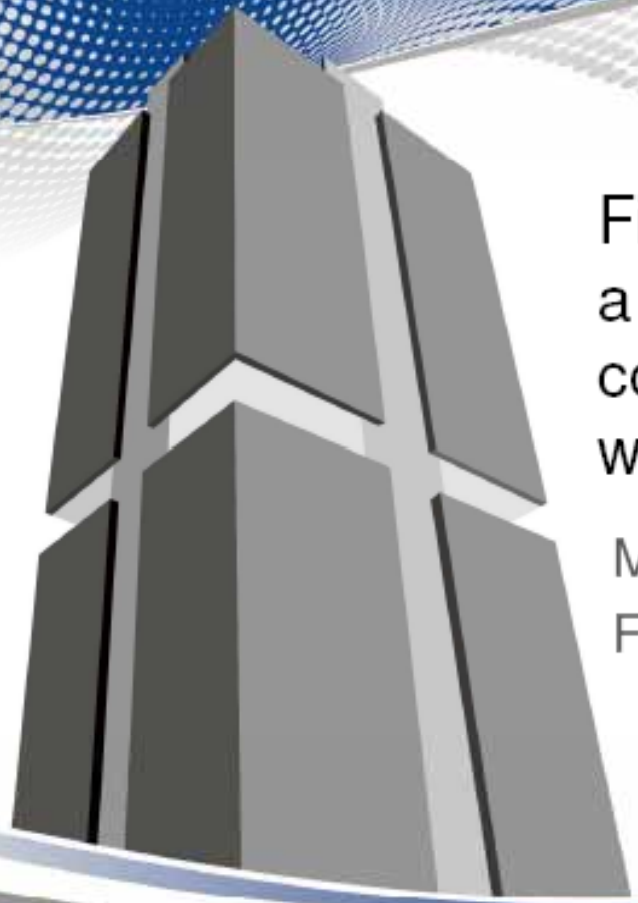
XII Seminário Anual de Metas para a Inflação
13 e 14 de maio de 2010 – Rio de Janeiro



Fiscal and monetary policy interaction: a simulated based analysis of a two country New Keynesian DSGE model with heterogeneous households.

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The views expressed here are those of the authors and not necessarily those of the Banco Central do Brasil.

The model: main references

We extend the NAWM (ECB): micro-founded open-economy model of the euro area

- *Coenen, McAdam e Straub*, JEDC, 2008: “Tax reform and labour-market performance in the euro area: a simulation-based analysis using the New Area-Wide Model”

- *Christoffel, Coenen e Warne*, WP ECB # 944, 2008: “The New Area-Wide Model of the euro area: a micro-founded open-economy model for forecasting and policy analysis”

The Model: map of core structure

Households

Type I	Type J
▪ consume (maximize utility) ▪ hold money ▪ investment: government bonds, international bonds and capital ▪ more specialized labor services	▪ consume (maximize utility) ▪ hold money ▪ less specialized labor services

Labor services market: *monopolistic competition with wage rigidities*

Capital market: *perfect competition*

Intermediate goods firms

▪ combine labor and capital (private + public) inputs

Domestic market	Exports

Intermediate goods market: *monopolistic competition with price rigidities*

Final goods firms

▪ combine domestic and imported intermediate goods

Private Consumption	Government Consumption	Private and Government Investment

Final goods market: *perfect competition (zero profit/price index)*

Government

- consumes final goods
- investments (buy final investment goods)
- issue domestic bonds
- levies distortive taxes: consumption, labor income and payroll
- transfers to households (biased to type 2 households)

Monetary Policy	Fiscal Policy
Interest rate rule (Forward Looking)	Primary surplus rule (Debt Stabilization Commitment and Countercyclical Components)

Domestic bonds market: households take IR

Rest of the world

modeled symmetrically, except for:

- monetary rule: backward looking.
- fiscal rules: government consumption rule and lump-sum taxes.
- steady state: smaller interest and inflation rates, and zero balance trade.

International markets:

- international bonds: sovereign *risk spread*
- intermediate goods: *local currency pricing*

The Model: frictions

- **Nominal and real frictions (same as NAWM):**
  - sticky prices and wages prices (Calvo's mechanism)
  - external habit formation in consumption
  - costs
    - adjustment of investment
    - variation in capital utilization
    - velocity of money in consumption (role for money)
    - adjustment of imports share in final goods production
    - financial risk premium on international bonds market (in addition to the steady state risk spread)
    - fixed cost on intermediate goods production (no dividends in s.s.)

The Model: corrections, extensions and adaptations

- **Public sector modeling**
  - primary surplus rule
    - debt stabilization commitment
    - countercyclical
    - smoothing (reversion to target)
  - mixed capital firms (private + public)
    - demand for subsidized public capital (covers depreciation)
    - government investment rule (reversion to target)
  - biased government transferences rule (reversion to target)
    - favorable to less specialized worker and investment constrained household (Type J)
  - forward-looking interest rate rule

The Model: corrections, extensions and adaptations

- **Heterogeneous job market**
  - specialized labor services
  - same stationary hours worked for each group
- **Perfect competition in final goods market**
  - price index: compatible with zero profit in final good production
  - aggregate resources equation: becomes the standard
- **Calibration for Brazil and ROW (Euro+EUA)**
  - small size open-economy (does not affect foreign economy)
  - different levels of inflation
  - domestic bond risk premium (in excess to the international rate)
  - non-zero domestic trade balance

The Model: size and computational aspects

- **Endogenous variables and equations**
  - 137 endogenous variables (each economy)
  - 274 equations (total)
- **Exogenous shocks**
  - monetary policy (interest rate shock)
  - fiscal policy (primary surplus shock)
  - government investment
  - government transfers
  - total productivity
  - labor productivity (permanent one)
- **Solution and simulations**
  - fist order approximation with Dynare on Matlab

SIMULATIONS

Simulations: main questions

✓ How are fiscal and monetary impulses transmitted through the model economy?

✓ How does the level of fiscal commitment to debt stabilization modify the impulse responses to a monetary policy shock?

✓ How do alternative specifications of the monetary policy rules modify the impulse responses to a fiscal or monetary policy shock?

Simulations

1) Temporary and discretionary deviation from previous announced automatic rules in the benchmark model:
   - shock to interest rate rule
   - shock to primary surplus rule
   - shock to government transferences rule
   - shock to government investment rule

2) Sensitivity analysis: fiscal compromise with debt stabilization (Φ_b)
   - impulse responses to a monetary shock

Simulations (cont.):

3) Monetary and Fiscal shocks:

- Impulse responses to combined shocks

Simulations (cont.):

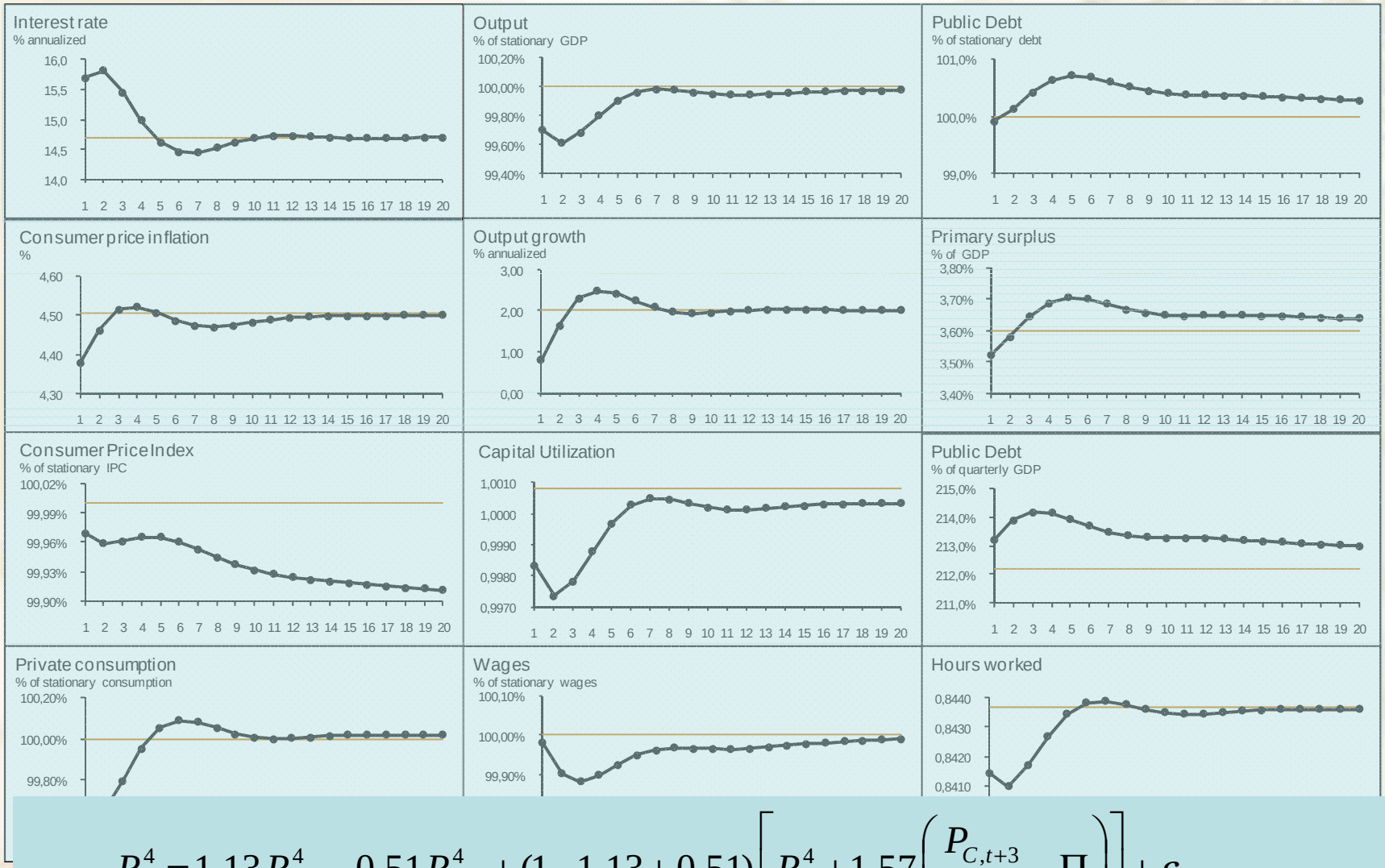
4) Alternative components for monetary rule, backward looking inflation, exchange rate and output growth:

- impulse responses to monetary shock and fiscal shock

Conclusions: simulations of the model economy

- Grater fiscal commitment with debt stabilization amplifies the impact on inflation of a interest rate shock.
- Higher government transfers impose smaller government consumption and investment, and also reduce incentives to work and invest (biased transfers to Type J) resulting that the higher level of total consumption is not sufficient to interrupt the slow down of economic activity.
- Increase in government investment is made through a drop in government consumption, and also reduces incentives to private investments (substitution effect), resulting in the slow down of the economy in the shot run.
- Distributive effects:
  - contractionist monetary policy benefits type I households (higher interest rate to investors)
  - expansionist fiscal primary surplus shock, as well, biased transfers shock, benefit Type J
  - government investment shock benefits type I (subsidies to investors) in the short run and Type J in the long run

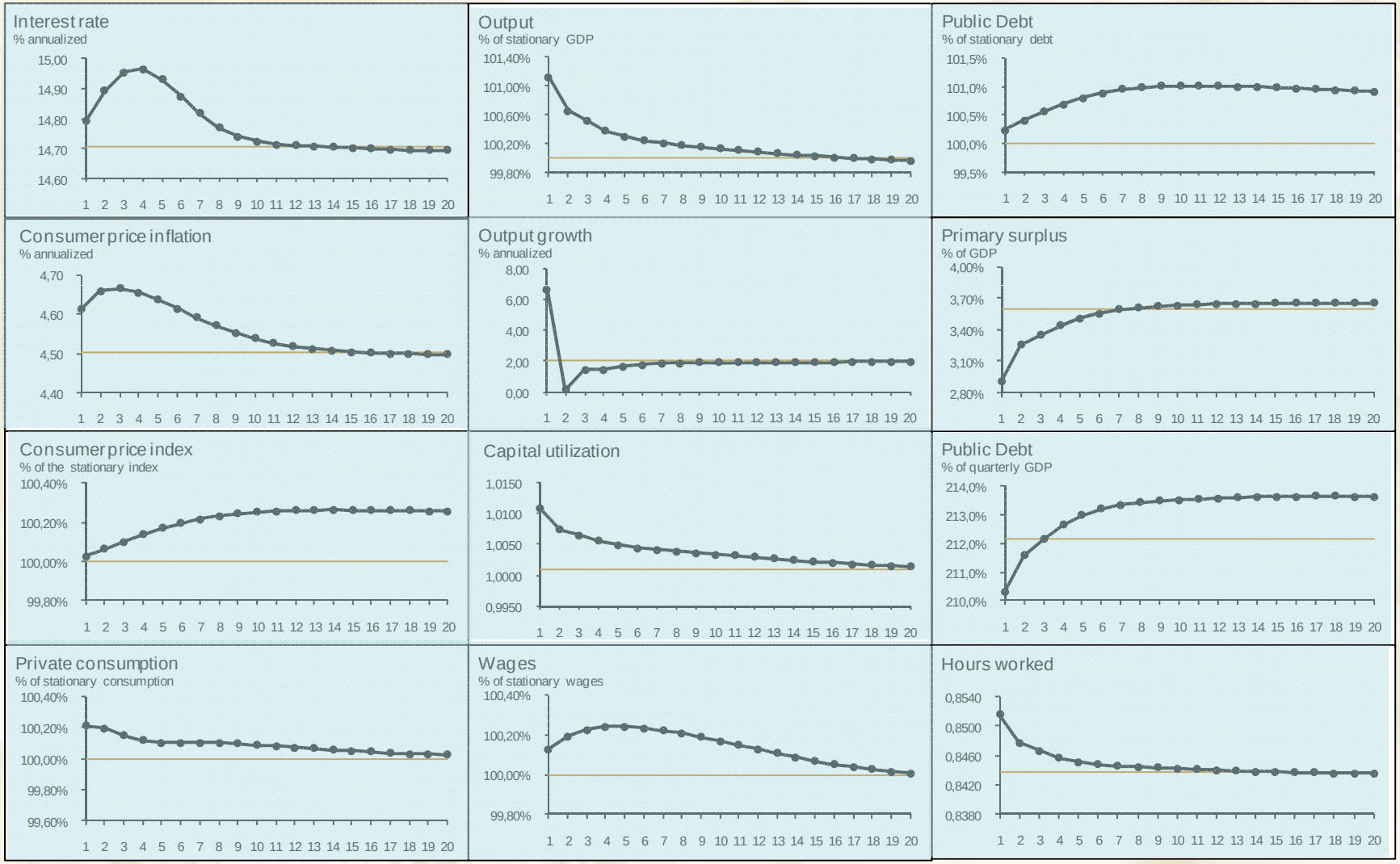
Benchmark calibration: interest rate shock



