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Model name: `RW`

1 RW

1.1 Optimisation problem

$$\max_{\pi_t, y_t, i_t} U_t = -0.5 \left(-\mathit{pistar} + \pi_t\right)^2 + \beta \mathrm{E}_t \left[U_{t+1}\right] - 0.5 \kappa \theta^{-1} {y_t}^2 \tag{1.1}$$

s.t. :

$$\pi_{t-1} = \beta \pi_t + \kappa y_{t-1} \quad \left(\lambda^{\mathrm{RW}^1}_t\right) \tag{1.2}$$

$$y_{t-1} = y_t - \sigma \left(i_{t-1} - m_{t-1} - \pi_t\right) \quad \left(\lambda^{\mathrm{RW}^2}_t\right) \tag{1.3}$$

1.2 First order conditions

$$\mathit{pistar} - \pi_t + \beta \lambda^{\mathrm{RW}^1}_t - \beta \mathrm{E}_t \left[\lambda^{\mathrm{RW}^1}_{t+1}\right] + \sigma \lambda^{\mathrm{RW}^2}_t = 0 \quad (\pi_t) \tag{1.4}$$

$$\lambda^{\mathrm{RW}^2}_t + \beta \left(\kappa \mathrm{E}_t \left[\lambda^{\mathrm{RW}^1}_{t+1}\right] - \mathrm{E}_t \left[\lambda^{\mathrm{RW}^2}_{t+1}\right]\right) - \kappa \theta^{-1} y_t = 0 \quad (y_t) \tag{1.5}$$

$$-\beta \sigma \mathrm{E}_t \left[\lambda^{\mathrm{RW}^2}_{t+1}\right] = 0 \quad (i_t) \tag{1.6}$$

2 EXOG

2.1 Identities

$$m_t = e^{\epsilon^{\mathrm{Z}}_t + \phi \log m_{t-1}} \tag{2.1}$$

3 Equilibrium relationships (after reduction)

$$-m_t + e^{\epsilon^{\mathrm{Z}}_t + \phi \log m_{t-1}} = 0 \tag{3.1}$$

$$-\pi_{t-1} + \beta \pi_t + \kappa y_{t-1} = 0 \tag{3.2}$$

$$-y_{t-1} + y_t - \sigma \left(i_{t-1} - m_{t-1} - \pi_t\right) = 0 \tag{3.3}$$

$$\lambda^{\mathrm{RW}^2}_t + \beta \left(\kappa \mathrm{E}_t \left[\lambda^{\mathrm{RW}^1}_{t+1}\right] - \mathrm{E}_t \left[\lambda^{\mathrm{RW}^2}_{t+1}\right]\right) - \kappa \theta^{-1} y_t = 0 \tag{3.4}$$

$$U_t + 0.5 \left(-\mathit{pistar} + \pi_t\right)^2 - \beta \mathrm{E}_t \left[U_{t+1}\right] + 0.5 \kappa \theta^{-1} {y_t}^2 = 0 \tag{3.5}$$

$$pistar - \pi_t + \beta \lambda_t^{\mathrm{RW}^1} - \beta \mathrm{E}_t \left[\lambda_{t+1}^{\mathrm{RW}^1} \right] + \sigma \lambda_t^{\mathrm{RW}^2} = 0 \tag{3.6}$$

$$-\beta \sigma \mathrm{E}_t \left[\lambda_{t+1}^{\mathrm{RW}^2} \right] = 0 \tag{3.7}$$

4 Steady state relationships (after reduction)

$$-m_{\mathrm{ss}} + e^{\phi \log m_{\mathrm{ss}}} = 0 \tag{4.1}$$

$$-\pi_{\mathrm{ss}} + \beta \pi_{\mathrm{ss}} + \kappa y_{\mathrm{ss}} = 0 \tag{4.2}$$

$$-\sigma \left(i_{\mathrm{ss}} - \pi_{\mathrm{ss}} - m_{\mathrm{ss}} \right) = 0 \tag{4.3}$$

$$\lambda_{\mathrm{ss}}^{\mathrm{RW}^2} + \beta \left(-\lambda_{\mathrm{ss}}^{\mathrm{RW}^2} + \kappa \lambda_{\mathrm{ss}}^{\mathrm{RW}^1} \right) - \kappa \theta^{-1} y_{\mathrm{ss}} = 0 \tag{4.4}$$

$$U_{\mathrm{ss}} + 0.5 \left(-pistar + \pi_{\mathrm{ss}} \right)^2 - \beta U_{\mathrm{ss}} + 0.5 \kappa \theta^{-1} {y_{\mathrm{ss}}}^2 = 0 \tag{4.5}$$

$$pistar - \pi_{\mathrm{ss}} + \sigma \lambda_{\mathrm{ss}}^{\mathrm{RW}^2} = 0 \tag{4.6}$$

