Generated on 2023-11-10 14:44:11 by `gEcon` version 1.2.1 (2023-01-18)
Model name: `RSW`

1 HIGHREGIME

1.1 Optimisation problem

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

s.t. :

$$piH_{t-1} = \log etapi_{t-1} + \beta \left(pH piH_t + piL_t (1 - pH)\right) + \kappa yH_{t-1} \quad \left(\lambda_t^{\mathrm{HIGHREGIME}^1}\right) \tag{1.2}$$

$$yH_{t-1} = pH yH_t + yL_t (1 - pH) - \sigma \left(iH_{t-1} - pH piH_t - piL_t (1 - pH)\right) \quad \left(\lambda_t^{\mathrm{HIGHREGIME}^2}\right) \tag{1.3}$$

1.2 First order conditions

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

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

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

2 LOWREGIME

2.1 Optimisation problem

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

s.t. :

$$piL_{t-1} = \log etapi_{t-1} + \beta \left(pL piL_t + piH_t (1 - pL)\right) + \kappa yL_{t-1} \quad \left(\lambda_t^{\mathrm{LOWREGIME}^1}\right) \tag{2.2}$$

$$yL_{t-1} = pL yL_t + yH_t (1 - pL) - \sigma \left(iL_{t-1} - pL piL_t - piH_t (1 - pL)\right) \quad \left(\lambda_t^{\mathrm{LOWREGIME}^2}\right) \tag{2.3}$$

2.2 First order conditions

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

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

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

3 EXOG

3.1 Identities

$$\mathit{etapi}_t = e^{\epsilon_t^{\pi} + \phi \log \mathit{etapi}_{t-1}} \tag{3.1}$$

4 Equilibrium relationships (after reduction)

$$-\mathit{etapi}_t + e^{\epsilon_t^{\pi} + \phi \log \mathit{etapi}_{t-1}} = 0 \tag{4.1}$$

$$pH\lambda_t^{\mathrm{HIGHREGIME}^2} + \beta pH\left(\kappa \mathrm{E}_t\left[\lambda_{t+1}^{\mathrm{HIGHREGIME}^1}\right] - \mathrm{E}_t\left[\lambda_{t+1}^{\mathrm{HIGHREGIME}^2}\right]\right) - \kappa\theta^{-1} yH_t = 0 \tag{4.2}$$

$$pL\lambda_t^{\mathrm{LOWREGIME}^2} + \beta pL\left(\kappa \mathrm{E}_t\left[\lambda_{t+1}^{\mathrm{LOWREGIME}^1}\right] - \mathrm{E}_t\left[\lambda_{t+1}^{\mathrm{LOWREGIME}^2}\right]\right) - \kappa\theta^{-1} yL_t = 0 \tag{4.3}$$

$$-piH_{t-1} + \log \mathit{etapi}_{t-1} + \beta\left(pH\,piH_t + piL_t\left(1 - pH\right)\right) + \kappa yH_{t-1} = 0 \tag{4.4}$$

$$-piL_{t-1} + \log \mathit{etapi}_{t-1} + \beta\left(pL\,piL_t + piH_t\left(1 - pL\right)\right) + \kappa yL_{t-1} = 0 \tag{4.5}$$

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

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

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

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

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

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

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

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

5 Steady state relationships (after reduction)

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

$$pH\lambda_{\mathrm{ss}}^{\mathrm{HIGHREGIME}^2} + \beta pH \left(-\lambda_{\mathrm{ss}}^{\mathrm{HIGHREGIME}^2} + \kappa\lambda_{\mathrm{ss}}^{\mathrm{HIGHREGIME}^1}\right) - \kappa\theta^{-1} yH_{\mathrm{ss}} = 0 \tag{5.2}$$

$$pL\lambda_{\mathrm{ss}}^{\mathrm{LOWREGIME}^2} + \beta pL \left(-\lambda_{\mathrm{ss}}^{\mathrm{LOWREGIME}^2} + \kappa\lambda_{\mathrm{ss}}^{\mathrm{LOWREGIME}^1}\right) - \kappa\theta^{-1} yL_{\mathrm{ss}} = 0 \tag{5.3}$$

$$-\mathit{piH}_{\mathrm{ss}} + \log \mathit{etapi}_{\mathrm{ss}} + \beta \left(pH\,\mathit{piH}_{\mathrm{ss}} + \mathit{piL}_{\mathrm{ss}}\left(1 - pH\right)\right) + \kappa yH_{\mathrm{ss}} = 0 \tag{5.4}$$