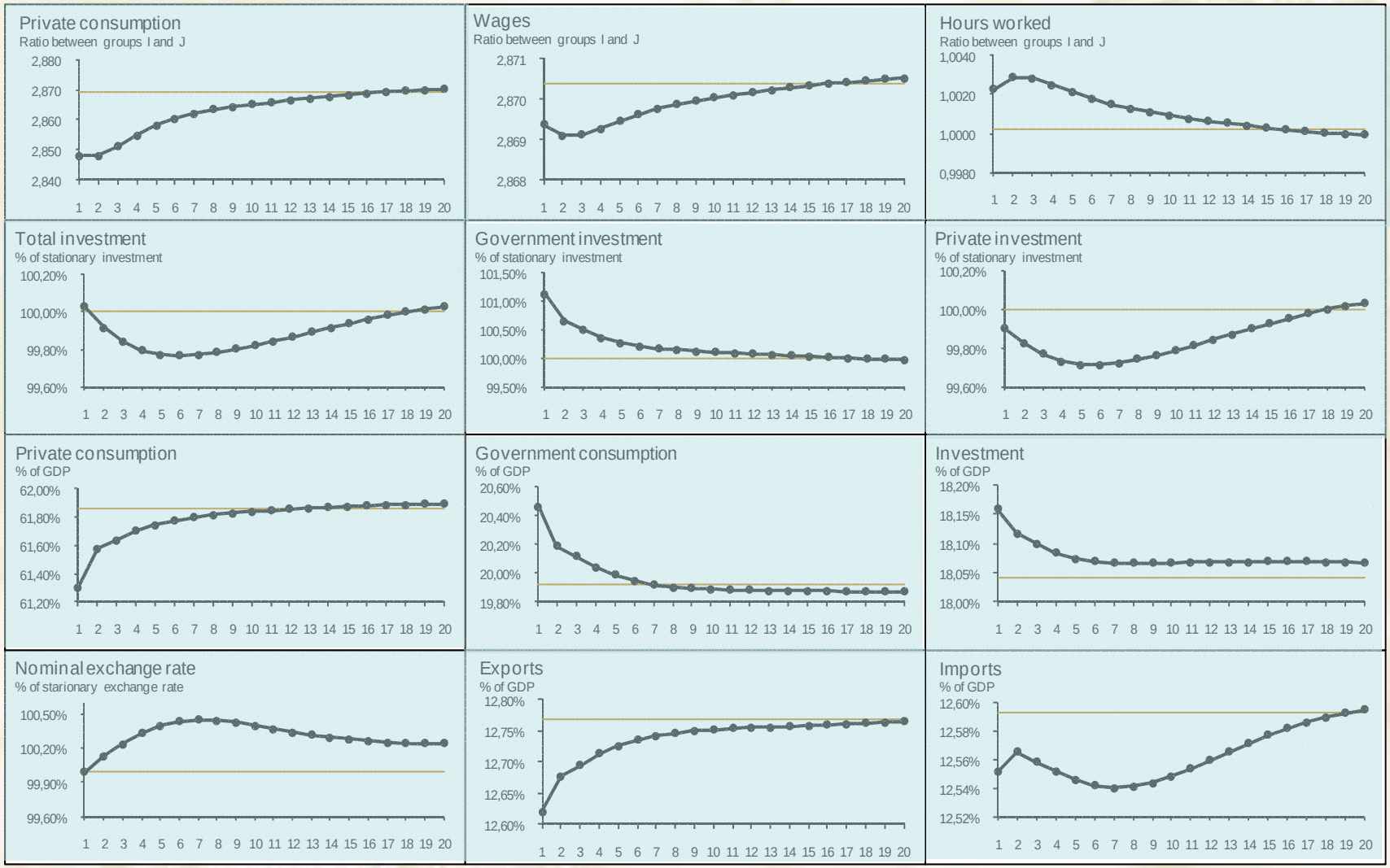
$$R_t^4 = 1.13 R_{t-1}^4 - 0.51 R_{t-2}^4 + (1 - 1.13 + 0.51)\left[R^4 + 1.57 \left(\frac{P_{C,t+3}}{P_{C,t-1}} - \Pi \right) \right] + \varepsilon_{R,t}$$

Benchmark calibration: interest rate shock (cont.)

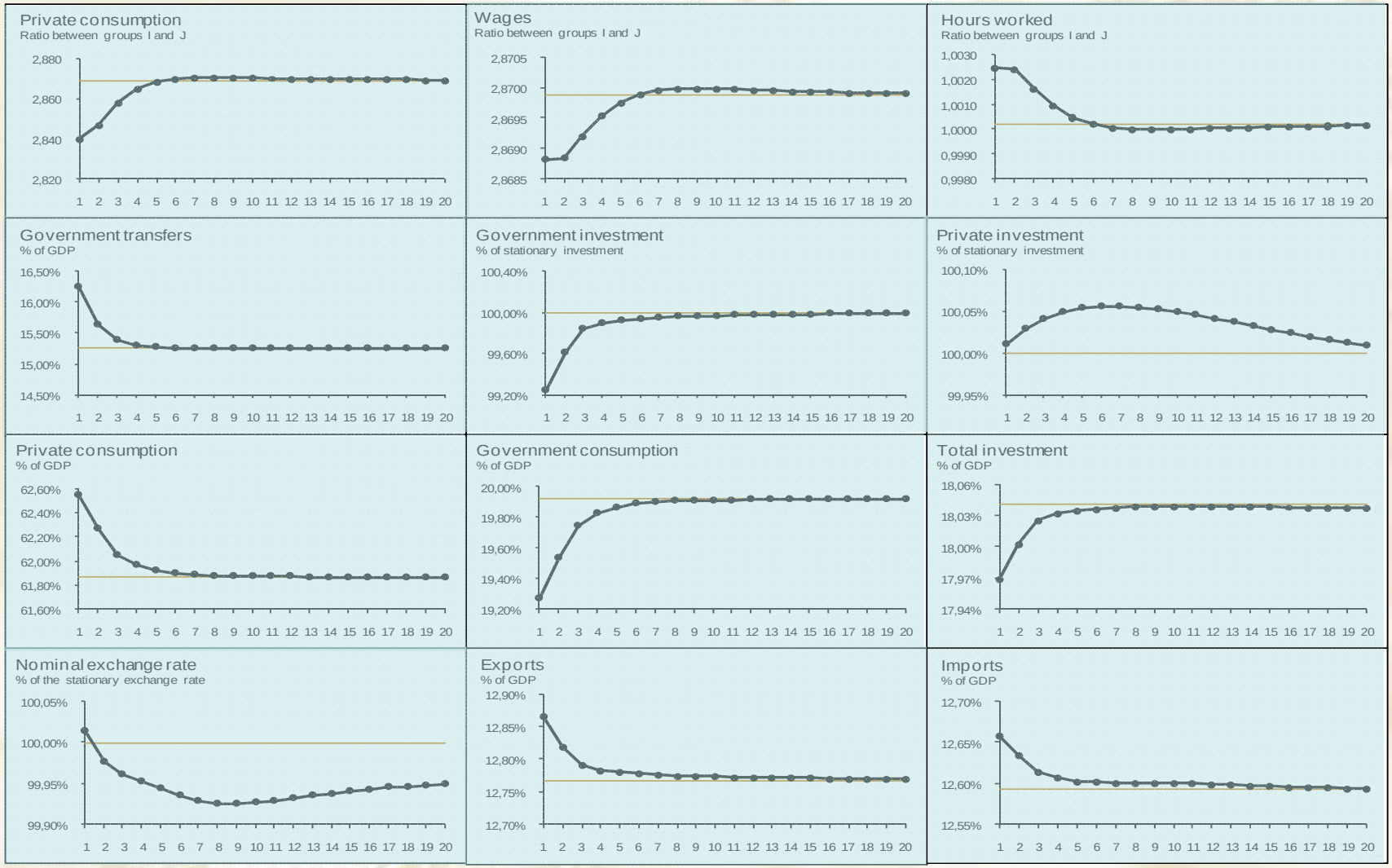
Benchmark model: shock to primary surplus



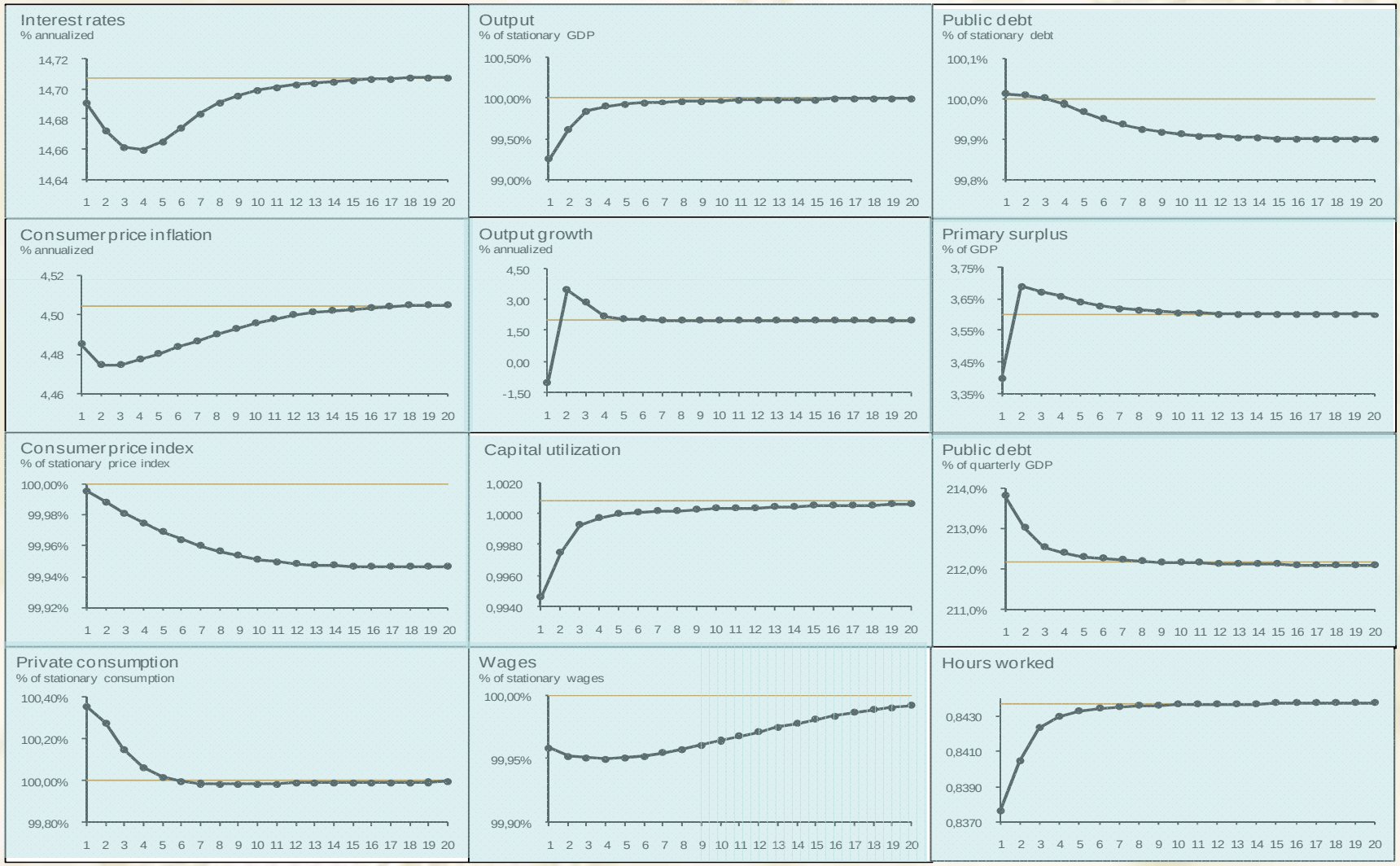
Benchmark model: shock to primary surplus (cont.)



Benchmark model: shock to gov. transferences

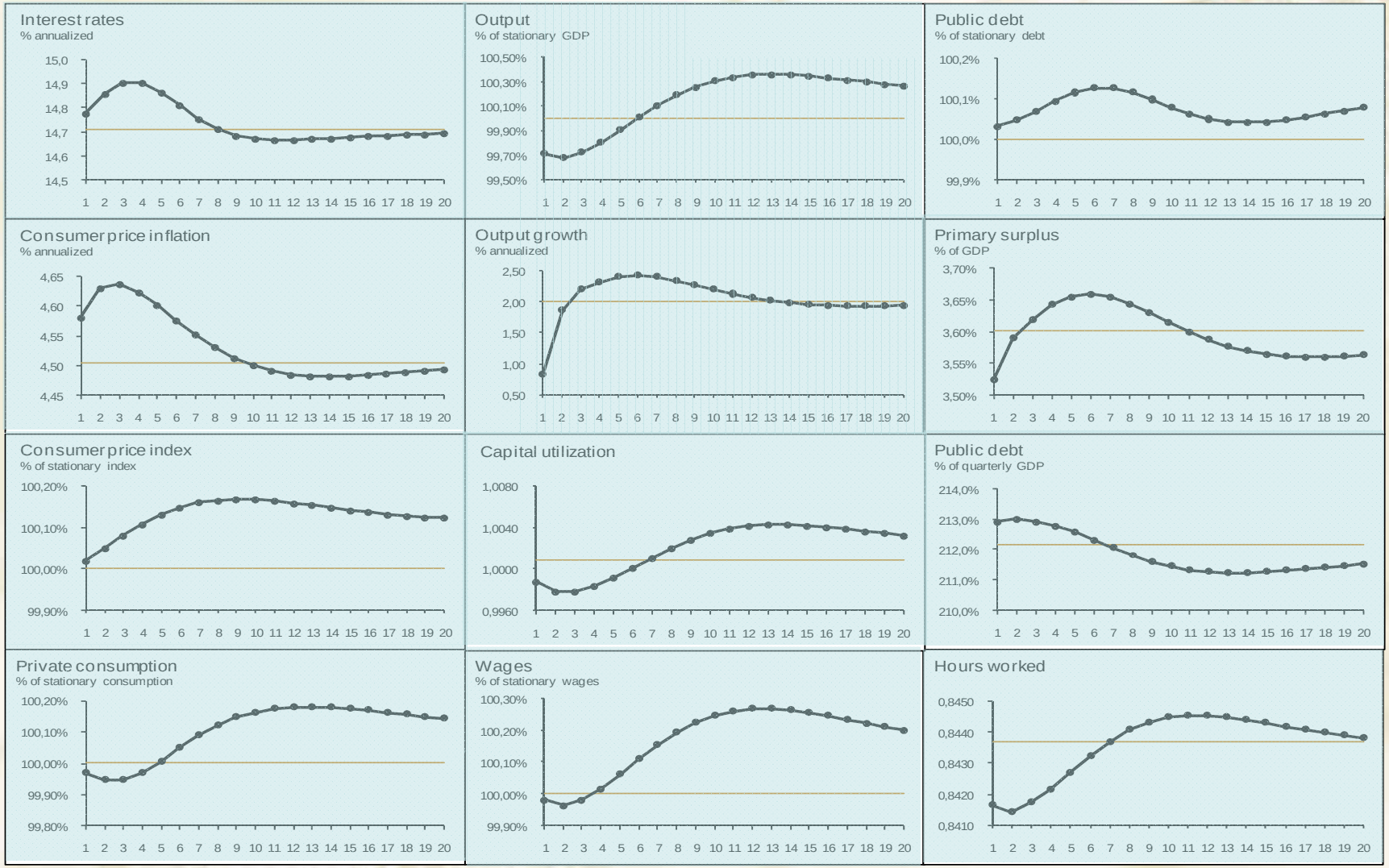


Benchmark model: shock to gov. transfer. (cont.)



