

# **Central Bank Losses and Monetary Policy Rules: A DSGE Investigation - Online Appendix\***

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## **Abstract**

This online appendix presents a detailed description of the Smets and Wouters (2007) model, data sources and transformations, Bayesian estimation results, estimated shocks, impulse response functions, and variances decompositions used in Benchimol and Fourçans (2019).

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# 1 Introduction

This appendix describes : the Smets and Wouters (2007) model (Section 2); its calibration (Section 4); the data (Section 3); the empirical results (Section 5) including Bayesian estimation results (estimated means, standard errors, and highest posterior density intervals) in Section 5.1, estimated shocks in Section 5.2, impulse response functions in Section 5.3, and variance decompositions in Section 5.4.

## 2 The Smets and Wouters model

This section develops the sticky-price and flexible-price economies of the linearized Smets and Wouters (2007) model. We use the same notation about variables and parameters as in their seminal paper.

### 2.1 Sticky-price economy

#### 2.1.1 Consumption

The consumption equation is given by

$$\begin{aligned} c_t = & \frac{h}{1+h} c_{t-1} + \frac{1}{1+h} E_t [c_{t+1}] - \frac{1-h}{\sigma_c (1+h)} (r_t - E_t [\pi_{t+1}] + \varepsilon_t^b) \\ & + \frac{(\sigma_c - 1)}{\sigma_c (1+h)} \frac{W_*^h L_*}{C_*} (l_t - E_t [l_{t+1}]) \end{aligned} \quad (1)$$

where  $c_t$  is the aggregate private consumption,  $r_t$  the central bank (nominal) interest rate,  $\pi_t$  the inflation rate,  $l_t$  household's hours worked, and  $\varepsilon_t^b$  a wedge between the interest rate controlled by the central bank and the return on assets held by households (i.e. risk premium shock).  $h = \lambda/\gamma$  is the modified household's consumption habits parameter,  $\lambda$  the external habit formation,  $\gamma^t$  the labour-augmenting deterministic growth rate in the economy,  $\sigma_c$  the inverse of the elasticity of intertemporal substitution,  $W_*^h$  the steady-state aggregate nominal wage rate,  $L_*$  the steady-state composite labour input, and  $C_*$  the steady-state household's consumption. All the variables in lowercase letters are in log deviation from the nonstochastic steady-state.

Notice that worked hours by the representative household enter the consumption equation mainly because Smets and Wouters (2007) assumed non-separability between consumption and labor in households' preferences,<sup>1</sup> whereas it is not the

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<sup>1</sup>Smets and Wouters (2007) use the following non-separable households' period-utility function

$$U_t = \frac{1}{1-\sigma_c} (C_t - \lambda C_{t-1})^{1-\sigma_c} \exp \left( \frac{\sigma_c - 1}{1-\sigma_l} L_t^{1-\sigma_l} \right) \quad (2)$$

case in Smets and Wouters (2003).

### 2.1.2 Investment

The investment equation is

$$i_t = \frac{1}{1 + \beta\gamma^{1-\sigma_c}} i_{t-1} + \frac{\beta\gamma^{1-\sigma_c}}{1 + \beta\gamma^{1-\sigma_c}} E_t [i_{t+1}] + \frac{1}{\varphi\gamma^2 (1 + \beta\gamma^{1-\sigma_c})} q_t + \varepsilon_t^i \quad (3)$$

where  $i_t$  is the aggregate investment,  $q_t$  the real value of the existing capital stock, and  $\varepsilon_t^i$  an investment-specific technology shock.  $\beta$  is the deterministic discount factor applied by households,  $\varphi$  the steady-state elasticity of the capital adjustment cost function.

Modeling the capital adjustment costs as a function of the change in investment rather than the change in its level introduces additional dynamics in the investment equation, a useful means to capture the hump-shaped response of investment to various shocks, including monetary policy shocks.

### 2.1.3 Production

The aggregate production function is such as

$$y_t = \phi_p (\alpha k_t^s + (1 - \alpha) l_t + \varepsilon_t^a) \quad (4)$$

where output  $y_t$  is produced using capital,  $k_t^s$ , and labor services,  $l_t$ , and  $\varepsilon_t^a$  is a technology shock (total factor productivity, TFP).  $\phi_p$  reflects the presence of fixed costs in production, and  $\alpha$  measures decreasing returns and the share of capital in production.

### 2.1.4 Capital

The value of capital equation is

$$\begin{aligned} q_t &= \frac{1 - \delta}{1 - \delta + R_*^k} E_t [q_{t+1}] + \frac{R_*^k}{1 - \delta + R_*^k} E_t [r_{t+1}^k] \\ &\quad - (r_t - E_t [\pi_{t+1}] + \varepsilon_t^b) \end{aligned} \quad (5)$$

where  $q_t$  is the current value of the capital stock,  $\delta$  its depreciation rate,  $r_t^k$  the real rental rate on capital, and  $R_*^k = \beta^{-1}\gamma^{\sigma_c} - 1 - \delta$  its steady-state value.

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where  $C_t$  and  $L_t$  are respectively the aggregate consumption and worked hours, and  $\sigma_l$  is the elasticity of labor supply with respect to the real wage. See, for instance, Benchimol (2016) for a comparison between standard (without money) and nonseparable (with money) utility functions.

The capital accumulation equation is written as

$$k_t = \frac{1-\delta}{\gamma} k_{t-1} + \frac{\gamma+\delta-1}{\gamma} i_t + (\gamma-1+\delta) \left(1 + \beta \gamma^{1-\sigma_c}\right) \gamma \varphi \varepsilon_t^i \quad (6)$$

where  $k_t$  is the installed capital.

The rental rate of capital is

$$r_t^k = -(k_t - l_t) + w_t \quad (7)$$

where  $r_t^k$  is the real rental rate of capital, and  $w_t$  wages (Eq. 12).

Current capital services used in production,  $k_t^s$ , is a function of capital installed in the previous period,  $k_{t-1}$  and the degree of capital utilization,  $z_t$ , such as

$$k_t^s = k_{t-1} + z_t \quad (8)$$

where the degree of capital utilization  $z_t$  is a positive function of the rental rate of capital such as

$$z_t = \frac{1-\psi}{\psi} r_t^k \quad (9)$$

where  $\psi$  is a positive function of the elasticity of the capital utilization adjustment cost function with respect to utilization (normalized to be between zero and one).

### 2.1.5 Prices

The **inflation** equation is given by

$$\begin{aligned} \pi_t &= \frac{\beta \gamma^{1-\sigma_c}}{1 + \beta \iota_p \gamma^{1-\sigma_c}} E_t [\pi_{t+1}] + \frac{\iota_p}{1 + \beta \iota_p \gamma^{1-\sigma_c}} \pi_{t-1} \\ &\quad - \frac{1}{1 + \beta \iota_p \gamma^{1-\sigma_c}} \frac{(1 - \beta \gamma^{1-\sigma_c} \xi_p) (1 - \xi_p)}{\xi_p (1 + (\phi_p - 1) \varepsilon_p)} \mu_t^p + \varepsilon_t^p \end{aligned} \quad (10)$$

where  $\iota_p$  is the degree of indexation to past inflation,  $\xi_p$  the degree of price stickiness,  $\varepsilon_p$  the curvature of the Kimball (1995) goods market aggregator,  $\phi_p - 1$  the steady-state price mark-up,  $\varepsilon_t^p$  the price mark-up shock and  $\mu_t^p$  the price mark-up defined as

$$\begin{aligned} \mu_t^p &= \alpha (k_t^s - l_t) - w_t + \varepsilon_t^a \\ &= - \left[ (1 - \alpha) w_t + \alpha r_t^k - \varepsilon_t^a \right] \end{aligned} \quad (11)$$

### 2.1.6 Wages

The real wage is such that

$$\begin{aligned} w_t = & \frac{\beta\gamma^{1-\sigma_c}}{1+\beta\gamma^{1-\sigma_c}}E_t[w_{t+1}] + \frac{1}{1+\beta\gamma^{1-\sigma_c}}w_{t-1} \\ & \frac{\beta\gamma^{1-\sigma_c}}{1+\beta\gamma^{1-\sigma_c}}E_t[\pi_{t+1}] - \frac{1+\beta\iota_w\gamma^{1-\sigma_c}}{1+\beta\gamma^{1-\sigma_c}}\pi_t + \frac{\iota_w}{1+\beta\gamma^{1-\sigma_c}}\pi_{t-1} \\ & - \frac{1}{1+\beta\gamma^{1-\sigma_c}}\frac{(1-\beta\gamma^{1-\sigma_c}\xi_w)(1-\xi_w)}{\xi_w(1+(\phi_w-1)\varepsilon_w)}\mu_t^w + \varepsilon_t^w \end{aligned} \quad (12)$$

where  $w_t$  is the real wage,  $\iota_w$  the degree of indexation to past wages,  $\xi_w$  the degree of wage stickiness,  $\varepsilon_w$  the curvature of the Kimball (1995) labor market aggregator,  $\phi_w - 1$  the steady-state labor mark-up,  $\varepsilon_t^w$  the wage mark-up shock and  $\mu_t^w$  the wage mark-up defined as

$$\mu_t^w = w_t - \left( \sigma_l l_t + \frac{1}{1-h} (c_t - hc_{t-1}) \right) \quad (13)$$

where  $\sigma_l$  is the elasticity of labor supply with respect to the real wage.

### 2.1.7 Equilibrium

The goods market equilibrium condition can be written as

$$y_t = c_y c_t + i_y i_t + z_y z_t + \varepsilon_t^g \quad (14)$$

where  $c_y$  is the steady-state share of consumption in output (equals to  $1 - g_y - i_y$ );  $g_y$  and  $i_y = (\gamma - 1 + \delta) k_y$  are respectively the steady-state exogenous spending-output ratio and investment-output ratio, and  $z_y = R_*^k k_y$ , where  $k_y$  is the steady-state capital-output ratio.

## 2.2 Flexible-price economy

### 2.2.1 Flexible-price consumption

Flexible-price consumption is defined as

$$\begin{aligned} c_t^p = & \frac{h}{1+h}c_{t-1}^p + \frac{1}{1+h}E_t[c_{t+1}^p] - \frac{1-h}{\sigma_c(1+h)}(r_t^p + \varepsilon_t^b) \\ & + \frac{(\sigma_c-1)}{\sigma_c(1+h)}\frac{W_*^h L_*}{C_*}(l_t^p - E_t[l_{t+1}^p]) \end{aligned} \quad (15)$$

where  $c_t^p$  is flexible-price consumption,  $r_t^p$  the natural interest rate (i.e. flexible-price interest rate), and  $l_t^p$  flexible-price worked hours.

### 2.2.2 Flexible-price investment

Flexible-price investment is

$$i_t^p = \frac{1}{1 + \beta\gamma^{1-\sigma_c}} i_{t-1}^p + \frac{\beta\gamma^{1-\sigma_c}}{1 + \beta\gamma^{1-\sigma_c}} E_t [i_{t+1}^p] + \frac{1}{\varphi\gamma^2 (1 + \beta\gamma^{1-\sigma_c})} q_t^p + \varepsilon_t^i \quad (16)$$

where  $i_t^p$  is flexible-price investment, and  $q_t^p$  the flexible-price real value of the existing capital stock.

### 2.2.3 Flexible-price production

The flexible-price aggregate production function is equal to

$$y_t^p = \phi_p (\alpha k_t^{sp} + (1 - \alpha) l_t^p + \varepsilon_t^a) \quad (17)$$

where flexible-price output,  $y_t^p$ , is a function of flexible-price capital services,  $k_t^{sp}$ , and flexible-price labor services,  $l_t^p$ .

### 2.2.4 Flexible-price capital

The flexible-price capital stock is

$$q_t^p = \frac{1 - \delta}{1 - \delta + R_*^k} E_t [q_{t+1}^p] + \frac{R_*^k}{1 - \delta + R_*^k} E_t [r_{t+1}^{kp}] - (r_t^p + \varepsilon_t^b) \quad (18)$$

where  $r_t^{kp}$  is the flexible-price real rental rate on capital.

The flexible-price capital accumulation equation is written as

$$k_t^p = \frac{1 - \delta}{\gamma} k_{t-1}^p + \frac{\gamma + \delta - 1}{\gamma} i_t^p + (\gamma - 1 + \delta) (1 + \beta\gamma^{1-\sigma_c}) \varphi \varepsilon_t^i \quad (19)$$

where  $k_t^p$  is the flexible-price installed capital.

The flexible-price rental rate of capital is given by

$$r_t^{kp} = -(k_t^p - l_t^p) + w_t^p \quad (20)$$

where  $w_t^p$  represents flexible-price wages.

Current flexible-price capital services used in production,  $k_t^{sp}$ , is a function of flexible-price capital installed in the previous period,  $k_{t-1}^p$ , and the degree of

flexible-price capital utilization,  $z_t^p$ , such as

$$k_t^{sp} = k_{t-1}^p + z_t^p \quad (21)$$

where the flexible-price degree of capital utilization  $z_t^p$  is a positive function of the rental rate of capital

$$z_t^p = \frac{1-\psi}{\psi} r_t^{kp} \quad (22)$$

### 2.2.5 Flexible-price marginal cost

By definition, there is no marginal cost in the flexible-price economy. Then, Eq. 11 leads to

$$\varepsilon_t^a = \alpha r_t^{kp} + (1 - \alpha) w_t^p \quad (23)$$

### 2.2.6 Flexible-price wages

The flexible-price real wage is equal to

$$w_t^p = \sigma_l l_t^p + \frac{1}{1-h} (c_t^p - hc_{t-1}^p) \quad (24)$$

### 2.2.7 Flexible-price equilibrium

The flexible-price goods market equilibrium condition can be written as

$$y_t^p = c_y c_t^p + i_y i_t^p + z_y z_t^p + \varepsilon_t^g \quad (25)$$

## 2.3 Stochastic structure

### 2.3.1 AR(1) shocks

The total factor productivity (TFP) shock,  $\varepsilon_t^a$ , the investment-specific technology shock,  $\varepsilon_t^i$ , the risk premium shock,  $\varepsilon_t^b$ , and the monetary policy shock,  $\varepsilon_t^r$ , are assumed to follow a first-order autoregressive functional form such as,  $\forall k \in \{a, i, b, r\}$ ,

$$\varepsilon_t^k = \rho_k \varepsilon_{t-1}^k + \eta_t^k \quad (26)$$

where  $\rho_k \in [0, 1[$  is the first-order autoregressive parameter of the shock  $k$ , and the innovation  $\eta_t^k$  is an *i.i.d.*-normal error term.

