10 Sticky-Price Models of Output, the Exchange Rate, and the Current Account

$$U_t^j = \sum_{s=t}^{\infty} \beta^{s-t} \left[\log C_s^j + \chi \log \frac{M_s^j}{P_s} - \frac{\kappa}{2} y_s(j)^2 \right] \quad (1)$$

$$C^j = \left[\int_0^1 c^j(z)^{\frac{\theta-1}{\theta}} \mathrm{d}z \right]^{\frac{\theta}{\theta-1}}, \quad (2)$$

$$P = \left[\int_0^1 p(z)^{1-\theta} \mathrm{d}z \right]^{\frac{1}{1-\theta}}. \quad (3)$$

$$\ell = \left(\frac{y}{A}\right)^{1/\alpha}.$$

$$P^* = \left[\int_0^1 p^*(z)^{1-\theta} \mathrm{d}z\right]^{\frac{1}{1-\theta}},$$

$$p(z) = \mathcal{E} p^*(z). \tag{4}$$

$$P = \left[\int_0^1 p(z)^{1-\theta}\mathrm{d}z\right]^{\frac{1}{1-\theta}}$$

$$= \left[\int_0^n p(z)^{1-\theta}\mathrm{d}z + \int_n^1 [\mathcal{E}p^*(z)]^{1-\theta}\mathrm{d}z\right]^{\frac{1}{1-\theta}} \tag{5}$$

$$P^* = \left[\int_0^1 p^*(z)^{1-\theta}\mathrm{d}z\right]^{\frac{1}{1-\theta}}$$

$$= \left[\int_0^n [p(z)/\mathcal{E}]^{1-\theta}\mathrm{d}z + \int_n^1 p^*(z)^{1-\theta}\mathrm{d}z\right]^{\frac{1}{1-\theta}} \tag{6}$$

$$P = \mathcal{E}P^*. \tag{7}$$

$$P_t B^j_{t+1} + M^j_t = P_t(1 + r_t)B^j_t + M^j_{t-1} + p_t(j)y_t(j) - P_t C^j_t - P_t \tau_t \tag{8}$$

$$0 = \tau_t + \frac{M_t - M_{t-1}}{P_t}. \tag{9}$$

$$c^j(z) = \left[\frac{p(z)}{P}\right]^{-\theta} C^j$$

$$c^{*j}(z) = \left[\frac{p^*(z)}{P^*}\right]^{-\theta} C^{*j}.$$

$$y^d(z) = \left[\frac{p(z)}{P}\right]^{-\theta} C^{\mathrm{W}}, \tag{10}$$

$$C^{\mathrm{W}} \equiv \int_0^n C^j \mathrm{d}j + \int_n^1 C^{*j} \mathrm{d}j = nC + (1-n)C^* \tag{11}$$

$$\max_{y(j), M^j, B^j} U_t^j$$

$$= \sum_{s=t}^{\infty} \beta^{s-t} \left\{ \log \left[(1+r_s) B_s^j + \frac{M_{s-1}^j}{P_s} + y_s(j)^{\frac{\theta-1}{\theta}} (C_s^{\mathrm{W}})^{\frac{1}{\theta}} \right. \right.$$

$$\left. \left. - \tau_s - B_{s+1}^j - \frac{M_s^j}{P_s} \right] + \chi \log \left(\frac{M_s^j}{P_s} \right) - \frac{\kappa}{2} y_s(j)^2 \right\} \tag{12}$$

$$C_{t+1} = \beta(1 + r_{t+1})C_t, \tag{13}$$

$$\frac{M_t}{P_t} = \chi C_t \left(\frac{1 + i_{t+1}}{i_{t+1}}\right), \tag{14}$$

$$y_t^{\frac{\theta+1}{\theta}} = \frac{\theta - 1}{\theta\kappa}(C_t^{\mathrm{W}})^{\frac{1}{\theta}}\frac{1}{C_t}, \tag{15}$$

$$1 + i_{t+1} = \frac{P_{t+1}}{P_t}(1 + r_{t+1}).$$

$$\lim_{T\to\infty} R_{t,t+T}\left(B_{t+T+1}+\frac{M_{t+T}}{P_{t+T}}\right)=0. \tag{16}$$

$$nB_{t+1}+(1-n)B^{*}_{t+1}=0. \tag{17}$$

$$\begin{aligned} C^{\mathrm{W}}_{t} &\equiv nC_t+(1-n)C^{*}_{t} \\ &= n\frac{p_t(h)}{P_t}y_t(h)+(1-n)\frac{p^{*}_{t}(f)}{P^{*}_{t}}y^{*}_{t}(f)\equiv Y^{\mathrm{W}}_{t} \end{aligned} \tag{18}$$

