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Model name: `RSW_RP_ONEOBJ`

1 OPTIMALMP

1.1 Optimisation problem

$$\max_{\mathit{piH}_t, \mathit{yH}_t, \mathit{piL}_t, \mathit{yL}_t} U_t = -0.25 \left(\mathit{pitH} - \mathit{pitCB} + \mathit{piH}_t\right)^2 - 0.25 \left(-\mathit{pitCB} + \mathit{pitL} + \mathit{piL}_t\right)^2 + \beta \mathrm{E}_t \left[U_{t+1}\right] - 0.25 \lambda {\mathit{yH}_t}^2 - 0.25 \lambda {\mathit{yL}_t}^2 \tag{1.1}$$

s.t. :

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

$$\mathit{piL}_{t-1} = \log \mathit{etapi}_{t-1} + \beta \mathit{piL}_t + \kappa \mathit{yL}_{t-1} + \beta \left(1 - \mathit{pL}\right) \left(\mathit{piH}_t - \mathit{piL}_t\right) \quad \left(\lambda_t^{\mathrm{OPTIMALMP}^2}\right) \tag{1.3}$$

1.2 First order conditions

$$-0.5 \mathit{pitH} + 0.5 \mathit{pitCB} - 0.5 \mathit{piH}_t - \beta \mathrm{E}_t \left[\lambda_{t+1}^{\mathrm{OPTIMALMP}^1}\right] + \lambda_t^{\mathrm{OPTIMALMP}^1} \left(\beta - \beta \left(1 - \mathit{pH}\right)\right) + \beta \lambda_t^{\mathrm{OPTIMALMP}^2} \left(1 - \mathit{pL}\right) = 0 \quad \left(\mathit{piH}_t\right) \tag{1.4}$$

$$-0.5 \lambda \mathit{yH}_t + \beta \kappa \mathrm{E}_t \left[\lambda_{t+1}^{\mathrm{OPTIMALMP}^1}\right] = 0 \quad \left(\mathit{yH}_t\right) \tag{1.5}$$

$$0.5 \mathit{pitCB} - 0.5 \mathit{pitL} - 0.5 \mathit{piL}_t - \beta \mathrm{E}_t \left[\lambda_{t+1}^{\mathrm{OPTIMALMP}^2}\right] + \lambda_t^{\mathrm{OPTIMALMP}^2} \left(\beta - \beta \left(1 - \mathit{pL}\right)\right) + \beta \lambda_t^{\mathrm{OPTIMALMP}^1} \left(1 - \mathit{pH}\right) = 0 \quad \left(\mathit{piL}_t\right) \tag{1.6}$$

$$-0.5 \lambda \mathit{yL}_t + \beta \kappa \mathrm{E}_t \left[\lambda_{t+1}^{\mathrm{OPTIMALMP}^2}\right] = 0 \quad \left(\mathit{yL}_t\right) \tag{1.7}$$

2 EXOG

2.1 Identities

$$\mathit{etapi}_t = e^{\epsilon_t^{\pi} + \phi \log \mathit{etapi}_{t-1}} \tag{2.1}$$

3 Equilibrium relationships (after reduction)

$$-\mathit{etapi}_t + e^{\epsilon_t^{\pi} + \phi \log \mathit{etapi}_{t-1}} = 0 \tag{3.1}$$

$$-0.5 \lambda \mathit{yH}_t + \beta \kappa \mathrm{E}_t \left[\lambda_{t+1}^{\mathrm{OPTIMALMP}^1}\right] = 0 \tag{3.2}$$

$$-0.5 \lambda \mathit{yL}_t + \beta \kappa \mathrm{E}_t \left[\lambda_{t+1}^{\mathrm{OPTIMALMP}^2}\right] = 0 \tag{3.3}$$

$$-\mathit{piH}_{t-1} + \log \mathit{etapi}_{t-1} + \beta \mathit{piH}_t + \kappa \mathit{yH}_{t-1} + \beta \left(1 - \mathit{pH}\right) \left(-\mathit{piH}_t + \mathit{piL}_t\right) = 0 \tag{3.4}$$