### 2.3.2 ARMA(1,1) shocks

The price and wage markup shocks,  $\varepsilon_t^p$  and  $\varepsilon_t^w$  respectively, are assumed to follow a first-order autoregressive moving-average functional form such as,  $\forall k \in \{p, w\}$ ,

$$\varepsilon_t^k = \rho_k \varepsilon_{t-1}^k + \eta_t^k - \mu_k \eta_{t-1}^k \quad (27)$$

where  $\rho_k \in [0, 1[$  is the first-order autoregressive parameter of the shock  $k$ ,  $\mu_k$  the moving average term, and the innovation  $\eta_t^k$  an *i.i.d.*-normal error term. This shock process is designed to capture high-frequency fluctuations in inflation and wage markups.

### 2.3.3 Government spending shock

The government spending shock,  $\varepsilon_t^g$ , is assumed to follow a first-order autoregressive process impacted by technology shocks such as

$$\varepsilon_t^g = \rho_g \varepsilon_{t-1}^g + \eta_t^g + \rho_{ga} \eta_t^a \quad (28)$$

where  $\rho_g \in [0, 1[$  is the first-order autoregressive parameter,  $\rho_{ga}$  represents domestic productivity developments, and the innovation  $\eta_t^g$  is an *i.i.d.*-normal error term.

## 3 Data

This section describes the measurement equations (Section 3.1), the data sources (Section 3.2) and the data transformations (Section 3.3).

### 3.1 Measurement equations

The measurement equations and data transformations we use are exactly the same as in Smets and Wouters (2007).  $\ln$  and  $\Delta \ln$  stand for log and log difference, respectively.

The observed real output is measured as

$$GDP_t = y_t - y_{t-1} + \bar{\gamma} \quad (29)$$

where  $GDP_t$  represents the real output data and  $\bar{\gamma} = 100(\gamma - 1)$  the common quarterly trend growth rate to real GDP.

The observed real consumption is measured as

$$CONS_t = c_t - c_{t-1} + \bar{\gamma} \quad (30)$$

where  $CONS_t$  represents the real consumption data.

The observed investment is measured as

$$INV_t = i_t - i_{t-1} + \bar{\gamma} \quad (31)$$

where  $INV_t$  represents the investment data.

The observed wage inflation is measured as

$$WAGE_t = w_t - w_{t-1} + \bar{\gamma} \quad (32)$$

where  $WAGE_t$  represents the wage inflation data.

The observed worked hours are measured as

$$HOURS_t = l_t - l_{t-1} + \bar{l} \quad (33)$$

where  $HOURS_t$  represents the worked hours data and  $\bar{l}$  the steady-state hours worked, which is normalized to be equal to zero.

The observed inflation is measured as

$$INF_t = \pi_t + \bar{\pi} \quad (34)$$

where  $INF_t$  represents the inflation data and  $\bar{\pi} = 100(\Pi^* - 1)$  the quarterly steady-state inflation rate.

The observed nominal interest rate is measured as

$$RATE_t = r_t + \bar{r} \quad (35)$$

where  $RATE_t$  represents the (nominal) interest rate data and  $\bar{r} = 100(\beta^{-1}\gamma^{\sigma_c}\Pi^* - 1)$  the quarterly steady-state interest rate.

### 3.2 Data sources

The identifier of the corresponding series is mentioned in parenthesis.

The U.S. Bureau of Economic Analysis is the source for GDP (Real Gross Domestic Product, GDPC1), inflation (GDP Implicit Price Deflator, GDPDEF), consumption (Personal Consumption Expenditures, PCEC), and investment (Fixed Private Investment, FPI) data.

The U.S. Bureau of Labor Statistics is the source for employment (Civilian Employment Level, CE16OV), population (Civilian Noninstitutional Population, CNP16OV), worked hours (Average Weekly Hours in the Nonfarm Business Sector, PRS85006023), and hourly wages (Compensation Per Hour in the Nonfarm Business Sector, COMPNFB) data.

The U.S. Board of Governors of the Federal Reserve System is the source for interest rate (Effective Federal Funds Rate, FEDFUND) data except between July 2009 to November 2015 where we use the shadow rate data from Wu and Xia (2016).

All these data are collected from FRED, Federal Reserve Bank of St. Louis.

### 3.3 Data transformations

According to Smets and Wouters (2007), measurement equations and statistical data match through the following data transformations.

$$GDP_t = 100 \ln \left( \frac{GDPC1_t}{CNP16OV_t} \right) \quad (36)$$

$$CONS_t = 100 \ln \left( \left( \frac{PCEC_t}{GDPDEF_t} \right) CNP16OV_t^{-1} \right) \quad (37)$$

$$INV_t = 100 \ln \left( \left( \frac{FPI_t}{GDPDEF_t} \right) CNP16OV_t^{-1} \right) \quad (38)$$

$$WAGE_t = 100 \ln \left( \frac{COMPNFB_t}{GDPDEF_t} \right) \quad (39)$$

$$HOURS_t = 100 \ln \left( PRS85006023_t \left( \frac{CE16OV_t}{100} \right) CNP16OV_t^{-1} \right) \quad (40)$$

$$INF_t = 100 \ln \left( \frac{GDPDEF_t}{GDPDEF_{t-1}} \right) \quad (41)$$

$$RATE_t = \frac{FEDFUNDSt}{4} \quad (42)$$

where  $CE16OV_t$  and  $CNP16OV_t$  are transformed in indexes of the same base.

## 4 Calibration

Table 1 defines all the estimated parameters of the models.

Table 2 presents calibration of models' parameters, as Smets and Wouters (2007), for each model and period.

## 5 Results

### 5.1 Estimated parameters

Tables 3 to 10 present estimation results for each model and period.

$\alpha$	Share of capital in production
$\lambda$	External habit formation
$\sigma_c$	Inverse of the elasticity of intertemporal substitution
$\sigma_l$	Elasticity of labor supply with respect to the real wage
$\xi_p$	Degree of price stickiness
$\xi_w$	Degree of wage stickiness
$\iota_p$	Degree of indexation to past prices
$\iota_w$	Degree of indexation to past wages
$\psi$	Function of the elasticity of the capital utilization adjustment cost
$\phi_p$	Share of fixed costs in production
$\rho$	Interest rate smoothing
$r_\pi$	Inflation weight in the monetary policy rule
$r_y$	Real output gap weight in the monetary policy rule
$r_{\Delta y}$	Real output gap growth weight in the monetary policy rule
$r_n$	Nominal output (growth or level) weight in the monetary policy rule
$100(\beta^{-1} - 1)$	Transformed household's subjective discount factor
$\varphi$	Steady-state elasticity of the capital adjustment cost function
$\bar{\pi}$	Steady-state inflation rate
$\bar{l}$	Steady-state hours worked
$\bar{\gamma}$	Common trend growth rate to output, consumption, investment and wages
$\rho_a$	Autoregressive parameter of the technology shock
$\rho_b$	Autoregressive parameter of the risk premium shock
$\rho_g$	Autoregressive parameter of the government spending shock
$\rho_i$	Autoregressive parameter of investment-specific technology shock
$\rho_r$	Autoregressive parameter of the monetary policy shock
$\rho_p$	Autoregressive parameter of the price markup shock
$\rho_w$	Autoregressive parameter of the wage markup shock
$\rho_{ga}$	Productivity developments in the government spending shock
$\mu_p$	Moving average parameter of the price markup shock
$\mu_w$	Moving average parameter of the wage markup shock
$\sigma_a$	Standard error of the technology shock
$\sigma_b$	Standard error of the risk premium shock
$\sigma_g$	Standard error of the government spending shock
$\sigma_i$	Standard error of investment-specific technology shock
$\sigma_r$	Standard error of the monetary policy shock
$\sigma_p$	Standard error of the price markup shock
$\sigma_w$	Standard error of the wage markup shock

Table 1: Definition of estimated models' parameters.

	<b>Distr.</b>	<b>Mean</b>	<b>Std.</b>		<b>Distr.</b>	<b>Mean</b>	<b>Std.</b>
$\alpha$	Normal	0.30	0.05	$\rho_a$	Beta	0.50	0.20
$\lambda$	Beta	0.70	0.10	$\rho_b$	Beta	0.50	0.20
$\sigma_c$	Normal	1.50	0.37	$\rho_g$	Beta	0.50	0.20
$\sigma_l$	Normal	2.00	0.75	$\rho_i$	Beta	0.50	0.20
$\xi_p$	Beta	0.50	0.10	$\rho_r$	Beta	0.50	0.20
$\xi_w$	Beta	0.50	0.10	$\rho_p$	Beta	0.50	0.20
$\iota_p$	Beta	0.50	0.15	$\rho_w$	Beta	0.50	0.20
$\iota_w$	Beta	0.50	0.15	$\rho_{ga}$	Normal	0.50	0.25
$\psi$	Beta	0.50	0.15	$\mu_p$	Beta	0.50	0.20
$\phi_p$	Normal	1.25	0.12	$\mu_w$	Beta	0.50	0.20
$\rho$	Beta	0.75	0.10	$\sigma_a$	Inv-gamma	0.10	2.00
$r_\pi$	Normal	1.50	0.25	$\sigma_b$	Inv-gamma	0.10	2.00
$r_y$	Normal	0.125	0.05	$\sigma_g$	Inv-gamma	0.10	2.00
$r_{\Delta y}$	Normal	0.125	0.05	$\sigma_i$	Inv-gamma	0.10	2.00
$r_n$	Normal	1.5 <sup>(*)</sup> /0.5 <sup>(**)</sup>	0.25	$\sigma_r$	Inv-gamma	0.10	2.00
$100(\beta^{-1} - 1)$	Gamma	0.25	0.10	$\sigma_p$	Inv-gamma	0.10	2.00
$\varphi$	Normal	4.00	1.50	$\sigma_w$	Inv-gamma	0.10	2.00
$\bar{\pi}$	Gamma	0.625	0.10				
$\bar{l}$	Normal	0.00	2.00				
$\bar{\gamma}$	Normal	0.40	0.10				

Table 2: Calibration of models' parameters. (\*) stands for NGDP growth targeting (rules 5 to 8) and (\*\*) for NGDP level targeting (rules 9 to 12). Distr. and Std. stand for the distribution and the standard error of the estimated parameter, respectively.

