

Households:

$$L = E_t \left\{ \sum_{t=0}^{\infty} \beta^t \left[ \frac{C_t^{1-\sigma}}{1-\sigma} - \frac{N_t^{1+\eta}}{1+\eta} - \mu M_t \right] \right\} + \vartheta_t \left[ \frac{W_t}{P_t} N_t + (1+i_{t-1}) \frac{B_{t-1}}{P_t} + \pi_t - C_t - \frac{B_t}{P_t} \right]$$

FOC labor:  $\vartheta_t = \beta^t C_t^{-\sigma}$

FOC consumption:  $\beta^t N_t^\eta = \vartheta_t \frac{W_t}{P_t}$

FOC bonds:  $\frac{\vartheta_t}{P_t} = (1+i_t) E_t \left( \frac{\vartheta_{t+1}}{P_{t+1}} \right)$

Emissions:  $Z_t = \mu M_t$

Total cost of emissions:  $CE_t(j) = \mu p_t^M M_t$

Production function:  $Y_t = A_t N_t^\alpha M_t^{1-\alpha}$

Marginal product of labor:  $MPL_t = A_t \alpha N_t^{\alpha-1} M_t^{1-\alpha}$

Firms:

$$\gamma = \frac{P_t(j)}{P_t} Y_t(j) - \frac{W_t}{P_t} N_t(j) - \frac{P_t^M}{P_t} M_t(j) - CE_t(j) + \lambda_t \{Y_t(j) - A_t N_t^\alpha(j) M_t^{1-\alpha}(j)\}$$

Labor demand:  $w_t = MC_t MPL_t$

FOC energy:  $p_t^M (1+\mu) = MC_t A_t (1-\alpha) N_t^\alpha M_t^{-\alpha}$

Marginal costs:

$$MC_t = \frac{(w_t)^\alpha}{A_t (\alpha)^\alpha (1-\alpha)^{1-\alpha} [p_t^M (1+\mu)]^{\alpha-1}}$$

Aggregate resource constraint:  $Y_t = C_t$

Flexible price Output:

$$\tilde{y}_t^f = \frac{1}{1+\eta+\alpha(\sigma-1)} \{(1+\eta)\tilde{\alpha}_t + (1+\eta)(1-\alpha)\tilde{m}_t\}$$

Phillips curve:  $\pi_t = \tilde{k} \tilde{m}_t + \beta E_t(\pi_{t+1})$

Output gap:  $x_t = Y_t - Y_t^f$

Monetary shock:  $\ln v_t - \ln \bar{v} = \rho_V \ln v_{t-1} - \rho_V \ln \bar{v} + \varepsilon_{t,v}$

Technology Shock:  $\ln A_t - \ln \bar{A} = \rho_Z \ln A_{t-1} - \rho_Z \ln \bar{A} + \varepsilon_{t,A}$