Appendices

Appendix A: The Complete Model

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The following summarizes the complete set of equations describing the equilibrium of the model.

1. Patient Households

The utility function for patient households is:

$$E_0 \sum_{t=0}^{\infty} \left(\beta G_C\right)^t z_t \left(\Gamma_c \log\left(c_t - \varepsilon c_{t-1}\right) + j_t \log h_t - \frac{\tau_t}{1+\eta}\left(n_{c,t}^{1+\xi} + n_{h,t}^{1+\xi}\right)^{\frac{1+\eta}{1+\xi}} \right)$$

By solving the function, we can obtain the marginal utility of consumption:

$$u_{c,t} = \left[\frac{G_C - \varepsilon}{G_C - \beta\varepsilon G_C}\right]\left[\frac{z_t}{\left(c_t - \varepsilon c_{t-1}\right)} - \frac{z_{t+1}\beta G_C \varepsilon}{\left(c_{t+1} - \varepsilon c_t\right)}\right] \quad \text{(A.1)}$$

and also the marginal utility of housing:

$$u_{h,t} = \frac{j_t z_t}{h_t} \quad \text{(A.2)}$$

The marginal disutility of working in the consumption goods sector and the housing sector are:

$$u_{nc,t} = -\tau_t n_{c,t}^{\xi}\left(n_{c,t}^{1+\xi} + n_{h,t}^{1+\xi}\right)^{\frac{\eta+\xi}{1+\xi}} \tag{A.3}$$

$$u_{nh,t} = -\tau_t n_{h,t}^{\xi}\left(n_{c,t}^{1+\xi} + n_{h,t}^{1+\xi}\right)^{\frac{\eta+\xi}{1+\xi}} \tag{A.4}$$

The budget constraint for patient households is:

$$\begin{aligned} & c_t + \frac{k_{c,t}}{A_{k,t}} - \left(\frac{1-\delta_{kc}}{A_{k,t}}\right) k_{c,t-1} + k_{h,t} - \left(1-\delta_{kh}\right) k_{h,t-1} + q_t h_t - \left(1-\delta_h\right) q_t h_{t-1} \\ & + b_t + k_{b,t} = \frac{w_{c,t}}{X_{wc,t}} n_{c,t} + \frac{w_{h,t}}{X_{wh,t}} n_{h,t} + R_{c,t} k_{c,t-1} + R_{h,t} k_{h,t-1} + p_{b,t} k_{b,t} \\ & + \frac{R_{t-1} b_{t-1}}{\pi_t} + f_t - \psi_{h,t} q_t h_t - \phi_t \end{aligned} \tag{A.5}$$

The corresponding first order conditions for patient households will be:

$$\left(1+\psi_t\right) u_{c,t} q_t = u_{h,t} + \beta G_C E_t\left(u_{c,t+1} q_{t+1}\left(1-\delta_h\right)\right) \tag{A.6}$$

$$u_{c,t} = \beta G_C E_t\left(u_{c,t+1} R_{t+1} / \pi_{t+1}\right) \tag{A.7}$$

$$\frac{u_{c,t}}{A_{k,t}} = \beta G_C E_t\left(u_{c,t+1}\left(R_{c,t+1} + \frac{1-\delta_{kc}}{A_{k,t}}\right)\right) \tag{A.8}$$

$$u_{h,t} = \beta G_C E_t\left(u_{c,t+1}\left(R_{h,t+1} + 1 - \delta_{kc}\right)\right) \tag{A.9}$$

$$\frac{u_{c,t} w_{c,t}}{X_{wc,t}} = u_{nc,t} \tag{A.10}$$

$$\frac{u_{c,t} w_{h,t}}{X_{wh,t}} = u_{nh,t} \tag{A.11}$$

and the wage stickness equations are:

$$\omega_{c,t} - \iota_{wc} \log \pi_{t-1} = \beta G_C \left(E_t \omega_{c,t+1} - \iota_{wc} \log \pi_t \right) - \varepsilon_{wc} \log \left(X_{wc,t} / X_{wc} \right) \tag{A.12}$$

$$\omega_{h,t} - \iota_{wh} \log \pi_{t-1} = \beta G_C \left(E_t \omega_{h,t+1} - \iota_{wh} \log \pi_t \right) - \varepsilon_{wh} \log \left(X_{wh,t} / X_{wh} \right) \tag{A.13}$$

2. Impatient Households

The utility function of borrowers is shown as follow:

$$E_0 \sum_{t=0}^{\infty} \left(\beta' G_C \right)^t z_t \left(\Gamma'_c \log \left(c'_t - \varepsilon' c'_{t-1} \right) + j_t \log h'_t - \frac{\tau_t}{1+\eta'} \left(\left(n'_{c,t} \right)^{1+\xi'} + \left(n'_{h,t} \right)^{1+\xi'} \right)^{\frac{1+\eta'}{1+\xi'}} \right)$$

By solving the utility function, the marginal utility of consumption, the marginal utility of housing and the marginal disutility of working in two sectors are:

$$u'_{c,t} = \left[\frac{G_C - \varepsilon'}{G_C - \beta' \varepsilon' G_C} \right] \left[\frac{z_t}{\left(c'_t - \varepsilon' c'_{t-1} \right)} - \frac{z_{t+1} \beta' G_C \varepsilon'}{\left(c'_{t+1} - \varepsilon' c'_t \right)} \right] \tag{A.14}$$

$$u'_{h,t} = \frac{j_t z_t}{h'_t} \tag{A.15}$$

$$u'_{nc,t} = -\tau_t n'^{\xi'}_{c,t} \left(n'^{1+\xi'}_{c,t} + n'^{1+\xi'}_{h,t} \right)^{\frac{\eta'+\xi'}{1+\xi'}} \tag{A.16}$$

$$u'_{nh,t} = -\tau_t n'^{\xi'}_{h,t} \left(n'^{1+\xi'}_{c,t} + n'^{1+\xi'}_{h,t} \right)^{\frac{\eta'+\xi'}{1+\xi'}} \tag{A.17}$$

The budget and borrowing constraint for impatient households are:

$$c'_t + q_t h'_t - (1-\delta_h) q_t h'_{t-1} + \frac{R_{t-1}}{\pi_t} b'_{t-1} = \frac{w'_{c,t}}{X'_{wc,t}} n'_{c,t} + \frac{w'_{h,t}}{X'_{wh,t}} n'_{h,t} + b'_t + f'_t - \psi_{h,t} q_t h'_t \tag{A.18}$$

$$b'_t = m E_t \left(q_{t+1} h'_t \pi_{t+1} / R_t \right) \tag{A.19}$$

and the first-order conditions are:

$$(1+\psi_t) u'_{c,t} q_t = u'_{h,t} + \beta' G_C E_t \left(u'_{c,t+1} \left(q_{t+1} (1-\delta_h) \right) \right) + E_t \left(\lambda_t \frac{m_t q_{t+1} \pi_{t+1}}{R_t} \right) \tag{A.20}$$

$$u'_{c,t} = \beta' G_C E_t \left(u'_{c,t+1} \frac{R_t}{\pi_{t+1}} \right) + \lambda_t \tag{A.21}$$

$$\frac{u'_{c,t} w'_{c,t}}{X'_{wc,t}} = u'_{nc,t} \tag{A.22}$$

$$\frac{u'_{c,t} w'_{h,t}}{X'_{wh,t}} = u'_{nh,t} \tag{A.23}$$

where λ_t reperesents the multiplier on the borrowing constraint.