1955-2017	Rule 1			Rule 2			Rule 3			Rule 4			Rule 5			Rule 6									
	Mean	Std.	90% HPDi	Mean	Std.	90% HPDi	Mean	Std.	90% HPDi	Mean	Std.	90% HPDi	Mean	Std.	90% HPDi	Mean	Std.	90% HPDi							
$\varphi$	4,025	0,189	2,643	5,428	9,171	0,901	7,564	10,758	6,123	0,741	4,520	7,690	8,715	1,032	7,005	10,398	4,417	0,808	2,983	5,830	4,541	0,442	2,999	6,030	
$\sigma_c$	1,422	0,058	1,128	1,698	1,440	0,084	1,279	1,599	0,955	0,066	0,812	1,094	1,274	0,073	1,157	1,388	1,337	0,126	1,069	1,594	1,354	0,051	1,079	1,619	
$\lambda$	0,494	0,015	0,389	0,590	0,580	0,019	0,819	0,878	0,637	0,027	0,584	0,692	0,844	0,020	0,811	0,879	0,492	0,032	0,404	0,578	0,487	0,026	0,400	0,574	
$\xi_w$	0,813	0,019	0,754	0,871	0,801	0,036	0,731	0,879	0,440	0,031	0,354	0,523	0,757	0,038	0,679	0,836	0,802	0,033	0,735	0,869	0,792	0,036	0,723	0,863	
$\sigma_I$	1,506	0,118	0,825	2,167	2,134	0,384	1,396	2,856	0,511	0,253	0,250	0,743	1,841	0,403	1,110	2,544	0,922	0,251	0,347	1,448	0,921	0,298	0,331	1,445	
$\xi_p$	0,803	0,031	0,714	0,888	0,691	0,034	0,635	0,747	0,608	0,029	0,548	0,669	0,646	0,029	0,594	0,699	0,747	0,028	0,691	0,804	0,737	0,023	0,681	0,793	
$t_w$	0,550	0,047	0,344	0,762	0,680	0,132	0,490	0,879	0,576	0,032	0,373	0,777	0,676	0,075	0,498	0,861	0,524	0,082	0,322	0,728	0,528	0,026	0,334	0,718	
$t_p$	0,247	0,055	0,113	0,373	0,206	0,042	0,088	0,317	0,151	0,067	0,068	0,232	0,216	0,077	0,095	0,331	0,275	0,052	0,141	0,406	0,291	0,041	0,161	0,419	
$\psi$	0,784	0,041	0,667	0,900	0,725	0,065	0,586	0,869	0,792	0,072	0,675	0,914	0,729	0,050	0,590	0,869	0,817	0,050	0,709	0,928	0,820	0,054	0,715	0,930	
$\Phi$	1,504	0,016	1,415	1,589	1,660	0,054	1,456	1,660	1,574	0,054	1,460	1,689	1,582	0,062	1,475	1,689	1,577	0,052	1,457	1,697	1,580	0,044	1,461	1,697	
$\rho$	0,856	0,019	0,819	0,892	0,803	0,016	0,769	0,837	0,677	0,024	0,632	0,722	0,754	0,022	0,719	0,790	0,832	0,016	0,802	0,863	0,826	0,015	0,796	0,857	
$r_{\pi}$	1,943	0,045	1,624	2,218	1,737	0,097	1,482	1,987	1,699	0,172	1,433	1,956	1,631	0,092	1,463	1,797	1,616	0,181	0,316	0,316	0,117	0,021	0,038	0,195	
$r_y$	0,106	0,008	0,070	0,140	0,100	0,022	0,061	0,138	0,016	0,014	0,001	0,033	0,248	0,029	0,181	0,316	0,248	0,029	0,181	0,316	0,117	0,021	0,038	0,195	
$r_{Ay}$	0,254	0,009	0,215	0,292																					
$r_n$	0,672	0,019	0,520	0,810	0,702	0,056	0,546	0,853	0,662	0,047	0,516	0,805	0,741	0,072	0,617	0,863	0,751	0,088	0,621	0,882	0,759	0,014	0,636	0,879	
$\bar{\pi}$	1,057	0,622	-0,371	2,457	0,650	0,995	-1,503	2,797	0,247	0,824	-1,997	2,487	-0,001	1,252	-2,104	0,207	-0,185	0,975	-2,170	1,799	-0,047	0,350	-1,953	1,888	
$\bar{I}$	0,343	0,023	0,278	0,403	0,286	0,026	0,244	0,329	0,309	0,051	0,242	0,381	0,280	0,033	0,234	0,324	0,346	0,030	0,288	0,405	0,346	0,022	0,286	0,405	
$100(\beta^{-1} - 1)$	0,519	0,038	0,424	0,612	0,522	0,046	0,427	0,618	0,513	0,062	0,412	0,613	0,524	0,062	0,428	0,620	0,511	0,051	0,413	0,610	0,510	0,052	0,413	0,608	
$\alpha$	0,187	0,014	0,166	0,210	0,195	0,013	0,174	0,216	0,180	0,012	0,153	0,207	0,189	0,016	0,167	0,210	0,186	0,012	0,162	0,211	0,187	0,008	0,163	0,210	
$\rho_a$	0,990	0,001	0,983	0,996	0,997	0,001	0,995	0,998	0,992	0,006	0,987	0,997	0,996	0,001	0,994	0,998	0,989	0,003	0,983	0,995	0,989	0,002	0,983	0,995	
$\rho_b$	0,876	0,052	0,818	0,935	0,937	0,077	0,213	0,399	0,823	0,033	0,773	0,875	0,288	0,063	0,187	0,387	0,860	0,034	0,810	0,912	0,863	0,028	0,814	0,913	
$\rho_g$	0,977	0,008	0,963	0,991	0,970	0,013	0,951	0,989	0,956	0,016	0,931	0,982	0,965	0,011	0,947	0,984	0,973	0,007	0,960	0,988	0,974	0,013	0,961	0,988	
$\rho_l$	0,791	0,025	0,718	0,866	0,805	0,034	0,749	0,860	0,736	0,042	0,671	0,802	0,783	0,035	0,727	0,840	0,762	0,040	0,686	0,839	0,767	0,045	0,693	0,840	
$\rho_r$	0,149	0,052	0,059	0,233	0,274	0,056	0,177	0,371	0,872	0,018	0,841	0,903	0,333	0,065	0,237	0,431	0,225	0,054	0,128	0,321	0,221	0,045	0,124	0,318	
$\rho_p$	0,936	0,022	0,895	0,985	0,995	0,021	0,896	0,977	0,961	0,014	0,932	0,992	0,936	0,020	0,904	0,970	0,954	0,017	0,925	0,984	0,954	0,020	0,923	0,985	
$\rho_w$	0,980	0,064	0,967	0,994	0,884	0,044	0,735	0,991	0,980	0,005	0,971	0,988	0,923	0,054	0,881	0,967	0,969	0,027	0,952	0,986	0,969	0,007	0,953	0,986	
$\mu_p$	0,922	0,056	0,818	0,999	0,807	0,046	0,726	0,893	0,782	0,033	0,703	0,862	0,759	0,056	0,675	0,844	0,876	0,040	0,818	0,937	0,874	0,034	0,814	0,936	
$\mu_w$	0,963	0,078	0,942	0,985	0,852	0,046	0,697	0,976	0,828	0,020	0,753	0,907	0,862	0,054	0,808	0,922	0,947	0,030	0,922	0,945	0,023	0,920	0,971		
$\sigma_a$	0,482	0,024	0,444	0,519	0,483	0,022	0,444	0,523	0,475	0,020	0,436	0,514	0,477	0,023	0,437	0,515	0,468	0,024	0,428	0,507	0,466	0,021	0,427	0,504	
$\sigma_b$	0,379	0,152	0,262	0,497	0,968	0,707	3,194	4,936	0,764	0,074	0,655	0,872	2,478	4,511	0,227	0,478	4,511	0,346	0,052	0,426	0,507	0,252	0,054	0,416	0,508
$\sigma_g$	0,472	0,020	0,437	0,506	0,465	0,021	0,432	0,498	0,476	0,022	0,439	0,511	0,463	0,020	0,430	0,496	0,019	0,440	0,508	0,474	0,021	0,439	0,508		
$\sigma_l$	0,381	0,022	0,322	0,437	0,334	0,029	0,286	0,382	0,358	0,040	0,295	0,419	0,324	0,031	0,275	0,372	0,384	0,032	0,325	0,442	0,379	0,034	0,321	0,437	
$\sigma_r$	0,213	0,010	0,194	0,231	0,216	0,010	0,199	0,233	0,106	0,013	0,131	0,220	0,010	0,202	0,237	0,244	0,014	0,217	0,271	0,241	0,014	0,214	0,248		
$\sigma_w$	0,187	0,009	0,136	0,238	0,139	0,012	0,119	0,160	0,136	0,010	0,118	0,154	0,145	0,011	0,125	0,165	0,159	0,011	0,140	0,178	0,159	0,012	0,140	0,178	

Table 3: Bayesian estimations of the models 1 to 6 for the period 1955 to 2017.

HPDi (Highest Posterior Density interval) is the shortest interval among all of the Bayesian credible intervals: any point *within* the interval has a higher density than any other point outside.

1955-2017	Rule 7						Rule 8						Rule 9						Rule 10						Rule 11						Rule 12					
	Mean	Std.	90% HPDi	Mean	Std.	90% HPDi	Mean	Std.	90% HPDi	Mean	Std.	90% HPDi	Mean	Std.	90% HPDi	Mean	Std.	90% HPDi	Mean	Std.	90% HPDi	Mean	Std.	90% HPDi	Mean	Std.	90% HPDi									
$\varphi$	3,344	0,518	2,267	4,349	2,719	0,339	2,000	3,411	3,983	0,147	2,752	5,115	4,299	0,396	2,702	5,745	3,920	0,328	2,000	5,283	5,066	0,306	2,001	7,136	0,999	1,278	0,892									
$\sigma_c$	1,356	0,128	0,099	1,607	1,159	0,076	0,971	1,345	1,543	0,046	1,273	1,809	1,414	0,034	1,123	1,740	1,041	0,079	0,831	1,264	1,140	0,035	0,999	1,278	0,663	0,892										
$\lambda$	0,460	0,044	0,387	0,531	0,528	0,018	0,448	0,607	0,550	0,014	0,481	0,622	0,664	0,011	0,565	0,762	0,569	0,032	0,491	0,646	0,787	0,014	0,689	0,855	0,250	1,093	0,891	0,939								
$\xi_w$	0,705	0,046	0,618	0,793	0,781	0,010	0,707	0,869	0,812	0,009	0,727	0,891	0,879	0,036	0,784	0,950	0,942	0,004	0,933	0,950	0,771	0,023	0,689	0,855	0,250	1,093	0,891	0,939								
$\sigma_l$	0,407	0,345	0,250	0,586	0,870	0,280	0,250	1,463	0,721	0,100	0,250	1,168	1,007	0,125	0,333	1,619	0,609	0,126	0,250	0,930	0,650	0,095	0,250	1,093	0,891	0,939										
$\xi_p$	0,737	0,024	0,679	0,795	0,762	0,023	0,705	0,817	0,909	0,011	0,881	0,940	0,873	0,014	0,812	0,941	0,730	0,013	0,639	0,855	0,914	0,013	0,891	0,939	0,250	1,093	0,891	0,939								
$t_w$	0,550	0,035	0,348	0,766	0,575	0,042	0,385	0,767	0,564	0,023	0,383	0,742	0,601	0,019	0,388	0,787	0,235	0,032	0,054	0,415	0,468	0,089	0,276	0,669	0,891	0,250	1,093	0,891	0,939							
$t_p$	0,197	0,051	0,085	0,306	0,269	0,057	0,131	0,405	0,148	0,035	0,056	0,238	0,211	0,033	0,085	0,327	0,243	0,052	0,102	0,372	0,166	0,030	0,066	0,262	0,891	0,250	1,093	0,891	0,939							
$\psi$	0,782	0,065	0,657	0,910	0,442	0,026	0,303	0,579	0,770	0,016	0,652	0,887	0,662	0,015	0,508	0,779	0,719	0,042	0,590	0,848	0,453	0,036	0,323	0,585	0,250	1,093	0,891	0,939								
$\Phi$	1,667	0,068	1,548	1,790	1,714	0,050	1,596	1,832	1,501	0,014	1,387	1,600	1,492	0,018	1,390	1,602	1,483	0,025	1,378	1,590	1,711	0,077	1,594	1,829	0,250	1,093	0,891	0,939								
$\rho$	0,776	0,021	0,728	0,827	0,881	0,006	0,865	0,898	0,520	0,015	0,500	0,546	0,523	0,016	0,500	0,550	0,520	0,014	0,652	0,799	0,520	0,024	0,500	0,545	0,250	1,093	0,891	0,939								
$r_{\pi}$																																				
$r_y$																																				
$r_{Ay}$																																				
$r_n$	1,790	0,100	1,462	2,112	2,172	0,035	1,927	2,400	0,602	0,049	0,484	0,714	0,606	0,044	0,514	0,701	0,553	0,036	0,295	0,846	0,401	0,028	0,319	0,481	0,250	1,093	0,891	0,939								
$\pi$	0,692	0,032	0,577	0,804	0,716	0,027	0,592	0,843	0,709	0,014	0,563	0,840	0,687	0,012	0,595	0,775	0,679	0,026	0,570	0,792	0,660	0,018	0,510	0,804	0,250	1,093	0,891	0,939								
$\bar{l}$	-0,132	1,189	-2,264	2,012	-0,654	0,684	-2,730	1,496	0,125	0,299	-1,811	1,999	-0,606	0,519	-2,648	1,443	-0,420	0,493	-2,426	1,612	-0,172	0,502	-2,180	1,862	0,250	1,093	0,891	0,939								
$\bar{\gamma}$	0,350	0,023	0,295	0,406	0,409	0,018	0,358	0,459	0,382	0,013	0,330	0,432	0,364	0,009	0,313	0,419	0,284	0,023	0,221	0,367	0,428	0,008	0,408	0,447	0,250	1,093	0,891	0,939								
$100(\beta^{-1} - 1)$	0,497	0,058	0,396	0,599	0,563	0,044	0,457	0,668	0,524	0,037	0,426	0,621	0,537	0,051	0,437	0,631	0,537	0,039	0,446	0,631	0,570	0,042	0,462	0,679	0,250	1,093	0,891	0,939								
$\alpha$	0,198	0,012	0,171	0,225	0,202	0,008	0,180	0,223	0,190	0,009	0,166	0,214	0,187	0,005	0,157	0,215	0,173	0,016	0,148	0,199	0,212	0,007	0,189	0,236	0,250	1,093	0,891	0,939								
$\rho_a$	0,988	0,003	0,982	0,994	0,980	0,004	0,971	0,991	0,990	0,001	0,982	0,997	0,993	0,004	0,986	0,998	0,993	0,008	0,989	0,997	0,983	0,005	0,997	0,990	0,250	1,093	0,891	0,939								
$\rho_b$	0,916	0,016	0,894	0,938	0,868	0,029	0,817	0,920	0,788	0,041	0,721	0,858	0,690	0,039	0,595	0,794	0,759	0,027	0,681	0,837	0,606	0,037	0,437	0,792	0,250	1,093	0,891	0,939								
$\rho_g$	0,964	0,012	0,947	0,981	0,974	0,009	0,962	0,987	0,981	0,008	0,969	0,995	0,980	0,009	0,964	0,997	0,950	0,010	0,923	0,982	0,971	0,007	0,959	0,983	0,250	1,093	0,891	0,939								
$\rho_l$	0,731	0,043	0,652	0,812	0,728	0,034	0,635	0,825	0,794	0,035	0,730	0,860	0,790	0,023	0,722	0,863	0,756	0,036	0,676	0,837	0,702	0,036	0,604	0,802	0,250	1,093	0,891	0,939								
$\rho_r$	0,462	0,036	0,387	0,539	0,054	0,034	0,011	0,991	0,962	0,007	0,946	0,978	0,964	0,032	0,949	0,978	0,988	0,026	0,946	0,986	0,990	0,006	0,983	0,943	0,017	0,919	0,968	0,250	1,093	0,891	0,939					
$\rho_p$	0,966	0,017	0,946	0,987	0,975	0,015	0,955	0,994	0,925	0,022	0,887	0,964	0,936	0,046	0,890	0,977	0,903	0,026	0,860	0,950	0,935	0,026	0,904	0,966	0,250	1,093	0,891	0,939								
$\rho_v$	0,977	0,006	0,967	0,988	0,970	0,035	0,953	0,987	0,978	0,006	0,959	0,996	0,902	0,047	0,752	0,996	0,943	0,039	0,927	0,988	0,982	0,003	0,971	0,994	0,250	1,093	0,891	0,939								
$\mu_p$	0,871	0,031	0,819	0,924	0,918	0,042	0,875	0,963	0,917	0,027	0,823	0,989	0,890	0,016	0,823	0,953	0,818	0,031	0,739	0,898	0,929	0,032	0,856	0,986	0,250	1,093	0,891	0,939								
$\mu_w$	0,939	0,012	0,911	0,969	0,946	0,035	0,917	0,974	0,961	0,009	0,937	0,986	0,886	0,026	0,727	0,988	0,945	0,046	0,921	0,990	0,958	0,006	0,935	0,983	0,250	1,093	0,891	0,939								
$\sigma_a$	0,447	0,025	0,411	0,484	0,469	0,021	0,432	0,506	0,480	0,017	0,440	0,520	0,487	0,019	0,446	0,526	0,502	0,022	0,454	0,548	0,470	0,022	0,433	0,507	0,250	1,093	0,891	0,939								
$\sigma_b$	0,452	0,029	0,394	0,508	0,359	0,069	0,263	0,452	0,747	0,181	0,576	0,922	1,215	0,768	1,631	0,708	0,055	0,53	0,864	2,005	0,701	0,202	3,291	0,521	0,250	1,093	0,891	0,939								
$\sigma_g$	0,476	0,020	0,442	0,510	0,486	0,024	0,450	0,521	0,474	0,018	0,439	0,508	0,470	0,026	0,435	0,504	0,470	0,021	0,434	0,505	0,486	0,020	0,450	0,521	0,250	1,093	0,891	0,939								
$\sigma_l$	0,423	0,043	0,349	0,496	0,419	0,027	0,356	0,480	0,411	0,037	0,349	0,473	0,414	0,027	0,353	0,476	0,394	0,034	0,321	0,465	0,454	0,032	0,388	0,518	0,250	1,093	0,891	0,939								
$\sigma_r$	0,276	0,021	0,240	0,312	0,243	0,012	0,221	0,265	0,274	0,012	0,246	0,301	0,252	0,011	0,229	0,275	0,147	0,012	0,190	0,236	0,011	0,214	0,258	0,250	1,093	0,891	0,939									
$\sigma_p$	0,145	0,013	0,126	0,165	0,157	0,011	0,138	0,193	0,010	0,131	0,255	0,146	0,013	0,127	0,166	0,175	0,011	0,153	0,197	0,185	0,012	0,121	0,250	0,250	1,093	0,891	0,939									
$\sigma_w$	0,358	0,016	0,328	0,387	0,356	0,023	0,327	0,386	0,331	0,015	0,305	0,357	0,331	0,025	0,302	0,360	0,368	0,019	0,323	0,406	0,305	0,015	0,305	0,360	0											