$$\bar{r} = \delta \equiv \frac{1-\beta}{\beta}, \tag{19}$$

$$\bar{C} = \delta \bar{B} + \frac{\bar{p}(h)\bar{y}}{\bar{P}}, \tag{20}$$

$$\bar{C}^{*} = -\left(\frac{n}{1-n}\right)\delta \bar{B} + \frac{\bar{p}^{*}(f)\bar{y}^{*}}{\bar{P}^{*}}. \tag{21}$$

$$\bar{p}_{0}(h)/\bar{P}_{0} = \bar{p}_{0}^{*}(f)/\bar{P}_{0}^{*} = 1 \tag{22}$$

$$\bar{C}_0 = \bar{C}_0^* = \bar{y}_0 = \bar{y}_0^* = \bar{C}_0^{\mathrm{W}}, \tag{23}$$

$$\bar{y}_0 = \bar{y}_0^* = \left(\frac{\theta - 1}{\theta\kappa}\right)^{\frac{1}{2}}. \tag{24}$$

$$\max_y \left(\log y - \frac{\kappa}{2} y^2\right).$$

$$y^{\mathrm{PLAN}} = \left(\frac{1}{\kappa}\right)^{\frac{1}{2}} > \left(\frac{\theta - 1}{\theta\kappa}\right)^{\frac{1}{2}} = \bar{y}_0. \tag{25}$$

$$\frac{\bar{M}_0}{\bar{P}_0} = \frac{\bar{M}_0^*}{\bar{P}_0^*} = \frac{\chi(1+\delta)}{\delta}\bar{y}_0, \tag{26}$$

$$P_t = \left\{ n p_t(h)^{1-\theta} + (1-n)\left[\mathcal{E}_t p_t^*(f)\right]^{1-\theta} \right\}^{\frac{1}{1-\theta}},$$

$$P_t^* = \left\{ n\left[p_t(h)/\mathcal{E}_t\right]^{1-\theta} + (1-n) p_t^*(f)^{1-\theta} \right\}^{\frac{1}{1-\theta}}.$$

$$\mathsf{p}_t = n\mathsf{p}_t(h) + (1-n)\left[\mathsf{e}_t + \mathsf{p}_t^*(f)\right] \tag{27}$$

$$\mathsf{p}_t^* = n\left[\mathsf{p}_t(h) - \mathsf{e}_t\right] + (1-n)\left[\mathsf{p}_t^*(f)\right] \tag{28}$$

$$\mathsf{e}_t = \mathsf{p}_t - \mathsf{p}_t^*. \tag{29}$$

$$\mathsf{y}_t = \theta\left[\mathsf{p}_t - \mathsf{p}_t(h)\right] + \mathsf{c}_t^{\mathrm{W}}, \tag{30}$$

$$\mathsf{y}_t^* = \theta\left[\mathsf{p}_t^* - \mathsf{p}_t^*(f)\right] + \mathsf{c}_t^{\mathrm{W}}. \tag{31}$$

$$\mathsf{c}_t^{\mathrm{w}} = n\mathsf{c}_t + (1-n)\mathsf{c}_t^* = n\mathsf{y}_t + (1-n)\mathsf{y}_t^* \equiv \mathsf{y}_t^{\mathrm{w}}. \tag{32}$$

$$(\theta + 1)\mathsf{y}_t = -\theta\mathsf{c}_t + \mathsf{c}_t^{\mathrm{w}}, \tag{33}$$

$$(\theta + 1)\mathsf{y}_t^* = -\theta\mathsf{c}_t^* + \mathsf{c}_t^{\mathrm{w}}, \tag{34}$$

$$\mathsf{c}_{t+1} = \mathsf{c}_t + \frac{\delta}{1+\delta}\mathsf{r}_{t+1}, \tag{35}$$

$$c^*_{t+1} = c^*_t + \frac{\delta}{1+\delta} r_{t+1} \tag{36}$$

$$m_t - p_t = c_t - \frac{r_{t+1}}{1+\delta} - \frac{p_{t+1} - p_t}{\delta}, \tag{37}$$

$$m^*_t - p^*_t = c^*_t - \frac{r_{t+1}}{1+\delta} - \frac{p^*_{t+1} - p^*_t}{\delta}. \tag{38}$$

$$m_t - m^*_t - e_t = c_t - c^*_t - \frac{1}{\delta}\left(e_{t+1} - e_t\right). \tag{39}$$

$$\bar{\mathsf{c}} = \delta\bar{\mathsf{b}} + \bar{\mathsf{p}}(h) + \bar{\mathsf{y}} - \bar{\mathsf{p}}, \tag{40}$$

$$\bar{\mathsf{c}}^* = -\left(\frac{n}{1-n}\right)\delta\bar{\mathsf{b}} + \bar{\mathsf{p}}^*(f) + \bar{\mathsf{y}}^* - \bar{\mathsf{p}}^*, \tag{41}$$