$$-\mathit{piL}_{\mathrm{ss}} + \log \mathit{etapi}_{\mathrm{ss}} + \beta \left(pL\,\mathit{piL}_{\mathrm{ss}} + \mathit{piH}_{\mathrm{ss}}\left(1 - pL\right)\right) + \kappa yL_{\mathrm{ss}} = 0 \tag{5.5}$$

$$-yH_{\mathrm{ss}} + pH\,yH_{\mathrm{ss}} - \sigma\left(iH_{\mathrm{ss}} - pH\,\mathit{piH}_{\mathrm{ss}} - \mathit{piL}_{\mathrm{ss}}\left(1 - pH\right)\right) + yL_{\mathrm{ss}}\left(1 - pH\right) = 0 \tag{5.6}$$

$$-yL_{\mathrm{ss}} + pL\,yL_{\mathrm{ss}} - \sigma\left(iL_{\mathrm{ss}} - pL\,\mathit{piL}_{\mathrm{ss}} - \mathit{piH}_{\mathrm{ss}}\left(1 - pL\right)\right) + yH_{\mathrm{ss}}\left(1 - pL\right) = 0 \tag{5.7}$$

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

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

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

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

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

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

6 Parameter settings

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

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

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

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

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

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

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

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

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

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

7 Steady-state values

	Steady-state value
$etapi$	1
iH	-1.9552
iL	1.9552
$\lambda^{\text{HIGHREGIME}^1}$	-0.0411
$\lambda^{\text{HIGHREGIME}^2}$	0
$\lambda^{\text{LOWREGIME}^1}$	0.0411
$\lambda^{\text{LOWREGIME}^2}$	0
piH	-2
piL	2
yH	-0.2418
yL	0.2418
UH	-0.1201
UL	-0.1201

8 The solution of the 1st order perturbation

Matrix P

$$\begin{array}{c}
\\ etapi_t \\ iH_t \\ iL_t \\ piH_t \\ piL_t \\ yH_t \\ yL_t
\end{array}
\begin{array}{c}
\begin{array}{ccccccc} etapi_{t-1} & iH_{t-1} & iL_{t-1} & piH_{t-1} & piL_{t-1} & yH_{t-1} & yL_{t-1} \end{array} \\
\begin{pmatrix}
0.95 & 0 & 0 & 0 & 0 & 0 & 0 \\
-6.6659 & -1.9645 & 0.0223 & 6.0298 & -0.0737 & -0.4226 & 0.005 \\
-6.6659 & 0.0223 & -1.9645 & -0.0737 & 6.0298 & 0.005 & -0.4226 \\
-0.5051 & 0 & 0 & 1.0204 & -0.0103 & -0.0304 & 0.0003 \\
-0.5051 & 0 & 0 & -0.0103 & 1.0204 & 0.0003 & -0.0304 \\
4.1777 & 8.1689 & -0.0825 & -8.4406 & 0.0853 & 1.2617 & -0.0127 \\
4.1777 & -0.0825 & 8.1689 & 0.0853 & -8.4406 & -0.0127 & 1.2617
\end{pmatrix}
\end{array}$$

Matrix Q

$$\begin{array}{c}
\\ etapi \\ iH \\ iL \\ piH \\ piL \\ yH \\ yL
\end{array}
\begin{array}{c}
\epsilon^{\pi} \\
\begin{pmatrix}
1 \\ -3.882 \\ -3.882 \\ 0 \\ 0 \\ 0 \\ 0
\end{pmatrix}
\end{array}$$