2007-2017	Rule 1						Rule 2						Rule 3						Rule 4						Rule 5					
	Mean	Std.	90% HPDI	Mean	Std.	90% HPDI	Mean	Std.	90% HPDI	Mean	Std.	90% HPDI	Mean	Std.	90% HPDI	Mean	Std.	90% HPDI	Mean	Std.	90% HPDI	Mean	Std.	90% HPDI	Mean	Std.	90% HPDI			
$\varphi$	6.325	0.984	4.377	8.245	6.727	0.919	4.767	8.664	6.227	1.033	4.269	8.123	7.732	1.404	5.804	9.635	7.848	0.512	5.800	9.868	7.979	0.335	5.798	10.169						
$\sigma_c$	0.871	0.154	0.661	1.080	0.885	0.116	0.665	1.102	0.922	0.126	0.698	1.142	1.002	0.116	0.540	0.857	0.605	0.061	0.474	0.732	0.605	0.055	0.476	0.731						
$\lambda$	0.682	0.050	0.583	0.784	0.721	0.044	0.625	0.820	0.631	0.036	0.549	0.713	0.814	0.039	0.759	0.869	0.808	0.017	0.752	0.866	0.809	0.032	0.753	0.867						
$\xi_w$	0.745	0.049	0.632	0.864	0.710	0.058	0.591	0.833	0.703	0.064	0.575	0.830	0.686	0.050	0.583	0.794	0.780	0.018	0.643	0.938	0.761	0.051	0.628	0.924						
$\sigma_I$	0.738	0.236	0.250	1.404	0.709	0.249	0.250	1.294	0.449	0.192	0.250	0.712	0.665	0.169	0.250	1.164	0.689	0.097	0.250	1.466	0.585	0.646	0.250	1.127						
$\xi_p$	0.879	0.023	0.832	0.929	0.861	0.025	0.803	0.921	0.902	0.018	0.865	0.940	0.841	0.029	0.784	0.899	0.896	0.021	0.854	0.941	0.893	0.007	0.851	0.937						
$t_w$	0.409	0.076	0.166	0.646	0.404	0.091	0.167	0.637	0.419	0.096	0.181	0.659	0.421	0.120	0.179	0.660	0.421	0.063	0.184	0.652	0.439	0.051	0.192	0.691						
$t_p$	0.288	0.069	0.115	0.458	0.292	0.081	0.118	0.459	0.248	0.066	0.093	0.394	0.278	0.068	0.107	0.440	0.274	0.050	0.103	0.443	0.267	0.049	0.102	0.428						
$\psi$	0.769	0.095	0.610	0.924	0.739	0.088	0.558	0.925	0.767	0.064	0.603	0.933	0.727	0.071	0.543	0.915	0.782	0.032	0.634	0.934	0.776	0.032	0.630	0.928						
$\Phi$	1.275	0.047	1.117	1.430	1.268	0.061	1.110	1.421	1.236	0.065	1.087	1.381	1.279	0.105	1.115	1.438	1.273	0.046	1.110	1.437	1.268	0.038	1.108	1.415						
$\rho$	0.847	0.030	0.789	0.907	0.810	0.037	0.745	0.877	0.802	0.029	0.744	0.859	0.809	0.025	0.755	0.864	0.867	0.013	0.818	0.917	0.865	0.030	0.815	0.915						
$r_\pi$	1.424	0.167	1.054	1.711	1.382	0.163	1.050	1.663	1.350	0.093	1.050	1.619	1.598	0.118	1.200	1.978														
$r_y$	0.187	0.027	0.131	0.241	0.191	0.026	0.139	0.244	0.145	0.017	0.074	0.215	0.153	0.027	0.074	0.230														
$r_{Ay}$	0.130	0.022	0.074	0.186																										
$r_n$																														
$\bar{\pi}$	0.512	0.036	0.418	0.604	0.530	0.051	0.434	0.624	0.431	0.053	0.346	0.515	0.476	0.047	0.376	0.573														
$\bar{t}$	2.016	0.642	0.566	3.467	2.049	0.732	0.576	3.507	0.540	1.101	-1.022	2.090	0.355	0.612	-1.040	1.752	1.266	0.396	-0.455	2.966	1.129	0.726	-0.598	2.892						
$\bar{\gamma}$	0.215	0.036	0.135	0.287	0.194	0.038	0.115	0.262	0.185	0.039	0.100	0.248	0.166	0.046	0.100	0.221	0.224	0.045	0.133	0.308	0.216	0.039	0.123	0.295						
$100(\beta^{-1} - 1)$	0.192	0.073	0.050	0.322	0.191	0.070	0.053	0.324	0.175	0.069	0.041	0.298	0.161	0.072	0.019	0.278	0.183	0.057	0.034	0.315	0.190	0.061	0.040	0.325						
$\alpha$	0.083	0.018	0.054	0.113	0.080	0.015	0.052	0.108	0.079	0.017	0.051	0.108	0.066	0.017	0.037	0.095	0.065	0.010	0.032	0.096	0.066	0.009	0.036	0.097						
$\rho_a$	0.890	0.048	0.807	0.979	0.882	0.050	0.795	0.975	0.929	0.044	0.871	0.998	0.905	0.040	0.829	0.985	0.911	0.047	0.833	0.991	0.916	0.044	0.838	0.991						
$\rho_b$	0.877	0.034	0.826	0.929	0.859	0.027	0.801	0.921	0.828	0.035	0.765	0.893	0.806	0.037	0.729	0.889	0.850	0.038	0.781	0.924	0.844	0.026	0.774	0.919						
$\rho_g$	0.816	0.079	0.678	0.963	0.784	0.093	0.617	0.957	0.774	0.076	0.611	0.939	0.738	0.094	0.563	0.920	0.805	0.059	0.664	0.955	0.791	0.057	0.645	0.945						
$\rho_l$	0.821	0.090	0.687	0.968	0.849	0.100	0.722	0.987	0.838	0.100	0.711	0.976	0.815	0.054	0.689	0.944	0.808	0.052	0.703	0.916	0.811	0.045	0.708	0.919						
$\rho_p$	0.512	0.088	0.354	0.674	0.513	0.073	0.353	0.673	0.895	0.023	0.856	0.935	0.551	0.062	0.420	0.686	0.423	0.075	0.284	0.562	0.426	0.115	0.284	0.572						
$\rho_r$	0.508	0.123	0.249	0.766	0.510	0.122	0.257	0.769	0.512	0.078	0.259	0.769	0.564	0.085	0.305	0.825	0.547	0.041	0.258	0.820	0.553	0.084	0.303	0.810						
$\rho_v$	0.248	0.144	0.044	0.438	0.246	0.090	0.045	0.434	0.294	0.087	0.063	0.509	0.246	0.140	0.043	0.438	0.258	0.051	0.045	0.457	0.254	0.046	0.048	0.446						
$\mu_w$	0.458	0.120	0.133	0.760	0.464	0.126	0.147	0.772	0.466	0.064	0.145	0.768	0.483	0.074	0.151	0.784	0.536	0.094	0.226	0.915	0.466	0.098	0.147	0.756						
$\mu_v$	0.561	0.124	0.398	0.724	0.552	0.087	0.396	0.711	0.562	0.081	0.368	0.759	0.556	0.098	0.399	0.723	0.573	0.032	0.408	0.739	0.579	0.060	0.407	0.743						
$\sigma_a$	0.476	0.055	0.388	0.563	0.486	0.049	0.394	0.575	0.467	0.047	0.385	0.547	0.494	0.048	0.402	0.585	0.482	0.042	0.395	0.567	0.482	0.042	0.395	0.566						
$\sigma_b$	0.356	0.122	0.200	0.506	0.466	0.098	0.241	0.687	0.461	0.073	0.323	0.594	0.584	0.104	0.251	0.897	0.367	0.137	0.124	0.603	0.385	0.068	0.135	0.633						
$\sigma_g$	0.291	0.025	0.247	0.335	0.287	0.026	0.243	0.330	0.284	0.025	0.240	0.326	0.292	0.027	0.243	0.340	0.313	0.028	0.259	0.365	0.310	0.031	0.257	0.362						
$\sigma_l$	0.253	0.075	0.155	0.357	0.241	0.084	0.146	0.342	0.244	0.080	0.153	0.341	0.244	0.081	0.145	0.344	0.238	0.043	0.145	0.326	0.234	0.042	0.143	0.321						
$\sigma_r$	0.115	0.013	0.091	0.138	0.106	0.012	0.090	0.159	0.120	0.016	0.087	0.153	0.120	0.016	0.094	0.142	0.134	0.015	0.099	0.168	0.131	0.023	0.099	0.162						
$\sigma_p$	0.123	0.018	0.089	0.157	0.125	0.017	0.090	0.159	0.120	0.016	0.087	0.154	0.122	0.016	0.085	0.162	0.117	0.016	0.084	0.148	0.120	0.023	0.099	0.162						
$\sigma_w$	0.716	0.071	0.595	0.836	0.726	0.065	0.603	0.848	0.716	0.064	0.593	0.839	0.751	0.075	0.625	0.877	0.755	0.085	0.624	0.886	0.760	0.083	0.631	0.888						

Table 5: Bayesian estimations of the models 1 to 6 for the period 2007 to 2017.

HPDi (Highest Posterior Density interval) is the shortest interval among all of the Bayesian credible intervals: any point *within* the interval has a higher density than any other point outside.