$$\mathsf{y}_t - \mathsf{y}_t^* = \theta[\mathsf{e}_t + \mathsf{p}_t^*(f) - \mathsf{p}_t(h)], \tag{42}$$

$$\mathsf{y}_t - \mathsf{y}_t^* = -\frac{\theta}{1+\theta}(\mathsf{c}_t - \mathsf{c}_t^*), \tag{43}$$

$$\bar{c} - \bar{c}^* = \left(\frac{1}{1-n}\right)\delta\bar{b} + \bar{y} - \bar{y}^* \\ - [\bar{e} + \bar{p}^*(f) - \bar{p}(h)] \tag{44}$$

$$\bar{c} - \bar{c}^* = \left(\frac{1}{1-n}\right)\left(\frac{1+\theta}{2\theta}\right)\delta\bar{b}. \tag{45}$$

$$\bar{p}(h) - \bar{e} - \bar{p}^*(f) = \left(\frac{1}{1-n}\right)\left(\frac{1}{2\theta}\right)\delta\bar{b}, \tag{46}$$

$$(1+\theta)y_t^{\mathrm{w}} = (1-\theta)c_t^{\mathrm{w}}.$$

$$\bar{\mathsf{y}}^{\mathrm{w}} = \bar{\mathsf{c}}^{\mathrm{w}} = 0. \tag{47}$$

$$\bar{\mathsf{c}} = \left(\frac{1+\theta}{2\theta}\right)\delta\bar{\mathsf{b}}, \tag{48}$$

$$\bar{\mathsf{c}}^{*} = -\left(\frac{n}{1-n}\right)\left(\frac{1+\theta}{2\theta}\right)\delta\bar{\mathsf{b}}. \tag{49}$$

$$\bar{\mathsf{p}} = \bar{\mathsf{m}} - \bar{\mathsf{c}}, \tag{50}$$

$$\bar{p}^* = \bar{m}^* - \bar{c}^*. \tag{51}$$

$$\bar{e} = \bar{m} - \bar{m}^* - (\bar{c} - \bar{c}^*). \tag{52}$$

$$\bar{m} - \bar{m}^* = m - m^*, \tag{53}$$

$$B_{t+1} - B_t = r_t B_t + \frac{p_t(h) y_t}{P_t} - C_t \tag{54}$$

$$\bar{\mathsf{b}} = \mathsf{y} - \mathsf{c} - (1 - n)\mathsf{e}, \tag{55}$$

$$\left(\frac{-n}{1-n}\right)\bar{\mathsf{b}} = \bar{\mathsf{b}}^* = \mathsf{y}^* - \mathsf{c}^* + n\mathsf{e}, \tag{56}$$

$$\mathsf{b}_t = \bar{\mathsf{b}}, \qquad \forall t \geq 2,$$

$$\bar{\mathsf{c}} - \bar{\mathsf{c}}^* = \mathsf{c} - \mathsf{c}^*, \tag{57}$$

$$\mathsf{m} - \mathsf{m}^* - \mathsf{e} = \mathsf{c} - \mathsf{c}^* - \frac{1}{\delta}\left(\bar{\mathsf{e}} - \mathsf{e}\right). \tag{58}$$

$$\bar{\mathsf{e}} = (\bar{\mathsf{m}} - \bar{\mathsf{m}}^*) - (\mathsf{c} - \mathsf{c}^*). \tag{59}$$

$$\mathsf{e} = (\mathsf{m} - \mathsf{m}^*) - (\mathsf{c} - \mathsf{c}^*). \tag{60}$$

$$\mathsf{e}_t = -(\mathsf{c}_1 - \mathsf{c}_1^*) + \frac{\delta}{1+\delta}\sum_{s=t}^{\infty}\left(\frac{1}{1+\delta}\right)^{s-t}(\mathsf{m}_s - \mathsf{m}_s^*) \tag{61}$$

$$\bar{\mathsf{b}} = (1-n)\left[(\mathsf{y}-\mathsf{y}^*) - (\mathsf{c}-\mathsf{c}^*) - \mathsf{e}\right]. \tag{62}$$

$$\mathsf{y} - \mathsf{y}^* = \theta\mathsf{e}, \tag{63}$$

$$\mathsf{e} = \frac{\delta(1+\theta) + 2\theta}{\delta(\theta^2 - 1)}(\mathsf{c} - \mathsf{c}^*), \tag{64}$$

$$\mathsf{e} = \frac{\delta(1+\theta)+2\theta}{\theta\delta(1+\theta)+2\theta}\left(\mathsf{m}-\mathsf{m}^*\right) < \mathsf{m}-\mathsf{m}^* \quad (65)$$

$$\mathsf{c}-\mathsf{c}^* = \frac{\delta(\theta^2-1)}{\theta\delta(1+\theta)+2\theta}(\mathsf{m}-\mathsf{m}^*). \quad (66)$$