Benchmark model: shock to gov. investment

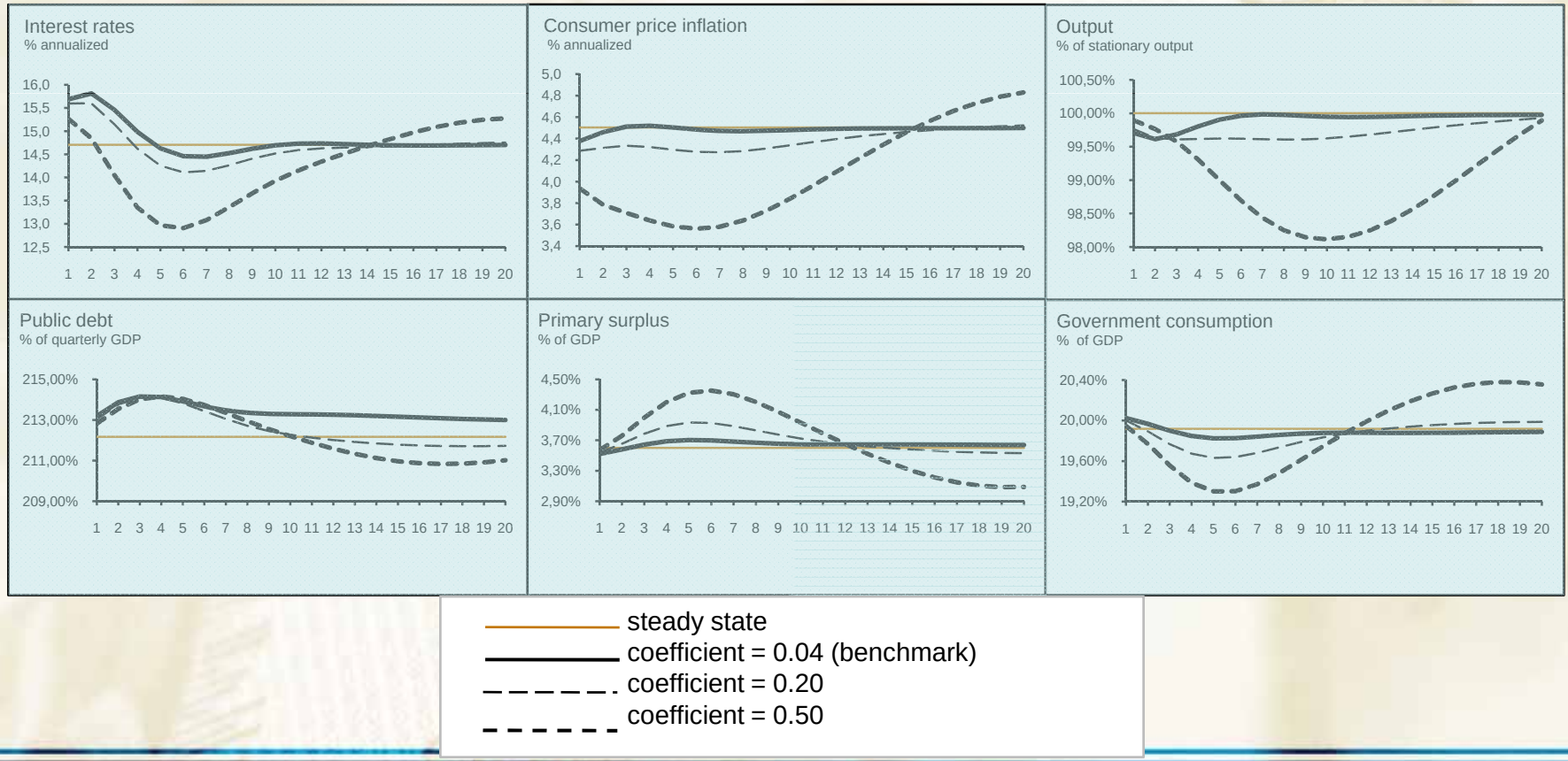
Benchmark model: shock to gov. investment (cont.)



Fiscal commitment with debt: monetary shock

Increase the reaction to debt deviation from steady state (Φ_b):

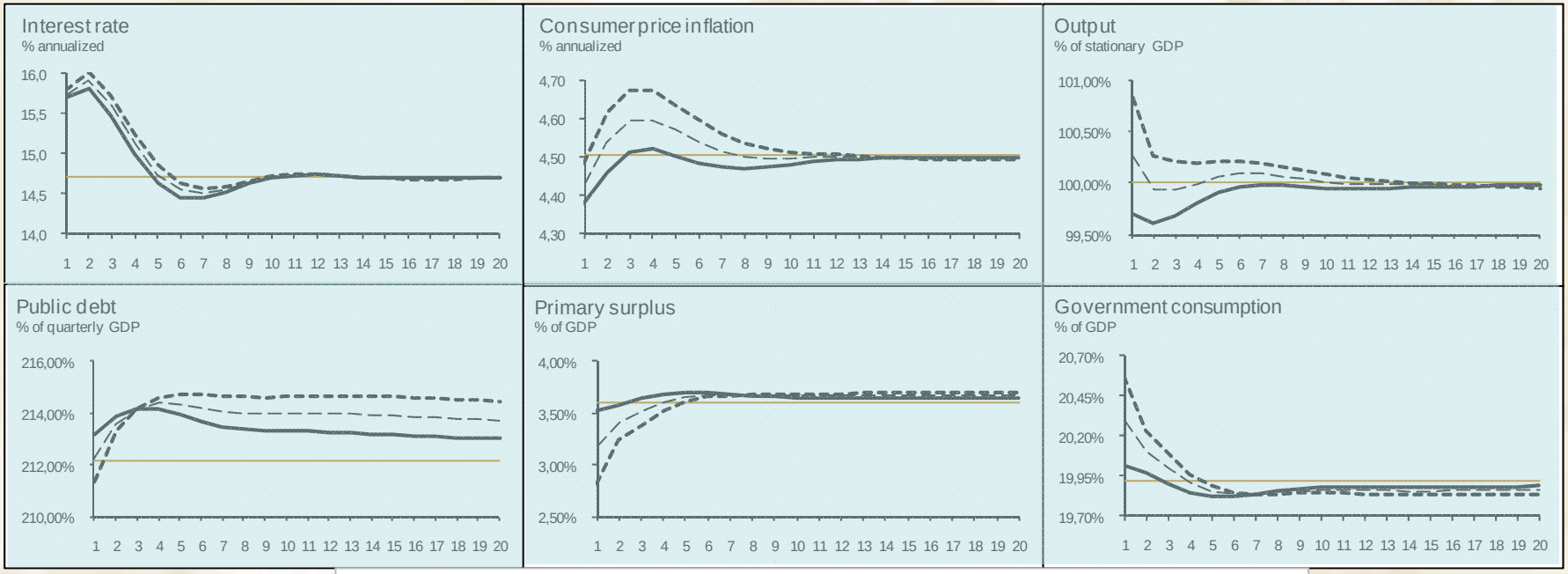
- public debt returns faster to the stationary trend;
- higher impact of a interest rate shock on inflation and output;



Combination of fiscal and monetary shocks

Positive interest rate shock + negative primary surplus shock:

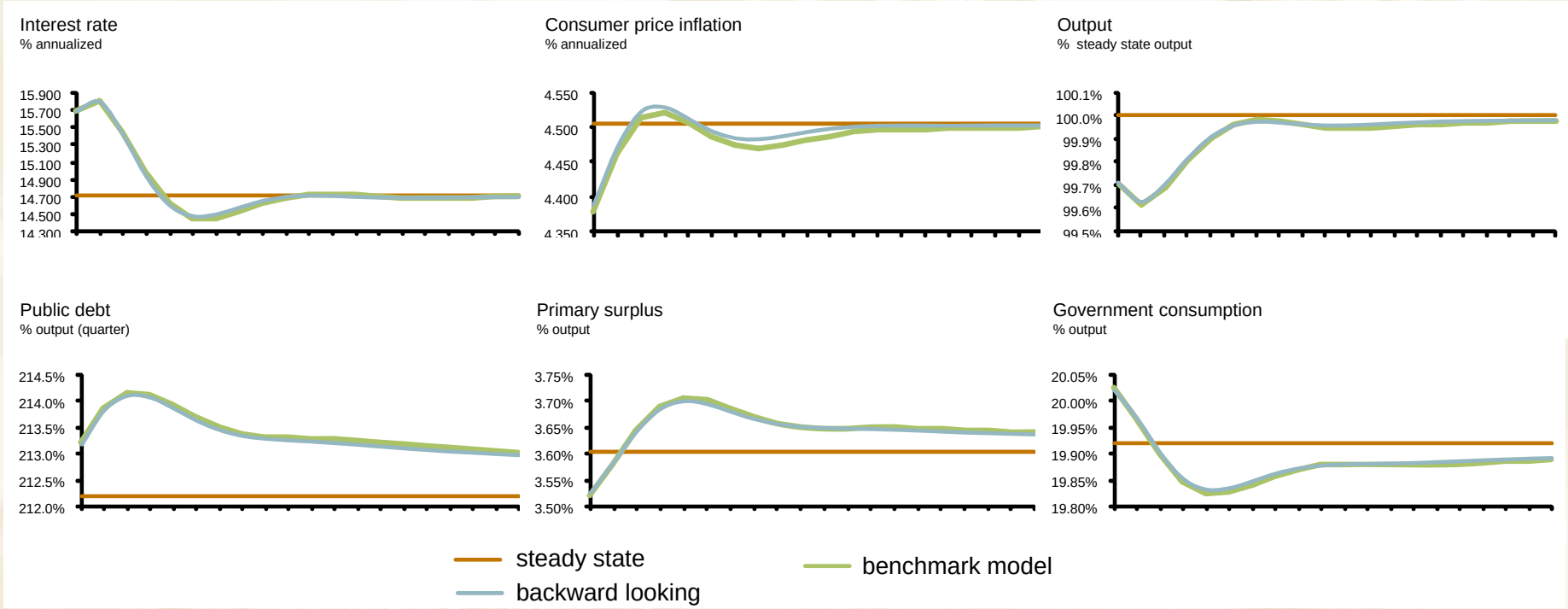
- debt returns more slowly to steady state level
- expansionist fiscal shocks mitigate contractionist effects of monetary policy shock on inflation and output



Monetary rules: response of monetary shock

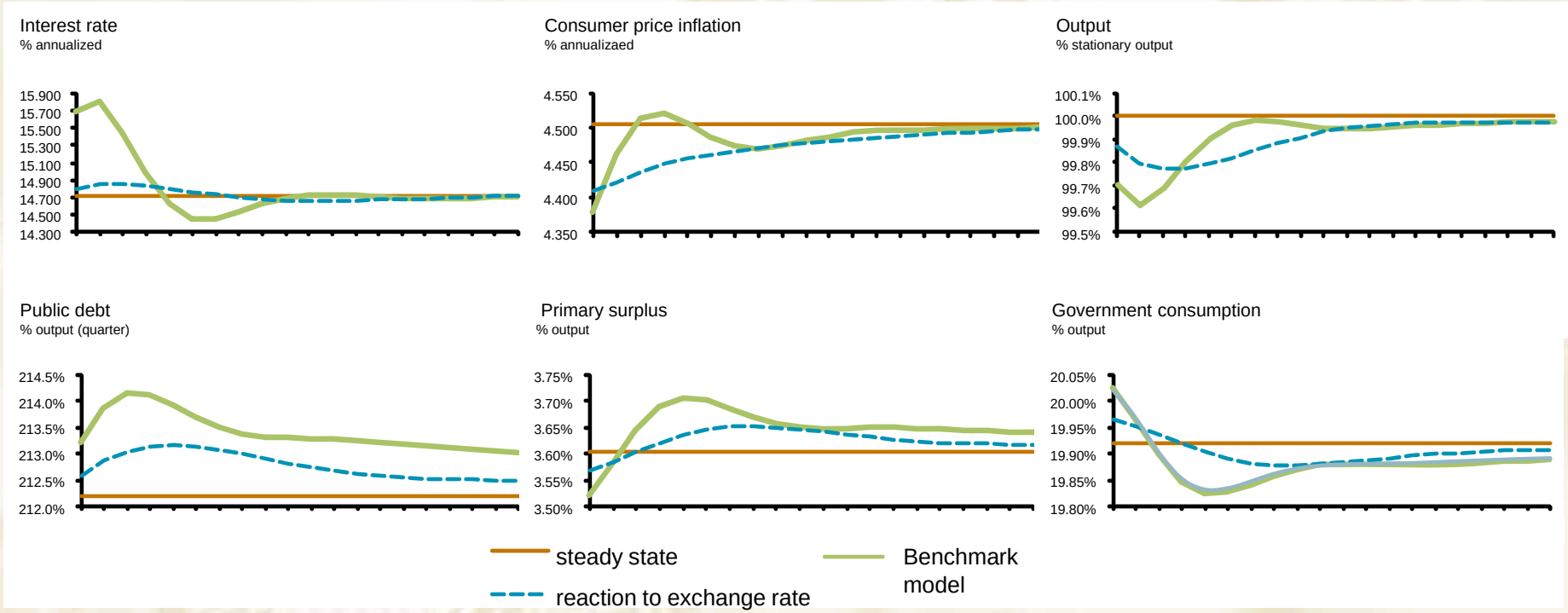
✓ Backward looking inflation:

