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Model name: `RSW`

1 HIGHREGIME

1.1 Optimisation problem

$$\max_{\mathit{piH}_t, \mathit{yH}_t, \mathit{iH}_t} UH_t = -0.5 \left(\mathit{pitH} - \mathit{pitCB} + \mathit{piH}_t\right)^2 + \beta \left(pH \mathrm{E}_t \left[UH_{t+1}\right] + (1 - pH) \mathrm{E}_t \left[UL_{t+1}\right]\right) - 0.5 \kappa \theta^{-1} \mathit{yH}_t{}^2 \tag{1.1}$$

s.t. :

$$\mathit{piH}_{t-1} = \beta \left(pH \mathit{piH}_t + \mathit{piL}_t (1 - pH)\right) + \kappa \mathit{yH}_{t-1} \quad \left(\lambda_t^{\mathrm{HIGHREGIME}^1}\right) \tag{1.2}$$

$$\mathit{yH}_{t-1} = pH \mathit{yH}_t + \mathit{yL}_t (1 - pH) - \sigma \left(\mathit{iH}_{t-1} - m_{t-1} - pH \mathit{piH}_t - \mathit{piL}_t (1 - pH)\right) \quad \left(\lambda_t^{\mathrm{HIGHREGIME}^2}\right) \tag{1.3}$$

1.2 First order conditions

$$-\mathit{pitH} + \mathit{pitCB} - \mathit{piH}_t + \beta pH \lambda_t^{\mathrm{HIGHREGIME}^1} - \beta pH \mathrm{E}_t \left[\lambda_{t+1}^{\mathrm{HIGHREGIME}^1}\right] + pH \sigma \lambda_t^{\mathrm{HIGHREGIME}^2} = 0 \quad (\mathit{piH}_t) \tag{1.4}$$

$$pH \lambda_t^{\mathrm{HIGHREGIME}^2} + \beta pH \left(\kappa \mathrm{E}_t \left[\lambda_{t+1}^{\mathrm{HIGHREGIME}^1}\right] - \mathrm{E}_t \left[\lambda_{t+1}^{\mathrm{HIGHREGIME}^2}\right]\right) - \kappa \theta^{-1} \mathit{yH}_t = 0 \quad (\mathit{yH}_t) \tag{1.5}$$

$$-\beta pH \sigma \mathrm{E}_t \left[\lambda_{t+1}^{\mathrm{HIGHREGIME}^2}\right] = 0 \quad (\mathit{iH}_t) \tag{1.6}$$

2 LOWREGIME

2.1 Optimisation problem

$$\max_{\mathit{piL}_t, \mathit{yL}_t, \mathit{iL}_t} UL_t = -0.5 \left(-\mathit{pitCB} + \mathit{pitL} + \mathit{piL}_t\right)^2 + \beta \left(pL \mathrm{E}_t \left[UL_{t+1}\right] + (1 - pL) \mathrm{E}_t \left[UH_{t+1}\right]\right) - 0.5 \kappa \theta^{-1} \mathit{yL}_t{}^2 \tag{2.1}$$

s.t. :

$$\mathit{piL}_{t-1} = \beta \left(pL \mathit{piL}_t + \mathit{piH}_t (1 - pL)\right) + \kappa \mathit{yL}_{t-1} \quad \left(\lambda_t^{\mathrm{LOWREGIME}^1}\right) \tag{2.2}$$

$$\mathit{yL}_{t-1} = pL \mathit{yL}_t + \mathit{yH}_t (1 - pL) - \sigma \left(\mathit{iL}_{t-1} - m_{t-1} - pL \mathit{piL}_t - \mathit{piH}_t (1 - pL)\right) \quad \left(\lambda_t^{\mathrm{LOWREGIME}^2}\right) \tag{2.3}$$

2.2 First order conditions

$$\mathit{pitCB} - \mathit{pitL} - \mathit{piL}_t + \beta pL \lambda_t^{\mathrm{LOWREGIME}^1} - \beta pL \mathrm{E}_t \left[\lambda_{t+1}^{\mathrm{LOWREGIME}^1}\right] + pL \sigma \lambda_t^{\mathrm{LOWREGIME}^2} = 0 \quad (\mathit{piL}_t) \tag{2.4}$$

$$pL\lambda_t^{\mathrm{LOWREGIME}^2} + \beta pL \left(\kappa \mathrm{E}_t \left[\lambda_{t+1}^{\mathrm{LOWREGIME}^1}\right] - \mathrm{E}_t \left[\lambda_{t+1}^{\mathrm{LOWREGIME}^2}\right]\right) - \kappa \theta^{-1} yL_t = 0 \quad (yL_t) \tag{2.5}$$

$$-\beta pL\sigma \mathrm{E}_t \left[\lambda_{t+1}^{\mathrm{LOWREGIME}^2}\right] = 0 \quad (iL_t) \tag{2.6}$$

