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Apêndice A: Derivação das Fórmulas 4.3.10 e 4.3.13

A.1. Fórmula 4.3.10

Igualando (4.3.9) com (4.3.8b), substituindo P^e_{t+1} por $w_j C_{t+1}$, C_{t+1} por $\lambda_j C_t$ e isolando $\left(w_i\right)^{(\alpha/\rho)}$ temos:

$$(w_i)^{(\alpha/\rho)} = \frac{\beta^{(\alpha/\rho)}}{c^{(\alpha/\rho)}} E_t\left[\left(\lambda_j\right)^{\frac{\alpha(\rho-1)}{\rho}}\left(w_j C_{t+1} + C_{t+1}\right)^{(\alpha/\rho)}\right] \quad \text{(A.1.1)}$$

Desenvolvendo a equação (A.1) chegamos a:

$$(w_i)^{(\alpha/\rho)} = \frac{\beta^{(\alpha/\rho)}}{c^{(\alpha/\rho)}} E_t\left[\left(\lambda_j\right)^{\frac{\alpha(\rho-1)}{\rho}}\left(C_{t+1}\right)^{(\alpha/\rho)}\left(w_j + 1\right)^{(\alpha/\rho)}\right] \quad \text{(A.1.2)}$$

Que pode ser escrita como:

$$(w_i)^{(\alpha/\rho)} = \frac{\beta^{(\alpha/\rho)}}{c^{(\alpha/\rho)}} E_t\left[\left(\lambda_j\right)^{\frac{\alpha(\rho-1)}{\rho}}\left(\lambda_j\right)^{\frac{\alpha}{\rho}} c^{(\alpha/\rho)}\left(w_j + 1\right)^{(\alpha/\rho)}\right] \quad \text{(A.1.2a)}$$

ou

$$(w_i)^{(\alpha/\rho)} = \beta^{(\alpha/\rho)} E_t\left[\left(\lambda_j\right)^{\alpha}\left(w_j + 1\right)^{(\alpha/\rho)}\right] \quad \text{(A.1.2b)}$$

Que após algumas operações resulta em:

$w_i = \beta\left[\sum_{j=1}^{n}\phi_{ij}\lambda_j^{\alpha}\left(w_j + 1\right)^{(\alpha/\rho)}\right]^{\rho/\alpha}$ para $i = 1,....,n$ (A.3) que é a equação (4.3.10)

A.2.
Fórmula 4.3.13

$\tilde{R}_{t+1}$ pode representar o retorno de qualquer tipo de ativo, como ações, ativo sem risco e o portifólio de mercado. Podemos substituir $\tilde{R}_{t+1}$ por P_i^f e $\tilde{M}_{t+1}$ por $\frac{P_{t+1}^e + C_{t+1}}{P_t^e}$ em (4.3.5):

$$E_t\left[\beta^{\alpha/\rho}\left(\frac{\tilde{C}_{t+1}}{C_t}\right)^{\frac{\alpha(\rho-1)}{\rho}}\left(\frac{P_{t+1}^e + C_{t+1}}{P_t^e}\right)^{(\alpha/\rho)-1} P_i^f\right] = 1 \qquad i = 1,\ldots,N$$

Realizando algumas substituições e simplificações obtemos:

$$P_i^f = \beta^{\alpha/\rho} E_t\left[\left(\frac{\lambda_j C_t}{C_t}\right)^{\frac{\alpha(\rho-1)}{\rho}}\left(\frac{w_j C_{t+1} + C_{t+1}}{w_i C_t}\right)^{(\alpha/\rho)-1}\right] \qquad i = 1,\ldots,N \qquad \text{(A.2.1)}$$

Que podemos reescrever como:

$$P_i^f = \beta^{\alpha/\rho} E_t\left[(\lambda_j)^{\frac{\alpha(\rho-1)}{\rho}}\left(\frac{\lambda_j C_t}{w_i C_t}\right)^{(\alpha/\rho)-1}\left(w_j + 1\right)^{(\alpha/\rho)-1}\right] \qquad i = 1,\ldots,N \qquad \text{(A.2.1a)}$$

ou

$$P_i^f = \beta^{\alpha/\rho} E_t\left[(\lambda_j)^{\alpha-1}\left(\frac{w_j + 1}{w_i}\right)^{(\alpha/\rho)-1}\right] \qquad i = 1,\ldots,N \qquad \text{(A.2.1b)}$$

Após a abertura do termo E_t temos:

$$P_i^f = \beta^{\alpha/\rho}\sum_{j=1}^{n}\phi_{ij}\lambda_j^{\alpha-1}\left(\frac{w_j + 1}{w_i}\right)^{(\alpha/\rho)-1}$$ (A.2.2) que é a equação (4.3.13).

Apêndice B: Propriedades da Distribuição Lognormal

1. Se $\ln z \sim N(\mu_z, \sigma_z^2)$, então $a \ln z \sim N(a\mu_z, a^2\sigma_z^2)$.

2. $\mathrm{E}(z^a) = \mathrm{E}[\exp(a \ln z)] = \exp\left(a\mu_z + \frac{1}{2}a^2\sigma_z^2\right)$.

3. $a \ln z + b \ln x \sim N(a\mu_z + b\mu_x, a^2\sigma_z^2 + b^2\sigma_z^2 + 2ab\rho\sigma_x\sigma_z$

   onde $\rho = cor(\ln x, \ln z)$.

4. $\mathrm{E}(z^a x^b) = \exp\left[a\mu_x + b\mu_x + \frac{1}{2}(a^2\sigma_z^2 + b^2\sigma_x^2)\right]$.

5. Se $x = z$, então $\mathrm{E}(z^a x^b) = \mathrm{E}(x^{a+b}) = \exp\left[(a+b)\mu_x + \frac{1}{2}(a+b)^2\sigma_x^2\right]$.

6. $\mathrm{var}(x) = \mathrm{E}(x^2) - [\mathrm{E}(x)]^2 = \exp(2\mu_x + 2\sigma_x^2) - \exp(2\mu_x + \sigma_x^2)$

   $= \exp(2\mu_x + \sigma_x^2)\exp(\sigma_x^2 - 1) = [\mathrm{E}(x)]^2 \exp(\sigma_x^2 - 1)$.

7. $\exp(\sigma_x^2) = 1 + \frac{\mathrm{var}(x)}{[\mathrm{E}(x)]^2}$, então $\sigma_x^2 = \ln\left\{1 + \frac{\mathrm{var}(x)}{[\mathrm{E}(x)]^2}\right\}$,

8. $\ln \mathrm{E}(x) = \mu_x + \frac{1}{2}\sigma_x^2$, então $\mu_x = \ln \mathrm{E}(x) - \frac{1}{2}\sigma_x^2$.