The sticky wage equations for impatient households are:

$$\omega'_{c,t} - \iota_{wc} \log \pi_{t-1} = \beta' G_C \left(E_t \omega'_{c,t+1} - \iota_{wc} \log \pi_t \right) - \varepsilon'_{wc} \log \left(X_{wc,t} / X_{wc} \right) \tag{A.24}$$

$$\omega'_{h,t} - \iota_{wh} \log \pi_{t-1} = \beta' G_C \left(E_t \omega'_{h,t+1} - \iota_{wh} \log \pi_t \right) - \varepsilon'_{wh} \log \left(X_{wh,t} / X_{wh} \right) \tag{A.25}$$

3. Consumption Goods Sector

The final goods firms aim to maximize the profit function as follow

$$\prod_c = \max \frac{Y_t}{X_t} - \left(w_{c,t} n_{c,t} + w'_{c,t} n'_{c,t} + R_{c,t} k_{c,t-1} \right)$$

where the production technology of intermediate goods firms is:

$$Y_t = \left(A_{c,t} \left(n_{c,t}^{\alpha} n_{c,t}'^{1-\alpha} \right) \right)^{1-v_c} k_{c,t-1}^{v_c} \tag{A.26}$$

The first-order condition for the final goods firms will be

$$w_{c,t} = (1-\nu_c)\alpha \frac{Y_t}{X_t n_{c,t}} \quad \text{(A.27)}$$

$$w'_{c,t} = (1-\nu_c)(1-\alpha)\frac{Y_t}{X_t n'_{c,t}} \quad \text{(A.28)}$$

$$R_{c,t} = \frac{\nu_c Y_t}{X_t k_{c,t-1}} \quad \text{(A.29)}$$

The Phillips curve is:

$$\log \pi_t - \iota_\pi \log \pi_{t-1} = \beta G_C \left(E_t \log \pi_{t+1} - \iota_\pi \log \pi_t \right) - \varepsilon_\pi \log\left(X_t / X \right) + \log \mu_{p,t} \quad \text{(A.30)}$$

4. Housing Sector

The housing firms solve the follow problem:

$$\prod_h = \max q_t IH_t - \left(w_{h,t} n_{h,t} + w'_{h,t} n'_{h,t} + R_{h,t} k_{h,t-1} + p_{l,t-1} l_{t-1} + p_{b,t} k_{b,t} \right)$$

and the production technology of housing firms is:

$$IH_t = \left(A_{h,t} \left(n_{h,t}^{\alpha} n'^{1-\alpha}_{h,t} \right) \right)^{1-\nu_h-\nu_b-\nu_l} \left(k_{h,t-1} + G_{i,t-1} \right)^{\nu_h} k_{b,t}^{\nu_b} l_{t-1}^{\nu_l} \quad \text{(A.31)}$$

The first-order conditions for the housing firms will be

$$w_{h,t} = \frac{\left(1 - v_h - v_b - v_l\right)\alpha q_t IH_t}{n_{h,t}} \quad \text{(A.32)}$$

$$w'_{h,t} = \frac{\left(1 - v_h - v_b - v_l\right)\left(1 - \alpha\right) q_t IH_t}{n'_{h,t}} \quad \text{(A.33)}$$

$$R_{h,t} = \frac{v_h q_t IH_t}{k_{h,t-1} + G_{i,t-1}} \quad \text{(A.34)}$$

$$p_{l,t-1} = \frac{v_l q_t IH_t}{l_{t-1}} \quad \text{(A.35)}$$

$$p_{b,t} = \frac{v_b q_t IH_t}{k_{b,t}} \quad \text{(A.36)}$$

5. Government

The budget of government is:

$$G_t = \psi_{h,t} q_t \left(h_t + h'_t\right) + p_{l,t-1} l_{t-1} \quad \text{(A.37)}$$

The affordable housing policy equation

$$G_{i,t} = \left(1 - \theta_g\right) G_t + g_t \quad \text{(A.38)}$$

The land policy equations is

$$p_{l,t} = p_{l,t-1}^{\rho_{pl}} \frac{\mu_{pl,t}}{e_t} \tag{A.39}$$

The monetary policy equation is

$$R_t = R_{t-1}^{r_R} \pi_t^{(1-r_R)r_\pi} \left(\frac{GDP_t}{G_C GDP_{t-1}} \right)^{(1-r_R)r_Y} \overline{rr}^{1-r_R} \mu_{R,t} \tag{A.40}$$

where $GDP_t = Y_t + IH_t$ is the sum of the value of two sectors.

The market equilibrium conditions are:

$$C_t + IK_{c,t} / A_{k,t} + IK_{h,t} + G_t + k_{b,t} = Y_t - \phi_t \tag{A.41}$$