$$-\beta \sigma \lambda_{\mathrm{ss}}^{\mathrm{RW}^2} = 0 \tag{4.7}$$

5 Parameter settings

$$\beta = 0.99 \tag{5.1}$$

$$\kappa = 0.2465 \tag{5.2}$$

$$\phi = 0.95 \tag{5.3}$$

$$pistar = 0 \tag{5.4}$$

$$\sigma = 1 \tag{5.5}$$

$$\theta = 6 \tag{5.6}$$

6 Steady-state values

	Steady-state value
i	1
λ^{RW^1}	0
λ^{RW^2}	0
π	0
m	1
y	0
U	0

7 The solution of the 1st order perturbation

Matrix P

$$\begin{array}{c} \\ i_t \\ \pi_t \\ m_t \\ y_t \end{array} \begin{array}{c} \begin{array}{cccc} i_{t-1} & \pi_{t-1} & m_{t-1} & y_{t-1} \end{array} \\ \begin{pmatrix} -1.9422 & 5.8224 & 2.8922 & -3.3774 \\ 0 & 1.0101 & 0 & -0.249 \\ 0 & 0 & 0.95 & 0 \\ 1 & -1.0101 & -1 & 1.249 \end{pmatrix} \end{array}$$

Matrix Q

$$\begin{array}{c} \\ i \\ \pi \\ m \\ y \end{array} \begin{array}{c} \epsilon^{\mathrm{Z}} \\ \begin{pmatrix} 1 \\ 0 \\ 1 \\ 0 \end{pmatrix} \end{array}$$

Matrix R

$$\begin{array}{c} \\ \lambda_t^{\mathrm{RW}^1} \\ \lambda_t^{\mathrm{RW}^2} \\ U_t \end{array} \begin{array}{c} \begin{array}{cccc} i_{t-1} & \pi_{t-1} & m_{t-1} & y_{t-1} \end{array} \\ \begin{pmatrix} -0.5005 & 3.4065 & 0.5005 & -1.3402 \\ 0.1309 & -0.5005 & -0.1309 & 0.2543 \\ 0 & 0 & 0 & 0 \end{pmatrix} \end{array}$$

Matrix S

$$\begin{array}{c} \\ \lambda^{\mathrm{RW}^1} \\ \lambda^{\mathrm{RW}^2} \\ U \end{array} \begin{array}{c} \epsilon^{\mathrm{Z}} \\ \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix} \end{array}$$

8 Model statistics

8.1 Basic statistics

	Steady-state value	Std. dev.	Variance	Loglin
i	1	0.1303	0.017	Y
λ^{RW^1}	0	0	0	N
λ^{RW^2}	0	0	0	N
π	0	0	0	N
m	1	0.1303	0.017	Y
y	0	0	0	N
U	0	0	0	N

8.2 Correlation matrix

	i	m
i	1	1
m		1

8.3 Cross correlations with the reference variable (i)

	$\sigma[\cdot]$ rel. to $\sigma[i]$	i_{t-5}	i_{t-4}	i_{t-3}	i_{t-2}	i_{t-1}	i_t	i_{t+1}	i_{t+2}	i_{t+3}	i_{t+4}	i_{t+5}
i_t	1	-0.016	0.11	0.271	0.471	0.713	1	0.713	0.471	0.271	0.11	-0.016
m_t	1	-0.016	0.11	0.271	0.471	0.713	1	0.713	0.471	0.271	0.11	-0.016

8.4 Autocorrelations

	Lag 1	Lag 2	Lag 3	Lag 4	Lag 5
i	0.713	0.471	0.271	0.11	-0.016
m	0.713	0.471	0.271	0.11	-0.016

9 Impulse response functions

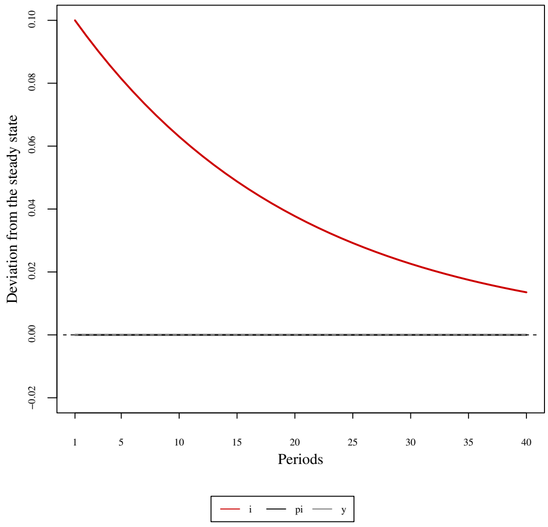

Figure 1: Impulse responses (i, π, y) to ϵ^{Z} shock