3 EXOG

3.1 Identities

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

4 Equilibrium relationships (after reduction)

$$-m_t + e^{\epsilon_t^{\mathrm{Z}} + \phi \log m_{t-1}} = 0 \tag{4.1}$$

$$-piH_{t-1} + \beta \left(pH piH_t + piL_t \left(1 - pH\right)\right) + \kappa yH_{t-1} = 0 \tag{4.2}$$

$$-piL_{t-1} + \beta \left(pL piL_t + piH_t \left(1 - pL\right)\right) + \kappa yL_{t-1} = 0 \tag{4.3}$$

$$pH\lambda_t^{\mathrm{HIGHREGIME}^2} + \beta pH \left(\kappa \mathrm{E}_t \left[\lambda_{t+1}^{\mathrm{HIGHREGIME}^1}\right] - \mathrm{E}_t \left[\lambda_{t+1}^{\mathrm{HIGHREGIME}^2}\right]\right) - \kappa \theta^{-1} yH_t = 0 \tag{4.4}$$

$$pL\lambda_t^{\mathrm{LOWREGIME}^2} + \beta pL \left(\kappa \mathrm{E}_t \left[\lambda_{t+1}^{\mathrm{LOWREGIME}^1}\right] - \mathrm{E}_t \left[\lambda_{t+1}^{\mathrm{LOWREGIME}^2}\right]\right) - \kappa \theta^{-1} yL_t = 0 \tag{4.5}$$

$$-yH_{t-1} + pH yH_t - \sigma \left(iH_{t-1} - m_{t-1} - pH piH_t - piL_t \left(1 - pH\right)\right) + yL_t \left(1 - pH\right) = 0 \tag{4.6}$$

$$-yL_{t-1} + pL yL_t - \sigma \left(iL_{t-1} - m_{t-1} - pL piL_t - piH_t \left(1 - pL\right)\right) + yH_t \left(1 - pL\right) = 0 \tag{4.7}$$

$$UH_t + 0.5 \left(pitH - pitCB + piH_t\right)^2 - \beta \left(pH \mathrm{E}_t \left[UH_{t+1}\right] + \left(1 - pH\right) \mathrm{E}_t \left[UL_{t+1}\right]\right) + 0.5 \kappa \theta^{-1} {yH_t}^2 = 0 \tag{4.8}$$

$$UL_t + 0.5 \left(-pitCB + pitL + piL_t\right)^2 - \beta \left(pL \mathrm{E}_t \left[UL_{t+1}\right] + \left(1 - pL\right) \mathrm{E}_t \left[UH_{t+1}\right]\right) + 0.5 \kappa \theta^{-1} {yL_t}^2 = 0 \tag{4.9}$$

$$-pitH + pitCB - piH_t + \beta pH \lambda_t^{\mathrm{HIGHREGIME}^1} - \beta pH \mathrm{E}_t \left[\lambda_{t+1}^{\mathrm{HIGHREGIME}^1}\right] + pH\sigma \lambda_t^{\mathrm{HIGHREGIME}^2} = 0 \tag{4.10}$$

$$pitCB - pitL - piL_t + \beta pL \lambda_t^{\mathrm{LOWREGIME}^1} - \beta pL \mathrm{E}_t \left[\lambda_{t+1}^{\mathrm{LOWREGIME}^1}\right] + pL\sigma \lambda_t^{\mathrm{LOWREGIME}^2} = 0 \tag{4.11}$$

$$-\beta pH\sigma \mathrm{E}_t \left[\lambda_{t+1}^{\mathrm{HIGHREGIME}^2}\right] = 0 \tag{4.12}$$

$$-\beta pL\sigma \mathrm{E}_t \left[\lambda_{t+1}^{\mathrm{LOWREGIME}^2}\right] = 0 \tag{4.13}$$