$$h_t + h_t' - (1-\delta_h)(h_{t-1} + h_{t-1}') = IH_t \tag{A.42}$$

Appendix B: Bayesian Estimation Results For The Parameters

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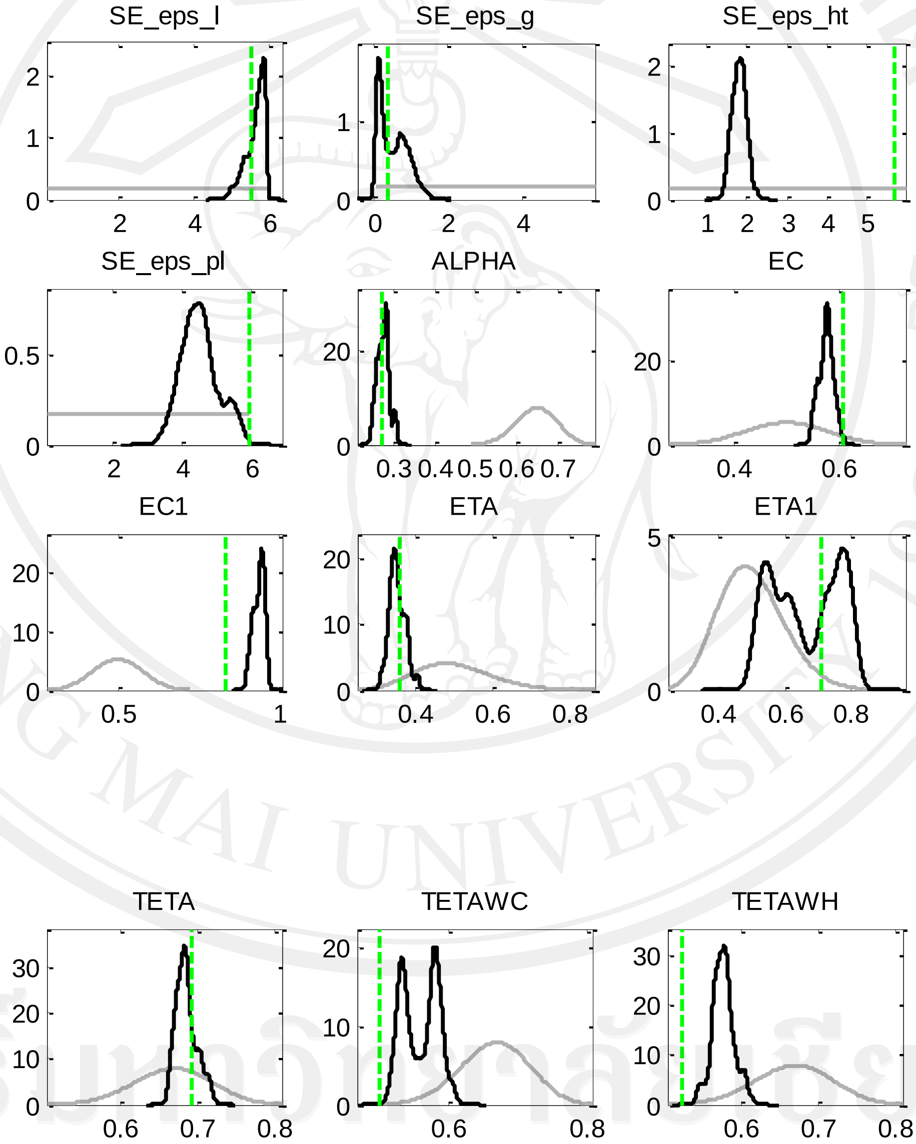
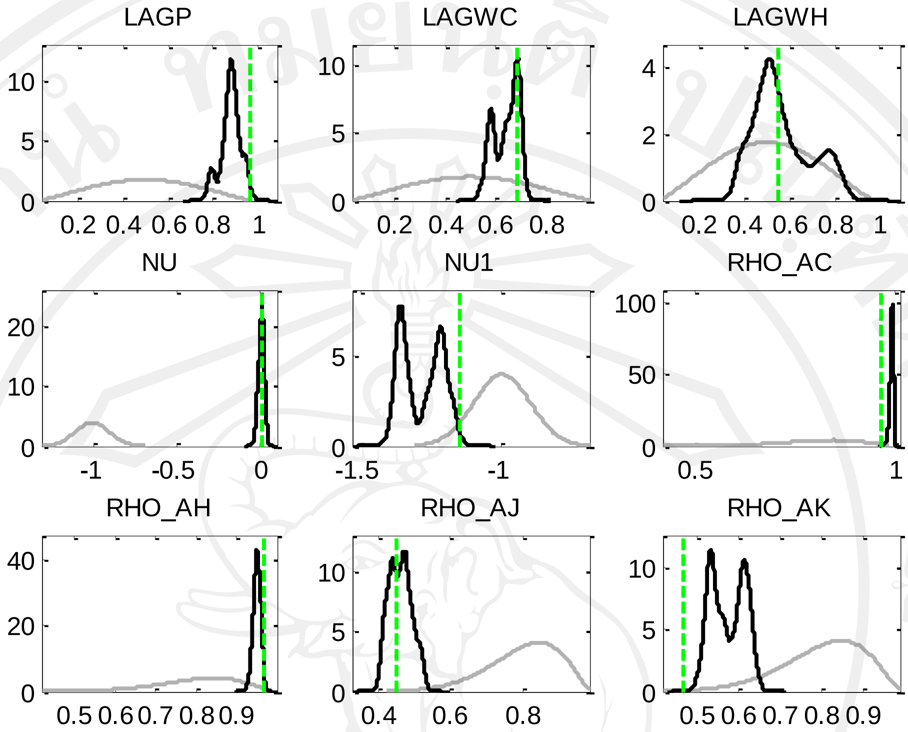
Figure A.1: The Priors and Posteriors of Parameters