- no significant differences



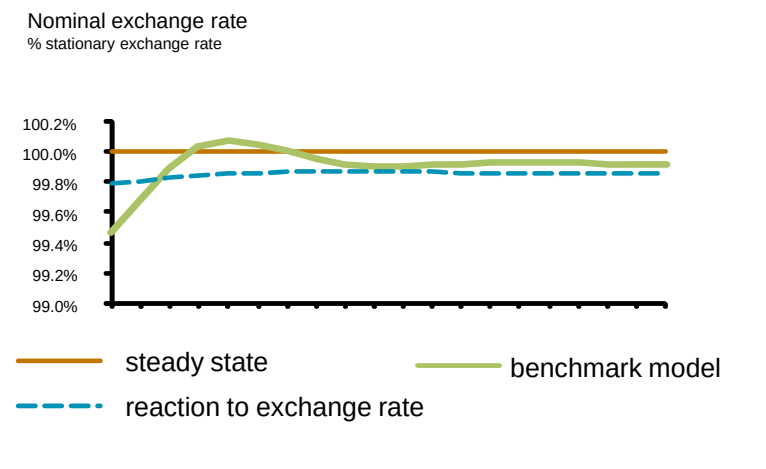
Monetary rules: response of monetary shock

- ✓ Reacting to exchange rate deviations:
  - monetary policy shock less active: interest rate deviates less from s.s.
  - inflation and output return more slowly to s.s.
  - debt, primary surplus and consumption deviate less from s.s.



Monetary rules: response of monetary shock

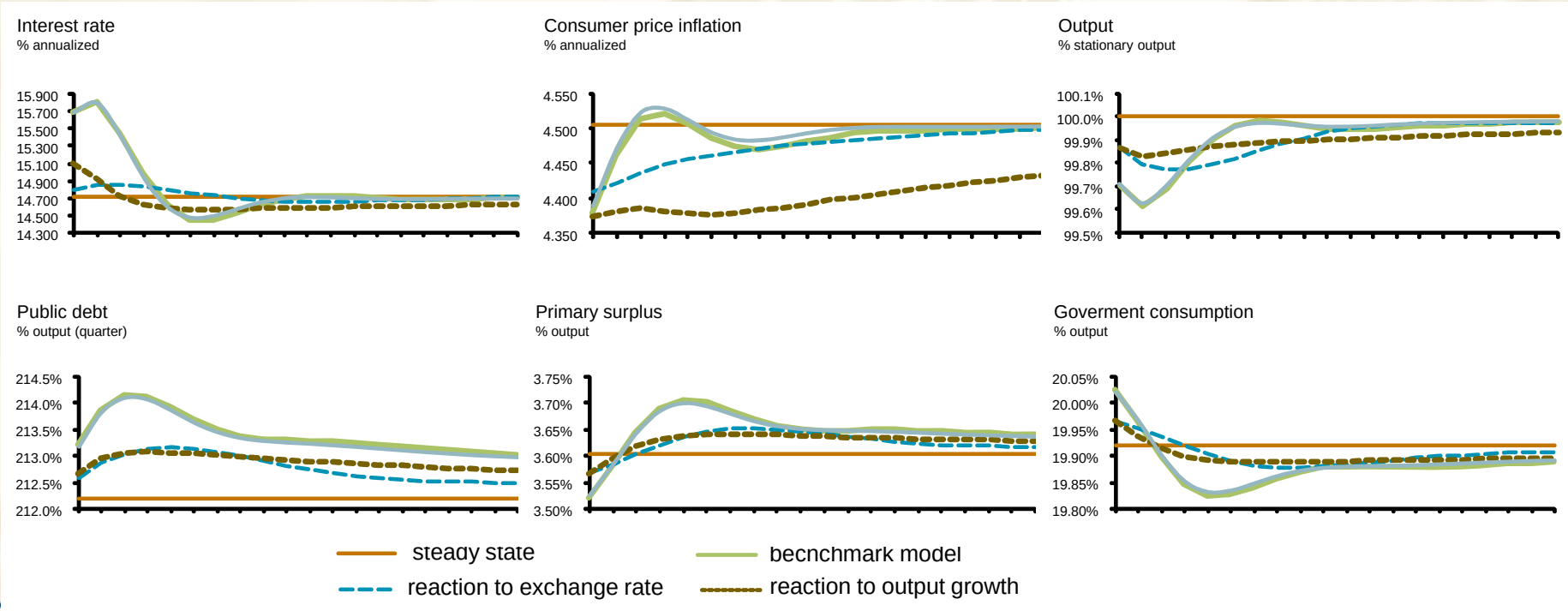
- ✓ Reacting to exchange rate deviations:
  - less volatile exchange rate, stabilizing at the same level in the long run;



Monetary rules: response of monetary shock

✓ Reacting to output growth:

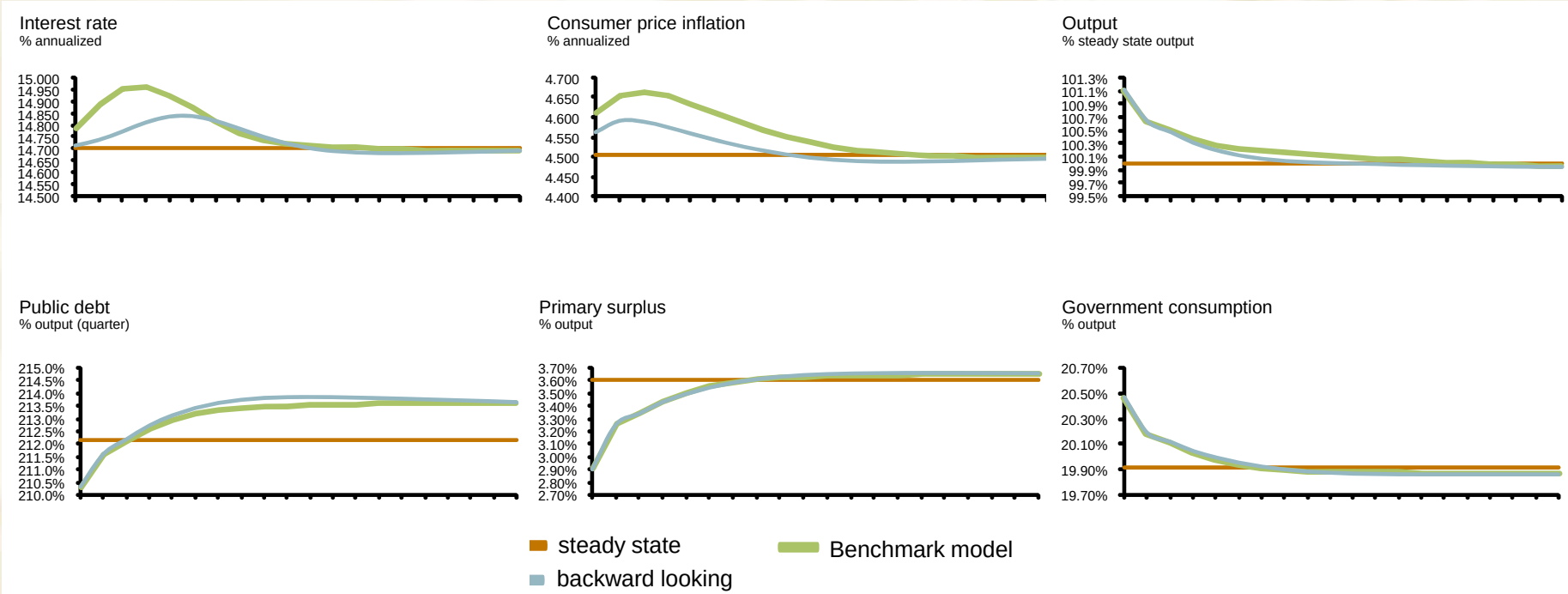
- monetary policy shock less active: interest rate drops and stays long period below steady state level for a long period
- inflation persists much longer below s.s.
- output deviates less from s.s.



Monetary rules: response of fiscal shock

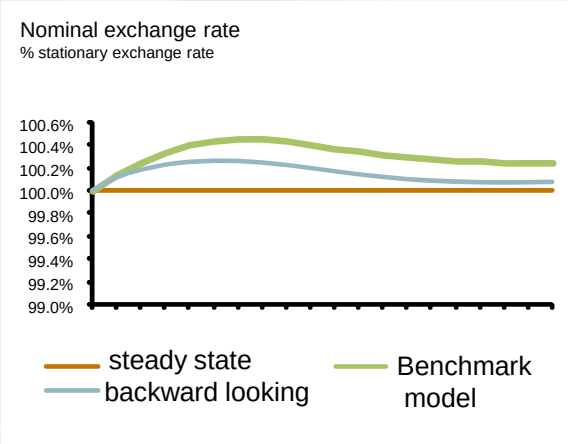
✓ Backward looking inflation:

- monetary policy reaction smaller and with a delay
- inflation deviates less from steady state
- output returns a little faster to steady state
- no significant differences in the trajectory of other variables



Monetary rules: response of fiscal shock

- ✓ Backward looking inflation:
  - exchange rate deviates less from steady state

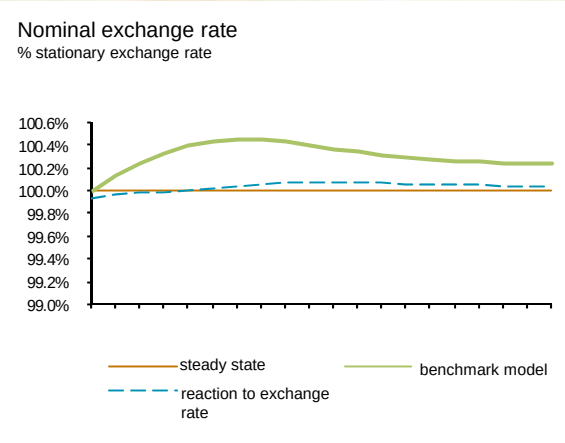


Monetary rules: response of fiscal shock

- ✓ Reacting to exchange rate deviations
  - no deviation of inflation from its steady state
  - interest rate drops a little in the short run
  - output returns faster to steady state level
  - debt increases more in the middle run (base effect of output)

Monetary rules: response of fiscal shock

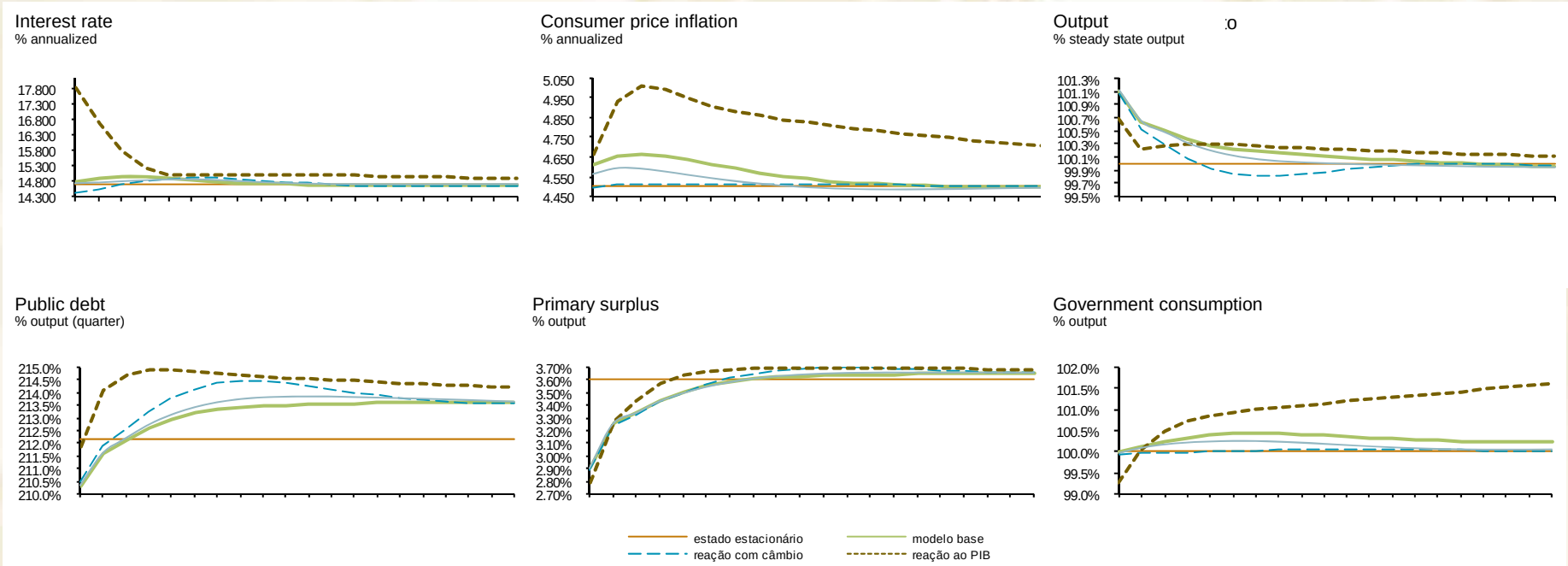
- ✓ Reacting to exchange rate deviations
  - exchange rate deviates less from steady state



Monetary rules: response of fiscal shock

✓Reacting to output growth:

- higher and more persistent inflation
- output deviates less from steady state in the short run
- public debt increases much more in the short run, but increases a little more in long run



