Roll the DICE Again: Economic Models of Global Warming

Appendix B

William D. Nordhaus and Joseph Boyer

Yale University
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Appendix B. Equations of DICE-99

(B.1) \[ W = \sum_{t} U[c(t),L(t)]R(t) \]

(B.2) \[ R(t) = \prod_{v=0}^{t} [1 + \rho(v)]^{-10} \]

\[ \rho(t) = \rho(0)\exp(-g^\rho t) \]

(B.3) \[ U[c(t),L(t)] = L(t) \{ \log[c(t)] \} \]

(B.4) \[ g^{\text{pop}}(t) = g^{\text{pop}}(0)\exp(-\delta^{\text{pop}} t) \]

\[ L(t) = L(0)\exp\left(\int_{0}^{t} g^{\text{pop}}(t)\right) \]

(B.5) \[ Q(t) = \Omega(t)(1-b_1(t)\mu(t)b_2)A(t)K(t)^\gamma L(t)^{1-\gamma} \]

(B.6) \[ g^A(t) = g^A(0)\exp(-\delta^A t) \]

\[ A(t) = A(0)\exp\left(\int_{0}^{t} g^A(t)\right) \]

(B.7) \[ \Omega(t) = 1/[1+D(t)] \]

(B.8) \[ D(t) = \theta_1 T(t) + \theta_2 T(t)^2 \]

(B.9) \[ g^b(t) = g^b(0) \exp(-\delta^b t) \]

\[ b_1(t) = b_1(t-1)/(1+g^b(t)) \]

\[ b_1(0) = b_1^* \]

(B.10) \[ E(t) = (1-\mu(t))\sigma(t)A(t)K(t)^\gamma L(t)^{1-\gamma} \]

(B.11) \[ g^\sigma(t) = g^\sigma(0)\exp(-\delta^\sigma t - \delta^\sigma t^2) \]
\[ \sigma(t) = \sigma(t-1)/(1 + g^\sigma(t)) \]
\[ \sigma(0) = \sigma^* \]

(B.12) \[ Q(t) + \tau(t)[\Pi(t) - E(t)] = C(t) + I(t) \]

(B.13) \[ \Pi(t) = E(t) \]

(B.14) \[ c(t) = C(t)/L(t) \]

(B.15) \[ K(t) = K(t-1)(1-\delta_K)^{10} + 10 \times I(t-1) \]
\[ K(0) = K^* \]

(B.16) \[ LU(t) = LU(0)(1-\delta_i)^t \]
\[ ET(t) = E(t) + LU(t) \]

(B.17a) \[ M_{AT}(t) = 10 \times ET(t) + \phi_{11} M_{AT}(t-1) - \phi_{12} M_{AT}(t-1) + \phi_{21} M_{UP}(t-1) \]
\[ M_{AT}(0) = M_{AT}^* \]

(B.17b) \[ M_{UP}(t) = \phi_{22} M_{UP}(t-1) + \phi_{12} M_{AT}(t-1) - \phi_{21} M_{UP}(t-1) + \phi_{32} M_{LO}(t-1) - \phi_{23} M_{UP}(t-1) \]
\[ M_{UP}(0) = M_{UP}^* \]

(B.17c) \[ M_{LO}(t) = \phi_{33} M_{LO}(t-1) - \phi_{32} M_{LO}(t-1) + \phi_{23} M_{UP}(t-1) \]
\[ M_{LO}(0) = M_{LO}^* \]

(B.18) \[ F(t) = \eta \{ \log[M_{AT}(t)/M_{AT}^{pl}] / \log(2) \} + O(t) \]
\[ O(t) = -0.1965 + 0.13465t \quad t < 11 \]
\[ = 1.15 \quad t > 10 \]

(B.19) \[ T(t) = T(t-1) + \sigma_1 \{ F(t) - \lambda T(t-1) - \sigma_2 [T(t-1) - T_{LO}(t-1)] \} \]
\[ T(0) = T^* \]
(B.20) \[ T_{LO}(t) = T_{LO}(t-1) + \sigma_{3}[T(t-1) - T_{LO}(t-1)] \]

\[ T_{LO} = T_{LO}^* \]