LAGP
LAGWC
LAGWH
NU
NU1
RHO_AC
RHO_AH
RHO_AJ
RHO_AK

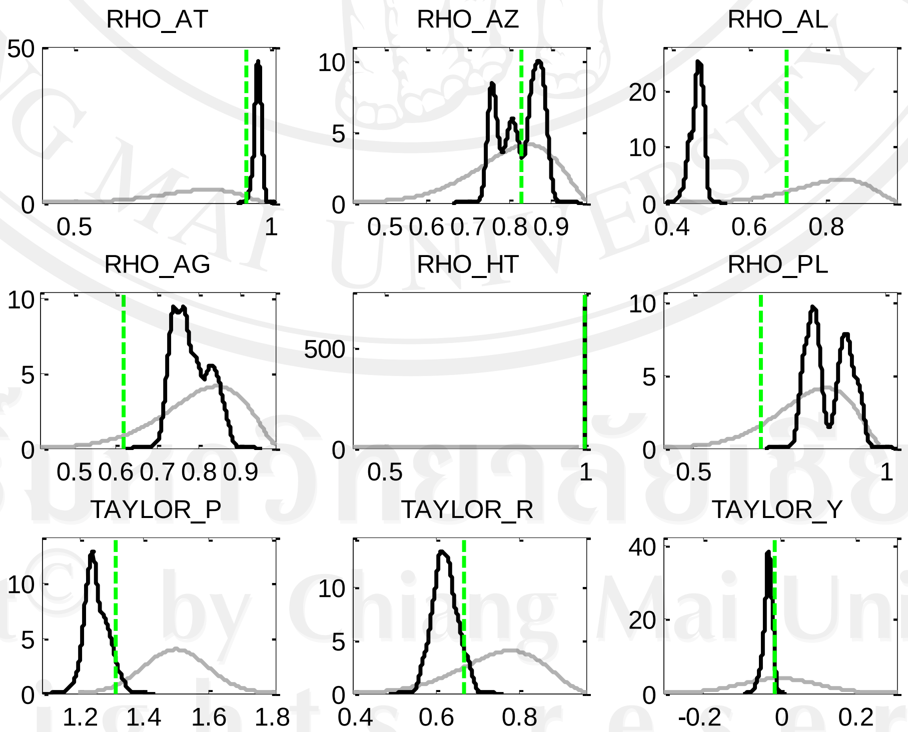

RHO_AT
RHO_AZ
RHO_AL
RHO_AG
RHO_HT
RHO_PL
TAYLOR_P
TAYLOR_R
TAYLOR_Y

Figure A.2: Multivariate MH convergence diagnosis

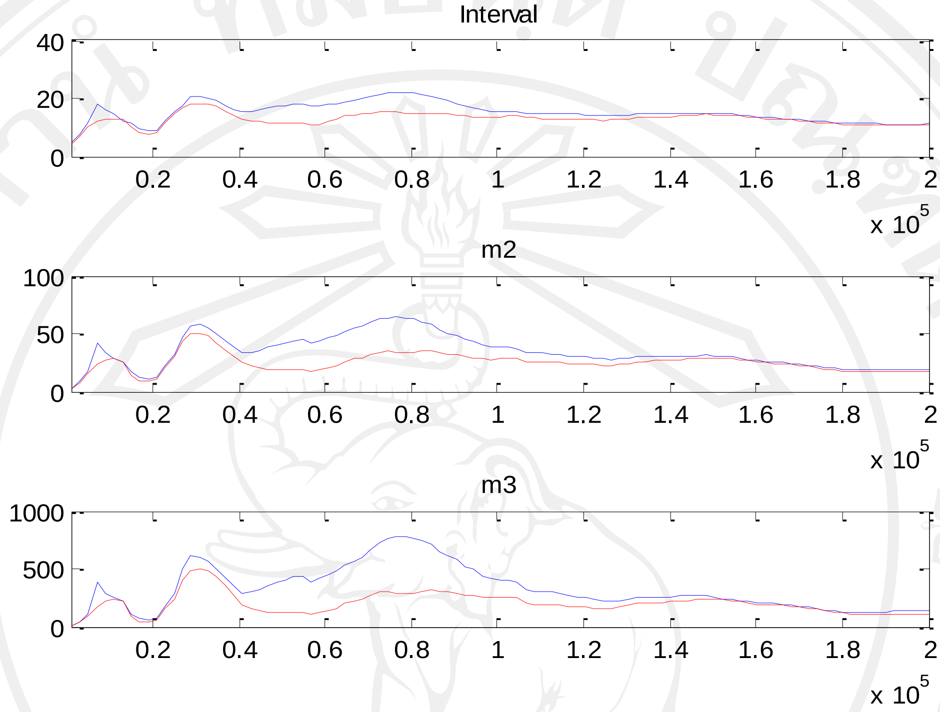


Figure A.3: Smoothed Variables

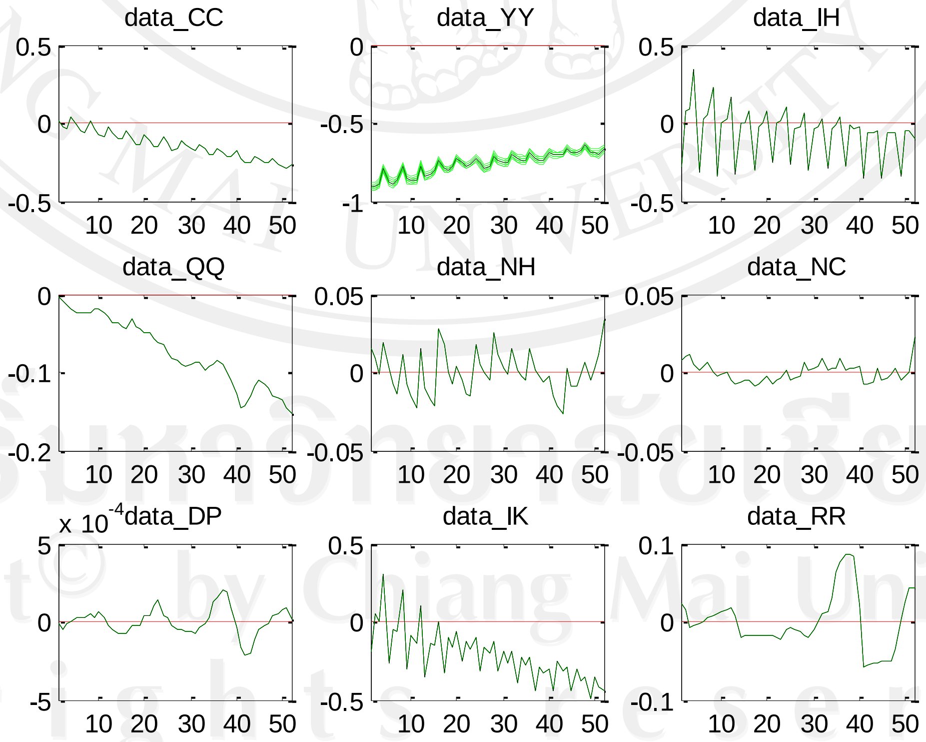
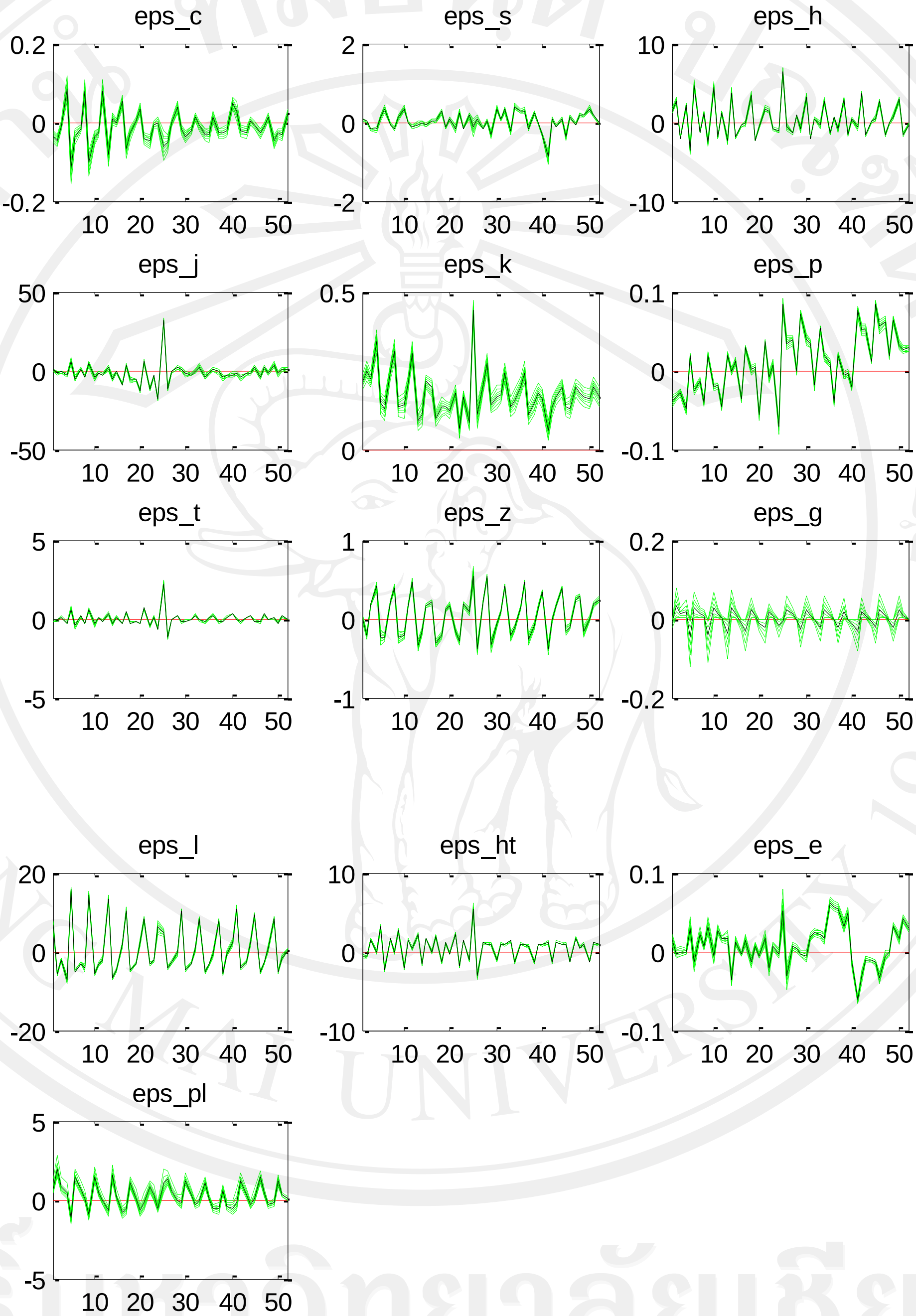