Monetary Policy Rule

Domestic economy:

$$R_t^4 = \phi_{R1}.R_{t-1}^4 + \phi_{R2}.R_{t-2}^4 + (1-\phi_{R1}-\phi_{R2}).\left[R^4 + \phi_{\Pi}\left(\frac{P_{C,t+3}}{P_{C,t-1}} - \Pi\right)\right]$$

$$+ \phi_{g_Y}\left(g_{Y,t-1} - g_Y\right) + \varepsilon_{R,t}$$

ROW:

$$R_t^4 = \phi_R.R_{t-1}^4 + (1-\phi_R).\left[R^4 + \phi_{\Pi}\left(\frac{P_{C,t}}{P_{C,t-3}} - \Pi_t\right)\right] + \phi_{g_Y}\left(\frac{Y_t}{Y_{t-1}} - g_Y\right) + \varepsilon_{R,t}$$

Calibration: some parameters and s.s. values

$TB/P_Y Y$	0.01194	Trade balance
IM/Y	0.12241	Imports
$P_I I_G/P_Y Y$	0.01860	Government investment
sp	0.03600	Primary surplus
Π	1.04500	Inflation target
w_I/w_J	2.86000	Wages ratio
ω	0.59260	Size of the Group J of households

Calibration: taxes

τ^C	0.16200	Consumption tax rate
τ^D	0.15000	Dividend income tax rate
τ^K	0.15000	Capital income tax rate
τ^N	0.15000	Wage income tax rate
τ^{W_h}	0.11000	Pay-roll tax rate levied on wage income (social security)
τ^{W_f}	0.20000	Pay-roll tax rate levied on wage payment (social security)

Risk adjusted uncovered interest parity

From de FOC's of the consumer (type I) maximization problem:

$$\beta R_t E_t\left[\frac{\Lambda_{i,t+1}}{\Lambda_{i,t}}\frac{P_{C,t}}{P_{C,t+1}}\right]=1$$

$$\beta\left(1-\Gamma_{B^F}(B^F_{I,t})\right)(prêmio)R_{F.t}E_t\left[\frac{\Lambda_{i,t+1}}{\Lambda_{i,t}}\frac{P_{C,t}}{P_{C,t+1}}\frac{S_{t+1}}{S_t}\right]=1$$

Then

$$R_t=\left(1-\Gamma_{B^F}(B^F_{I,t})\right)(prêmio)R_{F.t}E_t\left[\frac{S_{t+1}}{S_t}\right]$$

Fiscal Sector

Primary surplus:

$$SP_t = \tau_t^C P_{C,t} C_t + (\tau_t^N + \tau_t^{W_h} + \tau_t^{W_f}).W_t.N_t^D + \tau_t^D.D_t$$
$$+ \tau_t^K \left(R_{H,t}.u_{I,t} - (\Gamma_u(u_{I,t}) + \delta).P_{I,t}\right).K_{H,t} + u_{I,t}.R_{G,t}.K_{G,t}$$
$$- P_{I,t}.I_{G,t} - TR_t - P_{G,t}G_t$$

Capital accumulation: $K_{G,t+1} = (1-\delta).K_{G,t} + \left(1 - \Gamma_I\left(\frac{I_{G,t}}{I_{G,t-1}}\right)\right) I_{G,t}$

Transfers: $tr_t = (1-\rho_{tr}).tr + \rho_{tr}.tr_{t-1} + \varepsilon_{tr,t}$

Investment: $ig_t = (1-\rho_{ig}).ig + \rho_{ig}.ig_{t-1} + \varepsilon_{ig,t}$

Fiscal Sector (cont.)

Government budget constraint (costs of refinancing government):

$$\frac{b_t}{\pi_t . g_t} - \frac{b_{t+1}}{r_t} = sp_t + m_t - \frac{m_{t-1}}{\pi_t . g_t}$$

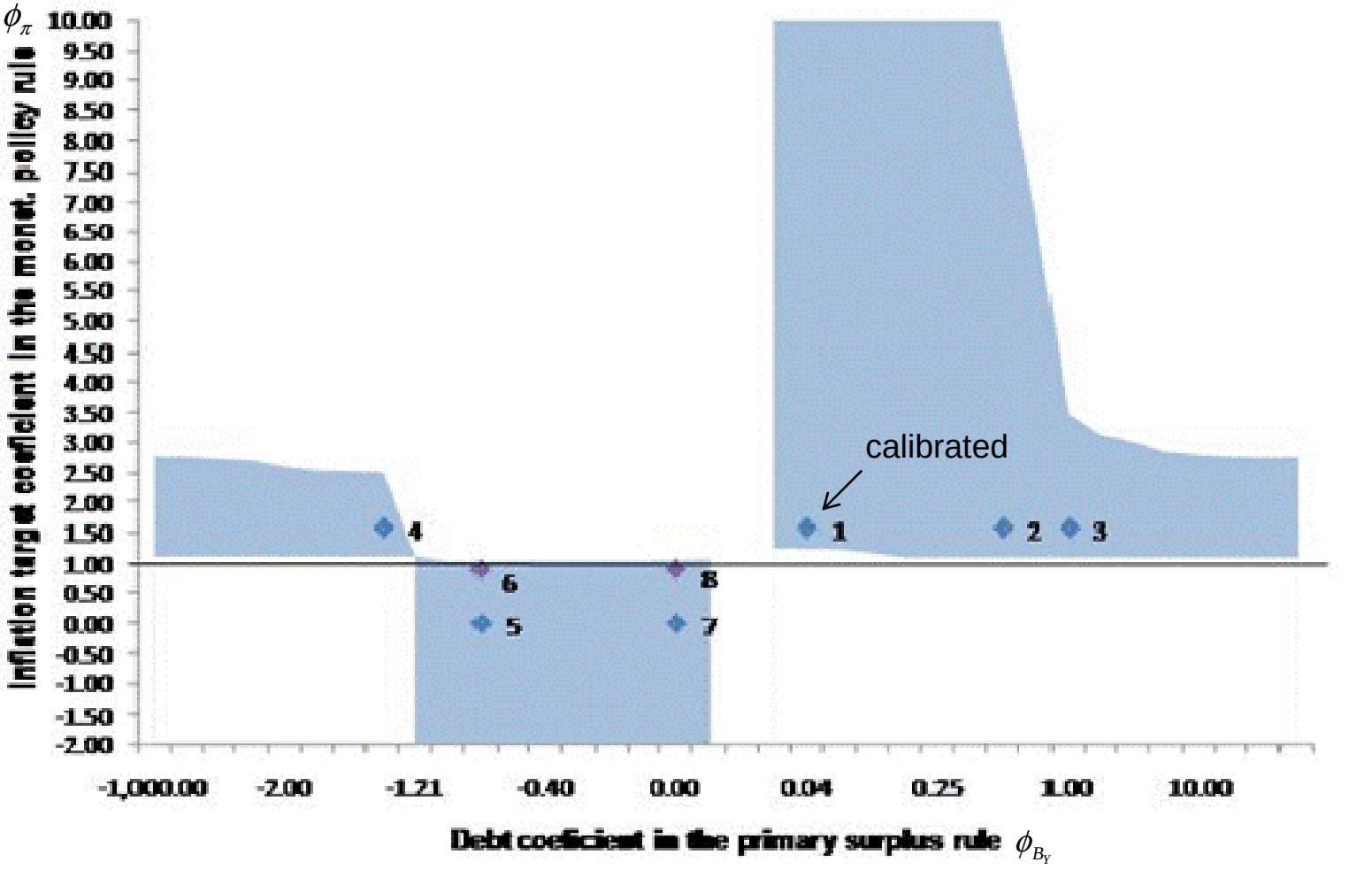
where $b_t := \frac{B_t}{P_{Y,t-1} . Y_{t-1}}$ and $m_t := \frac{M_t}{P_{Y,t} . Y_t}$

Primary surplus rule:

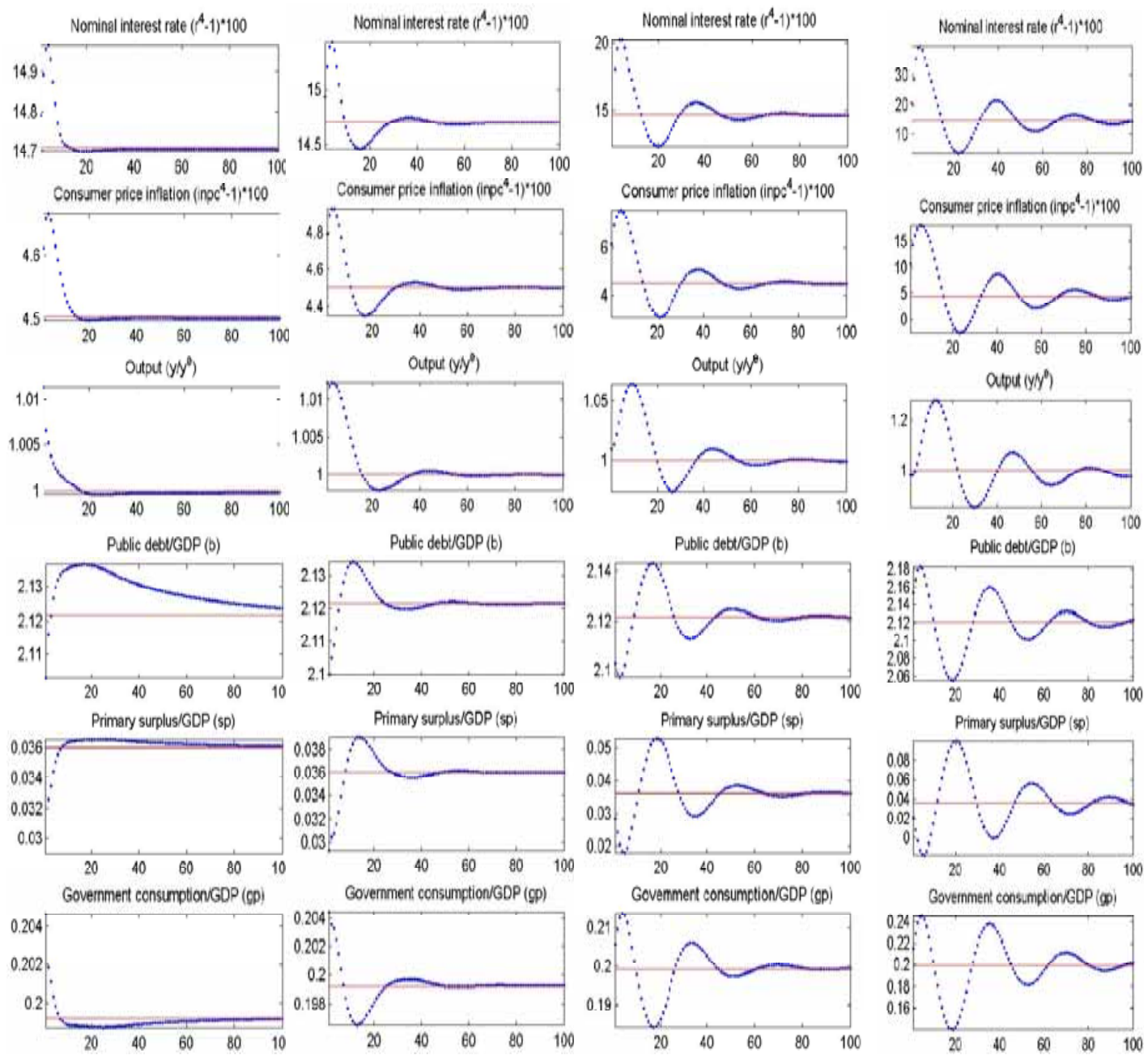
$$\begin{aligned} sp_t = {} & \rho_{1,sp} . sp_{t-1} + \rho_{2,sp} . sp_{t-2} \\ & + (1 - \rho_{1,sp} - \rho_{2,sp}) . \left\{ sp + \phi_{b_Y} . (b_t - b_Y) \right\} \\ & + \phi_{g_Y} . (g_{t-1} - g_Y) + \varepsilon_{sp,t} \end{aligned}$$

Regions of convergence (unique solution)

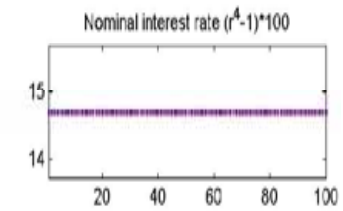
Fiscal x Monetary activeness

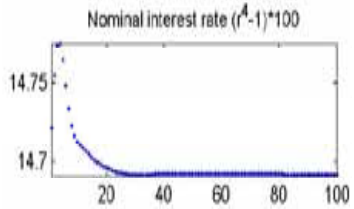


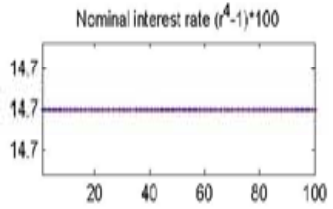
$\Phi_{by} = 0.04$ $\Phi_{\pi} = 1.57$	$\Phi_{by} = 0.30$ $\Phi_{\pi} = 1.57$	$\Phi_{by} = 1.00$ $\Phi_{\pi} = 1.57$	$\Phi_{by} = -1.25$ $\Phi_{\pi} = 1.57$

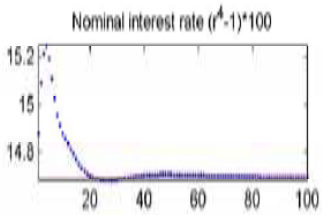


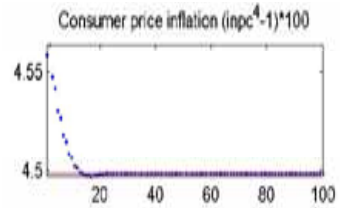
Φ_{by} = -1.00 Φ_{π} = 0.00	Φ_{by} = -1.00 Φ_{π} = 0.90	Φ_{by} = 0.00 Φ_{π} = 0.00	Φ_{by} = 0.00 Φ_{π} = 0.90