$$-\mathit{piL}_{t-1} + \log \mathit{etapi}_{t-1} + \beta \mathit{piL}_t + \kappa \mathit{yL}_{t-1} + \beta \left(1 - \mathit{pL}\right) \left(\mathit{piH}_t - \mathit{piL}_t\right) = 0 \tag{3.5}$$

$$-0.5\mathit{pitH} + 0.5\mathit{pitCB} - 0.5\mathit{piH}_t - \beta \mathrm{E}_t \left[\lambda_{t+1}^{\mathrm{OPTIMALMP}^1}\right] + \lambda_t^{\mathrm{OPTIMALMP}^1} \left(\beta - \beta \left(1 - \mathit{pH}\right)\right) + \beta \lambda_t^{\mathrm{OPTIMALMP}^2} \left(1 - \mathit{pL}\right) = 0 \tag{3.6}$$

$$0.5\mathit{pitCB} - 0.5\mathit{pitL} - 0.5\mathit{piL}_t - \beta \mathrm{E}_t \left[\lambda_{t+1}^{\mathrm{OPTIMALMP}^2}\right] + \lambda_t^{\mathrm{OPTIMALMP}^2} \left(\beta - \beta \left(1 - \mathit{pL}\right)\right) + \beta \lambda_t^{\mathrm{OPTIMALMP}^1} \left(1 - \mathit{pH}\right) = 0 \tag{3.7}$$

$$U_t + 0.25 \left(\mathit{pitH} - \mathit{pitCB} + \mathit{piH}_t\right)^2 + 0.25 \left(-\mathit{pitCB} + \mathit{pitL} + \mathit{piL}_t\right)^2 - \beta \mathrm{E}_t \left[U_{t+1}\right] + 0.25 \lambda {\mathit{yH}_t}^2 + 0.25 \lambda {\mathit{yL}_t}^2 = 0 \tag{3.8}$$

4 Steady state relationships (after reduction)

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

$$-0.5 \lambda \mathit{yH}_{\mathrm{ss}} + \beta \kappa \lambda_{\mathrm{ss}}^{\mathrm{OPTIMALMP}^1} = 0 \tag{4.2}$$

$$-0.5 \lambda \mathit{yL}_{\mathrm{ss}} + \beta \kappa \lambda_{\mathrm{ss}}^{\mathrm{OPTIMALMP}^2} = 0 \tag{4.3}$$

$$-\mathit{piH}_{\mathrm{ss}} + \log \mathit{etapi}_{\mathrm{ss}} + \beta \mathit{piH}_{\mathrm{ss}} + \kappa \mathit{yH}_{\mathrm{ss}} + \beta \left(1 - \mathit{pH}\right) \left(-\mathit{piH}_{\mathrm{ss}} + \mathit{piL}_{\mathrm{ss}}\right) = 0 \tag{4.4}$$

$$-\mathit{piL}_{\mathrm{ss}} + \log \mathit{etapi}_{\mathrm{ss}} + \beta \mathit{piL}_{\mathrm{ss}} + \kappa \mathit{yL}_{\mathrm{ss}} + \beta \left(1 - \mathit{pL}\right) \left(\mathit{piH}_{\mathrm{ss}} - \mathit{piL}_{\mathrm{ss}}\right) = 0 \tag{4.5}$$

$$-0.5\mathit{pitH} + 0.5\mathit{pitCB} - 0.5\mathit{piH}_{\mathrm{ss}} - \beta \lambda_{\mathrm{ss}}^{\mathrm{OPTIMALMP}^1} + \lambda_{\mathrm{ss}}^{\mathrm{OPTIMALMP}^1} \left(\beta - \beta \left(1 - \mathit{pH}\right)\right) + \beta \lambda_{\mathrm{ss}}^{\mathrm{OPTIMALMP}^2} \left(1 - \mathit{pL}\right) = 0 \tag{4.6}$$

$$0.5\mathit{pitCB} - 0.5\mathit{pitL} - 0.5\mathit{piL}_{\mathrm{ss}} - \beta \lambda_{\mathrm{ss}}^{\mathrm{OPTIMALMP}^2} + \lambda_{\mathrm{ss}}^{\mathrm{OPTIMALMP}^2} \left(\beta - \beta \left(1 - \mathit{pL}\right)\right) + \beta \lambda_{\mathrm{ss}}^{\mathrm{OPTIMALMP}^1} \left(1 - \mathit{pH}\right) = 0 \tag{4.7}$$