	Rule 7			Rule 8			Rule 9			Rule 10			Rule 11			Rule 12				
	Mean	Std.	90% HPDi	Mean	Std.	90% HPDi	Mean	Std.	90% HPDi	Mean	Std.	90% HPDi	Mean	Std.	90% HPDi	Mean	Std.	90% HPDi		
$\varphi$	5.843	1.090	3.843	7.823	6.454	1.039	4.242	8.627	6.135	1.484	4.152	8.112	6.264	0.798	4.311	8.215	5.819	1.461	3.869	7.764
$\sigma_c$	0.707	0.120	0.564	0.849	0.612	0.050	0.464	0.757	0.879	0.113	0.662	1.089	0.890	0.132	0.671	1.108	0.857	0.111	0.648	1.057
$\lambda$	0.629	0.062	0.547	0.715	0.751	0.031	0.670	0.835	0.673	0.046	0.567	0.780	0.681	0.057	0.576	0.790	0.605	0.043	0.519	0.692
$\zeta_w$	0.789	0.064	0.677	0.905	0.736	0.029	0.617	0.856	0.754	0.075	0.641	0.874	0.745	0.050	0.629	0.868	0.772	0.072	0.666	0.880
$\sigma_I$	0.631	0.473	0.250	1.152	0.549	0.399	0.250	0.967	0.735	0.208	0.250	1.414	0.722	0.464	0.250	1.388	0.464	0.173	0.250	0.750
$\zeta_p$	0.908	0.017	0.874	0.944	0.897	0.012	0.863	0.932	0.866	0.032	0.814	0.921	0.863	0.029	0.808	0.918	0.895	0.021	0.854	0.938
$t_w$	0.411	0.052	0.174	0.643	0.464	0.041	0.221	0.702	0.392	0.095	0.160	0.619	0.387	0.101	0.158	0.613	0.401	0.080	0.135	0.174
$t_p$	0.234	0.107	0.089	0.370	0.254	0.053	0.102	0.404	0.305	0.082	0.127	0.480	0.305	0.093	0.127	0.477	0.291	0.119	0.117	0.459
$\psi$	0.786	0.130	0.637	0.939	0.760	0.051	0.606	0.923	0.777	0.092	0.625	0.936	0.767	0.086	0.609	0.931	0.770	0.062	0.610	0.935
$\Phi$	1.218	0.037	1.063	1.365	1.395	0.035	1.236	1.552	1.253	0.093	1.094	1.409	1.243	0.071	1.085	1.395	1.231	0.079	1.083	1.314
$\rho$	0.791	0.041	0.713	0.871	0.894	0.012	0.868	0.922	0.687	0.062	0.570	0.804	0.682	0.072	0.555	0.804	0.707	0.083	0.585	0.834
$r_\pi$																				
$r_y$																				
$r_{\Delta y}$																				
$r_n$	1.739	0.155	1.420	2.052	1.961	0.050	1.631	2.285	0.233	0.045	1.61	3.04	0.241	0.035	1.668	3.13	0.313	0.149	1.195	0.050
$\bar{\pi}$	0.438	0.031	0.349	0.522	0.522	0.029	0.405	0.636	0.515	0.043	0.429	0.600	0.513	0.048	0.429	0.596	0.473	0.044	0.557	0.496
$\bar{I}$	2.415	0.538	0.841	1.373	1.373	0.729	-0.326	3.109	2.560	0.742	1.073	4.072	2.503	0.739	0.991	4.044	0.704	0.754	2.402	0.662
$100(\beta^{-1}-1)$	0.232	0.040	0.151	0.312	0.260	0.040	0.173	0.346	0.209	0.043	0.128	0.281	0.203	0.028	0.124	0.274	0.204	0.041	0.113	0.280
$\alpha$	0.068	0.030	0.035	0.101	0.115	0.008	0.077	0.153	0.087	0.016	0.057	0.117	0.086	0.014	0.056	0.116	0.080	0.021	0.051	0.110
$\rho_a$	0.908	0.058	0.834	0.990	0.923	0.031	0.864	0.983	0.886	0.045	0.799	0.980	0.883	0.055	0.795	0.980	0.935	0.029	0.879	0.998
$\rho_b$	0.942	0.014	0.919	0.965	0.868	0.027	0.821	0.918	0.878	0.042	0.823	0.935	0.872	0.033	0.815	0.932	0.853	0.044	0.785	0.922
$\rho_s$	0.838	0.096	0.715	0.973	0.858	0.038	0.758	0.968	0.814	0.099	0.672	0.964	0.805	0.083	0.657	0.961	0.801	0.076	0.658	0.954
$\rho_l$	0.823	0.053	0.698	0.954	0.889	0.032	0.814	0.968	0.825	0.072	0.686	0.979	0.839	0.075	0.705	0.987	0.826	0.062	0.697	0.965
$\rho_r$	0.542	0.058	0.448	0.636	0.276	0.056	0.147	0.406	0.637	0.099	0.471	0.812	0.636	0.069	0.477	0.801	0.926	0.021	0.897	0.957
$\rho_p$	0.523	0.130	0.275	0.776	0.483	0.032	0.228	0.747	0.509	0.110	0.253	0.769	0.502	0.126	0.240	0.765	0.498	0.077	0.244	0.759
$\rho_w$	0.259	0.096	0.050	0.453	0.246	0.037	0.041	0.441	0.227	0.093	0.040	0.403	0.228	0.110	0.041	0.405	0.252	0.149	0.050	0.442
$\mu_p$	0.456	0.119	0.187	0.718	0.475	0.054	0.191	0.854	0.456	0.114	0.155	0.730	0.453	0.185	0.146	0.728	0.428	0.081	0.170	0.689
$\mu_w$	0.552	0.082	0.383	0.719	0.549	0.038	0.364	0.735	0.566	0.057	0.427	0.709	0.561	0.061	0.424	0.702	0.576	0.048	0.419	0.734
$\sigma_a$	0.476	0.052	0.390	0.558	0.466	0.041	0.383	0.548	0.479	0.048	0.391	0.566	0.482	0.047	0.392	0.567	0.465	0.052	0.383	0.544
$\sigma_b$	0.228	0.033	0.172	0.282	0.309	0.059	0.174	0.439	0.372	0.161	0.192	0.545	0.407	0.107	0.206	0.599	0.355	0.098	0.219	0.489
$\sigma_s$	0.307	0.033	0.258	0.356	0.317	0.035	0.262	0.370	0.293	0.025	0.248	0.337	0.291	0.026	0.246	0.335	0.291	0.025	0.246	0.335
$\sigma_l$	0.248	0.036	0.156	0.341	0.229	0.024	0.166	0.288	0.256	0.051	0.156	0.362	0.249	0.052	0.153	0.349	0.247	0.045	0.154	0.340
$\sigma_r$	0.169	0.032	0.119	0.216	0.132	0.017	0.102	0.162	0.084	0.012	0.084	0.123	0.084	0.018	0.058	0.123	0.082	0.011	0.079	0.115
$\sigma_p$	0.116	0.017	0.089	0.143	0.122	0.016	0.090	0.155	0.125	0.017	0.093	0.156	0.125	0.016	0.093	0.157	0.122	0.020	0.094	0.149
$\sigma_w$	0.713	0.072	0.587	0.837	0.740	0.067	0.614	0.868	0.717	0.070	0.599	0.835	0.719	0.073	0.601	0.838	0.714	0.070	0.593	0.833

Table 6: Bayesian estimations of the models 7 to 12 for the period 2007 to 2017.

HPDi (Highest Posterior Density interval) is the shortest interval among all of the Bayesian credible intervals: any point *within* the interval has a higher density than any other point outside.

1985-2007	Rule 1			Rule 2			Rule 3			Rule 4			Rule 5			Rule 6			
	Mean	Std.	90% HPDI	Mean	Std.	90% HPDI	Mean	Std.	90% HPDI	Mean	Std.	90% HPDI	Mean	Std.	90% HPDI	Mean	Std.	90% HPDI	
$\varphi$	6.697	0.780	4.913	8.491	8.514	0.459	6.334	10.607	7.483	5.771	9.198	6.649	6.483	10.214	6.360	0.854	4.403	8.306	
$\sigma_c$	1.115	0.114	0.869	1.357	1.435	0.092	0.957	1.798	0.921	0.075	1.727	1.111	1.381	0.093	1.185	1.576	0.991	1.112	4.523
$\lambda$	0.480	0.059	0.379	0.578	0.729	0.023	0.601	0.833	0.592	0.044	0.514	0.673	0.577	0.022	0.692	0.825	0.447	0.026	0.076
$\xi_w$	0.772	0.035	0.629	0.900	0.740	0.045	0.625	0.852	0.722	0.043	0.607	0.835	0.503	0.029	0.389	0.617	0.781	0.058	0.025
$\sigma_l$	2.047	0.421	1.184	2.897	1.768	0.170	0.665	2.797	1.162	0.299	0.508	1.796	1.579	0.303	0.672	2.456	1.539	0.132	0.247
$\xi_p$	0.875	0.031	0.830	0.922	0.859	0.029	0.809	0.910	0.869	0.026	0.832	0.907	0.734	0.025	0.675	0.795	0.871	0.020	0.820
$t_w$	0.442	0.054	0.211	0.672	0.445	0.071	0.202	0.689	0.437	0.078	0.200	0.670	0.479	0.097	0.234	0.719	0.419	0.052	0.179
$t_p$	0.275	0.086	0.105	0.433	0.243	0.043	0.085	0.393	0.244	0.053	0.093	0.385	0.210	0.161	0.086	0.329	0.233	0.061	0.099
$\psi$	0.729	0.055	0.583	0.881	0.661	0.053	0.481	0.845	0.771	0.049	0.637	0.910	0.780	0.085	0.654	0.912	0.796	0.059	0.674
$\Phi$	1.451	0.091	1.306	1.593	1.449	0.039	1.280	1.609	1.366	0.085	1.220	1.508	1.583	0.061	1.438	1.724	1.555	0.034	1.407
$\rho$	0.871	0.024	0.833	0.909	0.821	0.017	0.777	0.866	0.810	0.021	0.768	0.854	0.793	0.019	0.756	0.821	0.870	0.016	0.842
$r_{\pi}$	1.958	0.125	1.513	2.394	1.488	0.087	1.068	1.834	1.370	0.116	1.050	1.629	2.067	0.150	1.784	2.349	1.899	0.086	0.865
$r_y$	0.143	0.039	0.067	0.217	0.193	0.008	0.112	0.274	0.181	0.015	0.111	0.250	0.183	0.022	0.111	0.254	0.109	0.013	0.032
$r_{Ay}$	0.174	0.019	0.130	0.218													0.185	0.032	0.032
$r_n$	0.651	0.050	0.556	0.747	0.637	0.046	0.536	0.734	0.618	0.048	0.525	0.711	0.645	0.051	0.550	0.740	0.617	0.036	0.024
$\bar{\pi}$	-0.333	0.598	-1.590	0.909	-0.013	0.771	-1.426	1.394	-0.447	0.778	-1.746	0.855	-1.107	0.666	-2.572	0.341	-1.230	0.826	-2.621
$\bar{l}$	0.475	0.019	0.436	0.513	0.461	0.009	0.428	0.496	0.469	0.021	0.432	0.506	0.416	0.017	0.375	0.457	0.441	0.023	0.394
$\bar{\gamma}$	0.354	0.098	0.197	0.510	0.339	0.087	0.185	0.491	0.345	0.081	0.197	0.493	0.332	0.063	0.182	0.484	0.339	0.077	0.178
$100(\beta^{-1} - 1)$	0.186	0.018	0.147	0.225	0.177	0.014	0.142	0.213	0.171	0.018	0.133	0.210	0.190	0.016	0.158	0.221	0.192	0.016	0.150
$\alpha$	0.909	0.031	0.861	0.969	0.895	0.027	0.839	0.951	0.923	0.030	0.877	0.971	0.923	0.024	0.878	0.978	0.918	0.035	0.876
$\rho_a$	0.908	0.040	0.857	0.959	0.940	0.069	0.106	0.909	0.855	0.030	0.803	0.908	0.193	0.112	0.931	0.340	0.892	0.032	0.848
$\rho_b$	0.975	0.014	0.957	0.995	0.984	0.003	0.969	0.997	0.976	0.011	0.957	0.994	0.968	0.008	0.949	0.989	0.960	0.013	0.938
$\rho_s$	0.663	0.075	0.540	0.787	0.662	0.059	0.546	0.782	0.550	0.067	0.427	0.675	0.592	0.050	0.486	0.703	0.642	0.060	0.526
$\rho_l$	0.376	0.079	0.231	0.518	0.631	0.038	0.507	0.756	0.869	0.027	0.818	0.921	0.504	0.055	0.412	0.597	0.248	0.049	0.140
$\rho_r$	0.747	0.080	0.583	0.916	0.740	0.034	0.586	0.898	0.726	0.049	0.575	0.885	0.587	0.071	0.775	0.945	0.836	0.052	0.726
$\rho_p$	0.720	0.066	0.494	0.959	0.664	0.060	0.464	0.883	0.676	0.081	0.475	0.885	0.925	0.026	0.878	0.972	0.711	0.036	0.436
$\rho_w$	0.703	0.109	0.449	0.962	0.600	0.037	0.373	0.826	0.586	0.061	0.351	0.827	0.653	0.071	0.497	0.809	0.779	0.115	0.601
$\mu_p$	0.551	0.066	0.260	0.827	0.460	0.046	0.199	0.728	0.485	0.062	0.228	0.740	0.663	0.081	0.521	0.807	0.565	0.044	0.272
$\mu_w$	0.373	0.029	0.323	0.420	0.384	0.030	0.334	0.435	0.366	0.028	0.321	0.409	0.355	0.027	0.311	0.400	0.315	0.027	0.315
$\sigma_a$	0.190	0.043	0.132	0.248	0.167	0.024	0.201	0.692	0.392	0.041	0.315	0.466	0.495	0.106	0.665	0.147	0.026	0.104	0.188
$\sigma_b$	0.383	0.025	0.339	0.427	0.372	0.025	0.332	0.412	0.373	0.026	0.332	0.415	0.368	0.021	0.330	0.406	0.385	0.029	0.341
$\sigma_g$	0.305	0.051	0.227	0.381	0.326	0.046	0.245	0.404	0.391	0.046	0.290	0.489	0.354	0.044	0.273	0.494	0.310	0.036	0.236
$\sigma_l$	0.101	0.010	0.086	0.117	0.093	0.008	0.080	0.106	0.058	0.006	0.046	0.069	0.101	0.008	0.086	0.115	0.121	0.013	0.099
$\sigma_r$	0.104	0.011	0.074	0.144	0.088	0.009	0.068	0.108	0.088	0.009	0.069	0.107	0.083	0.011	0.067	0.099	0.100	0.011	0.075
$\sigma_p$	0.288	0.035	0.227	0.350	0.293	0.032	0.230	0.354	0.296	0.035	0.236	0.355	0.343	0.041	0.275	0.409	0.308	0.024	0.238
$\sigma_w$																0.377	0.304	0.032	0.239

Table 7: Bayesian estimations of the models 1 to 6 for the period 1985 to 2007.

HPDi (Highest Posterior Density interval) is the shortest interval among all of the Bayesian credible intervals: any point *within* the interval has a higher density than any other point outside.