Matrix R

$$\begin{array}{c}
\\ \lambda_t^{\text{HIGHREGIME}^1} \\ \lambda_t^{\text{HIGHREGIME}^2} \\ \lambda_t^{\text{LOWREGIME}^1} \\ \lambda_t^{\text{LOWREGIME}^2} \\ UH_t \\ UL_t
\end{array}
\begin{array}{c}
\begin{array}{ccccccc} etapi_{t-1} & iH_{t-1} & iL_{t-1} & piH_{t-1} & piL_{t-1} & yH_{t-1} & yL_{t-1} \end{array} \\
\begin{pmatrix}
-145.5977 & -24.5389 & 0.5003 & 170.4191 & -3.0404 & -8.1131 & 0.1525 \\
1.0038 & 0.2633 & -0.0047 & -1.0321 & 0.021 & 0.0633 & -0.0012 \\
-145.5977 & 0.5003 & -24.5389 & -3.0404 & 170.4191 & 0.1525 & -8.1131 \\
1.0038 & -0.0047 & 0.2633 & 0.021 & -1.0321 & -0.0012 & 0.0633 \\
-4.386 & -0.0001 & 0.0048 & 0.6855 & -0.032 & -0.0204 & 0.0015 \\
4.386 & -0.0048 & 0.0001 & 0.032 & -0.6855 & -0.0015 & 0.0204
\end{pmatrix}
\end{array}$$

Matrix S

$$
\begin{array}{l}
 \\
\lambda^{\text{HIGHREGIME}^1} \\
\lambda^{\text{HIGHREGIME}^2} \\
\lambda^{\text{LOWREGIME}^1} \\
\lambda^{\text{LOWREGIME}^2} \\
UH \\
UL
\end{array}
\begin{array}{c}
\epsilon^{\pi} \\
\begin{pmatrix}
-65.1667 \\
0.5246 \\
-65.1667 \\
0.5246 \\
-4.2729 \\
4.2729
\end{pmatrix}
\end{array}
$$

9 Model statistics

9.1 Basic statistics

	Steady-state value	Std. dev.	Variance	Loglin
etapi	1	0.1303	0.017	Y
iH	-1.9552	0.3948	0.1559	Y
iL	1.9552	0.3948	0.1559	Y
$\lambda^{\text{HIGHREGIME}^1}$	-0.0411	7.2017	51.8645	Y
$\lambda^{\text{HIGHREGIME}^2}$	0	0.0506	0.0026	N
$\lambda^{\text{LOWREGIME}^1}$	0.0411	7.2017	51.8645	Y
$\lambda^{\text{LOWREGIME}^2}$	0	0.0506	0.0026	N
piH	-2	0.0492	0.0024	Y
piL	2	0.0492	0.0024	Y
yH	-0.2418	2.8648	8.2069	Y
yL	0.2418	2.8648	8.2069	Y
UH	-0.1201	0.5746	0.3302	Y
UL	-0.1201	0.5746	0.3302	Y

9.2 Correlation matrix

	etapi	*iH*	*iL*	$\lambda^{\text{HIGHREGIME}^1}$	$\lambda^{\text{HIGHREGIME}^2}$	$\lambda^{\text{LOWREGIME}^1}$	$\lambda^{\text{LOWREGIME}^2}$	*piH*	*piL*
etapi	1	-0.301	-0.301	-0.825	0.436	-0.825	0.436	-0.491	-0.49
iH		1	1	0.567	-0.977	0.567	-0.977	-0.323	-0.32
iL			1	0.567	-0.977	0.567	-0.977	-0.323	-0.32
$\lambda^{\text{HIGHREGIME}^1}$				1	-0.725	1	-0.725	0.567	0.56
$\lambda^{\text{HIGHREGIME}^2}$					1	-0.725	1	0.116	0.11
$\lambda^{\text{LOWREGIME}^1}$						1	-0.725	0.567	0.56
$\lambda^{\text{LOWREGIME}^2}$							1	0.116	0.11
piH								1	1
piL									1
yH									
yL									
UH									
UL									