5 Steady state relationships (after reduction)

$$-m_{\mathrm{ss}} + e^{\phi \log m_{\mathrm{ss}}} = 0 \tag{5.1}$$

$$-\mathit{piH}_{\mathrm{ss}} + \beta \left(\mathit{pH}\,\mathit{piH}_{\mathrm{ss}} + \mathit{piL}_{\mathrm{ss}} \left(1 - \mathit{pH}\right)\right) + \kappa \mathit{yH}_{\mathrm{ss}} = 0 \tag{5.2}$$

$$-\mathit{piL}_{\mathrm{ss}} + \beta \left(\mathit{pL}\,\mathit{piL}_{\mathrm{ss}} + \mathit{piH}_{\mathrm{ss}} \left(1 - \mathit{pL}\right)\right) + \kappa \mathit{yL}_{\mathrm{ss}} = 0 \tag{5.3}$$

$$\mathit{pH}\,\lambda_{\mathrm{ss}}^{\mathrm{HIGHREGIME}^2} + \beta \mathit{pH} \left(-\lambda_{\mathrm{ss}}^{\mathrm{HIGHREGIME}^2} + \kappa \lambda_{\mathrm{ss}}^{\mathrm{HIGHREGIME}^1}\right) - \kappa \theta^{-1} \mathit{yH}_{\mathrm{ss}} = 0 \tag{5.4}$$

$$\mathit{pL}\,\lambda_{\mathrm{ss}}^{\mathrm{LOWREGIME}^2} + \beta \mathit{pL} \left(-\lambda_{\mathrm{ss}}^{\mathrm{LOWREGIME}^2} + \kappa \lambda_{\mathrm{ss}}^{\mathrm{LOWREGIME}^1}\right) - \kappa \theta^{-1} \mathit{yL}_{\mathrm{ss}} = 0 \tag{5.5}$$

$$-\mathit{yH}_{\mathrm{ss}} + \mathit{pH}\,\mathit{yH}_{\mathrm{ss}} - \sigma \left(\mathit{iH}_{\mathrm{ss}} - m_{\mathrm{ss}} - \mathit{pH}\,\mathit{piH}_{\mathrm{ss}} - \mathit{piL}_{\mathrm{ss}} \left(1 - \mathit{pH}\right)\right) + \mathit{yL}_{\mathrm{ss}} \left(1 - \mathit{pH}\right) = 0 \tag{5.6}$$

$$-\mathit{yL}_{\mathrm{ss}} + \mathit{pL}\,\mathit{yL}_{\mathrm{ss}} - \sigma \left(\mathit{iL}_{\mathrm{ss}} - m_{\mathrm{ss}} - \mathit{pL}\,\mathit{piL}_{\mathrm{ss}} - \mathit{piH}_{\mathrm{ss}} \left(1 - \mathit{pL}\right)\right) + \mathit{yH}_{\mathrm{ss}} \left(1 - \mathit{pL}\right) = 0 \tag{5.7}$$

$$\mathit{UH}_{\mathrm{ss}} + 0.5 \left(\mathit{pitH} - \mathit{pitCB} + \mathit{piH}_{\mathrm{ss}}\right)^2 - \beta \left(\mathit{pH}\,\mathit{UH}_{\mathrm{ss}} + \mathit{UL}_{\mathrm{ss}} \left(1 - \mathit{pH}\right)\right) + 0.5 \kappa \theta^{-1} {\mathit{yH}_{\mathrm{ss}}}^2 = 0 \tag{5.8}$$

$$\mathit{UL}_{\mathrm{ss}} + 0.5 \left(-\mathit{pitCB} + \mathit{pitL} + \mathit{piL}_{\mathrm{ss}}\right)^2 - \beta \left(\mathit{pL}\,\mathit{UL}_{\mathrm{ss}} + \mathit{UH}_{\mathrm{ss}} \left(1 - \mathit{pL}\right)\right) + 0.5 \kappa \theta^{-1} {\mathit{yL}_{\mathrm{ss}}}^2 = 0 \tag{5.9}$$

$$-\mathit{pitH} + \mathit{pitCB} - \mathit{piH}_{\mathrm{ss}} + \mathit{pH}\,\sigma \lambda_{\mathrm{ss}}^{\mathrm{HIGHREGIME}^2} = 0 \tag{5.10}$$

$$\mathit{pitCB} - \mathit{pitL} - \mathit{piL}_{\mathrm{ss}} + \mathit{pL}\,\sigma \lambda_{\mathrm{ss}}^{\mathrm{LOWREGIME}^2} = 0 \tag{5.11}$$

$$-\beta \mathit{pH}\,\sigma \lambda_{\mathrm{ss}}^{\mathrm{HIGHREGIME}^2} = 0 \tag{5.12}$$

$$-\beta \mathit{pL}\,\sigma \lambda_{\mathrm{ss}}^{\mathrm{LOWREGIME}^2} = 0 \tag{5.13}$$