1985-2007	Rule 1						Rule 2						Rule 3						Rule 4						Rule 5					
	Mean	Std.	90% HPDi	Mean	Std.	90% HPDi	Mean	Std.	90% HPDi	Mean	Std.	90% HPDi	Mean	Std.	90% HPDi	Mean	Std.	90% HPDi	Mean	Std.	90% HPDi	Mean	Std.	90% HPDi						
$\varphi$	6,931	1,282	5,045	8,756	4,534	2,542	6,422	6,224	0,550	4,347	8,067	6,144	0,569	4,316	7,970	6,894	0,530	5,192	8,588	4,387	0,832	2,673	6,055							
$\sigma_c$	0,894	0,099	0,620	1,161	1,154	0,102	0,913	1,388	1,281	0,119	0,953	1,597	1,310	0,117	0,993	1,632	1,024	0,103	1,258	1,148	0,109	0,855	1,435	0,435	0,435	0,672				
$\lambda$	0,476	0,041	0,367	0,585	0,406	0,037	0,295	0,514	0,503	0,045	0,402	0,603	0,487	0,049	0,382	0,589	0,533	0,043	0,444	0,623	0,553	0,035	0,435	0,672						
$\xi_w$	0,573	0,059	0,395	0,730	0,626	0,042	0,437	0,852	0,797	0,070	0,692	0,899	0,796	0,047	0,679	0,904	0,577	0,032	0,577	0,888	0,666	0,042	0,501	0,848						
$\sigma_l$	1,189	0,380	0,533	1,834	0,984	0,295	0,250	1,669	1,943	0,304	1,060	2,813	1,961	0,225	1,041	2,870	0,937	0,045	0,345	1,468	0,926	0,302	0,250	1,631						
$\xi_p$	0,872	0,020	0,834	0,911	0,878	0,020	0,840	0,916	0,905	0,016	0,873	0,939	0,907	0,017	0,876	0,940	0,905	0,015	0,872	0,939	0,909	0,017	0,879	0,942						
$t_w$	0,431	0,043	0,195	0,659	0,436	0,052	0,190	0,674	0,435	0,071	0,208	0,661	0,427	0,048	0,191	0,655	0,446	0,090	0,218	0,664	0,414	0,075	0,182	0,641						
$t_p$	0,246	0,076	0,100	0,384	0,246	0,049	0,094	0,386	0,347	0,073	0,121	0,580	0,335	0,128	0,111	0,549	0,305	0,063	0,110	0,493	0,320	0,054	0,105	0,533						
$\psi$	0,791	0,069	0,665	0,922	0,528	0,079	0,340	0,711	0,764	0,058	0,622	0,908	0,745	0,052	0,605	0,691	0,777	0,054	0,652	0,652	0,553	0,063	0,366	0,734						
$\Phi$	1,436	0,048	1,264	1,647	1,055	1,507	1,789	1,400	0,047	1,252	1,541	1,387	0,060	1,249	1,523	1,388	0,051	1,240	1,535	1,553	0,045	1,391	1,714							
$\rho$	0,858	0,029	0,822	0,895	0,890	0,013	0,869	0,912	0,700	0,030	0,607	0,792	0,658	0,020	0,542	0,763	0,824	0,017	0,768	0,881	0,724	0,032	0,638	0,812						
$r_{\pi}$																														
$r_y$																														
$r_{Ay}$																														
$r_n$	2,032	0,088	1,728	2,326	2,197	0,139	1,910	2,483	0,118	0,020	0,042	0,193	0,514	0,098	0,327	0,699	0,487	0,067	0,306	0,670	0,586	0,091	0,329	0,862	0,432	0,039	0,281	0,585		
$\bar{\pi}$	0,620	0,056	0,529	0,710	0,594	0,050	0,488	0,697	0,622	0,036	0,539	0,704	0,622	0,029	0,540	0,705	0,616	0,047	0,531	0,700	0,611	0,047	0,520	0,703						
$\bar{t}$	-0,898	0,909	-2,473	0,663	-0,786	0,667	-2,109	0,529	-0,266	0,702	-1,652	1,099	-0,184	0,977	-1,566	1,205	-0,555	0,964	-1,417	0,905	-1,981	-0,272	0,529	-1,417	0,856					
$\bar{\gamma}$	0,478	0,024	0,440	0,517	0,486	0,023	0,450	0,523	0,475	0,018	0,439	0,512	0,477	0,013	0,443	0,512	0,476	0,016	0,441	0,510	0,501	0,012	0,476	0,526						
$100(\beta^{-1}-1)$	0,348	0,080	0,198	0,501	0,444	0,075	0,268	0,618	0,366	0,091	0,209	0,523	0,372	0,066	0,217	0,531	0,343	0,055	0,197	0,493	0,418	0,089	0,253	0,583						
$\alpha$	0,164	0,021	0,121	0,207	0,206	0,020	0,171	0,242	0,196	0,017	0,155	0,238	0,197	0,017	0,155	0,238	0,179	0,024	0,141	0,217	0,207	0,007	0,170	0,243						
$\rho_a$	0,914	0,029	0,868	0,962	0,904	0,029	0,861	0,950	0,913	0,033	0,858	0,970	0,910	0,033	0,855	0,966	0,916	0,025	0,867	0,968	0,936	0,012	0,901	0,972						
$\rho_b$	0,965	0,009	0,952	0,978	0,866	0,040	0,809	0,926	0,889	0,044	0,837	0,942	0,889	0,047	0,837	0,944	0,865	0,030	0,815	0,919	0,883	0,042	0,828	0,943						
$\rho_g$	0,963	0,013	0,943	0,985	0,969	0,010	0,954	0,985	0,981	0,007	0,964	0,996	0,982	0,007	0,966	0,996	0,978	0,009	0,961	0,994	0,959	0,011	0,941	0,977						
$\rho_l$	0,603	0,051	0,491	0,718	0,650	0,070	0,530	0,773	0,688	0,049	0,574	0,805	0,694	0,061	0,586	0,805	0,594	0,059	0,477	0,713	0,641	0,066	0,521	0,764						
$\rho_{\bar{s}}$	0,328	0,049	0,222	0,435	0,115	0,042	0,038	0,189	0,901	0,031	0,855	0,948	0,913	0,025	0,875	0,952	0,916	0,018	0,878	0,956	0,832	0,052	0,749	0,918						
$\rho_r$	0,784	0,041	0,646	0,930	0,790	0,057	0,651	0,929	0,689	0,058	0,408	0,918	0,696	0,050	0,454	0,914	0,709	0,041	0,522	0,906	0,702	0,053	0,436	0,918						
$\rho_p$	0,933	0,019	0,900	0,982	0,864	0,059	0,712	0,971	0,687	0,057	0,471	0,931	0,693	0,039	0,470	0,942	0,718	0,072	0,488	0,962	0,852	0,032	0,692	0,973						
$\rho_w$	0,663	0,077	0,403	0,893	0,737	0,095	0,532	0,967	0,892	0,054	0,827	0,956	0,889	0,088	0,827	0,956	0,903	0,082	0,857	0,952	0,877	0,019	0,805	0,955						
$\mu_w$	0,748	0,083	0,598	0,906	0,666	0,087	0,478	0,859	0,531	0,068	0,259	0,817	0,537	0,076	0,253	0,824	0,548	0,094	0,267	0,823	0,676	0,057	0,485	0,868						
$\sigma_a$	0,371	0,028	0,323	0,419	0,365	0,027	0,318	0,412	0,371	0,025	0,322	0,420	0,374	0,029	0,324	0,421	0,366	0,026	0,320	0,411	0,388	0,027	0,335	0,441						
$\sigma_b$	0,170	0,017	0,141	0,199	0,043	0,121	0,243	0,290	0,204	0,073	0,372	0,292	0,086	0,202	0,377	0,330	0,036	0,254	0,403	0,211	0,047	0,211	0,428							
$\sigma_g$	0,381	0,027	0,337	0,424	0,394	0,029	0,347	0,440	0,383	0,027	0,338	0,426	0,383	0,024	0,338	0,426	0,376	0,022	0,333	0,418	0,389	0,025	0,343	0,435						
$\sigma_l$	0,327	0,043	0,248	0,407	0,335	0,037	0,265	0,404	0,327	0,040	0,254	0,399	0,325	0,044	0,254	0,394	0,366	0,049	0,274	0,457	0,379	0,044	0,298	0,458						
$\sigma_r$	0,124	0,018	0,100	0,147	0,128	0,012	0,108	0,147	0,106	0,012	0,089	0,123	0,100	0,009	0,084	0,115	0,162	0,139	0,016	0,084	0,099	0,088	0,007	0,076	0,101					
$\sigma_p$	0,093	0,010	0,073	0,111	0,102	0,009	0,077	0,136	0,138	0,011	0,116	0,160	0,138	0,011	0,115	0,162	0,139	0,017	0,161	0,135	0,011	0,113	0,161							
$\sigma_w$	0,313	0,038	0,250	0,375	0,284	0,028	0,228	0,339	0,284	0,035	0,223	0,343	0,283	0,033	0,222	0,341	0,288	0,029	0,227	0,349	0,270	0,021	0,218	0,323						

Table 8: Bayesian estimations of the models 7 to 12 for the period 1985 to 2007.

HPDi (Highest Posterior Density interval) is the shortest interval among all of the Bayesian credible intervals: any point *within* the interval has a higher density than any other point outside.

1955-1985										1985-2010														
Rule 1					Rule 2					Rule 3					Rule 4									
	Mean	Std.	90% HPDi	Mean	Std.	90% HPDi	Mean	Std.	90% HPDi	Mean	Std.	90% HPDi	Mean	Std.	90% HPDi	Mean	Std.	90% HPDi	Mean					
$\varphi$	4.768	0.581	3.173	6.335	5.999	0.905	4.431	7.564	4.927	1.073	3.255	6.584	5.998	0.455	4.131	7.652	4.238	0.732	2.591	5.823	4.312	0.558	2.548	
$\sigma_c$	1.289	0.130	1.041	1.533	1.243	0.90	1.064	1.415	1.176	0.141	0.943	1.403	1.087	0.079	0.971	1.200	1.233	0.084	0.942	1.520	1.197	0.076	0.933	1.461
$\lambda$	0.744	0.034	0.663	0.827	0.821	0.025	0.775	0.868	0.603	0.040	0.533	0.673	0.821	0.015	0.775	0.870	0.549	0.042	0.429	0.668	0.567	0.020	0.455	0.674
$\xi_w$	0.777	0.030	0.709	0.846	0.743	0.045	0.677	0.809	0.640	0.047	0.550	0.729	0.761	0.028	0.697	0.827	0.796	0.023	0.734	0.861	0.803	0.016	0.744	0.863
$\sigma_l$	1.608	0.249	0.443	2.651	1.519	0.381	2.489	0.465	0.108	0.250	0.730	0.288	0.340	1.202	2.962	0.759	0.235	0.250	1.328	0.963	0.165	0.250	1.663	
$\xi_p$	0.588	0.037	0.509	0.657	0.566	0.049	0.500	0.622	0.569	0.043	0.500	0.628	0.529	0.021	0.500	0.561	0.568	0.030	0.500	0.624	0.567	0.033	0.500	0.621
$t_w$	0.613	0.098	0.423	0.804	0.647	0.100	0.463	0.834	0.637	0.109	0.459	0.816	0.687	0.055	0.521	0.858	0.558	0.063	0.379	0.740	0.558	0.059	0.384	0.738
$t_p$	0.235	0.047	0.098	0.369	0.221	0.075	0.089	0.348	0.228	0.058	0.096	0.354	0.238	0.086	0.098	0.375	0.344	0.057	0.161	0.511	0.333	0.120	0.160	0.501
$\psi$	0.422	0.095	0.216	0.624	0.432	0.088	0.229	0.629	0.487	0.099	0.269	0.700	0.481	0.103	0.286	0.675	0.588	0.068	0.403	0.774	0.570	0.040	0.388	0.752
$\Phi$	1.543	0.056	1.417	1.668	1.523	0.079	1.402	1.643	1.447	0.062	1.329	1.564	1.494	0.044	1.382	1.606	1.552	0.052	1.426	1.673	1.536	0.019	1.415	1.655
$\rho$	0.789	0.025	0.737	0.842	0.772	0.032	0.720	0.825	0.744	0.028	0.685	0.798	0.682	0.027	0.625	0.740	0.796	0.035	0.751	0.841	0.788	0.019	0.742	0.835
$r_{\pi}$	1.828	0.123	1.555	2.102	1.671	0.161	1.411	1.926	1.809	0.119	1.522	2.092	1.439	0.077	1.274	1.600	0.110	0.253	0.115	0.036	0.194	0.045	1.734	2.225
$r_y$	0.155	0.014	0.100	0.210	0.142	0.022	0.081	0.202	0.137	0.038	0.063	0.210	0.181	0.030	0.110	0.253	0.205	0.129	1.757	2.288	1.986	0.045	1.734	2.225
$r_{Ay}$	0.196	0.019	0.146	0.245																				
$r_h$																								
$\bar{\pi}$	0.685	0.049	0.512	0.858	0.682	0.087	0.509	0.851	0.676	0.077	0.510	0.840	0.772	0.044	0.606	0.937	0.776	0.048	0.615	0.935	0.757	0.015	0.611	0.915
$\bar{t}$	0.835	1.082	-1.022	2.705	0.599	0.912	-1.287	2.537	0.507	0.819	-1.433	1.579	0.636	0.705	-2.607	1.286	-0.954	0.680	-2.780	0.890	-0.899	0.505	-2.738	0.921
$\bar{\gamma}$	0.364	0.038	0.277	0.455	0.364	0.038	0.287	0.440	0.410	0.035	0.336	0.483	0.354	0.039	0.276	0.434	0.324	0.051	0.246	0.406	0.328	0.014	0.246	0.411
$100(\beta^{-1}-1)$	0.571	0.073	0.437	0.702	0.570	0.077	0.441	0.701	0.592	0.078	0.468	0.719	0.595	0.075	0.464	0.725	0.597	0.081	0.467	0.727	0.597	0.070	0.467	0.729
$\alpha$	0.217	0.016	0.186	0.248	0.211	0.016	0.182	0.240	0.202	0.018	0.170	0.234	0.211	0.016	0.183	0.239	0.209	0.017	0.176	0.241	0.209	0.013	0.176	0.242
$\rho_a$	0.989	0.003	0.982	0.996	0.990	0.005	0.984	0.996	0.975	0.012	0.960	0.990	0.993	0.003	0.988	0.997	0.983	0.007	0.974	0.993	0.984	0.004	0.974	0.993
$\rho_b$	0.355	0.064	0.182	0.525	0.245	0.070	0.118	0.368	0.629	0.071	0.507	0.753	0.207	0.093	0.087	0.324	0.780	0.034	0.687	0.880	0.773	0.046	0.668	0.880
$\rho_g$	0.921	0.034	0.874	0.970	0.916	0.026	0.869	0.965	0.909	0.028	0.866	0.954	0.927	0.044	0.881	0.975	0.922	0.022	0.881	0.964	0.922	0.031	0.880	0.966
$\rho_l$	0.724	0.057	0.607	0.844	0.719	0.060	0.608	0.829	0.721	0.063	0.608	0.834	0.798	0.046	0.712	0.886	0.724	0.045	0.611	0.837	0.731	0.046	0.618	0.845
$\rho_t$	0.237	0.072	0.098	0.371	0.233	0.078	0.104	0.359	0.797	0.062	0.714	0.891	0.283	0.095	0.151	0.414	0.246	0.057	0.119	0.373	0.249	0.042	0.117	0.378
$\rho_r$	0.930	0.036	0.852	0.995	0.931	0.016	0.867	0.993	0.952	0.014	0.904	0.994	0.905	0.046	0.848	0.964	0.893	0.034	0.797	0.992	0.907	0.080	0.817	0.992
$\rho_w$	0.906	0.024	0.768	0.990	0.894	0.089	0.771	0.985	0.865	0.108	0.718	0.985	0.854	0.032	0.757	0.949	0.927	0.056	0.875	0.981	0.926	0.021	0.873	0.980
$\mu_p$	0.801	0.073	0.661	0.939	0.778	0.066	0.639	0.920	0.801	0.057	0.677	0.927	0.666	0.103	0.504	0.830	0.779	0.056	0.617	0.938	0.791	0.031	0.623	0.939
$\mu_w$	0.841	0.041	0.670	0.970	0.810	0.095	0.652	0.949	0.760	0.116	0.585	0.928	0.721	0.063	0.579	0.867	0.874	0.093	0.793	0.958	0.872	0.036	0.789	0.958
$\sigma_a$	0.537	0.033	0.476	0.596	0.542	0.036	0.482	0.602	0.544	0.036	0.484	0.603	0.543	0.030	0.482	0.603	0.530	0.037	0.470	0.589	0.532	0.034	0.472	0.592
$\sigma_b$	2.301	0.306	1.320	3.256	3.628	0.622	2.624	4.732	1.226	0.153	0.987	1.455	3.234	0.524	2.160	4.325	0.594	0.081	0.361	0.807	0.605	0.186	0.363	0.836
$\sigma_g$	0.525	0.032	0.471	0.578	0.525	0.035	0.471	0.577	0.529	0.032	0.473	0.585	0.528	0.032	0.474	0.582	0.532	0.037	0.476	0.586	0.531	0.032	0.476	0.585
$\sigma_l$	0.475	0.060	0.360	0.451	0.600	0.348	0.551	0.452	0.074	0.332	0.568	0.355	0.047	0.283	0.425	0.461	0.052	0.354	0.566	0.454	0.051	0.348	0.557	
$\sigma_r$	0.286	0.019	0.252	0.319	0.297	0.019	0.263	0.330	0.165	0.022	0.123	0.206	0.301	0.021	0.266	0.335	0.334	0.039	0.281	0.385	0.330	0.026	0.279	0.380
$\sigma_p$	0.176	0.018	0.140	0.211	0.169	0.019	0.134	0.204	0.166	0.020	0.132	0.199	0.170	0.018	0.136	0.204	0.205	0.015	0.173	0.238	0.206	0.018	0.172	0.239
$\sigma_w$	0.221	0.016	0.191	0.251	0.227	0.018	0.196	0.258	0.236	0.018	0.205	0.266	0.220	0.016	0.189	0.251	0.214	0.016	0.187	0.241	0.214	0.014	0.187	0.242

