1) $E_0[m_{02}, f_2] : E_0[m_{02}(S_2 - F_{02})] = E[m_{02} S_2] - E[m_{02} F_{02}]$

$$= S_0 - D_0 - \frac{1}{R_f^2} F_{02}$$

$$= 0$$

Since we know that $F_{02} = R_f^2 (S_0 - D_0)$

2) $U(C_t, t) = -\delta^{t} e^{-\alpha C_t}$

$U_c(C_t, t) = a\delta^t e^{-aC_t}$

$\gamma_0 = E_0\left(\sum_{t=1}^{\infty} \frac{U_c(C_t, t)}{U_0(C_0, 0)} d_t\right)$

$= E_0\left[\sum_{t=1}^{\infty} \delta^t e^{-a(d_t - d_0)} d_t\right)$

3) $\frac{P_t}{d_t} = E_t\left[\sum_{j=1}^{\infty} \delta^j \left(\frac{C^*_{t+j}}{C^*_t}\right)^{\gamma-1} \left(\frac{d_{t+j}}{d_t}\right)\right]$

$= E_t\left[\sum_{j=1}^{\infty} \delta^j e^{(\gamma-1)\ln\left(\frac{c_{t+j}}{c_t}\right) + \ln(d_{t+j}/d_t)}\right]$

$\frac{P_t}{d_t} = E_t\left[\sum_{j=1}^{\infty} \delta^j e^{j[(\gamma-1)\mu_c + \mu_c] + \sum_{i=1}^{j}(\gamma-1)6_c n_{t+j} + 6_d \varepsilon_{t+j}}\right]$

$= \sum_{j=1}^{\infty} e^{(\ln\delta - (1-\gamma)\mu_c + \mu_d + \frac{1}{2}((1-\gamma)^2 6_c^2 + 6_d^2) - (1-\gamma) 6_c 6_d \rho}]$

$= \frac{1}{1 - \delta e^{-(1-\gamma)\mu_c + \mu_d + \frac{1}{2}((1-\gamma)^2 6_c^2 + 6_d^2) - (1-\gamma) 6_c 6_d \rho}} - 1$

So, $P_t = d_t \frac{\delta e^{\alpha}}{1 - \delta e^{\alpha}}$; $\alpha \equiv \mu_d - (1-\gamma)\mu_c + \frac{1}{2}[(1-\gamma)^2 6_c^2 + 6_d^2] - (1-\gamma)\rho 6_c 6_d$

4. a) $E_t[b_{t+1}] = \frac{R_f}{q_t} b + q_t + E_t[e_{t+1}] q_t + (1 - q_t) E_t[z_{t+1}] = R_f b_t$

b) From $E_t[b_{t+1}] = R_f b_t$

$$\lim E_t[b_{t+i}] = \begin{cases} +\infty & \text{if } b_t > 0 \\ -\infty & \text{if } b_t < 0 \end{cases}$$

b_t should > 0, as it limited.

c) A rational bubble can't be existed, as the bond price is required to be $P_t = d_t$ at maturity and be 0 after that. Only rational price is $P_t = p^*_t$

5. $P_t = f_t + b_t$ w/ $b_t \neq 0$ couldn't happen,

$P_t = f_t = d_t$ at date T