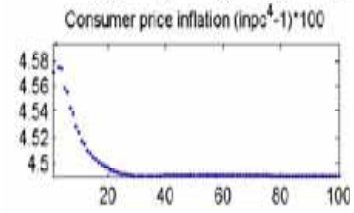


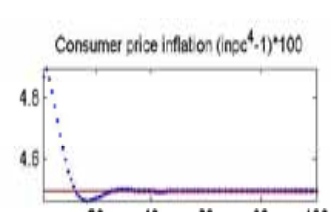


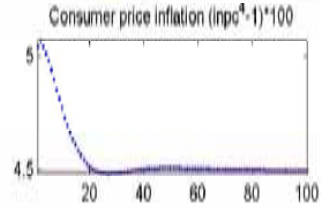


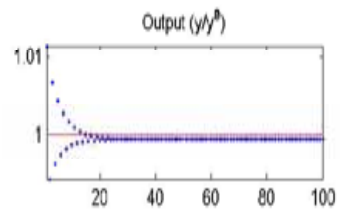


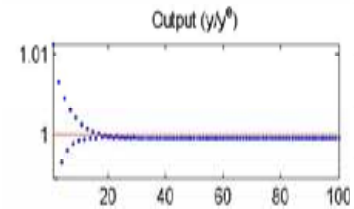


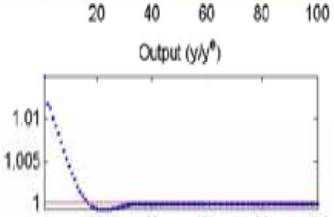


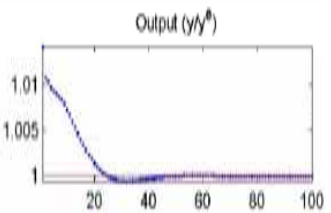


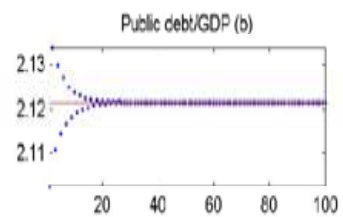


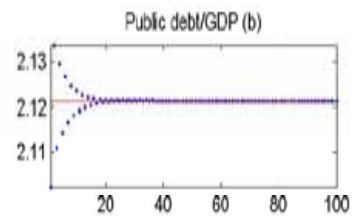


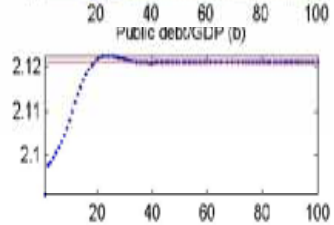


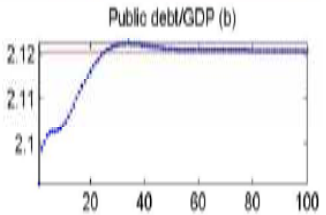


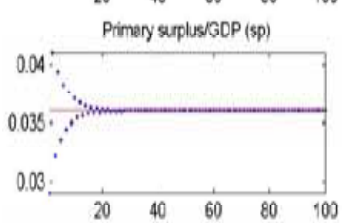


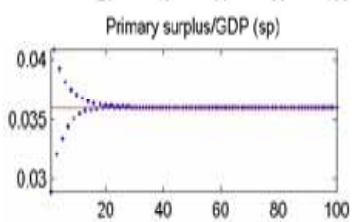


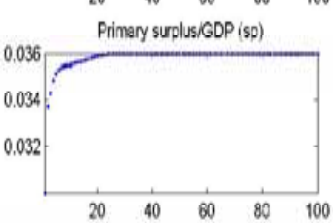


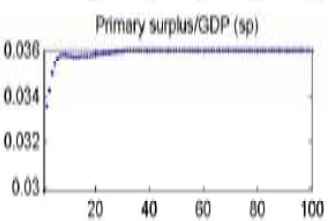


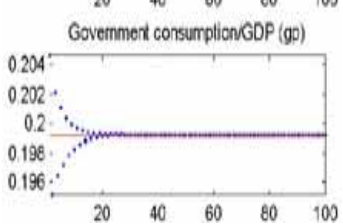


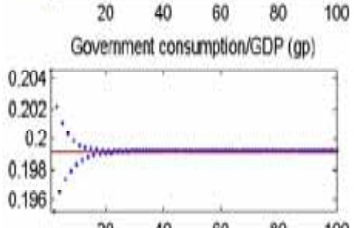


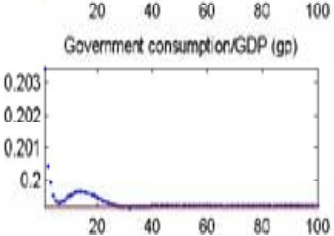


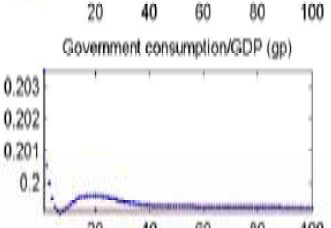












Labor Services Market

Labor services aggregation technology of the firm *f:*

$$N_{f,t}^{D} = \left((1-\nu_{\omega}\omega)^{1/\eta}\left(N_{f,t}^{I}\right)^{1-1/\eta} + (\nu_{\omega}\omega)^{1/\eta}\left(N_{f,t}^{J}\right)^{1-1/\eta}\right)^{\eta/(\eta-1)}$$

where

ω: relative size of the group *J* (= 59.26%)

ν_{ω}: bias on use of labor services of the group *J* (= 0.004381)

$\nu_{\omega}.\omega$: proportion of labor services of group J if same wage (= 0. 26%)

$$N_{f,t}^{I} := \left[\left(\frac{1}{1-\omega}\right)^{1/\eta_I}\int_{0}^{1-\omega}\left(N_{f,t}^{i}\right)^{1-1/\eta_I} di\right]^{\eta_I/(\eta_I-1)}$$

$$N_{f,t}^{J} := \left[\left(\frac{1}{\omega}\right)^{1/\eta_J}\int_{1-\omega}^{1}\left(N_{f,t}^{j}\right)^{1-1/\eta_J} dj\right]^{\eta_J/(\eta_J-1)}$$

Mixed-capital: technologies

Production function of firm *f*: $Y_{f,t} = z_t.\left(K^S_{f,t}\right)^{\alpha}.\left(zn_t.N^D_{f,t}\right)^{1-\alpha} - \psi.zn_t$

Technology of capital inputs aggregation :

$$K^S_{f,t} = \left[\left(1-\omega_g\right)^{1-\eta_g}.\left(K^S_{H,f,t}\right)^{\frac{\eta_g-1}{\eta_g}} + \left(\omega_g\right)^{1-\eta_g}.\left(K^S_{G,f,t}\right)^{\frac{\eta_g-1}{\eta_g}}\right]^{\frac{\eta_g}{\eta_g-1}}$$

ω_g : proportion of government capital if same rate of return of private capital, calibrated in order cover up depreciation (= 5.2%)

η_g : price elasticity to demand for capital (~ 1)

FOCs: $K^S_{G,t} = \omega_g.\left(\frac{R_{G,t}}{R_{K,t}}\right)^{-\eta_g}.K^S_t$ $\qquad$ $K^S_{H,t} = \left(1-\omega_g\right).\left(\frac{R_{H,t}}{R_{K,t}}\right)^{-\eta_g}.K^S_t$

where $R_{K,t} = \left((1-\omega_g).\left(R^H_{K,t}\right)^{1-\eta_g} + \omega_g.\left(R^G_{K,t}\right)^{1-\eta_g}\right)^{\frac{1}{1-\eta_g}}$

Mixed-capital: investment and capital accumulation

Government investment:

$$ig_t = (1-\rho_{ig}).ig + \rho_{ig}.ig_{t-1} + \varepsilon_{ig,t}$$

Capital accumulation equation:

$$K_{G,t+1} = (1-\delta).K_{G,t} + \left(1-\Gamma_I\left(\frac{I_{G,t}}{I_{G,t-1}}\right)\right)I_{G,t}$$

Government budget constraint:

$$\begin{aligned}
&\tau_t^C P_{C,t} C_t + (\tau_t^N + \tau_t^{W_h} + \tau_t^{W_f}).W_t.N_t^D \\
&+ \tau_t^K \left(R_{K,t}.u_{I,t} - (\Gamma_u(u_{I,t}) + \delta).P_{I,t}\right).K_t \\
&+ \tau_t^D.D_t + T_t + R_t^{-1}.B_{t+1} + M_t + u_{I,t}.R_{G,t}.K_{G,t} \\
&- P_{G,t}G_t - TR_t - B_t - M_{t-1} - P_{I,t}.I_{G,t} = 0
\end{aligned}$$

Consumer price index

Minimization of costs of production of final goods:

$$\min_{H_t^C, IM_t^C} \; P_{H,t}.H_t^C + P_{IM,t}.IM_t^C$$

s.t.

$$Q_t^C := \left\{ \begin{array}{l} (\nu_C)^{1/\mu_C} \left[H_t^C\right]^{(\mu_C-1)/\mu_C} + \\ (1-\nu_C)^{1/\mu_C} \left[\left(1-\Gamma_{IM^C}(IM_t^C/Q_t^C)\right).IM_t^C\right]^{(\mu_C-1)/\mu_C} \end{array} \right\}^{\mu_C/(\mu_C-1)}$$

Lagrange:

$$\min_{H_t^C, IM_t^C, \lambda_t^C} \; P_{H,t}.H_t^C + P_{IM,t}.IM_t^C$$

$$+\lambda_t^C \left\{ Q_t^C - \left\{ \begin{array}{l} (\nu_C)^{1/\mu_C} \left[H_t^C\right]^{1-1/\mu_C} + \\ (1-\nu_C)^{1/\mu_C} \left[\left(1-\Gamma_{IM^C}(IM_t^C/Q_t^C)\right)IM_t^C\right]^{1-1/\mu_C} \end{array} \right\}^{\mu_C/(\mu_C-1)} \right\}$$

Consumer price index (cont.)

FOCs:

$$H_t^C = \nu_C \cdot \left(\frac{P_{H,t}}{\lambda_t^C} \right)^{-\mu_C} \cdot Q_t^C$$

$$IM_t^C = (1-\nu_C) \cdot \left(\frac{P_{IM,t} / \Gamma^{\Im}{}_{IM^C}(IM_t^C / Q_t^C)}{\lambda_t^C} \right)^{-\mu_C} \cdot \frac{Q_t^C}{\left(1-\Gamma_{IM^C}(IM_t^C / Q_t^C)\right)}$$

$$\lambda_t^C = \left[\nu_C P_{H,t}{}^{1-\mu_C} + (1-\nu_C) \left(P_{IM,t} / \Gamma^{\Im}{}_{IM^C}(IM_t^C / Q_t^C) \right)^{1-\mu_C} \right]^{\frac{1}{1-\mu_C}}$$

where

$$\Gamma^{\Im}_{IM^C}\left(IM_t^C / Q_t^C\right) := 1-\Gamma_{IM^C}\left(IM_t^C / Q_t^C\right) - \Gamma'_{IM^C}\left(IM_t^C / Q_t^C\right) \cdot \left(IM_t^C / Q_t^C\right)$$

Consumer price index (cont.)

$$P_{H,t}.H_t^C + P_{IM,t}.IM_t^C =$$

$$= \left\{ \nu_C . \left(\frac{P_{H,t}}{\lambda_t^C} \right)^{1-\mu_C} + (1-\nu_C) . \left(\frac{P_{IM,t} / \Gamma^{\Im}{}_{IM^C}(IM_t^C / Q_t^C)}{\lambda_t^C} \right)^{1-\mu_C} . \left(\frac{\Gamma^{\Im}{}_{IM^C}(IM_t^C / Q_t^C)}{1-\Gamma_{IM^C}(IM_t^C / Q_t^C)} \right) \right\} . \lambda_t^C . Q_t^C$$

$$= \left\{ \nu_C . \left(P_{H,t}\right)^{1-\mu_C} + (1-\nu_C) . \left(P_{IM,t} / \Gamma^{\Im}{}_{IM^C}(IM_t^C / Q_t^C)\right)^{1-\mu_C} . \left(\frac{\Gamma^{\Im}{}_{IM^C}(IM_t^C / Q_t^C)}{1-\Gamma_{IM^C}(IM_t^C / Q_t^C)} \right) \right\} . \left(\lambda_t^C\right)^{\mu_C} . Q_t^C$$

$$= P_{C,t}.Q_t^C$$

zero profit assumption (perfect competition)

Consumer price index (cont.)

Price index

$$P_t^C = \left(\lambda_t^C\right)^{\mu_C} . \left(\Omega_t^C\right)^{1-\mu_C}$$

where

$$\lambda_t^C = \left[\nu_C . P_{H,t}^{\ 1-\mu_C} + (1-\nu_C) . \left(P_{IM,t} / \Gamma^{\Im}{}_{IM^C}\left(IM_t^C / Q_t^C\right)\right)^{1-\mu_C}\right]^{\frac{1}{1-\mu_C}}$$

$$\Omega_t^C = \left\{\nu_C \left(P_{H,t}\right)^{1-\mu_C} + (1-\nu_C) . \left(\frac{\Gamma^{\Im}{}_{IM^C}\left(IM_t^C / Q_t^C\right)}{1-\Gamma_{IM^C}\left(IM_t^C / Q_t^C\right)}\right) . \left(P_{IM,t} / \Gamma^{\Im}{}_{IM^C}\left(IM_t^C / Q_t^C\right)\right)^{1-\mu_C}\right\}^{\frac{1}{1-\mu_C}}$$

Aggregated resources equation

Using our price index

$$P_{Y,t}.Y_t = P_{C,t}.Q_t^C + P_{I,t}.Q_t^I + P_{G,t}Q_t^G + S_t.P_{X,t}.X_t - P_{IM,t}IM_t$$

Using price index in CMS

$$P_{Y,t}.Y_t = P_{C,t}.Q_t^C + P_{I,t}.Q_t^I + P_{G,t}Q_t^G + S_t.P_{X,t}.X_t$$

$$- P_{IM,t}.\left[IM_t^C . \frac{1-\Gamma_{IM^C}(IM_t^C / Q_t^C)}{\Gamma^{\Im}_{IM^C}(IM_t^C / Q_t^C)} + IM_t^I . \frac{1-\Gamma_{IM^I}(IM_t^I / Q_t^I)}{\Gamma^{\Im}_{IM^I}(IM_t^I / Q_t^I)} \right]$$