Figure A.4: Smoothed Shocks



Appendix C: Dynare Code

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```
var
a_c a_h a_j a_k a_t a_z b c c1 a_s a_ht a_pl a_g
data_CC data_DP data_IH data_IK data_NC data_NH data_QQ data_RR data_WC data_WH
data_YY data_KH dp h h1 I kc kh lm nc nc1 nh nh1 q r rkc rkh rkb
uc uc1 wc wc1 wh wh1 X xwc xwc1 xwh xwh1 Y zata_GDP zkc zkh kb
pl land G g1 g2 kt;

varexo eps_c eps_s eps_h eps_j eps_k eps_p eps_t eps_z eps_g eps_l eps_ht eps_e eps_pl;

parameters   BETA BETA1 M JEI MUC MUH DKC DKH DH ETA ETA1 EC EC1 FIKC FIKH
             ALPHA TETA TAYLOR_R TAYLOR_Y TAYLOR_P X_SS LAGP
             RHO_AC RHO_AH RHO_AJ RHO_AK RHO_AT RHO_AZ RHO_AS
             NU NU1 KAPPA XW_SS TETAWC TETAWH LAGWC LAGWH ZETAKC
             TREND_AC TREND_AH TREND_AK MUBB RHO_AG
             MUL RHO_AL RHO_HT TETAG ht RHO_PL;

//% local model parameters: IKC_SS IKH_SS TRENDY TRENDK    TRENDH ;
//% local model parameters: NC_SS NH_SS CC_SS IH_SS IK_SS QQ_SS

//% Calibrated parameters
X_SS = 1.15 ;
XW_SS = 1.15 ;
BETA = 0.985 ;
BETA1 = 0.97 ;
JEI = 0.16 ;
MUC = 0.436 ;
MUH = 0.20 ;
MUBB = 0.20 ;
MUL =0.20 ;
DKC = 0.025 ;
DKH = 0.03 ;
DH = 0.01 ;
M = 0.70 ;
KAPPA= 0.1 ;

//% Estimated parameters (mean)
ALPHA = 0.64 ;
EC = 0.31423 ;
```

```
EC1 =     0.56897 ;
ETA =     0.52381 ;
ETA1      =     0.50602 ;
FIKC      =     14.47013       ;
FIKH      =     11.02808       ;
LAGP      =     0.69106 ;
LAGWC     =     0.08301 ;
LAGWH     =     0.41186 ;
NU   =     -0.6833 ;
NU1 =     -0.96538       ;
TAYLOR_P      =     1.40444 ;
TAYLOR_R      =     0.59913 ;
TAYLOR_Y      =     0.51261 ;
TETA      =     0.83671 ;

//% a fraction cannot set prices optimally in consumption sector
TETAWC    =     0.79204 ;
TETAWH    =     0.91181 ;
TETAG     =     0.95;
TREND_AC      =     0.0032    ;
TREND_AH      =     0.0008    ;
TREND_AK      =     0.00275 ;
ZETAKC    =     0.70394 ;

//% 2 - Shocks parameters (mean)
RHO_AC    =     0.94265 ;
RHO_AH    =     0.99713 ;
RHO_AJ    =     0.95875 ;
RHO_AK    =     0.92384 ;
RHO_AT     =    0.92158 ;
RHO_AZ    =     0.96439 ;
RHO_AS    = 0.975;
RHO_AL    =   0.94;
RHO_AG    =   0.96;
RHO_HT    =   0.94;
RHO_PL    =   0.975;
STDERR_AG    =   0.04;
STDERR_AL    = 0.01;
STDERR_AC     =     0.01011 ;
STDERR_AE     =     0.00336 ;
STDERR_AH     =     0.01942 ;
STDERR_AJ     =     0.04094 ;
```

```
STDERR_AK    =    0.01068 ;
STDERR_AP    =    0.00457 ;
STDERR_AS    =    0.00034*100 ;
STDERR_AT    =    0.0252   ;
STDERR_AZ    =    0.01711 ;
STDERR_HT=0.01;
STDERR_PL=0.01;
ht=0.01;


model ;

# TRENDK = TREND_AC + 1/(1-MUC)*TREND_AK ;
# TRENDY = TREND_AC + MUC/(1-MUC)*TREND_AK;
# TRENDH = (1-MUH-KAPPA-MUBB)*TREND_AH + (MUH+MUBB)*TREND_AC +
                MUC*(MUH+MUBB)/(1-MUC)*TREND_AK ;
# TRENDQ = (1-MUH-MUBB)*TREND_AC + MUC*(1-MUH-MUBB)/(1-MUC)*TREND_AK –
                (1-MUH-KAPPA-MUBB)*TREND_AH ;

# llEXPTRENDY = exp ( TRENDY ) ;
# llEXPTRENDK = exp ( TRENDK ) ;
# llEXPTRENDQ = exp ( TRENDQ ) ;
# llEXPTRENDH = exp ( TRENDH ) ;
# llgamma_k = exp ( TREND_AK );

# llr = 1 / BETA ;
# llr1 =   llr / llEXPTRENDY - 1 ;

# llZETA0 = BETA*llEXPTRENDK*MUC/(llgamma_k-BETA*(1-DKC))/X_SS ;
# llZETA1 = BETA*llEXPTRENDY*MUH/(1-BETA*(1-DKH));
# llZETA2 = JEI/(1-BETA*llEXPTRENDQ*(1-DH)) ;
# llZETA3 = JEI/(1-BETA1*llEXPTRENDQ*(1-DH)-llEXPTRENDQ*(BETA-BETA1)*M) ;
# llZETA4 = (llr/llEXPTRENDY-1)*M*llEXPTRENDQ/llr ;

# llDH1 = 1 - (1-DH)/llEXPTRENDH ;
# llDKC1 = 1 - (1-DKC)/llEXPTRENDK ;
# llDKH1 = 1 - (1-DKH)/llEXPTRENDY ;

# llCHI1 = 1+llDH1*llZETA2*(1-llr1*llZETA1-KAPPA-ALPHA*(1-MUH-KAPPA-MUBB)) ;
# llCHI2 = (llr1*llZETA1+KAPPA+ALPHA*(1-MUH-KAPPA-MUBB))*llDH1*llZETA3+
              llZETA4*llZETA3 ;
# llCHI3 = (X_SS-1+llr1*llZETA0*X_SS+ALPHA*(1-MUC))/X_SS ;
```