$$\bar{\mathsf{b}} = \frac{2(1-n)(\theta-1)}{\delta(1+\theta)+2}\left(\mathsf{m}-\mathsf{m}^*\right). \quad (67)$$

$$\bar{\mathsf{p}}(h)-\bar{\mathsf{e}}-\bar{\mathsf{p}}^*(f) = \frac{\delta(\theta-1)}{\theta\delta(1+\theta)+2\theta}(\mathsf{m}-\mathsf{m}^*). \quad (68)$$

$$\bar{c}^W = c^W + \frac{\delta}{1+\delta} r. \tag{69}$$

$$c^W = -\frac{\delta}{1+\delta} r. \tag{70}$$

$$m^W = c^W - \frac{r}{1+\delta} - \frac{m^W}{\delta}, \tag{71}$$

$$c^W = m^W = y^W, \tag{72}$$

$$\mathsf{r} = -\left(\frac{1+\delta}{\delta}\right)\mathsf{m}^{\mathrm{w}}, \tag{73}$$

$$\mathsf{y} = \mathsf{m}^{\mathrm{w}} + (1-n)\theta\mathsf{e}.$$

$$\begin{aligned}\mathsf{y} = {} & \frac{\delta(1+\theta)+2[n(1-\theta)+\theta]}{\delta(1+\theta)+2}\ \mathsf{m} \\ & + \frac{(1-n)2(1-\theta)}{\delta(1+\theta)+2}\ \mathsf{m}^{*}\end{aligned} \tag{74}$$

$$U_t^{\mathrm{R}} \equiv \sum_{s=t}^{\infty} \beta^{s-t} \left(\log C_s - \frac{\kappa}{2} y_s^2 \right)$$

$$\mathrm{d}U^{\mathrm{R}} = \mathsf{c} - \kappa \bar{y}_0^2 \mathsf{y} + \frac{1}{\delta} \left(\bar{\mathsf{c}} - \kappa \bar{y}_0^2 \bar{\mathsf{y}} \right) .$$

$$\mathrm{d}U^{\mathrm{R}} = \mathsf{c} - \left(\frac{\theta - 1}{\theta} \right) \mathsf{y} + \frac{1}{\delta} \left[\bar{\mathsf{c}} - \left(\frac{\theta - 1}{\theta} \right) \bar{\mathsf{y}} \right]. \qquad (75)$$

$$\mathsf{c} = \frac{\delta(1-n)(\theta^2 - 1)}{\delta(1+\theta) + 2\theta} \mathsf{e} + \mathsf{m}^{\mathrm{w}}.$$

$$\bar{c} = \frac{\delta(1-n)(\theta^2-1)}{\delta(1+\theta)+2\theta}e.$$

$$\bar{y} = -\frac{\delta\theta(1-n)(\theta-1)}{\delta(1+\theta)+2\theta}e$$

$$dU^{R} = \frac{c^{W}}{\theta} = \frac{m^{W}}{\theta}. \tag{76}$$

$$\begin{aligned} P_t B_{t+1} + M_t = {} & P_t(1+r_t)B_t + M_{t-1} \\ & + (1-\tau^{L})p_t y_t - P_t C_t - P_t \tau_t \end{aligned} \tag{77}$$

$$0 = \tau_t + \frac{\tau^{\mathrm{L}}}{nP_t} \int_0^n p_t(z) y_t(z) \mathrm{d}z + \frac{M_t - M_{t-1}}{P_t}$$

$$0 = \tau_t + \frac{\tau^{\mathrm{L}} p_t(h) y_t(h)}{P_t} + \frac{M_t - M_{t-1}}{P_t} \tag{78}$$

$$y_t^{\frac{\theta+1}{\theta}} = \left(1 - \tau^{\mathrm{L}}\right) \frac{\theta - 1}{\theta\kappa} \left(C_t^{\mathrm{W}}\right)^{\frac{1}{\theta}} \frac{1}{C_t}. \tag{79}$$

$$\bar{y}_0 = \bar{y}_0^* = \left[\frac{(\theta - 1)\left(1 - \tau^{\mathrm{L}}\right)}{\theta\kappa} \right]^{\frac{1}{2}} \tag{80}$$

$$\mathrm{d}U^{\mathrm{R}} = \left[\frac{(1-n)\mathsf{m}^*}{\theta}\right]\left[1 - \frac{\tau^{\mathrm{L}}(\theta-1)^2}{\delta(1+\theta)+2}\right] \tag{81}$$

$$\begin{aligned} U_t^j = \sum_{s=t}^{\infty} \beta^{s-t} \Bigg[& \gamma \log C_{\mathrm{T},s}^j + (1-\gamma) \log C_{\mathrm{N},s}^j \\ & + \frac{\chi}{1-\varepsilon}\left(\frac{M_s^j}{P_s}\right)^{1-\varepsilon} - \frac{\kappa}{2} y_{\mathrm{N},s}(j)^2 \Bigg] \end{aligned} \tag{82}$$