Table 9: Bayesian estimations of the models 1 to 6 for the period 1955 to 1985.

HPDi (Highest Posterior Density interval) is the shortest interval among all of the Bayesian credible intervals: any point *within* the interval has a higher density than any other point outside.

1955-1985											
Rule 1				Rule 2				Rule 3			
	Mean	Std.	90% HPDi	Mean	Std.	90% HPDi	Mean	Std.	90% HPDi	Mean	Std.
$\varphi$	3.186	0.907	2.000	4.170	5.164	0.833	3.016	7.240	4.633	3.149	6.112
$\sigma_c$	1.295	0.161	0.994	1.592	0.917	0.071	0.820	1.012	1.321	0.110	1.074
$\lambda$	0.480	0.048	0.395	0.566	0.820	0.030	0.757	0.885	0.748	0.054	0.665
$\xi_w$	0.753	0.033	0.685	0.824	0.832	0.035	0.767	0.898	0.794	0.047	0.718
$\sigma_I$	0.445	0.195	0.250	0.682	0.886	0.493	0.250	1.615	0.426	0.145	0.250
$\xi_p$	0.576	0.039	0.500	0.635	0.575	0.039	0.506	0.634	0.695	0.033	0.618
$t_w$	0.542	0.067	0.362	0.725	0.628	0.103	0.443	0.821	0.556	0.077	0.371
$t_p$	0.270	0.083	0.117	0.419	0.224	0.068	0.089	0.353	0.207	0.065	0.081
$\psi$	0.538	0.073	0.362	0.716	0.369	0.097	0.208	0.523	0.345	0.071	0.173
$\Phi$	1.601	0.046	1.479	1.725	1.646	0.052	1.513	1.775	1.525	0.052	1.400
$\rho$	0.775	0.040	0.719	0.832	0.844	0.024	0.814	0.874	0.604	0.039	0.513
$r_\pi$											
$r_y$											
$r_{Ay}$											
$r_n$	1.832	0.121	1.524	2.132	1.742	0.204	1.452	2.025	0.701	0.081	0.520
$\bar{\pi}$	0.776	0.048	0.628	0.924	0.713	0.054	0.558	0.865	0.736	0.072	0.546
$\bar{I}$	-0.698	1.157	-2.769	1.300	-1.523	0.957	-3.098	0.044	-0.177	0.605	-2.237
$\bar{\gamma}$	0.351	0.033	0.273	0.428	0.402	0.055	0.318	0.485	0.364	0.033	0.300
$100(\beta^{-1} - 1)$	0.589	0.070	0.457	0.723	0.645	0.096	0.500	0.791	0.573	0.060	0.444
$\alpha$	0.221	0.015	0.188	0.254	0.241	0.015	0.211	0.221	0.217	0.015	0.187
$\rho_a$	0.978	0.005	0.967	0.988	0.960	0.013	0.934	0.987	0.988	0.006	0.995
$\rho_b$	0.883	0.024	0.849	0.919	0.364	0.100	0.184	0.540	0.432	0.025	0.581
$\rho_g$	0.904	0.026	0.863	0.945	0.902	0.030	0.856	0.950	0.908	0.027	0.860
$\rho_l$	0.711	0.055	0.603	0.820	0.768	0.051	0.692	0.848	0.655	0.058	0.531
$\rho_r$	0.404	0.046	0.291	0.519	0.134	0.055	0.042	0.221	0.853	0.026	0.793
$\rho_p$	0.950	0.022	0.894	0.995	0.950	0.067	0.907	0.991	0.968	0.009	0.946
$\rho_w$	0.952	0.030	0.922	0.984	0.793	0.036	0.573	0.967	0.636	0.144	0.341
$\mu_p$	0.832	0.049	0.727	0.936	0.814	0.127	0.711	0.919	0.916	0.019	0.861
$\mu_w$	0.896	0.050	0.838	0.956	0.732	0.047	0.479	0.939	0.587	0.139	0.290
$\sigma_a$	0.509	0.031	0.453	0.564	0.517	0.034	0.458	0.574	0.549	0.035	0.487
$\sigma_b$	0.634	0.060	0.523	0.741	2.656	0.521	1.245	4.021	2.531	0.662	3.497
$\sigma_g$	0.532	0.034	0.476	0.586	0.543	0.032	0.486	0.599	0.522	0.027	0.469
$\sigma_l$	0.487	0.072	0.373	0.600	0.378	0.051	0.298	0.456	0.537	0.066	0.407
$\sigma_r$	0.343	0.047	0.286	0.398	0.331	0.027	0.287	0.373	0.345	0.024	0.301
$\sigma_p$	0.196	0.024	0.162	0.230	0.177	0.020	0.144	0.210	0.166	0.018	0.132
$\sigma_w$	0.217	0.017	0.189	0.244	0.217	0.016	0.185	0.247	0.227	0.019	0.192

Rule 4											
Rule 5				Rule 6							
	Mean	Std.	90% HPDi		Mean	Std.	90% HPDi		Mean	Std.	90% HPDi
$\varphi$	3.149	6.112	4.339		2.915	5.726	5.451		5.110	6.996	6.982
$\sigma_c$	0.863	1.345	1.558		1.091	1.599	1.414		1.026	0.074	0.914
$\lambda$	0.720	0.832	0.832		0.618	0.811	0.794		0.733	0.881	0.848
$\xi_w$	0.791	0.792	0.792		0.727	0.857	0.807		0.733	0.881	0.848
$\sigma_I$	0.871	0.718	0.888		0.750	0.559	0.408		0.750	0.614	0.645
$\xi_p$	0.775	0.750	0.750		0.676	0.827	0.632		0.676	0.554	0.711
$t_w$	0.747	0.602	0.747		0.604	0.604	0.604		0.604	0.417	0.793
$t_p$	0.740	0.602	0.740		0.380	0.206	0.380		0.380	0.120	0.380
$\psi$	0.730	0.551	0.730		0.330	0.055	0.330		0.330	0.171	0.503
$\Phi$	1.600	1.600	1.600		1.660	1.660	1.660		1.660	1.631	1.592
$\rho$	0.500	0.634	0.567		0.500	0.634	0.567		0.500	0.538	0.606
$r_\pi$											
$r_y$											
$r_{Ay}$											
$r_n$	0.690	0.898	0.690		0.690	0.046	0.690		0.690	0.029	0.839
$\bar{\pi}$	0.781	0.924	0.781		0.781	0.031	0.781		0.781	0.029	0.839
$\bar{I}$	0.717	0.546	0.717		0.717	0.027	0.717		0.717	0.027	0.834
$\bar{\gamma}$	0.417	0.364	0.417		0.417	0.027	0.417		0.417	0.027	0.834
$100(\beta^{-1} - 1)$	0.701	0.580	0.701		0.701	0.073	0.701		0.701	0.073	0.834
$\alpha$	0.620	0.444	0.620		0.620	0.027	0.620		0.620	0.027	0.834
$\rho_a$	0.981	0.995	0.981		0.981	0.003	0.981		0.981	0.003	0.981
$\rho_b$	0.511	0.506	0.511		0.511	0.056	0.511		0.511	0.061	0.511
$\rho_g$	0.860	0.958	0.860		0.860	0.025	0.860		0.860	0.027	0.860
$\rho_l$	0.973	0.907	0.973		0.973	0.025	0.973		0.973	0.025	0.973
$\rho_r$	0.793	0.779	0.793		0.793	0.026	0.793		0.793	0.026	0.793
$\rho_p$	0.986	0.913	0.986		0.986	0.031	0.986		0.986	0.031	0.986
$\rho_w$	0.563	0.563	0.563		0.563	0.026	0.563		0.563	0.026	0.563
$\mu_a$	0.614	0.614	0.614		0.614	0.059	0.614		0.614	0.059	0.614
$\mu_b$	0.547	0.547	0.547		0.547	0.037	0.547		0.547	0.037	0.547
$\mu_g$	0.611	0.549	0.611		0.611	0.037	0.611		0.611	0.037	0.611
$\mu_l$	0.575	0.575	0.575		0.575	0.018	0.575		0.575	0.018	0.575
$\mu_r$	0.974	0.968	0.974		0.974	0.018	0.974		0.974	0.018	0.974
$\mu_p$	0.968	0.968	0.968		0.968	0.018	0.968		0.968	0.018	0.968
$\mu_w$	0.999	0.999	0.999		0.999	0.026	0.999		0.999	0.026	0.999
$\sigma_a$	0.644	0.549	0.644		0.644	0.035	0.644		0.644	0.035	0.644
$\sigma_b$	1.245	0.402	1.245		1.245	0.028	1.245		1.245	0.028	1.245
$\sigma_g$	0.574	0.524	0.574		0.574	0.032	0.574		0.574	0.032	0.574
$\sigma_l$	0.757	0.524	0.757		0.757	0.027	0.757		0.757	0.027	0.757
$\sigma_r$	0.519	0.519	0.519		0.519	0.028	0.519		0.519	0.028	0.519
$\sigma_p$	0.680	0.485	0.680		0.680	0.047	0.680		0.680	0.047	0.680
$\sigma_w$	0.599	0.599	0.599		0.599	0.030	0.599		0.599	0.030	0.599

Table 10: Bayesian estimations of the models 7 to 12 for the period 1955 to 1985.

HPDi (Highest Posterior Density interval) is the shortest interval among all of the Bayesian credible intervals: any point *within* the interval has a higher density than any other point outside.

## 5.2 Estimated shocks

Fig. 1 to Fig. 4 present estimated shocks, for each model and sample.

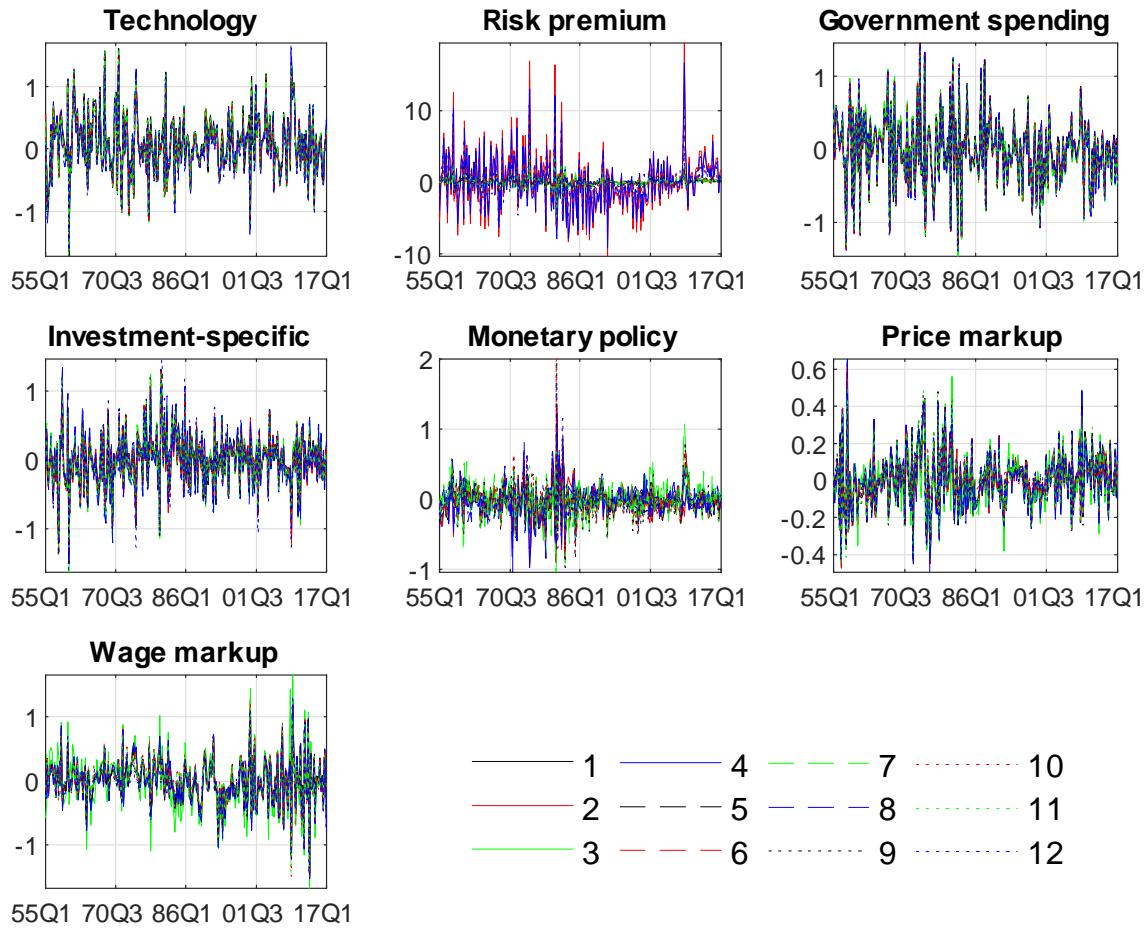


Figure 1: Estimated shocks between 1955 and 2017 (rules 1 to 12).