```
# llCHI4 = 1+llDH1*llZETA3*(1-(1-ALPHA)*(1-MUH-KAPPA-MUBB))+llZETA4*llZETA3 ;
# llCHI5 = (1-ALPHA)*(1-MUH-KAPPA-MUBB)*llDH1*llZETA2 ;
# llCHI6 = (1-ALPHA)*(1-MUC)/X_SS ;

# llCY = (llCHI3*llCHI4+llCHI2*llCHI6)/(llCHI1*llCHI4-llCHI2*llCHI5) ;
# llCYPRIME = (llCHI1*llCHI6+llCHI3*llCHI5)/(llCHI1*llCHI4-llCHI2*llCHI5) ;
# llQIY = llDH1*llZETA2*llCY + llDH1*llZETA3*llCYPRIME ;

# llRATION = (1-MUH-KAPPA-MUBB)/(1-MUC)*X_SS*llQIY    ;
# llNHNC = llRATION^(1/(1-NU)) ;
# llNHNC1 = llRATION^(1/(1-NU1)) ;

# llnc =
( ((1-MUC)*ALPHA/llCY/X_SS/XW_SS)/(1+llRATION)^((ETA+NU)/(1-NU)) )^(1/(1+ETA)) ;
# llnh = llNHNC*llnc ;

# llnc1 =
( ((1-MUC)*(1-ALPHA)/llCYPRIME/X_SS/XW_SS)/(1+llRATION)^((ETA1+NU1)/(1-NU1)) )^(1/
(1+ETA1)) ;
# llnh1 = llNHNC1*llnc1 ;

# llY = (llnc^ALPHA)*(llnc1^(1-ALPHA)) *    llZETA0^(MUC/(1-MUC)) /
llEXPTRENDK^(MUC/(1-MUC)) ;

# llI = (llnh^(ALPHA*(1-MUH-KAPPA-MUBB))) * (llnh1^((1-ALPHA)*(1-MUH-KAPPA-MUBB)))
* llZETA1^MUH * (llY*llQIY)^MUH / llEXPTRENDY^(MUH) * (MUBB*llY*llQIY)^MUBB ;

# llq = llQIY*llY / llI ;

# llQI = llQIY*llY ;

# llkc = llZETA0*llY ;

# llkh = llZETA1*llQI ;

# llc = llCY*llY ;
# llc1 = llCYPRIME*llY ;

# llh = llZETA2*llc/llq ;
# llh1 = llZETA3*llc1/llq ;

# llb = M*llq*llEXPTRENDQ*llh1/llr ;
```

```
# llCC = llc + llc1 ;
# llIH = llI    ;
# llIK = llDKC1 * llkc + llDKH1* llkh    ;

# llikc = llDKC1 * llkc ;
# llikh = llDKH1 * llkh ;
# IKC_SS = log(llikc) ;
# IKH_SS = log(llikh) ;

# BB_SS = log(llb) ;
# CC_SS = log(llCC) ;
# IH_SS = log(llIH) ;
# IK_SS = log(llIK) ;
# QQ_SS = log(llq) ;
# RR_SS = log(llr) ;
# NC_SS = ALPHA*log(llnc) + (1-ALPHA)*log(llnc1) ;
# NH_SS = ALPHA*log(llnh) + (1-ALPHA)*log(llnh1) ;

//% Patient households

//% 1 constraint for patient households
exp(c) + exp(kc)/exp(a_k) + exp(kh)    +exp(q+h) + ht*exp(q+h+a_ht)+ exp(b)=
(1-DH)*exp(q+h(-1)-TRENDH) + exp(wc+nc) + exp(wh+nh) + (1-1/exp(X))*exp(Y) +
exp(r(-1)-dp+b(-1)-TRENDY)
+ (exp(rkc+zkc)+(1-DKC)/exp(a_k))*exp(kc(-1)-TRENDK) +
(exp(rkh+zkh)+(1-DKH))*exp(kh(-1)-TRENDY);

//% 2 respect to h
exp(q+uc)+ ht*exp(q+uc+a_ht) = exp(a_z+a_j-h)*JEI +
BETA*exp(TRENDY)*(1-DH)*exp(q(+1)+TRENDQ+uc(+1)-TRENDY);

//% 3 respect to b
exp(uc) = BETA*exp(TRENDY)*exp(r-dp(+1)+uc(+1)-TRENDY) ;

//% 4
exp(uc)/exp(a_k) * ( 1 + FIKC*(exp(kc-kc(-1))-1 ) ) =
BETA*exp(TRENDY) * exp(uc(+1)-TRENDK)
* ( exp(rkc(+1)+zkc(+1)) + (1-DKC)/exp(a_k(+1)) +
FIKC/2*exp(TRENDK)*(exp(kc(+1))^2/(exp(kc))^2-1) ) ;

//% 5
```

```
exp(uc) * ( 1 + FIKH*(exp(kh-kh(-1))-1 ) ) =
BETA*exp(TRENDY) * exp(uc(+1)-TRENDY)
* ( exp(rkh(+1)+zkh(+1)) + (1-DKH) + FIKH/2*exp(TRENDY)*(exp(kh(+1))^2/(exp(kh))^2-1) ) ;

//% 6
  exp(a_t) * exp(a_z) * ( exp(nc)^(1-NU) + exp(nh)^(1-NU) )^((ETA+NU)/(1-NU)) *
exp(nc)^(-NU)
= exp(wc+uc-xwc)    ;

//% 7
  exp(a_t) * exp(a_z) * ( exp(nc)^(1-NU) + exp(nh)^(1-NU) )^((ETA+NU)/(1-NU)) *
exp(nh)^(-NU)
= exp(wh+uc-xwh)    ;


//% Impatient households

//% 8
exp(c1) + exp(q+h1)+ht*exp(q+h1+a_ht) - (1-DH)*exp(q+h1(-1)-TRENDH) = exp(wc1+nc1) +
exp(wh1+nh1) +
exp(b) - exp(r(-1)-dp+b(-1)-TRENDY) ;

//% 9
exp(q+uc1)+ht*exp(q+uc1+a_ht) = exp(a_z+a_j-h1 )*JEI+
BETA1*exp(TRENDY)*(1-DH)*exp(q(+1)+TRENDQ+uc1(+1)-TRENDY) +
M*exp(lm+(q(+1)+ TRENDQ -r+dp(+1))) ;

//% 10
b = log(M) + (q(+1)+TRENDQ) + h1    - r + dp(+1)    ;

//% 11
exp(uc1) = BETA1*exp(TRENDY)*exp(r-dp(+1)+uc1(+1)-TRENDY) + exp(lm) ;

//% 12
    exp(a_t) * exp(a_z) *    ( exp(nc1)^(1-NU1) + exp(nh1)^(1-NU1) )^((ETA1+NU1)/(1-NU1)) *
(exp(nc1))^(-NU1)
= exp(wc1+uc1-xwc1)    ;

//% 13
  exp(a_t) * exp(a_z) * ( exp(nc1)^(1-NU1) + exp(nh1)^(1-NU1) )^((ETA1+NU1)/(1-NU1)) *
(exp(nh1))^(-NU1)
= exp(wh1+uc1-xwh1)    ;
```