$$U_{\mathrm{ss}} + 0.25 \left(\mathit{pitH} - \mathit{pitCB} + \mathit{piH}_{\mathrm{ss}}\right)^2 + 0.25 \left(-\mathit{pitCB} + \mathit{pitL} + \mathit{piL}_{\mathrm{ss}}\right)^2 - \beta U_{\mathrm{ss}} + 0.25 \lambda {\mathit{yH}_{\mathrm{ss}}}^2 + 0.25 \lambda {\mathit{yL}_{\mathrm{ss}}}^2 = 0 \tag{4.8}$$

5 Parameter settings

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

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

$$\lambda = 0.04106 \tag{5.3}$$

$$\phi = 0.95 \tag{5.4}$$

$$\mathit{pitH} = 2 \tag{5.5}$$

$$\mathit{pitCB} = 2 \tag{5.6}$$

$$\mathit{pitL} = 4 \tag{5.7}$$

$$\mathit{pH} = 0.99 \tag{5.8}$$

$$\mathit{pL} = 0.99 \tag{5.9}$$

$$\sigma = 1 \tag{5.10}$$

$$\theta = 6 \tag{5.11}$$

6 Steady-state values

	Steady-state value
etapi	1
$\lambda^{\text{OPTIMALMP}^1}$	0.0068
$\lambda^{\text{OPTIMALMP}^2}$	-0.0136
piH	-0.0004
piL	-1.9996
yH	0.0803
yL	-0.1614
U	-0.0334

7 The solution of the 1st order perturbation

Matrix P

$$\begin{array}{c} \\ etapi_t \\ piH_t \\ piL_t \\ yH_t \\ yL_t \end{array} \begin{array}{c} \begin{array}{ccccc} etapi_{t-1} & piH_{t-1} & piL_{t-1} & yH_{t-1} & yL_{t-1} \end{array} \\ \begin{pmatrix} 0.95 & 0 & 0 & 0 & 0 \\ -2509.0443 & 1.0204 & -51.1947 & -50.1556 & 1.0187 \\ -0.5052 & 0 & 1.0204 & 0.0001 & -0.0203 \\ -81.9707 & 0.0143 & -1.213 & -0.7053 & 0.0241 \\ -40.767 & -0.0001 & 35.444 & 0.006 & -0.7053 \end{pmatrix} \end{array}$$

Matrix Q

$$\begin{array}{c} \\ etapi \\ piH \\ piL \\ yH \\ yL \end{array} \begin{array}{c} \epsilon^{\pi} \\ \begin{pmatrix} 1 \\ 0 \\ 0 \\ -49.4067 \\ -24.5717 \end{pmatrix} \end{array}$$

Matrix R

$$\begin{array}{c} \\ \lambda_t^{\text{OPTIMALMP}^1} \\ \lambda_t^{\text{OPTIMALMP}^2} \\ U_t \end{array} \begin{array}{c} \begin{array}{ccccc} etapi_{t-1} & piH_{t-1} & piL_{t-1} & yH_{t-1} & yL_{t-1} \end{array} \\ \begin{pmatrix} -157.5109 & 0.0455 & -5.0667 & -2.2382 & 0.1008 \\ -78.3358 & -0.0005 & 112.4831 & 0.0249 & -2.2382 \\ -3.4381 & -0.0001 & 0.8138 & 0.004 & -0.0162 \end{pmatrix} \end{array}$$

Matrix S

$$\begin{array}{c} \\ \lambda^{\text{OPTIMALMP}^1} \\ \lambda^{\text{OPTIMALMP}^2} \\ U \end{array} \begin{array}{c} \epsilon^{\pi} \\ \begin{pmatrix} -49.4067 \\ -24.5717 \\ -3.4037 \end{pmatrix} \end{array}$$

8 Model statistics

8.1 Basic statistics

	Steady-state value	Std. dev.	Variance	Loglin
etapi	1	0.1303	0.017	Y
$\lambda^{\text{OPTIMALMP}^1}$	0.0068	6.7345	45.3534	Y
$\lambda^{\text{OPTIMALMP}^2}$	-0.0136	3.3493	11.2178	Y
piH	-0.0004	9.6383	92.8973	Y
piL	-1.9996	0.0019	0	Y
yH	0.0803	6.5317	42.6626	Y
yL	-0.1614	3.2484	10.5523	Y
U	-0.0334	0.4442	0.1973	Y

