sum_{m=1}^{K}\sum_{n=1}^{K} \beta_{im}\ \beta_{jn}\ \rho_{mn}$

12. $Current\ return = R_t = (1-\lambda) r_t + \lambda R_{t-1}$

where λ *may range from* 0 *to* 1

13. $var(r) = \left(\frac{1+\lambda}{1-\lambda}\right) var(R) > var(R)$

14. ARCH Methodology

$\sigma_t^2 = \gamma + \alpha\sigma_{t-1}^2 + \beta\eta_t^2$

Rearranging the above equation:

$\sigma_t^2 = \gamma + (\alpha+\beta)\sigma_{t-1}^2 + \beta(\eta_t^2 - \sigma_{t-1}^2)$

Reading 12: Overview of Asset Allocation

1. Risky Asset Allocation $= w^* = \frac{1}{\lambda}\left[\frac{\mu - r_f}{\sigma^2}\right]$

Reading 13: Principles of Asset Allocation

1. $U_m = E(R_m) - 0.005\lambda\sigma_m^2$
2. $w_i \times Cov(r_i, r_P) = \frac{1}{n}\sigma_P^2$
3. Marginal contribution to risk $(MCTR_i)$ = (Beta of Asset Class i relative to Portfolio) x (Portfolio Std. Dev.)