6 Parameter settings

$$\beta = 0.99 \tag{6.1}$$

$$\kappa = 0.2465 \tag{6.2}$$

$$\phi = 0.95 \tag{6.3}$$

$$\mathit{pitH} = 2 \tag{6.4}$$

$$\mathit{pitCB} = 0 \tag{6.5}$$

$$\mathit{pitL} = -2 \tag{6.6}$$

$$\mathit{pH} = 0.99 \tag{6.7}$$

$$\mathit{pL} = 0.99 \tag{6.8}$$

$$\sigma = 1 \tag{6.9}$$

$$\theta = 6 \tag{6.10}$$

7 Steady-state values

	Steady-state value
iH	-0.9551
iL	2.9552
$\lambda^{\mathrm{HIGHREGIME}^1}$	-0.0411
$\lambda^{\mathrm{HIGHREGIME}^2}$	0
$\lambda^{\mathrm{LOWREGIME}^1}$	0.0411
$\lambda^{\mathrm{LOWREGIME}^2}$	0
piH	-2
piL	2
m	1
yH	-0.2418
yL	0.2418
UH	-0.1201
UL	-0.1201

8 The solution of the 1st order perturbation

Matrix P

$$
\begin{array}{c c}
 & \begin{array}{ccccccc} iH_{t-1} & iL_{t-1} & piH_{t-1} & piL_{t-1} & m_{t-1} & yH_{t-1} & yL_{t-1} \end{array} \\
\begin{array}{c} iH_t \\ iL_t \\ piH_t \\ piL_t \\ m_t \\ yH_t \\ yL_t \end{array} &
\begin{pmatrix}
-1.9645 & 0.069 & 12.3428 & -0.1509 & 3.028 & -0.8651 & 0.0101 \\
0.0072 & -1.9645 & -0.0488 & 3.9893 & 0.9787 & 0.0033 & -0.2796 \\
0 & 0 & 1.0204 & -0.0103 & 0 & -0.0304 & 3e-04 \\
0 & 0 & -0.0103 & 1.0204 & 0 & 3e-04 & -0.0304 \\
0 & 0 & 0 & 0 & 0.95 & 0 & 0 \\
3.9907 & -0.1247 & -8.4406 & 0.0853 & -4.136 & 1.2617 & -0.0127 \\
-0.0403 & 12.3471 & 0.0853 & -8.4406 & -4.136 & -0.0127 & 1.2617
\end{pmatrix}
\end{array}
$$

Matrix Q

$$
\begin{array}{c c}
 & \epsilon^{\mathrm{Z}} \\
\begin{array}{c} iH \\ iL \\ piH \\ piL \\ m \\ yH \\ yL \end{array} &
\begin{pmatrix}
1.047 \\ 0.3384 \\ 0 \\ 0 \\ 1 \\ 0 \\ 0
\end{pmatrix}
\end{array}
$$

Matrix R

$$
\begin{array}{c c}
 & \begin{array}{ccccccc} iH_{t-1} & iL_{t-1} & piH_{t-1} & piL_{t-1} & m_{t-1} & yH_{t-1} & yL_{t-1} \end{array} \\
\begin{array}{c} \lambda_t^{\mathrm{HIGHREGIME}^1} \\ \lambda_t^{\mathrm{HIGHREGIME}^2} \\ \lambda_t^{\mathrm{LOWREGIME}^1} \\ \lambda_t^{\mathrm{LOWREGIME}^2} \\ UH_t \\ UL_t \end{array} &
\begin{pmatrix}
-11.9879 & 0.7562 & 170.4191 & -3.0404 & 12.2951 & -8.1131 & 0.1525 \\
0.1286 & -0.0071 & -1.0321 & 0.021 & -0.1323 & 0.0633 & -0.0012 \\
0.2444 & -37.0899 & -3.0404 & 170.4191 & 12.2951 & 0.1525 & -8.1131 \\
-0.0023 & 0.3979 & 0.021 & -1.0321 & -0.1323 & -0.0012 & 0.0633 \\
-1e-04 & 0.0072 & 0.6855 & -0.032 & -0.0024 & -0.0204 & 0.0015 \\
-0.0023 & 2e-04 & 0.032 & -0.6855 & 0.0024 & -0.0015 & 0.0204
\end{pmatrix}
\end{array}
$$