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}
$etapi_t$	0.33	0.098	0.131	0.177	0.258	0.444	-0.301	-0.254	-0.21	-0.169	-0.132
iH_t	1	-0.028	-0.035	-0.051	-0.093	-0.219	1	-0.219	-0.093	-0.051	-0.035
iL_t	1	-0.028	-0.035	-0.051	-0.093	-0.219	1	-0.219	-0.093	-0.051	-0.035
$\lambda_t^{\mathrm{HIGHREGIME}^1}$	18.242	-0.078	-0.1	-0.134	-0.204	-0.385	0.567	0.47	0.151	0.043	0.003
$\lambda_t^{\mathrm{HIGHREGIME}^2}$	0.128	0.04	0.051	0.071	0.122	0.269	-0.977	0.043	0.043	0.041	0.038
$\lambda_t^{\mathrm{LOWREGIME}^1}$	18.242	-0.078	-0.1	-0.134	-0.204	-0.385	0.567	0.47	0.151	0.043	0.003
$\lambda_t^{\mathrm{LOWREGIME}^2}$	0.128	0.04	0.051	0.071	0.122	0.269	-0.977	0.043	0.043	0.041	0.038
piH_t	0.125	-0.046	-0.056	-0.071	-0.096	-0.156	-0.323	0.852	0.236	0.04	-0.022
piL_t	0.125	-0.046	-0.056	-0.071	-0.096	-0.156	-0.323	0.852	0.236	0.04	-0.022
yH_t	7.256	-0.069	-0.092	-0.121	-0.164	-0.245	-0.443	0.551	0.273	0.164	0.111
yL_t	7.256	-0.069	-0.092	-0.121	-0.164	-0.245	-0.443	0.551	0.273	0.164	0.111
UH_t	1.455	-0.098	-0.13	-0.176	-0.256	-0.44	0.272	0.295	0.217	0.166	0.127
UL_t	1.455	0.098	0.13	0.176	0.256	0.44	-0.272	-0.295	-0.217	-0.166	-0.127

9.4 Autocorrelations

	Lag 1	Lag 2	Lag 3	Lag 4	Lag 5
$etapi$	0.713	0.471	0.271	0.11	-0.016
iH	-0.219	-0.093	-0.051	-0.035	-0.028
iL	-0.219	-0.093	-0.051	-0.035	-0.028
$\lambda^{\mathrm{HIGHREGIME}^1}$	0.51	0.081	-0.065	-0.117	-0.134
$\lambda^{\mathrm{HIGHREGIME}^2}$	-0.074	-0.071	-0.066	-0.06	-0.054
$\lambda^{\mathrm{LOWREGIME}^1}$	0.51	0.081	-0.065	-0.117	-0.134
$\lambda^{\mathrm{LOWREGIME}^2}$	-0.074	-0.071	-0.066	-0.06	-0.054
piH	0.22	-0.024	-0.095	-0.11	-0.107
piL	0.22	-0.024	-0.095	-0.11	-0.107
yH	0.504	0.261	0.116	0.017	-0.055
yL	0.504	0.261	0.116	0.017	-0.055
UH	0.729	0.455	0.251	0.094	-0.027
UL	0.729	0.455	0.251	0.094	-0.027

10 Impulse response functions

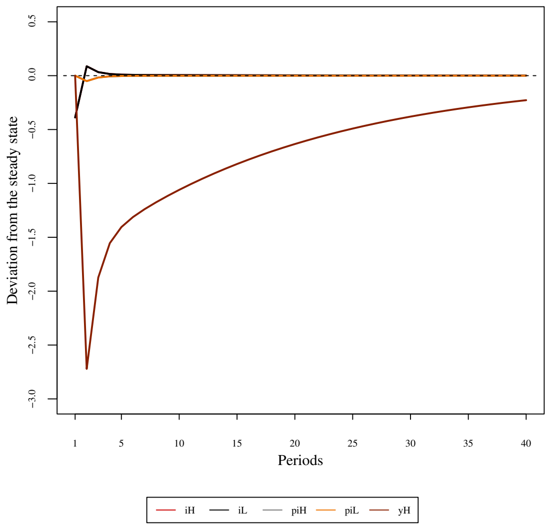

Figure 1: Impulse responses (iH, iL, piH, piL, yH) to ϵ^{π} shock

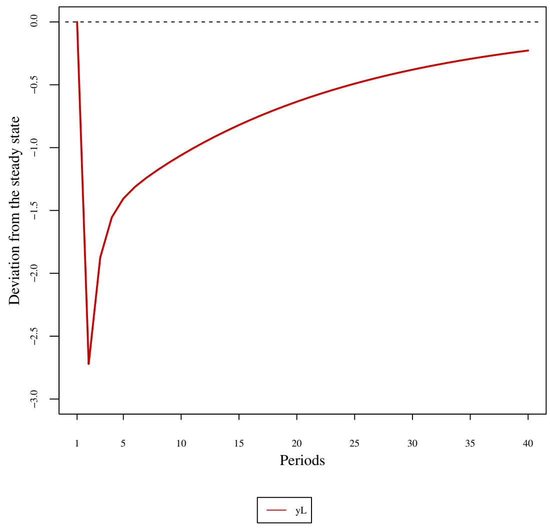

Figure 2: Impulse response (yL) to ϵ^{π} shock