Construção Teórica do Modelo

O Modelo: construção teórica

Famílias tipo *I*: $i \in I = [0,1-\omega]$

Max $$E_t\left\{\sum_{k=0}^{\infty}\beta^k\left[\frac{1}{1-o}\left(C_{i,t+k}-\kappa.C_{I,t+k-1}\right)^{1-\sigma}-\frac{1}{1+\zeta}\left(N_{i,t+k}^{1+\zeta}\right)\right]\right\}$$

$$\{C_{i,t}, I_{i,t}, K_{i,H,t+1}, u_{i,t}, B_{i,t+1}, B_{t+1}^{F}, M_{i,t}\}$$

s.a.
$$\left(1+\tau_t^C+\Gamma_v(v_{i,t})\right)P_{C,t}C_{i,t}+P_{I,t}I_{i,H,t}+R_t^{-1}B_{i,t+1}$$
$$+\left(\left(1-\Gamma_{B^F}(B_{I,t}^F)\right).rp.R_{F,t}\right)^{-1}S_tB_{i,t+1}^F+M_{i,t}+\Xi_{i,t}+\Phi_{i,t}$$
$$=\left(1-\tau_t^N-\tau_t^{W_h}\right)W_{i,t}N_{i,t}+\left(1-\tau_t^K\right).\left[u_{i,t}R_{K,H,t}-\Gamma_u(u_{i,t})P_{I,t}\right].K_{i,H,t}+\tau_t^K.\delta.P_{I,t}.K_{i,H,t}$$
$$+\left(1-\tau_t^D\right)D_{i,t}+TR_{i,t}-T_{i,t}+B_{i,t}+S_tB_{i,t}^F+M_{i,t-1}$$

$$K_{i,H,t+1}=(1-\delta).K_{i,H,t}+\left(1-\Gamma_I\left(\frac{I_{i,H,t}}{I_{i,H,t-1}}\right)\right)I_{i,H,t}$$

O Modelo: construção teórica

CPOs:

$$\Lambda_{i,t} = \frac{\left(C_{i,t} - \kappa C_{I,t-1}\right)^{-\sigma}}{1+\tau_t^C + \Gamma_v(v_{i,t}) + \Gamma_v'(v_{i,t})v_{i,t}}$$

$$\frac{P_{I,t}}{P_{C,t}} = Q_{i,t}\left(1-\Gamma_I\left(\frac{I_{i,H,t}}{I_{i,H,t-1}}\right)-\Gamma_I'\left(\frac{I_{i,H,t}}{I_{i,H,t-1}}\right)\frac{I_{i,H,t}}{I_{i,H,t-1}}\right)+\beta E_t\left[\frac{\Lambda_{i,t+1}}{\Lambda_{i,t}}Q_{i,t}\Gamma_I'\left(\frac{I_{i,H,t+1}}{I_{i,H,t}}\right)\frac{I_{i,H,t+1}^2}{I_{i,H,t}^2}\right]$$

$$Q_{i,t} = \beta E_t\left[\frac{\Lambda_{i,t+1}}{\Lambda_{i,t}}\left((1-\delta)Q_{i,t+1}+(1-\tau_{t+1}^K)\frac{R_{K,H,t+1}}{P_{C,t+1}}u_{i,t+1}+\tau_{t+1}^K\delta\frac{P_{I,t+1}}{P_{C,t+1}}\right)\right]$$

$$(1-\tau_t^K).\frac{R_{K,H,t}}{P_{C,t}}+\Gamma_u'(u_{i,t}).\left(\tau_t^K.\frac{P_{I,t}}{P_{C,t}}-.Q_{i,t}\right)=0$$

O Modelo: construção teórica

CPOs:

$$\beta R_t E_t\left[\frac{\Lambda_{i,t+1}}{\Lambda_{i,t}}\frac{P_{C,t}}{P_{C,t+1}}\right]=1$$

$$\beta\left(1-\Gamma_{B^F}(B^F_{I,t})\right)R_{F.t}E_t\left[\frac{\Lambda_{i,t+1}}{\Lambda_{i,t}}\frac{P_{C,t}}{P_{C,t+1}}\frac{S_{t+1}}{S_t}\right]=1$$

$$\beta E_t\left[\frac{\Lambda_{i,t+1}}{\Lambda_{i,t}}\frac{P_{C,t}}{P_{C,t+1}}\right]=1-\Gamma_v'(v_{i,t})\frac{v_{i,t}^2}{(1+\tau_t^C)}$$

O Modelo: construção teórica

Prob $(1-\xi_I)$ de escolher otimamente $\tilde{W}_{i,t}$

Prob ξ_I de reajuste automático $\overline{W}_{i,t} := \left(\frac{P_{C,t-1}}{P_{C,t-2}}\right)^{\chi_I} \pi_C^{1-\chi_I} W_{i,t-1}$

Representação recursiva da CPO:

$$(1-\omega)^{\zeta} \cdot \left(\frac{\tilde{W}_{I,t}}{P_{C,t}}\right)^{1+\eta_I \cdot \zeta} = \frac{\eta_I}{\eta_I - 1} \cdot \frac{F_{I,t}}{G_{I,t}}$$

$$F_{I,t} := \left(\left(\frac{W_{I,t}}{P_{C,t}}\right)^{\eta_I} N_t^I\right)^{1+\zeta} + \xi_I . \beta . E_t \left\{\left(\frac{\pi_{C,t+1}}{\pi_{C,t}^{\chi_I} . \pi_C^{1-\chi_I}}\right)^{\eta_I (1+\zeta)} . F_{I,t+1}\right\}$$

$$G_{I,t} := \Lambda_{I,t}\left(1-\tau_t^N-\tau_t^{W_h}\right)\left(\frac{W_{I,t}}{P_{C,t}}\right)^{\eta_I} N_{I,t} + \xi_I . \beta . E_t \left\{\left(\frac{\pi_{C,t+1}}{\pi_{C,t}^{\chi_I} . \pi_C^{1-\chi_I}}\right)^{\eta_I - 1} . G_{I,t+1}\right\}$$

O Modelo: construção teórica

Famílias tipo *J*: $j \in J = [1-\omega, 1]$

$$\underset{\{C_{j,t}, M_{j,t}\}}{\text{Max}} \; E_t \left\{ \sum_{k=0}^{\infty} \beta^k \left[\frac{1}{1-\sigma} \left(C_{j,t+k} - \kappa . C_{J,t+k-1} \right)^{1-\sigma} - \frac{1}{1+\zeta} \left(N_{j,t+k}^{1+\zeta} \right) \right] \right\}$$

$$\text{s.a.} \left(1 + \tau_t^C + \Gamma_v \left(v_{j,t}\right)\right) P_{C,t} C_{j,t} + M_{j,t}$$
$$= \left(1 - \tau_t^N - \tau_t^{W_h}\right) W_{j.t} N_{j,t} + TR_{j,t} - T_{j,t} + M_{j,t-1} + \Phi_{j,t}$$

Fixação de salário análoga ao grupo *I*, mas com prob $1-\xi_J$ de otimizar

O Modelo: construção teórica

Firmas de bens intermediários:

Função Prod. $$Y_{f,t} = z_t.\left(u_{I,t}.K_{f,t}\right)^{\alpha}.\left(zn_t.N_{f,t}^{D}\right)^{1-\alpha} - \psi.zn_t$$

$$\ln(z_t) = (1-\rho_z).\ln(z) + \rho_z.\ln(z_{t-1}) + \varepsilon_{z,t}$$

$$\frac{zn_t}{zn_{t-1}} = (1-\rho_{zn}).gy + \rho_{zn}.\frac{zn_{t-1}}{zn_{t-2}} + \varepsilon_{zn,t}$$

Min custo dos fatores:

$$MC_{f,t} = \frac{R_{K,t}K_{f,t} + (1+\tau_t^{W_f})W_t N_{f,t}}{Y_{f,t} + \psi}$$

ou:

$$MC_t = \frac{1}{z_t \alpha^{\alpha}(1-\alpha)^{1-\alpha}}\left(R_{K,t}\right)^{\alpha}\left((1+\tau_t^{W_f})W_t\right)^{1-\alpha}$$

O Modelo: construção teórica

$$Y_{f,t} = z_t.\left(u_{I,t}.K^S_{f,t}\right)^{\alpha}.\left(zn_t.N^D_{f,t}\right)^{1-\alpha} - \psi.zn_t$$

Agregador de capital:

$$K^S_{f,t} = \left[\left(1-\omega_g\right)^{1-\eta_g}.\left(K^H_{f,t}\right)^{\frac{\eta_g-1}{\eta_g}} + \left(\omega_g\right)^{1-\eta_g}.\left(K^G_{f,t}\right)^{\frac{\eta_g-1}{\eta_g}}\right]^{\frac{\eta_g}{\eta_g-1}}$$

ω_g : Grau de dependência da economia ao capital público. Calibragem Brasil (hipótese de rkg = dt*pi) $\Rightarrow$0.052

CPOs:

$$R_{K,t} = \left((1-\omega_g).\left(R^H_{K,t}\right)^{1-\eta_g} + \omega_g.\left(R^G_{K,t}\right)^{1-\eta_g}\right)^{\frac{1}{1-\eta_g}}$$

$$K_{G,t} = \omega_g\left(\frac{R_{G,t}}{R_{K,t}}\right)^{-\eta_g} K^S_t \qquad K_{H,t} = \left(1-\omega_g\right)\left(\frac{R_{H,t}}{R_{K,t}}\right)^{-\eta_g} K^S_t$$

O Modelo: construção teórica

Escolha de preços de bens intermediários: $P_{H,f,t}$ e $P_{X,f,t}$

Prob. de não otimizar: ξ_H e ξ_X

Regras de atualização:

$$\overline{P}_{H,f,t} := \left(\frac{P_{H,t-1}}{P_{H,t-2}}\right)^{\chi_H} (\pi_H)^{1-\chi_H} P_{H,f,t-1}$$

$$\overline{P}_{X,f,t} := \left(\frac{P_{X,t-1}}{P_{X,t-2}}\right)^{\chi_X} (\pi_X)^{1-\chi_X} P_{X,f,t-1}$$

CPO recursiva de *H*:

$$\frac{\tilde{P}_{H,t}}{P_{H,t}} = \frac{\theta}{\theta-1}\frac{F_{H,t}}{G_{H,t}}$$

$$F_{H,t} := MC_t H_t + \xi_H \beta E_t \left\{ \frac{\Lambda^*_{I,t+1}}{\Lambda^*_{I,t}} \left(\frac{\pi_{H,t+1}}{\pi_{H,t}^{\chi_H} \pi_H^{1-\chi_H}} \right)^{\theta} F_{H,t+1} \right\}$$

$$G_{H,t} := P_{H,t} H_t + \xi_H \beta E_t \left\{ \frac{\Lambda^*_{I,t+1}}{\Lambda^*_{I,t}} \left(\frac{\pi_{H,t+1}}{\pi_{H,t}^{\chi_H} \pi_H^{1-\chi_H}} \right)^{\theta-1} G_{H,t+1} \right\}$$

O Modelo: construção teórica

Minimização de custos pelas firmas produtoras de bens de consumo finais (como em CMS):

$$\min_{H_t^C, IM_t^C} \; P_{H,t}.H_t^C + P_{IM,t}.IM_t^C$$

s.a.

$$Q_t^C := \left\{ \begin{array}{l} (\nu_C)^{1/\mu_C} \left[H_t^C\right]^{(\mu_C-1)/\mu_C} + \\ (1-\nu_C)^{1/\mu_C} \left[\left(1-\Gamma_{IM^C}(IM_t^C/Q_t^C)\right).IM_t^C\right]^{(\mu_C-1)/\mu_C} \end{array} \right\}^{\mu_C/(\mu_C-1)}$$

Lagrangeano:

$$\min_{H_t^C, IM_t^C, \lambda_t^C} \; P_{H,t}.H_t^C + P_{IM,t}.IM_t^C$$

$$+\lambda_t^C \left\{ Q_t^C - \left\{ \begin{array}{l} (\nu_C)^{1/\mu_C} \left[H_t^C\right]^{1-1/\mu_C} + \\ (1-\nu_C)^{1/\mu_C} \left[\left(1-\Gamma_{IM^C}(IM_t^C/Q_t^C)\right)IM_t^C\right]^{1-1/\mu_C} \end{array} \right\}^{\mu_C/(\mu_C-1)} \right\}$$

O Modelo: construção teórica

CPOs:

$$H_t^C = \nu_C \cdot \left(\frac{P_{H,t}}{\lambda_t^C} \right)^{-\mu_C} \cdot Q_t^C$$

$$IM_t^C = (1-\nu_C) \cdot \left(\frac{P_{IM,t} / \Gamma^{\Im}{}_{IM^C}(IM_t^C / Q_t^C)}{\lambda_t^C} \right)^{-\mu_C} \cdot \frac{Q_t^C}{\left(1-\Gamma_{IM^C}(IM_t^C / Q_t^C)\right)}$$

$$\lambda_t^C = \left[\nu_C P_{H,t}{}^{1-\mu_C} + (1-\nu_C) \left(P_{IM,t} / \Gamma^{\Im}{}_{IM^C}(IM_t^C / Q_t^C) \right)^{1-\mu_C} \right]^{\frac{1}{1-\mu_C}}$$

em que

$$\Gamma^{\Im}_{IM^C}\left(IM_t^C / Q_t^C\right) := 1-\Gamma_{IM^C}\left(IM_t^C / Q_t^C\right) - \Gamma'_{IM^C}\left(IM_t^C / Q_t^C\right).\left(IM_t^C / Q_t^C\right)$$

O Modelo: construção teórica

$$P_{H,t}.H_t^C + P_{IM,t}.IM_t^C =$$

$$= \left\{ \nu_C . \left(\frac{P_{H,t}}{\lambda_t^C} \right)^{1-\mu_C} + (1-\nu_C) . \left(\frac{P_{IM,t} / \Gamma^{\Im}{}_{IM^C}(IM_t^C / Q_t^C)}{\lambda_t^C} \right)^{1-\mu_C} . \left(\frac{\Gamma^{\Im}{}_{IM^C}(IM_t^C / Q_t^C)}{1-\Gamma_{IM^C}(IM_t^C / Q_t^C)} \right) \right\} . \lambda_t^C . Q_t^C$$

$$= \left\{ \nu_C . \left(P_{H,t}\right)^{1-\mu_C} + (1-\nu_C) . \left(P_{IM,t} / \Gamma^{\Im}{}_{IM^C}(IM_t^C / Q_t^C)\right)^{1-\mu_C} . \left(\frac{\Gamma^{\Im}{}_{IM^C}(IM_t^C / Q_t^C)}{1-\Gamma_{IM^C}(IM_t^C / Q_t^C)} \right) \right\} . \left(\lambda_t^C\right)^{\mu_C} . Q_t^C$$

$$= P_{C,t}.Q_t^C$$

Hipótese de lucro zero

O Modelo: construção teórica

Então:

$$P_t^C = \left(\lambda_t^C\right)^{\mu_C} . \left(\Omega_t^C\right)^{1-\mu_C}$$

em que

$$\lambda_t^C = \left[\nu_C . P_{H,t}^{\ 1-\mu_C} + (1-\nu_C) . \left(P_{IM,t} / \Gamma^{\Im}{}_{IM^C}\left(IM_t^C / Q_t^C\right)\right)^{1-\mu_C}\right]^{\frac{1}{1-\mu_C}}$$

$$\Omega_t^C = \left\{\nu_C \left(P_{H,t}\right)^{1-\mu_C} + (1-\nu_C) . \left(\frac{\Gamma^{\Im}{}_{IM^C}\left(IM_t^C / Q_t^C\right)}{1-\Gamma_{IM^C}\left(IM_t^C / Q_t^C\right)}\right) . \left(P_{IM,t} / \Gamma^{\Im}{}_{IM^C}\left(IM_t^C / Q_t^C\right)\right)^{1-\mu_C}\right\}^{\frac{1}{1-\mu_C}}$$

