Exercise 1:

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(1)

① $V_B^t = 1+d$

First $U_A^t = 1 + RV_t$

and $V_B^t + U_A^t = \frac{2P_t}{B_t P_0}$

$$\Rightarrow P_t = (1+d + 1 + RV_t) \frac{B_t P_0}{2}$$

and $B_t = 1 \Rightarrow P_{t_1} = \frac{P_0}{2}(1+1+d+RV_t)$

② $V_B^t = \frac{R'V_t - 1}{2} - RV_t$

$$\Rightarrow P_{t_2} = \left(\frac{1}{2}R'V_t - \frac{1}{2} - RV_t + 1 + RV_t\right)\frac{P_0}{2}$$

$$= \frac{1}{2}(R'V_t + 1)\frac{P_0}{2} = \frac{P_0}{4}(R'V_t + 1)$$

(2) $r = \frac{P_{t_2}}{P_{t_1}} - 1 = \frac{\frac{P_0}{4}(R'V_t + 1)}{\frac{P_0}{2}(1+1+d+RV_t)} - 1$

$$= \frac{1+R'V_t}{2(1+1+d+RV_t)} - 1$$

Exercise 2:

$$\begin{cases} V_B^t \leq 0 \\ 2(V_A^t - |V_B^t| - (V_A^t - 1)\frac{\tilde{R}}{R})^+ < 1 + R' V_t \end{cases}$$

$\Rightarrow \quad 2(1 + (R - \tilde{R}) V_t - |V_B^t|)^+ < 1 + R' V_t$

① $1 + (R - \tilde{R}) V_t - |V_B^t| \geq 0$

$$V_B^t \geq (\tilde{R} - R) V_t - 1$$

$2(1 + (R - \tilde{R}) V_t - |V_B^t|) < 1 + R' V_t$,

$$V_B^t < (\tilde{R} + \frac{R'}{2} - R) V_t - \frac{1}{2}$$

② $1 + (R - \tilde{R}) V_t - |V_B^t| \leq 0$

$\Rightarrow \quad V_B^t \leq (\tilde{R} - R) V_t - 1$

So we can get:

$$V_B^t < (\tilde{R} + \frac{R'}{2} - R) V_t - \frac{1}{2}$$

First, $V_B^t = H_d \qquad V_A = 1 + R V_t$

$\Rightarrow \quad P_{t_1} = \frac{P_0}{2}(1 + R V_t + H_d)$

Second, $V_B^t = (\tilde{R} + \frac{R'}{2} - R) V_t - \frac{1}{2}$

$\Rightarrow \quad P_{t_2} = \frac{P_0}{4}(1 + (2\tilde{R} + R') V_t)$

$$r = \frac{P_{t_2}}{P_{t_1}} - 1 = \frac{1}{2} \frac{1 + (2R^2 + R')Vt}{1 + RVt + Hd} - 1$$