$$(1+\tau_t^c)\lambda_t = \frac{v_t}{C_t - hC_{t-1}} - \beta h \frac{v_{t+1}}{C_{t+1} - hC_t} \tag{1}$$

$$\lambda_t(1-\tau_t^k)R_t = \mu_t(\delta_1 + \delta_2(u_t - 1)) \tag{2}$$

$$\lambda_t = \beta\lambda_{t+1}\frac{1+i_t}{\pi_{t+1}} \tag{3}$$

$$(1+\tau_t^c)\lambda_t = \mu_t Z_t \left(1 - \frac{\kappa}{2}\left(\frac{I_t}{I_{t-1}} - 1\right)^2 - \kappa\left(\frac{I_t}{I_{t-1}} - 1\right)\frac{I_t}{I_{t-1}}\right) + \beta\mu_{t+1}Z_{t+1}\kappa\left(\frac{I_{t+1}}{I_t} - 1\right)\left(\frac{I_{t+1}}{I_t}\right)^2 \tag{4}$$

$$\mu_t = \beta\left(\lambda_{t+1}(1-\tau_{t+1}^k)R_{t+1}u_{t+1} + \mu_{t+1}(1 - \delta_0 - \delta_1(u_{t+1}-1) - \frac{\delta_2}{2}(u_{t+1}-1)^2)\right) \tag{5}$$

$$f_{1,t} = v_t\epsilon_t^l\left(\frac{w_t}{w_t^*}\right)^{\epsilon_w(1+\xi)} L_{d,t}^{1+\xi} + \phi_w\beta\left(1+\pi_t\right)^{-\zeta_w\epsilon_w(1+\xi)}\left(1+\pi_{t+1}\right)^{\epsilon_w(1+\xi)}\left(\frac{w_{t+1}^*}{w_t^*}\right)^{\epsilon_w(1+\xi)} f_{1,t+1} \tag{6}$$

$$f_{2,t} = (1-\tau_t^l)\lambda_t\left(\frac{w_t}{w_t^*}\right)^{\epsilon_w} L_{d,t} + \phi_w\beta\left(1+\pi_t\right)^{\zeta_w(1-\epsilon_w)}\left(1+\pi_{t+1}\right)^{\epsilon_w - 1}\left(\frac{w_{t+1}^*}{w_t^*}\right)^{\epsilon_w} f_{2,t+1} \tag{7}$$

$$w_t^* = \frac{\epsilon_w}{\epsilon_w - 1}\frac{f_{1,t}}{f_{2,t}} \tag{8}$$

$$\frac{w_t}{R_t} = \frac{(1-\alpha)}{\alpha}\frac{\hat{K}_{t-1}}{L_{d,t}} \tag{9}$$

$$mc_t = \frac{w_t}{(1-\alpha)A_t\left(\frac{\hat{K}_{t-1}}{L_{d,t}}\right)^{\alpha}} \tag{10}$$

$$g_{1,t} = \lambda_t mc_t Y_t + \phi_p\beta\left(1+\pi_t\right)^{-\zeta_p\epsilon_p}\left(1+\pi_{t+1}\right)^{\epsilon_p} g_{1,t+1} \tag{11}$$

$$g_{2,t} = \lambda_t Y_t + \phi_p\beta\left(1+\pi_t\right)^{\zeta_p(1-\epsilon_p)}\left(1+\pi_{t+1}\right)^{\epsilon_p - 1} g_{2,t+1} \tag{12}$$

$$1 + \pi_t^* = \frac{\epsilon_p}{\epsilon_p - 1}(1+\pi_t)\frac{g_{1,t}}{g_{2,t}} \tag{13}$$

$$Y_t = C_t + I_t + G_t \tag{14}$$

$$K_t = Z_t \left(1 - \frac{\kappa}{2}\left(\frac{I_t}{I_{t-1}} - 1\right)^2\right) I_t + \left(1 - \delta_0 - \delta_1(u_t - 1) - \frac{\delta_2}{2}(u_t - 1)^2\right) K_{t-1} \tag{15}$$

$$KG_t = (1 - \delta_g) KG_{t-1} + G_t \tag{16}$$

$$Y_t \nu_t^p = A_t \hat{K}_{t-1}^{\alpha} L_{d,t}^{1-\alpha} KG_{t-1}^{\alpha_g} \tag{17}$$

$$\hat{K}_t = u_t K_t \tag{18}$$

$$\nu_t^p = (1 - \phi_p)\left(\frac{1 + \pi_t^*}{1 + \pi_t}\right)^{-\epsilon_p} + \phi_p \left(1 + \pi_{t-1}\right)^{-\zeta_p \epsilon_p} \left(1 + \pi_t\right)^{\epsilon_p} \nu_{t-1}^p \tag{19}$$

$$(1 + \pi_t)^{1-\epsilon_p} = (1 - \phi_p)(1 + \pi_t^*)^{1-\epsilon_p} + \phi_p (1 + \pi_{t-1})^{\zeta_p (1-\epsilon_p)} \tag{20}$$

$$w_t^{1-\epsilon_w} = (1 - \phi_w) w_t^{*1-\epsilon_w} + \phi_w (1 + \pi_{t-1})^{\zeta_w (1-\epsilon_w)} (1 + \pi_t)^{\epsilon_w - 1} w_{t-1}^{1-\epsilon_w} \tag{21}$$

$$i_t = (1 - \rho_i) i + \rho_i i_{t-1} + (1 - \rho_i)[\phi_\pi (\pi_t - \pi^{\text{target}}) + \phi_y (\ln Y_t - \ln Y_{t-1})] + \eta_t^i \tag{22}$$

$$\ln G_t = (1 - \rho_g) \ln(\omega Y_t) + \rho_g \ln G_{t-1} + \eta_t^g \tag{23}$$

$$\ln A_t = (1 - \rho_a) \ln A + \rho_a \ln A_{t-1} + \eta_t^a \tag{24}$$

$$\ln Z_t = (1 - \rho_z) \ln Z + \rho_z \ln Z_{t-1} + \eta_t^z \tag{25}$$

$$\ln v_t = (1 - \rho_v) \ln v + \rho_v \ln v_{t-1} + \eta_t^v \tag{26}$$

$$\ln \epsilon_t^l = (1 - \rho_{\epsilon^l}) \ln \epsilon^l + \rho_{\epsilon^l} \ln \epsilon_{t-1}^l + \eta_t^{\epsilon^l} \tag{27}$$

$$\tau_t^c = (1 - \rho_{\tau^c}) \tau^c + \rho_{\tau^c} \tau_{t-1}^c + \eta_t^{\tau^c} \tag{28}$$

$$\tau_t^l = (1 - \rho_{\tau^l})\tau^l + \rho_{\tau^l}\tau_{t-1}^l + \eta_t^{\tau^l} \tag{29}$$

$$\tau_t^k = (1 - \rho_{\tau^k})\tau^k + \rho_{\tau^k}\tau_{t-1}^k + \eta_t^{\tau^k} \tag{30}$$

$$Welfare_t = v_t \left(\log(C_t - hC_{t-1}) - \frac{\epsilon_t^l L_t^{1+\xi}}{1+\xi} \right) + \beta Welfare_{t+1} \tag{31}$$