O Modelo: construção teórica

Firmas de bens de consumo do governo:

$$Q_t^G = H_t^G := \left(\int_0^1 (H_{f,t}^G)^{1-1/\theta} df \right)^{\theta/(\theta-1)}$$

CPO

$$H_t^G = Q_t^G$$

$$\Rightarrow P_{G,t} = P_{H,t}$$

$$\Rightarrow H_{f,t}^G = \left(\frac{P_{H,f,t}}{P_{H,t}} \right)^{-\theta} H_t^G$$

O Modelo: construção teórica

Agregação:

$$H_t := H_t^C + H_t^I + H_t^G$$

$$IM_t := IM_t^C + IM_t^I$$

$$(1-s)X^*_{f^*,t} = sIM_{f^*,t}$$

$$P_{IM,f^*,t} = P^*_{X,f^*,t} \qquad \Rightarrow P_{IM,t} = \left[\int_0^1 (P_{IM,f^*,t})^{1-\theta^*} df^*\right]^{\frac{1}{1-\theta^*}} = \left[\int_0^1 (P^*_{X,f^*,t})^{1-\theta^*} df^*\right]^{\frac{1}{1-\theta^*}} := P^*_{X,t}$$

$$sX_{f,t} = (1-s)IM^*_{f,t}$$

$$P^*_{IM,f,t} = P_{X,f,t}$$

$$P_{X,t} := \left[\int_0^1 (P_{X,f,t})^{1-\theta} df\right]^{\frac{1}{1-\theta}} = \left[\int_0^1 (P^*_{IM,f,t})^{1-\theta} df\right]^{\frac{1}{1-\theta}} = P^*_{IM,t}$$

Calibration: domestic economy

- Small open economy
- Mean during inflation target regime period:
  - domestic and external debt
  - interest and exchange rates
  - inflation target
  - national accounts
  - wage income distribution
  - primary surplus
  - risk spread

Calibration: domestic economy

- From other papers
  - preferences (for some values the same of NAWM)
  - tax rates

Simulations (cont.):

3) Monetary and Fiscal shocks:

- responses of combined impulses

- moments and variance decomposition of inflation and output growth
  - fiscal commitment to debt (Φ_b)
  - rigor in fiscal implementation (variance of fiscal shock)
  - correlation of shocks
  - monetary commitment to inflation (Φ_m)

Simulations (cont.):

4) Alternative components for monetary rule: backward looking inflation, exchange rate and output growth

- impulse responses of monetary shock and fiscal shock

- moments and variance decomposition of inflation, output growth and exchange rate

Fiscal commitment with debt stabilization

Increase the reaction to debt deviation from steady state (Φ_b):

- higher volatility of inflation
- non-linear impact on volatility output
- higher correlation between inflation and output

Standard deviation (SD) and Correlations (CR) of shocks				
SD monetary shocks = 1.00 p.p.		SD fiscal shocks = 1.00 p.p.		CR = 0.00
Fiscal commitment with public debt stabilization				
Coeficient of the fiscal rule	0.04	**0.18**	**0.31**	0.50
SD and CR of endogenous variables (p.p.)				
DP inflation	0.10	0.20	0.44	1.04
DP output growth	1.30	**1.28**	1.37	1.93
CR inflation and output growth	4.78	9.68	29.41	58.85

Fiscal commitment with debt stabilization

$\phi_b = 0.18$:

- minimize output volatility
- minimize explanation of output variance by monetary shock

$\phi_b = 0.31$:

- minimize explanation of inflation variance by fiscal shock

Standard deviations (SD) and Correlations (CR) of shocks								
DP monetary shock = 1.00 p.p. DP fiscal shock = 1.00 p.p. CR = 0.00								
Fiscal commitment with public debt stabilization								
Coeficient of fiscal rule	0.04		**0.18**		**0.31**		0.50	
Momentos das variáveis (p.p.)								
DP output growth	1.30		**1.28**		1.37		1.93	
Variance decomposition (%)								
	CM	CF	CM	CF	CM	CF	CM	CF
Inflation	15.63	84.37	47.98	52.02	58.48	**41.52**	45.16	54.84
Outputgrowth	7.86	92.14	**5.22**	94.78	10.85	89.15	25.53	74.47

Choques fiscais e monetários: inflação e produto

- ✓ maior rigor na execução das regras fiscais:
  - mantém conclusão de que variância da inflação aumenta com o compromisso com a dívida
  - relativamente ao *benchmark*:
    - menores variâncias de inflação e produto;
    - maior correlação entre inflação e produto;

Momentos dos choques (p.p.)				
DP do choque monetário = 1,00		DP do choque fiscal = **0,47**		CR entre os choques = 0,00
Compromisso fiscal com a dívida pública				
Coeficiente da regra fiscal	0,04	**0,18**	**0,31**	0,50
Momentos das variáveis (p.p.)				
DP da inflação	0,06	0,16	0,36	0,79
DP do crescimento do PIB	0,69	**0,66**	0,76	1,25
CR entre as variáveis	24,41	14,81	39,12	65,23

Choques fiscais e monetários: inflação e produto

- ✓ maior rigor na execução das regras fiscais (cont.):
  - relativamente ao benchmark:
    - diminui a explicação da variância da inflação pelo choque fiscal (uniformemente em ϕ_b);
    - aumenta a explicação da variância do produto pelo choque monetário (menor aumento quando $\phi_b = 0.18$);

Momentos dos choques (p.p.)								
DP do choque monetário = 1,00								
DP do choque fiscal = **0,47**								
CR entre os choques = 0,00								
Compromisso fiscal com a dívida pública								
Coeficiente da regra fiscal	0,04		**0,18**		**0,31**		0,50	
Decomposição das variâncias (%)								
	CM	CF	CM	CF	CM	CF	CM	CF
Inflação	45,12	54,88	80,36	19,64	86,21	**13,79**	78,51	21,49
Crescimento do PIB	27,45	72,55	**19,64**	80,36	35,06	64,94	60,34	39,66

Choques fiscais e monetários: inflação e produto

✓Menor (mais negativa) correlação dos choque fiscais e monetários:

- reduz a variância da inflação e do produto;
- diminui correlação entre inflação e produto;

Momentos dos choques (p.p.)					
DP do choque monetário = 1,00					
DP entre os choque fiscal = **0,47**					
Correlação entre os choques	0,80	0,50	0,00	**-0,50**	**-0,80**
Compromisso fiscal com a dívida pública					
Coeficiente da regra fiscal = **0,18**					
Momentos das variáveis (p.p.)					
DP da inflação	0,19	0,18	0,16	0,13	**0,11**
DP do crecimento do PIB	0,80	0,75	0,66	0,55	**0,47**
CR entre as variáveis	18,44	17,40	14,81	9,95	**4,25**

Choques fiscais e monetários: inflação e produto

✓menor (mais negativa) correlação dos choque fiscais e monetários:

- mínima explicação da variância do produto pelo choque monetário (quando ocorre 1º), com correlação de choques em -50%;
- mínima explicação da variância da inflação pelo choque fiscal (quando ocorre 1º), com correlação de choques em -50%;

Momentos dos choques (p.p.)					
DP do choque monetário = 1,00					
DP entre os choque fiscal = **0,47**					
Correlação entre os choques	0,80	0,50	0,00	**-0,50**	**-0,80**
Compromisso fiscal com a dívida pública					
Coeficiente da regra fiscal = **0,18**					

Decomposição das variâncias (%) - quando o 1º choque é o monetário										
	CM	CF	CM	CF	CM	CF	CM	CF	CM	CF
Inflação	95,27	4,73	88,74	11,26	80,36	19,64	78,70	21,30	86,04	13,96
Crescimento do PIB	80,49	19,51	53,70	46,30	19,64	80,36	**13,68**	86,32	44,07	55,93

Decomposição das variâncias (%) - quando o 1º choque é o fiscal										
	CF	CM	CF	CM	CF	CM	CF	CM	CF	CM
Inflação	80,63	19,37	53,94	46,06	19,64	80,74	**12,83**	87,17	42,86	57,14
Crescimento do PIB	95,23	4,77	88,68	11,32	80,36	19,64	78,90	21,10	86,33	13,67

Choques fiscais e monetários: inflação e produto

- ✓ maior compromisso da regra monetária com a meta de inflação:
  - diminui a variância da inflação e do produto;
  - diminui a correlação da inflação e do produto;
  - aumenta a explicação da variância da inflação pelo choque fiscal;

Momentos dos choques (p.p.) e CR entre os choques				
DP do choque monetário = 1,00	DP do choque fiscal = **0,47**		CR entre os choques = 0,00	
Compromisso fiscal com dívida pública				
Coeficiente da regra fiscal = **0,18**				
Compromisso monetário com a meta de inflação				
Coeficientre da regra monetária	1,20	1,57	**2,44**	5,2
Momentos das variáveis (p.p.)				
DP da inflação	0,82	0,16	0,07	0,04
DP do crecimento do PIB	0,73	0,66	0,63	0,61
CR entre as variáveis	25,52	14,81	8,40	0,00

Decomposição das variâncias (%)								
	CM	CF	CM	CF	CM	CF	CM	CF
Inflação	93,01	6,99	80,36	19,64	64,72	35,28	60,37	39,63
Crescimento do PIB	29,57	70,43	19,64	80,36	**18,13**	81,87	22,08	77,92

Choques fiscais e monetários: inflação e produto

- ✓ maior compromisso da regra monetária com a meta de inflação:
  - existe um nível de compromisso com a inflação (ϕ_m = 2.44) que minimiza a influência do choque monetário na explicação da variância do produto.

Momentos dos choques (p.p.) e CR entre os choques								
DP do choque monetário = 1,00		DP do choque fiscal = **0,47**				CR entre os choques = 0,00		
Compromisso fiscal com dívida pública								
Coeficiente da regra fiscal = **0,18**								
Compromisso monetário com a meta de inflação								
Coeficientre da regra monetária	1,20		1,57		**2,44**		5,2	
Decomposição das variâncias (%)								
	CM	CF	CM	CF	CM	CF	CM	CF
Inflação	93,01	6,99	80,36	19,64	64,72	35,28	60,37	39,63
Crescimento do PIB	29,57	70,43	19,64	80,36	**18,13**	81,87	22,08	77,92

Choques fiscais e monetários: inflação e produto

✓existe combinação de coeficientes das regras fiscal e monetária que minimiza a variância do produto mantendo a mesma variância da inflação;

Momentos dos choques (p.p.)				
DP do choque monetário = 1,00				
DP do choque fiscal = 1,00				
CR entre os choques = 0,00				
Compromisso fiscal com dívida pública				
Coeficiente da regra fiscal	0,04		**0,27**	
Compromisso monetário com a meta de inflação				
Coeficiente da regra monetária	1,57		**4,50**	
Momentos das variáveis (p.p.)				
DP da inflação	**0,10**		**0,10**	
DP do crecimento do PIB	1,30		**1,17**	
CR entre as variáveis	4,78		-15,58	
Decomposição das variâncias (%)				
	CM	CF	CM	CF
Inflação	15,63	84,37	25,31	**74,69**
Crescimento do PIB	7,86	92,14	**3,88**	96,12

Regras monetárias: inflação, produto e câmbio

- reação à variação do câmbio:
  - menor variância do câmbio;
  - menor variância da inflação, com mínima explicação pelo choque fiscal;
  - menor (pouco) variância do produto, com mínima explicação da variância do produto pelo choque monetário;

Momentos dos choques (p.p.) e CR entre os choques

DP do choque monetário 1,00 DP do choque fiscal = 1,00 CR entre os choques = 0

Regras monetárias			
	modelo base	modelo base c/ reação ao câmbio	modelo base c/ reação ao produto
Momentos das variáveis (p.p.)			
DP da inflação	0,10	**0,04**	0,41
DP do crecimento do PIB	1,30	1,27	**0,85**
DP da variação cambial	0,68	**0,22**	1,28
CR entre inflação e PIB	4,78	0,46	-7,51
CR entre inflação e câmbio	48,84	40,25	46,36
CR entre PIB e câmbio	8,58	-25,58	-78,61

Regras monetárias						
	modelo base		modelo base c/ reação ao câmbio		modelo base c/ reação ao produto	
Decomposição das variâncias (%)						
	CM /2	CF /2	CM	CF	CM	CF
Inflação	15,63	84,37	97,67	**2,33**	10,14	89,86
Crescimento do PIB	7,86	92,14	**1,75**	98,25	2,80	97,20
Variação cambial	89,44	10,56	86,16	13,84	**5,12**	94,88

Regras monetárias: inflação, produto e câmbio

- reação ao crescimento do produto:
  - menor variância do produto;
  - maior variância da inflação e do câmbio;
  - mínima explicação da variância do câmbio pelo choque monetário.

Momentos dos choques (p.p.) e CR entre os choques
DP do choque monetário 1,00 DP do choque fiscal = 1,00 CR entre os choques = 0

Regras monetárias			
	modelo base	modelo base c/ reação ao câmbio	modelo base c/ reação ao produto
Momentos das variáveis (p.p.)			
DP da inflação	0,10	**0,04**	0,41
DP do crecimento do PIB	1,30	1,27	**0,85**
DP da variação cambial	0,68	**0,22**	1,28
CR entre inflação e PIB	4,78	0,46	-7,51
CR entre inflação e câmbio	48,84	40,25	46,36
CR entre PIB e câmbio	8,58	-25,58	-78,61

Regras monetárias						
	modelo base		modelo base c/ reação ao câmbio		modelo base c/ reação ao produto	
Decomposição das variâncias (%)						
	CM /2	CF /2	CM	CF	CM	CF
Inflação	15,63	84,37	97,67	**2,33**	10,14	89,86
Crescimento do PIB	7,86	92,14	**1,75**	98,25	2,80	97,20
Variação cambial	89,44	10,56	86,16	13,84	**5,12**	94,88