8.2 Correlation matrix

	$etapi$	$\lambda^{\mathrm{OPTIMALMP}^1}$	$\lambda^{\mathrm{OPTIMALMP}^2}$	piH	piL	yH	yL	U
$etapi$	1	-0.999	-0.999	-0.677	-0.677	-1	-1	-1
$\lambda^{\mathrm{OPTIMALMP}^1}$		1	1	0.71	0.71	1	1	0.999
$\lambda^{\mathrm{OPTIMALMP}^2}$			1	0.71	0.71	1	1	0.999
piH				1	1	0.688	0.688	0.677
piL					1	0.688	0.688	0.677
yH						1	1	1
yL							1	1
U								1

8.3 Cross correlations with the reference variable (piH)

	$\sigma[\cdot]$ rel. to $\sigma[piH]$	piH_{t-5}	piH_{t-4}	piH_{t-3}	piH_{t-2}	piH_{t-1}	piH_{t}	piH_{t+1}	piH_{t+2}	piH_{t+3}	piH_{t}
$etapi_t$	0.014	-0.211	-0.404	-0.626	-0.849	-0.972	-0.677	-0.429	-0.226	-0.064	0.06
$\lambda_t^{\mathrm{OPTIMALMP}^1}$	0.699	0.202	0.396	0.621	0.849	0.982	0.71	0.462	0.253	0.084	-0.0
$\lambda_t^{\mathrm{OPTIMALMP}^2}$	0.347	0.202	0.396	0.621	0.849	0.982	0.71	0.462	0.253	0.084	-0.0
piH_t	1	0.005	0.162	0.357	0.588	0.83	1	0.83	0.588	0.357	0.16
piL_t	0	0.005	0.162	0.357	0.588	0.83	1	0.83	0.588	0.357	0.16
yH_t	0.678	0.208	0.402	0.625	0.849	0.976	0.688	0.44	0.235	0.07	-0.0
yL_t	0.337	0.208	0.402	0.625	0.849	0.976	0.688	0.44	0.235	0.07	-0.0
U_t	0.046	0.211	0.404	0.626	0.849	0.973	0.677	0.43	0.227	0.064	-0.0

8.4 Autocorrelations

	Lag 1	Lag 2	Lag 3	Lag 4	Lag 5
$etapi$	0.713	0.471	0.271	0.11	-0.016
$\lambda^{\mathrm{OPTIMALMP}^1}$	0.74	0.498	0.291	0.122	-0.011
$\lambda^{\mathrm{OPTIMALMP}^2}$	0.74	0.498	0.291	0.122	-0.011
piH	0.83	0.588	0.357	0.162	0.005
piL	0.83	0.588	0.357	0	0
yH	0.722	0.48	0.278	0.114	-0.015
yL	0.722	0.48	0.278	0.114	-0.015
U	0.714	0.472	0.272	0.11	-0.016

9 Impulse response functions

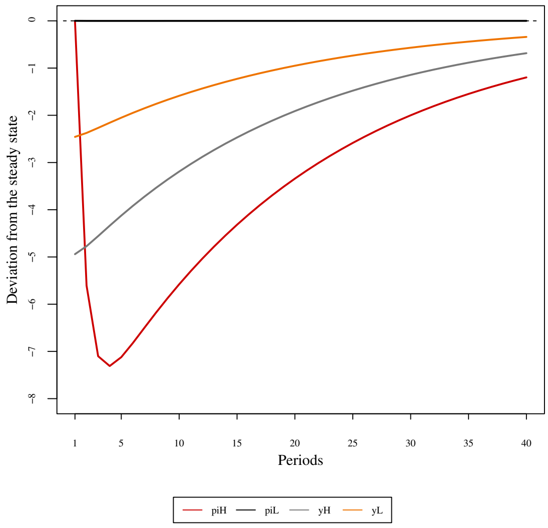

Figure 1: Impulse responses (piH, piL, yH, yL) to ϵ^{π} shock