$$C_{\mathrm{N}} = \left[\int_0^1 c_{\mathrm{N}}(z)^{\frac{\theta-1}{\theta}} \mathrm{d}z\right]^{\frac{\theta}{\theta-1}}.$$

$$P \equiv P_{\mathrm{T}}^{\gamma} P_{\mathrm{N}}^{1-\gamma} / \gamma^{\gamma} (1-\gamma)^{1-\gamma}, \tag{83}$$

$$P_{\mathrm{N}} = \left[\int_0^1 p_{\mathrm{N}}(z)^{1-\theta} \mathrm{d}z \right]^{\frac{1}{1-\theta}},$$

$$\begin{aligned} & P_{\mathrm{T},t} B_{t+1}^{j} + M_t^j \\ & \quad = P_{\mathrm{T},t}(1+r) B_t^j + M_{t-1}^j + p_{\mathrm{N},t}(j) y_{\mathrm{N},t}(j) \\ & \qquad + P_{\mathrm{T},t} \bar{y}_{\mathrm{T}} - P_{\mathrm{N},t} C_{\mathrm{N},t}^j - P_{\mathrm{T},t} C_{\mathrm{T},t}^j - P_{\mathrm{T},t} \tau_t, \end{aligned} \tag{84}$$

$$0 = \tau_t + \frac{M_t - M_{t-1}}{P_{\mathrm{T},t}}. \tag{85}$$

$$y_{\mathrm{N}}^d(j) = \left[\frac{p_{\mathrm{N}}(j)}{P_{\mathrm{N}}}\right]^{-\theta} C_{\mathrm{N}}^{\mathrm{A}}, \tag{86}$$

$$C_{\mathrm{T},t+1} = C_{\mathrm{T},t}, \tag{87}$$

$$\frac{\gamma}{C_{\mathrm{T},t}} = \chi \frac{P_{\mathrm{T},t}}{P_t} \left(\frac{M_t}{P_t}\right)^{-\varepsilon} + \beta \frac{P_{\mathrm{T},t}}{P_{\mathrm{T},t+1}} \left(\frac{\gamma}{C_{\mathrm{T},t+1}}\right) \tag{88}$$

$$C_{\mathrm{N},t} = \frac{1-\gamma}{\gamma}\left(\frac{P_{\mathrm{T},t}}{P_{\mathrm{N},t}}\right) C_{\mathrm{T},t}, \tag{89}$$

$$y_{\mathrm{N},t}{}^{\frac{\theta+1}{\theta}} = \left[\frac{(\theta-1)(1-\gamma)}{\kappa\theta}\right]\left(C^{\mathrm{A}}_{\mathrm{N},t}\right)^{\frac{1}{\theta}} \frac{1}{C_{\mathrm{N},t}} \tag{90}$$

$$C_{\mathrm{T},t} = \bar{y}_{\mathrm{T}}, \qquad \forall t. \tag{91}$$

$$\frac{M_t}{P_t} = \left\{\frac{\chi}{\gamma}\left[\frac{C_{\mathrm{T},t} P_{\mathrm{T},t}/P_t}{1-(\beta P_{\mathrm{T},t}/P_{\mathrm{T},t+1})}\right]\right\}^{1/\varepsilon}. \tag{92}$$

$$\bar{y}_{\mathrm{N}} = \bar{C}_{\mathrm{N}} = \left[\frac{(\theta - 1)(1 - \gamma)}{\kappa \theta} \right]^{\frac{1}{2}}. \tag{93}$$

$$\frac{\bar{p}_{\mathrm{N},0}}{\bar{P}_{\mathrm{N},0}} = 1.$$

$$y^d_{\mathrm{N}} = C_{\mathrm{N}}. \tag{94}$$

$$y_{\mathrm{N}} = C_{\mathrm{N}} = \frac{1 - \gamma}{\gamma} \left(\frac{P_{\mathrm{T}}}{\bar{P}_{\mathrm{N}}} \right) \bar{y}_{\mathrm{T}}, \tag{95}$$

$$\varepsilon(\mathsf{m} - \mathsf{p}) = \mathsf{p}_{\mathrm{T}} - \mathsf{p} + \frac{\beta}{1 - \beta}(\mathsf{p}_{\mathrm{T}} - \bar{\mathsf{p}}_{\mathrm{T}}), \tag{96}$$

$$\mathsf{p} = \gamma \mathsf{p}_{\mathrm{T}}. \tag{97}$$

$$\bar{\mathsf{p}}_{\mathrm{T}} = \bar{\mathsf{m}} = \mathsf{m}, \tag{98}$$

$$\mathsf{p}_{\mathrm{T}} = \frac{\beta + (1 - \beta)\varepsilon}{\beta + (1 - \beta)(1 - \gamma + \gamma\varepsilon)}\mathsf{m}. \tag{99}$$