Matrix S

$$\begin{array}{l} \\ \lambda^{\text{HIGHREGIME}^1} \\ \lambda^{\text{HIGHREGIME}^2} \\ \lambda^{\text{LOWREGIME}^1} \\ \lambda^{\text{LOWREGIME}^2} \\ UH \\ UL \end{array} \begin{array}{c} \epsilon^{Z} \\ \begin{pmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} \end{array}$$

9 Model statistics

9.1 Basic statistics

	Steady-state value	Std. dev.	Variance	Loglin
iH	-0.9551	0.1365	0.0186	Y
iL	2.9552	0.0441	0.0019	Y
$\lambda^{\text{HIGHREGIME}^1}$	-0.0411	0	0	Y
$\lambda^{\text{HIGHREGIME}^2}$	0	0	0	N
$\lambda^{\text{LOWREGIME}^1}$	0.0411	0	0	Y
$\lambda^{\text{LOWREGIME}^2}$	0	0	0	N
piH	-2	0	0	Y
piL	2	0	0	Y
m	1	0.1303	0.017	Y
yH	-0.2418	0	0	Y
yL	0.2418	0	0	Y
UH	-0.1201	0	0	Y
UL	-0.1201	0	0	Y

9.2 Correlation matrix

	iH	iL	m
iH	1	1	1
iL		1	1
m			1

9.3 Cross correlations with the reference variable (iH)

	$\sigma[\cdot]$ rel. to $\sigma[iH]$	iH_{t-5}	iH_{t-4}	iH_{t-3}	iH_{t-2}	iH_{t-1}	iH_t	iH_{t+1}	iH_{t+2}	iH_{t+3}	iH_{t+4}	iH_{t+5}
iH_t	1	-0.016	0.11	0.271	0.471	0.713	1	0.713	0.471	0.271	0.11	-0.016
iL_t	0.323	-0.016	0.11	0.271	0.471	0.713	1	0.713	0.471	0.271	0.11	-0.016
m_t	0.955	-0.016	0.11	0.271	0.471	0.713	1	0.713	0.471	0.271	0.11	-0.016

9.4 Autocorrelations

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

10 Impulse response functions

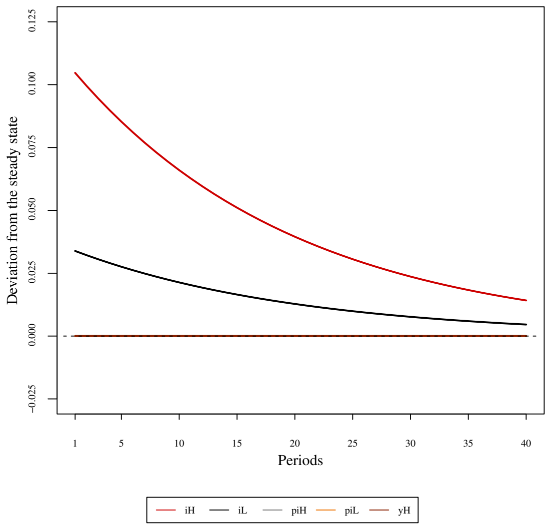

Figure 1: Impulse responses (iH, iL, piH, piL, yH) to ϵ^{Z} shock

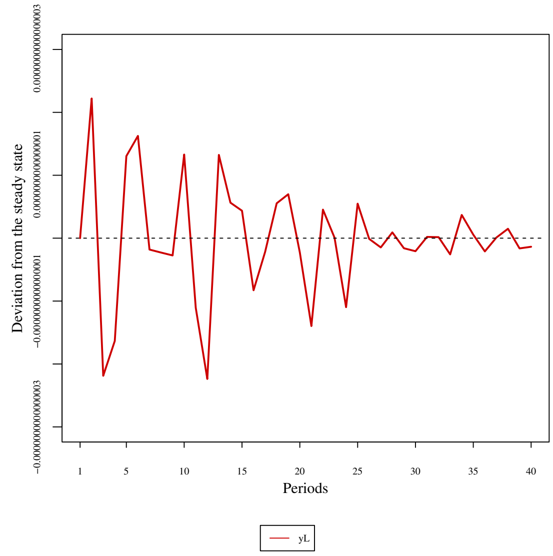

Figure 2: Impulse response (yL) to ϵ^{Z} shock