```
//% Firms

//% 14
Y = (1-MUC)*(a_c) + (1-MUC)*ALPHA*nc + (1-MUC)*(1-ALPHA)*nc1 +
MUC*(kc(-1)+zkc-TRENDK) ;

//% 15
I = (1-MUH-MUBB-MUL)*(a_h) + MUBB*kb
+ (1-MUH-MUBB-MUL)*ALPHA*nh + (1-MUH-MUBB-MUL)*(1-ALPHA)*nh1 +
MUH*(kt(-1)+zkh-TRENDY) + MUL*land(-1);

//% 16
exp(kt) = exp(kh) + exp(g2);

//% 17
log(1-MUC) + log(ALPHA) + Y - X - nc = wc ;

//% 18
log(1-MUC) + log(1-ALPHA) + Y - X - nc1 = wc1 ;

//% 19
log(1-MUH-MUL-MUBB) + log(ALPHA) + q + I - nh = wh ;

//% 20
log(1-MUH-MUL-MUBB) + log(1-ALPHA) + q + I - nh1 = wh1 ;

//% 21
log(MUC) + Y - X - kc(-1) + TRENDK = rkc + zkc ;

//% 22
log(MUH) + q + I - kh(-1) + TRENDY = rkh + zkh    ;

//% 23
log(MUL)+q+I=land(-1)+pl(-1);

//% 24
log(MUBB) +q+I = rkb+kb;

//% 25
dp - LAGP*dp(-1) = BETA*exp(TRENDY)*(dp(1) - LAGP*dp) -
```

```
((1-TETA)*(1-BETA*exp(TRENDY)*TETA)/TETA)*(X-log(X_SS)) + eps_p ;

//% 26
r = TAYLOR_R*r(-1) + (1-TAYLOR_R)*(TAYLOR_P)*dp +
(1-TAYLOR_R)*TAYLOR_Y*(zata_GDP-zata_GDP(-1)) +
(1-TAYLOR_R)*log(1/BETA) + eps_e - a_s/100;

//% 27
exp(h) + exp(h1) = (1-DH)*exp(h(-1)-TRENDH) + (1-DH)*exp(h1(-1)-TRENDH) + exp(I) ;


//% DEFINITIONS OF MARGINAL UTILITY OF CONSUMPTION

//% 28
exp(uc) = exp(a_z) * ( ((exp(TRENDY)-EC)/(exp(TRENDY)-BETA*EC*exp(TRENDY))) *
( 1 / ( exp(c) - EC*exp(c(-1)-TRENDY)    ) - BETA*EC*exp(TRENDY)    / ( exp(c(+1)+TRENDY)
- EC*exp(c)    ) ) ) ;

//% 29
exp(uc1) = exp(a_z) * ( ((exp(TRENDY)-EC1)/(exp(TRENDY)-BETA1*EC1*exp(TRENDY))) *
( 1 / ( exp(c1) - EC1*exp(c1(-1)-TRENDY) ) - BETA1*EC1*exp(TRENDY) /
( exp(c1(+1)+TRENDY) - EC1*exp(c1) ) ) ) ;


//% WAGE EQUATIONS
//% 30
wc = (1/(1+BETA*exp(TRENDY)))*wc(-1) + (1-(1/(1+BETA*exp(TRENDY))))*(wc(1)+dp(+1))
- (1+BETA*exp(TRENDY)*LAGWC)/(1+BETA*exp(TRENDY))*dp +
LAGWC/(1+BETA*exp(TRENDY))*dp(-1)
-((1-TETAWC)*(1-BETA*exp(TRENDY)*TETAWC)/TETAWC)/(1+BETA*exp(TRENDY))*(xwc-
log(XW_SS))    ;

//% 31
wc1 = (1/(1+BETA1*exp(TRENDY)))*wc1(-1) +
(1-(1/(1+BETA1*exp(TRENDY))))*(wc1(1)+dp(+1))
- (1+BETA1*exp(TRENDY)*LAGWC)/(1+BETA1*exp(TRENDY))*dp +
LAGWC/(1+BETA1*exp(TRENDY))*dp(-1) -
((1-TETAWC)*(1-BETA1*exp(TRENDY)*TETAWC)/TETAWC)/(1+BETA1*exp(TRENDY))*(xw
c1-log(XW_SS))    ;

//% 32
wh = (1/(1+BETA*exp(TRENDY)))*wh(-1) + (1-(1/(1+BETA*exp(TRENDY))))*(wh(1)+dp(+1))
```

```
- (1+BETA*exp(TRENDY)*LAGWH)/(1+BETA*exp(TRENDY))*dp +
LAGWH/(1+BETA*exp(TRENDY))*dp(-1) -
((1-TETAWH)*(1-BETA*exp(TRENDY)*TETAWH)/TETAWH)/(1+BETA*exp(TRENDY))*(xwh-l
og(XW_SS))    ;

//% 33
wh1 = (1/(1+BETA1*exp(TRENDY)))*wh1(-1) +
(1-(1/(1+BETA1*exp(TRENDY))))*(wh1(1)+dp(+1))
- (1+BETA1*exp(TRENDY)*LAGWH)/(1+BETA1*exp(TRENDY))*dp +
LAGWH/(1+BETA1*exp(TRENDY))*dp(-1) -
((1-TETAWH)*(1-BETA1*exp(TRENDY)*TETAWH)/TETAWH)/(1+BETA1*exp(TRENDY))*(xw
h1-log(XW_SS))    ;

//% 34
exp(G)=ht*exp(q+h1+a_ht)+ht*exp(q+h+a_ht) +exp(land+pl);

//% 35
exp(g1)=TETAG*exp(G);

//% 36
exp(g2)=(1-TETAG)*exp(G)+a_g/10;

//% 37
exp(c)+exp(c1)+exp(kc) - (1-DKC)*exp(kc(-1)-TRENDK) +    exp(kh) -
(1-DKH)*exp(kh(-1)-TRENDY)+exp(kb)+exp(G)=exp(Y);


//% CAPACITY

//% 38
exp(rkc+a_k) / ( (1/BETA)*exp(TREND_AK)-(1-DKC) ) = ZETAKC/(1-ZETAKC)*exp(zkc) +
(1-ZETAKC/(1-ZETAKC));

//% 39
exp(rkh) / ( (1/BETA)-(1-DKH) ) = ZETAKC/(1-ZETAKC)*exp(zkh) + (1-ZETAKC/(1-ZETAKC));

//% 40
pl = RHO_AL* pl(-1) + eps_l/2 - a_pl/10;


//% DEFINITION OF VARIABLES TAKEN TO THE DATA
data_CC = log(exp(c) + exp(c1)) - CC_SS + TRENDY ;
```

