Shareholders

$$\max E_0 \sum_{t=0}^{\infty} \beta^t u^s(c_t^s, h_t^s)$$

s.t.

$$wh_t^s + q_t(s_t + D_t) \geq c_t^s + q_{t+1} s_{t+1}$$

FOC

$$w = -\frac{u_h^s(c_t^s, h_t^s)}{u_c^s(c_t^s, h_t^s)}$$

$$\frac{s_{t+1}}{s_{t+1} + D_{t+1}} = \frac{\beta u_c^s(c_{t+1}^s, h_{t+1}^s)}{u_c^s(c_t^s, h_t^s)}$$

Workers

$$\max \sum_{t=0}^{\infty} \beta^t u^w(c_t^w, h_t^w)$$

s.t.

$$wh_t^w \geq c_t$$

F.O.C

$$w = -\frac{u_h^w(c_t^w, h_t^w)}{u_c^w(c_t^w, h_t^w)}$$

Utility Function

$$u(c_t, h_t) = \frac{[c_t^i - \chi^i (h_t^i)^{\omega}]^{1-\gamma} - 1}{1-\gamma}, \quad \gamma > 0$$

Firms

$$\max E_0 \sum_{t=0}^{\infty} \beta^t D_t$$

Where D_t is defined as:

$$D_{t+1} = y_t - w_t(\xi h_t^s + (1-\xi) h_t^w) - i_t + d_{t+1} - d_t(1 + r_t)$$

subject to

$$y_t = z_t k^{\alpha} (\xi h_t^s + (1-\xi) h_t^w)^{1-\alpha}$$

$$k_{t+1} = (1-\delta) k_t + i_t - \frac{\phi}{2} (k_{t+1} - k_t)^2$$

F.O.C

$$w_t = (1-\alpha) z_t k^{\alpha} (\xi h_t^s + (1-\xi) h_t^w)^{-\alpha}$$

$$\frac{1}{\beta} = E_t (1 + r_{t+1})$$

$$1 + \phi(k_{t+1} - k_t) = \beta\{\alpha z_{t+1} k_{t+1}^{\alpha-1} (\xi h_{t+1}^s + (1-\xi) h_{t+1}^w)^{1-\alpha} + (1-\delta) + \phi(k_{t+2} - k_{t+1})\}$$

risk premium

$$p(d) = \varphi(e^{d_t - \bar{d}} - 1)$$

$$e^r = r_w + p(d)$$

$$\bar{d} = \mu k$$

$$w = (1-\alpha) k^{\alpha} (\xi h^s + (1-\xi) h^w)^{-\alpha}$$

$$\frac{1}{\beta} = (1 + \bar{r})$$

$$\left\{ \frac{1}{\alpha} \left(\frac{1}{\beta} - 1 + \delta \right) \right\}^{\frac{1}{\alpha-1}} = \frac{k}{h}$$

$$\left(\frac{1-\beta}{\beta} \right) s = D$$

$$w = (1-\alpha) \left\{ \frac{1}{\alpha} \left(\frac{1}{\beta} - 1 + \delta \right) \right\}^{\frac{\alpha}{\alpha-1}}$$

$$w = \chi^s \omega (h^s)^{\omega-1}$$

$$w = \chi^w \omega (h^w)^{\omega-1}$$

$$h^s = \left(\frac{1-\alpha}{\chi^s \omega}\right)^{\frac{1}{\omega-1}} \left\{\frac{1}{\alpha}\left(\frac{1}{\beta}-1+\delta\right)\right\}^{\frac{\alpha}{(\alpha-1)(\omega-1)}}$$

$$h^w = \left(\frac{1-\alpha}{\chi^w \omega}\right)^{\frac{1}{\omega-1}} \left\{\frac{1}{\alpha}\left(\frac{1}{\beta}-1+\delta\right)\right\}^{\frac{\alpha}{(\alpha-1)(\omega-1)}}$$

$$k = \left\{\frac{1}{\alpha}\left(\frac{1}{\beta}-1+\delta\right)\right\}^{\frac{1}{\alpha-1}} \{\xi h^s + (1-\xi) h^w\}$$

$$c^w = (1-\alpha)\left(\frac{1-\alpha}{\chi^w \omega}\right)^{\frac{1}{\omega-1}} \left\{\frac{1}{\alpha}\left(\frac{1}{\beta}-1+\delta\right)\right\}^{\frac{\alpha\omega}{(\alpha-1)(\omega-1)}}$$

$$i = \delta k$$

$$D = y - wh - i - \bar{r}d$$

$$c^s = (1-\alpha)\left(\frac{1-\alpha}{\chi^s \omega}\right)^{\frac{1}{\omega-1}} \left\{\frac{1}{\alpha}\left(\frac{1}{\beta}-1+\delta\right)\right\}^{\frac{\alpha\omega}{(\alpha-1)(\omega-1)}} + D$$