$$p_T = e,$$

$$\Delta \log p = 0.039 + 1.042 \Delta B / Y, \qquad R^2 = 0.31$$
$$(0.027) \; (0.433)$$

$$\log C + \chi \log \frac{M}{P} - \frac{\kappa}{2} y^2.$$

$$(\theta + 1) y_t = -\theta c_t + c_t^W + \theta a_t, \tag{100}$$

$$(\theta + 1)\mathsf{y}_t^* = -\theta \mathsf{c}_t^* + \mathsf{c}_t^{\mathrm{W}} + \theta \mathsf{a}_t^*, \tag{101}$$

$$\mathsf{a}_t \equiv -\frac{\kappa_t - \bar{\kappa}_0}{\bar{\kappa}_0}$$

$$\mathsf{y}_t - \mathsf{y}_t^* = -\frac{\theta}{1+\theta}(\mathsf{c}_t - \mathsf{c}_t^*) + \frac{\theta}{1+\theta}(\mathsf{a}_t - \mathsf{a}_t^*),$$

$$\begin{aligned} \bar{\mathsf{c}} - \bar{\mathsf{c}}^* = &\left(\frac{1}{1-n}\right)\left(\frac{1+\theta}{2\theta}\right)\delta \bar{\mathsf{b}} \\ &+ \left(\frac{\theta - 1}{2\theta}\right)(\bar{\mathsf{a}} - \bar{\mathsf{a}}^*) \end{aligned} \tag{102}$$

$$\bar{\mathsf{a}} \equiv -\frac{\bar{\kappa} - \bar{\kappa}_0}{\bar{\kappa}_0}$$

$$\bar{\mathsf{p}}(h) - \bar{\mathsf{e}} - \bar{\mathsf{p}}^*(f) = \left(\frac{1}{1-n}\right)\left(\frac{1}{2\theta}\right)\delta\bar{\mathsf{b}} - \frac{\bar{\mathsf{a}} - \bar{\mathsf{a}}^*}{2\theta} \qquad (103)$$

$$\bar{\mathsf{c}}^{\mathrm{w}} = \bar{\mathsf{y}}^{\mathrm{w}} = \frac{\bar{\mathsf{a}}^{\mathrm{w}}}{2}. \qquad (104)$$

$$\mathsf{e} = (\mathsf{m} - \mathsf{m}^*) - (\mathsf{c} - \mathsf{c}^*)\,.$$

$$\mathsf{e} = \frac{\delta(1+\theta)+2\theta}{\delta(\theta^2-1)}\left(\mathsf{c}-\mathsf{c}^*\right) - \frac{\bar{\mathsf{a}}-\bar{\mathsf{a}}^*}{\delta(1+\theta)}, \quad (105)$$

$$\mathsf{e} = \frac{\delta(1+\theta)+2\theta}{\theta\delta(1+\theta)+2\theta}\left(\mathsf{m}-\mathsf{m}^*\right) - \frac{\theta-1}{\theta\delta(1+\theta)+2\theta}\left(\bar{\mathsf{a}}-\bar{\mathsf{a}}^*\right) \quad (106)$$

$$\mathsf{m}^{\mathrm{w}} = \mathsf{c}^{\mathrm{w}} - \frac{\mathsf{r}}{1+\delta} - \frac{\mathsf{m}^{\mathrm{w}}}{\delta} + \frac{\bar{\mathsf{a}}^{\mathrm{w}}}{2\delta}.$$

$$\mathsf{r} = \left(\frac{1+\delta}{\delta}\right)\left(\frac{\bar{\mathsf{a}}^{\mathrm{w}}}{2} - \mathsf{m}^{\mathrm{w}}\right). \tag{107}$$

$$G = \left[\int_0^1 g(z)^{\frac{\theta-1}{\theta}} \mathrm{d}z\right]^{\frac{\theta}{\theta-1}}, G^*$$

$$= \left[\int_0^1 g^*(z)^{\frac{\theta-1}{\theta}} \mathrm{d}z\right]^{\frac{\theta}{\theta-1}}$$

$$g(z) = \left[\frac{p(z)}{P}\right]^{-\theta} G.$$

$$G_t = \tau_t + \frac{M_t - M_{t-1}}{P_t}, \tag{108}$$

$$y^d = \left(\frac{p}{P}\right)^{-\theta} (C^{\mathrm{W}} + G^{\mathrm{W}}), \tag{109}$$

$$y^{\frac{\theta+1}{\theta}} = \frac{\theta - 1}{\theta\kappa} \left(C^{\mathrm{W}} + G^{\mathrm{W}}\right)^{\frac{1}{\theta}} \frac{1}{C}. \tag{110}$$

$$\bar{C} = \delta \bar{B} + \frac{\bar{p}(h)\bar{y}}{\bar{P}} - \bar{G}, \tag{111}$$