```
data_DP = dp    ;
data_IH = I -    IH_SS + TRENDH ;
data_IK = log ( exp(kc) - (1-DKC)*exp(kc(-1)-TRENDK) + exp(kh) –
            (1-DKH)*exp(kh(-1)-TRENDY) ) - IK_SS + TRENDK ;
data_NC = ALPHA*nc + (1-ALPHA)*nc1 - NC_SS ;
data_NH = ALPHA*nh + (1-ALPHA)*nh1 - NH_SS ;
data_QQ = q    - QQ_SS + TRENDQ ;
data_RR = r - log(1/BETA)    ;
data_WC = log(exp(wc)+exp(wc1)) ;
data_WH = log(exp(wh)+exp(wh1)) ;
data_YY = Y- CC_SS + TRENDY;
data_KH = log(exp(kh) - (1-DKH)*exp(kh(-1)-TRENDY)) - IK_SS + TRENDK;
zata_GDP =
(exp(CC_SS)/(exp(CC_SS)+exp(QQ_SS+IH_SS)+exp(IK_SS)))*(data_CC-TRENDY)
+(exp(IK_SS)/(exp(CC_SS)+exp(QQ_SS+IH_SS)+exp(IK_SS)))*(data_IK-TRENDK)
+(exp(QQ_SS+IH_SS)/(exp(CC_SS)+exp(QQ_SS+IH_SS)+exp(IK_SS)))*(data_IH-TRENDH)
+log(exp(G));


//% STOCHASTIC PROCESSES FOR THE SHOCKS
a_c = RHO_AC * a_c(-1) + eps_c ;
a_h = RHO_AH * a_h(-1) + eps_h ;
a_j = RHO_AJ * a_j(-1) + eps_j ;
a_k = RHO_AK * a_k(-1) + eps_k ;
a_t = RHO_AT * a_t(-1) + eps_t ;
a_z = RHO_AZ * a_z(-1) + eps_z ;
a_g = RHO_AG * a_g(-1) + eps_g ;
a_s = RHO_AS * a_s(-1) + eps_s ;
a_pl = RHO_PL* a_pl(-1) + eps_pl ;
a_ht = RHO_HT * a_ht(-1) + eps_ht ;

end ;

steady;

shocks;
var eps_g ; stderr STDERR_AG    ;
var eps_c ; stderr STDERR_AC    ;
var eps_h ; stderr STDERR_AH    ;
var eps_k ; stderr STDERR_AK    ;
var eps_j ; stderr STDERR_AJ    ;
var eps_e ; stderr STDERR_AE    ;
```

```
var eps_z ; stderr STDERR_AZ   ;
var eps_t ; stderr STDERR_AT   ;
var eps_p ; stderr STDERR_AP   ;
var eps_l ; stderr STDERR_AL   ;
var eps_ht ; stderr STDERR_HT   ;
var eps_s ; stderr STDERR_AS   ;
var eps_pl; stderr STDERR_PL;
end;

stoch_simul(order=1,irf=20) data_CC data_IK data_IH data_QQ zata_GDP data_RR   ;

end;


estimated_params ;

//%              START VALUES          &            PRIORS
stderr eps_c     ,   uniform_pdf,    3    ,    1.7 ;
stderr eps_e     ,   uniform_pdf,   3     ,    1.7;
stderr eps_h     ,   uniform_pdf,   3     ,   1.7 ;
stderr eps_s     ,   uniform_pdf,   3     ,   1.7 ;
stderr eps_j     ,   uniform_pdf,   3     ,    1.7 ;
stderr eps_k     ,    uniform_pdf,    3    ,    1.7 ;
stderr eps_p     ,    uniform_pdf,    3    ,    1.7 ;
stderr eps_t     ,   uniform_pdf,   3    ,    1.7 ;
stderr eps_z     ,    uniform_pdf,    3    ,   1.7 ;
stderr eps_l     ,   uniform_pdf,    3    ,    1.7 ;
stderr eps_g     ,    uniform_pdf,   3     ,   1.7 ;
stderr eps_ht    ,     uniform_pdf,    3    ,    1.7 ;
stderr eps_pl    ,     uniform_pdf,   3    ,    1.7 ;
ALPHA                ,  beta_pdf    ,    0.65      ,    0.05 ;
EC                   ,  beta_pdf    ,    0.50      ,    0.075 ;
EC1                  ,  beta_pdf    ,    0.50      ,    0.075 ;
ETA                  ,  gamma_pdf   ,    0.50     ,    0.1   ;
ETA1                 ,  gamma_pdf   ,    0.50     ,    0.1   ;
LAGP                 ,  beta_pdf    ,    0.5      ,    0.2   ;
LAGWC                ,  beta_pdf    ,    0.5      ,    0.2   ;
LAGWH                ,  beta_pdf    ,    0.5      ,    0.2   ;
NU                   ,  normal_pdf ,    -1        ,    0.10   ;
NU1                  ,  normal_pdf ,    -1        ,    0.10   ;
RHO_AC               ,  beta_pdf    ,    0.80      ,    0.10 ;
RHO_AH               ,  beta_pdf    ,    0.80      ,    0.10 ;
```

```
RHO_AJ        ,   beta_pdf   ,   0.80    ,   0.10 ;
RHO_AK        ,   beta_pdf   ,   0.80    ,   0.10 ;
RHO_AT        ,   beta_pdf   ,   0.80    ,   0.10 ;
RHO_AZ        ,   beta_pdf   ,   0.80    ,   0.10 ;
RHO_AL        ,   beta_pdf   ,   0.80    ,   0.10 ;
RHO_AG        ,   beta_pdf   ,   0.80    ,   0.10 ;
RHO_HT        ,   beta_pdf   ,   0.80    ,   0.10 ;
RHO_PL        ,   beta_pdf   ,   0.80    ,   0.10 ;
TAYLOR_P      ,   normal_pdf ,   1.5     ,   0.1  ;
TAYLOR_R      ,   beta_pdf   ,   0.75    ,   0.1  ;
TAYLOR_Y      ,   normal_pdf ,   0       ,   0.1  ;
TETA          ,   beta_pdf   ,   0.667   ,   0.05 ;
TETAWC        ,   beta_pdf   ,   0.667   ,   0.05 ;
TETAWH        ,   beta_pdf   ,   0.667   ,   0.05 ;

end;

varobs data_CC data_DP data_IH data_IK data_NC data_NH data_QQ data_RR data_WC
data_WH;

observation_trends;
data_CC (TREND_AC + MUC/(1-MUC)*TREND_AK) ;
data_IH ( (MUH+MUBB)*TREND_AC + (1-MUH-MUBB-KAPPA)*TREND_AH
        +(MUH+MUBB)*MUC/(1-MUC)*TREND_AK) ;
data_IK (TREND_AC + 1/(1-MUC)*TREND_AK) ;
data_QQ ((1-MUH-MUBB)*TREND_AC + MUC*(1-MUH-MUBB)/(1-MUC)*TREND_AK –
        (1-MUH-MUBB-KAPPA)*TREND_AH) ;
end;

estimation ( datafile=chinadata2,
          bayesian_irf,irf=20,
          conf_sig=0.95,
          smoother,
          mh_jscale=0.2,
          mode_compute=6,
          presample=0,
          prior_trunc=1e-100,
          mh_replic=200000,
          mh_nblocks=2,
          lik_init=1 )
data_CC data_YY data_IH data_QQ data_NH data_NC data_DP data_IK data_RR;
```

Curriculum Vitae

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