$$\bar{C}^* = -\left(\frac{n}{1-n}\right)\delta\bar{B} + \frac{\bar{p}^*(f)\bar{y}^*}{\bar{P}^*} - \bar{G}^* \tag{112}$$

$$\mathsf{y}_t = \theta\left[\mathsf{p}_t - \mathsf{p}_t(h)\right] + \mathsf{c}_t^{\mathrm{W}} + \mathsf{g}_t^{\mathrm{W}}, \tag{113}$$

$$\mathsf{y}_t^* = \theta\left[\mathsf{p}_t^* - \mathsf{p}_t^*(f)\right] + \mathsf{c}_t^{\mathrm{W}} + \mathsf{g}_t^{\mathrm{W}}, \tag{114}$$

$$\mathsf{y}_t^{\mathrm{W}} = \mathsf{c}_t^{\mathrm{W}} + \mathsf{g}_t^{\mathrm{W}}, \tag{115}$$

$$(\theta + 1)\mathsf{y}_t = -\theta \mathsf{c}_t + \mathsf{c}_t^{\mathrm{w}} + \mathsf{g}_t^{\mathrm{w}}, \tag{116}$$

$$(\theta + 1)\mathsf{y}_t^* = -\theta \mathsf{c}_t^* + \mathsf{c}_t^{\mathrm{w}} + \mathsf{g}_t^{\mathrm{w}}, \tag{117}$$

$$\bar{\mathsf{c}} = \delta \bar{\mathsf{b}} + \bar{\mathsf{p}}(h) + \bar{\mathsf{y}} - \bar{\mathsf{p}} - \bar{\mathsf{g}}, \tag{118}$$

$$\bar{\mathsf{c}}^* = -\left(\frac{n}{1-n}\right) \delta \bar{\mathsf{b}} + \bar{\mathsf{p}}^*(f) + \bar{\mathsf{y}}^* - \bar{\mathsf{p}}^* - \bar{\mathsf{g}}^*, \tag{119}$$

$$B_{t+1} - B_t = r_t B_t + \frac{p_t(h) y_t}{P_t} - C_t - G_t \tag{120}$$

$$\bar{\mathsf{b}} = \mathsf{y} - \mathsf{c} - (1 - n)\mathsf{e} - \mathsf{g}, \tag{121}$$

$$\left(\frac{-n}{1 - n}\right) \bar{\mathsf{b}} = \bar{\mathsf{b}}^* = \mathsf{y}^* - \mathsf{c}^* + n\mathsf{e} - \mathsf{g}^* \tag{122}$$

$$(\theta + 1)\mathsf{y}_t^{\mathrm{w}} = (1 - \theta)\mathsf{c}_t^{\mathrm{w}} + \mathsf{g}_t^{\mathrm{w}}.$$

$$\bar{\mathsf{y}}^{\mathrm{w}} = \frac{1}{2}\bar{\mathsf{g}}^{\mathrm{w}}, \tag{123}$$

$$\bar{\mathsf{c}}^{\mathrm{w}} = -\frac{1}{2}\bar{\mathsf{g}}^{\mathrm{w}}. \tag{124}$$

$$\bar{\mathsf{c}} - \bar{\mathsf{c}}^{*} = \left(\frac{1}{1-n}\right)\left(\frac{1+\theta}{2\theta}\right)\delta\bar{\mathsf{b}} - \frac{1+\theta}{2\theta}\left(\bar{\mathsf{g}} - \bar{\mathsf{g}}^{*}\right) \tag{125}$$

$$\bar{\mathsf{p}}(h) - \bar{\mathsf{e}} - \bar{\mathsf{p}}^*(f) = \left(\frac{1}{1-n}\right)\left(\frac{1}{2\theta}\right)\delta\bar{\mathsf{b}} - \frac{1}{2\theta}\left(\bar{\mathsf{g}} - \bar{\mathsf{g}}^*\right) \tag{126}$$

$$\mathsf{e} = \left(\mathsf{m} - \mathsf{m}^*\right) - \left(\mathsf{c} - \mathsf{c}^*\right).$$

$$\mathsf{e} = \frac{\delta(1+\theta) + 2\theta}{\delta(\theta^2 - 1)}\left(\mathsf{c} - \mathsf{c}^*\right) + \frac{1}{\theta - 1}\left[\mathsf{g} - \mathsf{g}^* + \left(\frac{1}{\delta}\right)\left(\bar{\mathsf{g}} - \bar{\mathsf{g}}^*\right)\right]. \tag{127}$$

$$\mathsf{e} = \frac{\delta(1+\theta)}{\theta\delta(1+\theta)+2\theta}\left[\mathsf{g}-\mathsf{g}^* + \left(\frac{1}{\delta}\right)\left(\bar{\mathsf{g}}-\bar{\mathsf{g}}^*\right)\right]. \tag{128}$$

$$\bar{\mathsf{b}} = \frac{(1-n)\delta(1+\theta)}{\delta(1+\theta)+2}\left[\mathsf{g}-\mathsf{g}^* + \left(\frac{1}{\delta}\right)\left(\bar{\mathsf{g}}-\bar{\mathsf{g}}^*\right)\right] - (1-n)\left(\mathsf{g}-\mathsf{g}^*\right) \tag{129}$$

$$\mathsf{r} = -\left(\frac{1+\delta}{\delta}\right)\frac{\bar{\mathsf{g}}^{\mathrm{W}}}{2}. \tag{130}$$

$$Y_{\mathrm{N},t} = \left[\int_0^1 \ell_t(z)^{\frac{\phi-1}{\phi}}\mathrm{d}z\right]^{\frac{\phi}{\phi-1}}, \tag{131}$$

$$U_t^j = \sum_{s=t}^{\infty} \beta^{s-t} \Bigg[\gamma \log C_{\mathrm{T},s}^j + (1-\gamma) \log C_{\mathrm{N},s}$$

$$+ \frac{\chi}{1-\varepsilon} \left(\frac{M_s^j}{P_s} \right)^{1-\varepsilon} - \frac{\kappa}{2} \ell_s(j)^2 \Bigg] \qquad (132)$$

$$P \equiv P_{\mathrm{T}}^{\gamma} P_{\mathrm{N}}^{1-\gamma} / \gamma^{\gamma} (1-\gamma)^{1-\gamma},$$

$$P_{\mathrm{T},t} B_{t+1}^j + M_t^j = P_{\mathrm{T},t}(1+r) B_t^j + M_{t-1}^j + w_t(j)\ell_t(j)$$

$$+ P_{\mathrm{T},t}\bar{y}_{\mathrm{T}} - P_{\mathrm{N},t} C_{\mathrm{N},t}^j - P_{\mathrm{T},t} C_{\mathrm{T},t}^j - P_{\mathrm{T},t}\tau_t, \qquad (133)$$

$$P_{\mathrm{N}}Y_{\mathrm{N}} - \int_0^1 w(z)\ell(z)\mathrm{d}z, \tag{134}$$

$$\ell_t^d(j) = \left[\frac{w_t(j)}{P_{\mathrm{N},t}}\right]^{-\phi} Y_{\mathrm{N},t}. \tag{135}$$

$$\ell_t^{\frac{\phi+1}{\phi}} = \left[\frac{(\phi-1)(1-\gamma)}{\kappa\phi}\right] Y_{\mathrm{N},t}^{\frac{1}{\phi}} \left(\frac{1}{C_{\mathrm{N},t}}\right) \tag{136}$$

$$Y_{\mathrm{N},t} = \ell_t, \tag{137}$$

$$w_t = P_{\mathrm{N},t}. \tag{138}$$

$$Y_{\mathrm{N},t} = C_{\mathrm{N},t}. \tag{139}$$

$$\bar{\ell} = \left[\frac{(\phi - 1)(1 - \gamma)}{\kappa\phi}\right]^{\frac{1}{2}} = \bar{Y}_{\mathrm{N}}. \tag{140}$$

$$\ell = Y_{\mathrm{N}} = C_{\mathrm{N}}.$$

$$U_t^j = \sum_{s=t}^{\infty} \beta^{s-t} \left[\log C_s^j + \chi \log \frac{M_s^j}{P_s} - \frac{\kappa}{2} \ell_s(j)^2 \right], \tag{141}$$

$$y_t(j) = \frac{1}{2} \left[2 \int_0^{\frac{1}{2}} \ell_t(z)^{\frac{\phi-1}{\phi}} \mathrm{d}z \right]^{\frac{\phi}{\phi-1}}, \tag{142}$$

$$p_t(j) y_t(j) - \int_0^{\frac{1}{2}} w_t(z) \ell_t(z) \mathrm{d}z$$

$$p_t(j) = \frac{\theta}{\theta - 1} w_t$$

$$\bar{y}_0 = \bar{y}_0^* = \left[\left(\frac{\phi - 1}{\phi}\right)\left(\frac{\theta - 1}{\theta}\right)\frac{1}{\kappa}\right]^{\frac{1}{2}} \tag{143}$$

$$p_t(h) = \mathcal{E}_t p_t^*(h) = \frac{\theta}{\theta - 1} w_t. \tag{144}$$

Table 10.1 Dynamic Response of the U.S. Current Account to a 20 Percent Real Dollar Depreciation (percent of GDP)

Year	Change in Current Account
1	–0.24
2	0.61
3	1.22
4	1.36
5	1.46
6	1.54

Source: Bryant, Holtham, and Hooper (1988), Table II-5, p. 113. The table averages estimates from the DRI, EPA, MCM, OECD, NIESR-GEM, and Taylor models; simulations cover the years 1986–91.