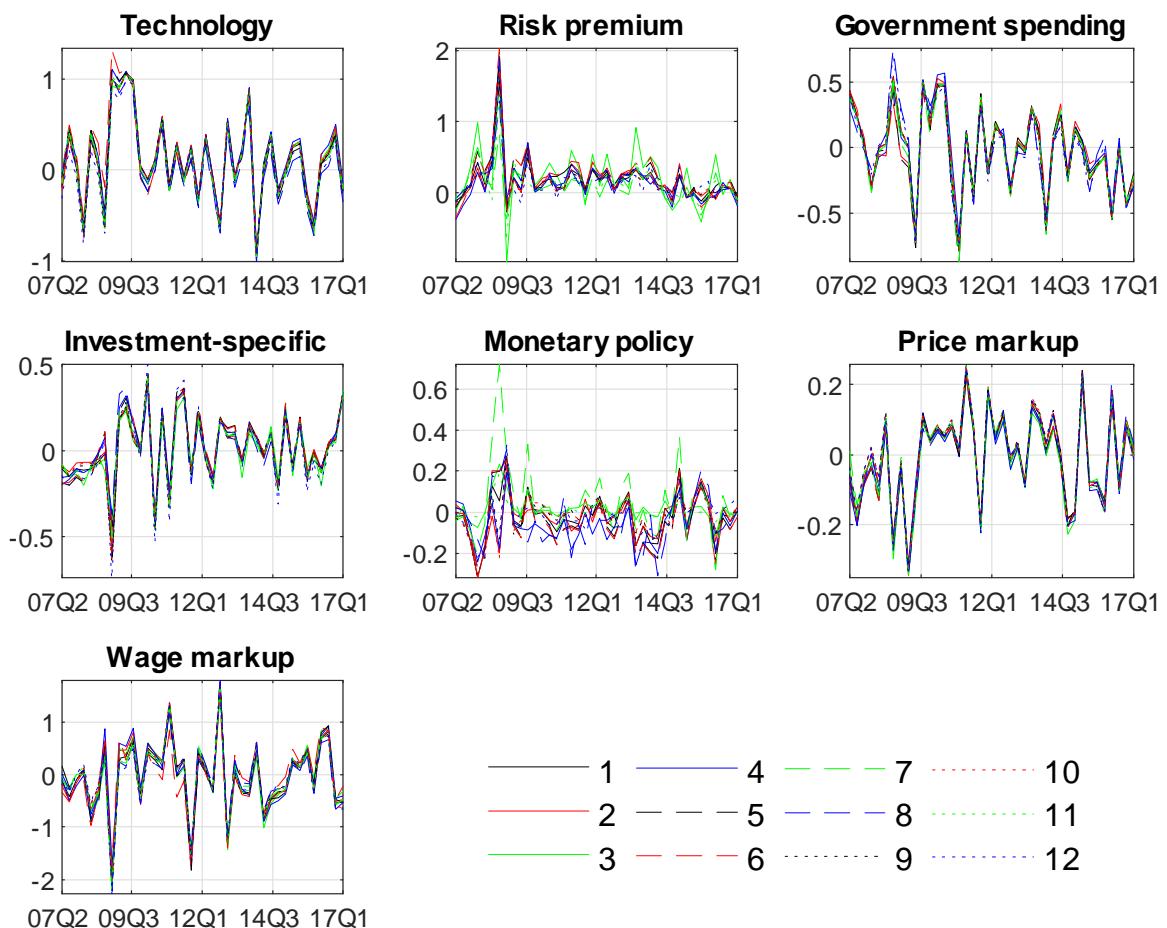


Figure 2: Estimated shocks between 2007 and 2017 (rules 1 to 12).

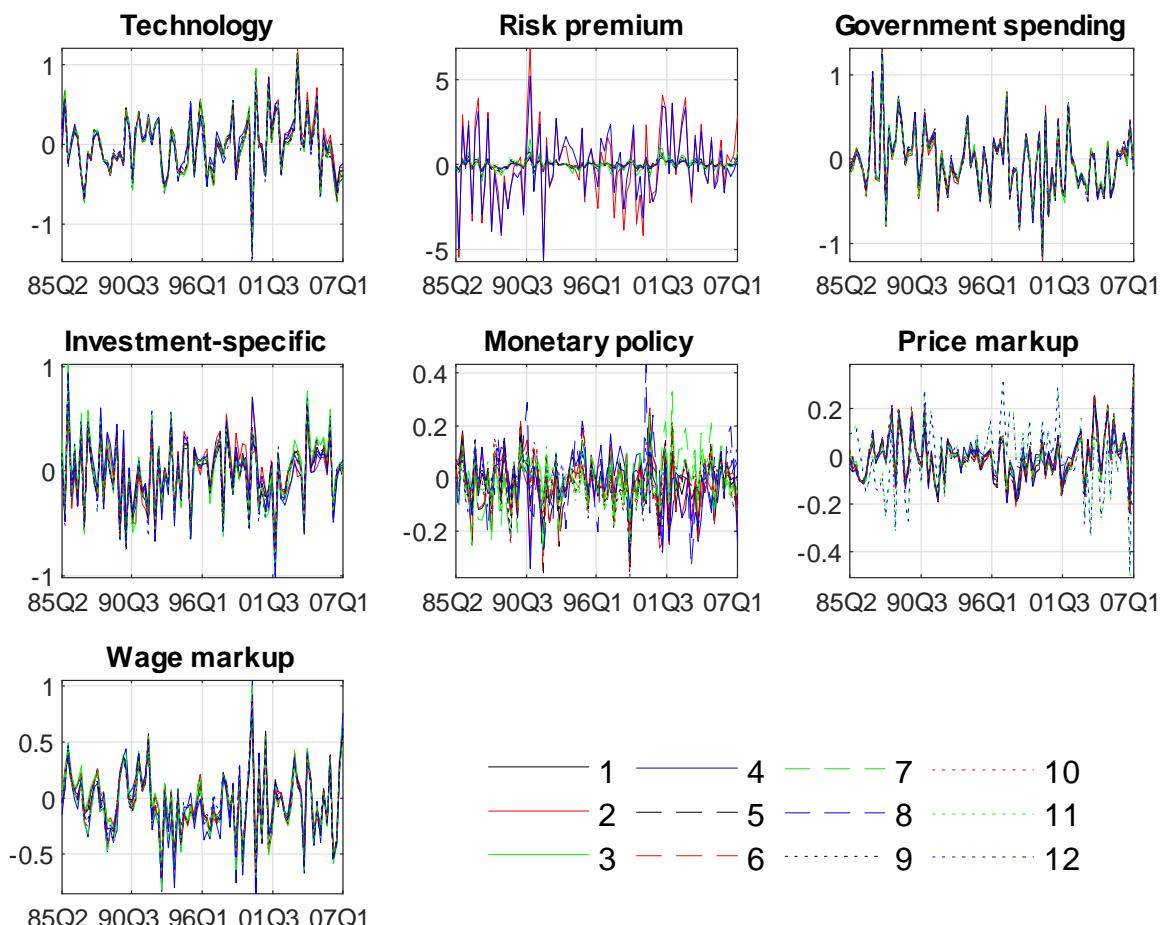


Figure 3: Estimated shocks between 1985 and 2007 (rules 1 to 12).

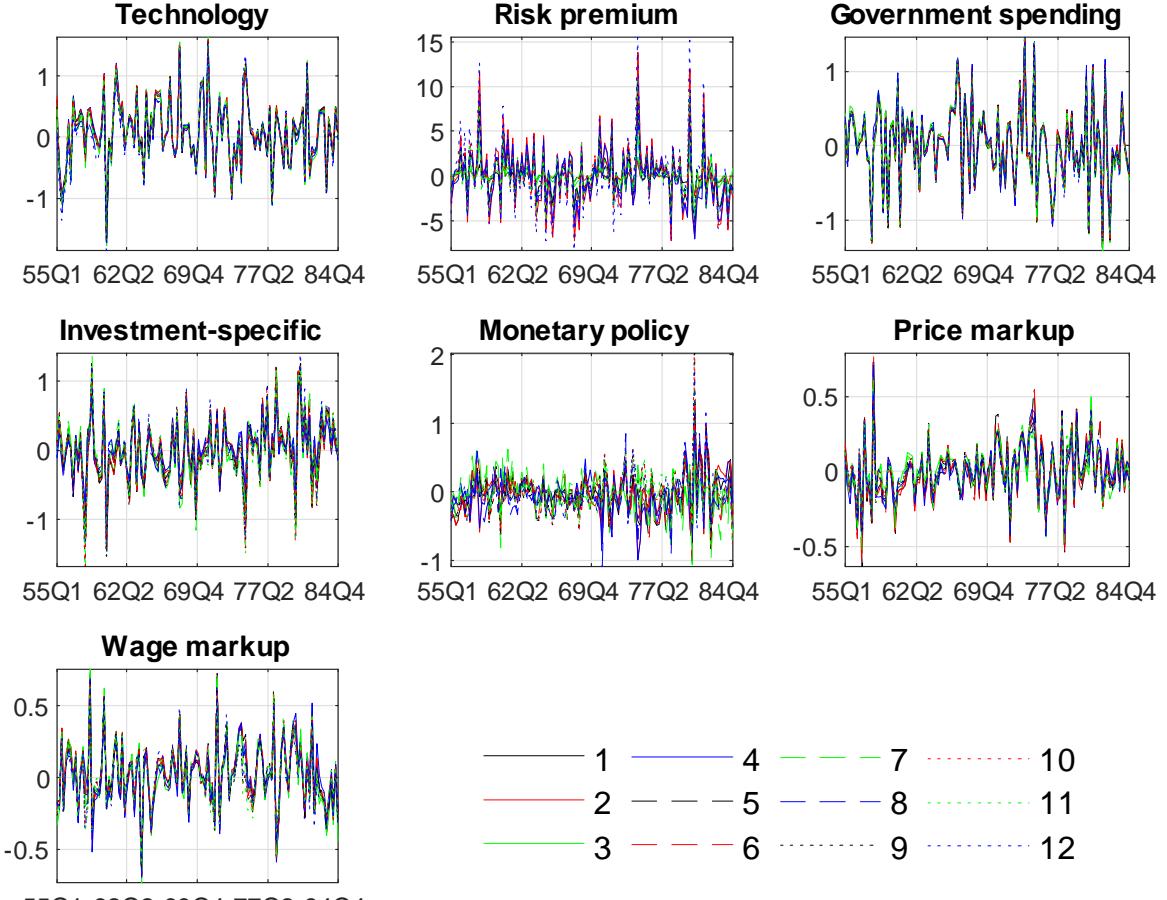


Figure 4: Estimated shocks between 1955 and 1985 (rules 1 to 12).

The estimates of the innovation component of each structural shock appears to respect *i.i.d* properties and are centered around zero (as assumed in Section 2.3). These results suggest that the estimated models are statistically not misspecified.

### 5.3 Impulse response functions

Fig. 5 to Fig. 8 show the responses of inflation, output, interest rate, wages and investment to all shocks and with respect to all periods.

The impact of a monetary policy shock on inflation is strongest under rule 3 during all the periods. Rule 11 performs similarly in a manner similar to rule 3, with the highest on-impact response of inflation to monetary policy shocks during the GFC/ZLB period.

A technology shock has a greater negative impact on inflation during the 1955-1985 period than during any other period. The lowest impact occurred during the GFC/ZLB. Different rules over different periods lead to the lowest inflation decrease following a technology shock. However, rule 3 reaches the steady-state the fastest, except during the GFC/ZLB, leading to the lowest inflation decrease

as time elapses.

The impact of a risk premium shock on inflation is heterogeneous, depending on the rule. Following a risk premium shock, rules 3, 7 and 11 lead to an increase in inflation during the GFC/ZLB while other rules lead to a decrease. This phenomenon is present over almost all sample periods. Having the natural interest rate included in the policy rules seems to soften the impact of risk premium shocks.

The response of inflation to a government expenditure shock is weaker over the GFC/ZLB and GM periods, whereas it is stronger over the 1955-1985 period.

Regarding the short-run impact of the monetary policy shock on output, rules 3 and 11 (negatively) dominate the others during the GFC/ZLB period, and rule 3 dominates during the GM and 1955-1985 periods.

When considering the technology shock, the on-impact response of output is the highest under rule 7 in all periods (yet very close to rules 3 and 11).

The impact of a risk premium shock on output is always lower under rules 3 and 11 than under any other rule, whatever the sample period. Interestingly, the impact of such shock on output was generally stronger during the GFC/ZLB and the GM periods than during the 1955-1985 or the overall periods.

The short-run impact of the government expenditure shock on output does not substantially vary across rules or periods, in terms of lasting through time, at least when it relates to the GFC/ZLB and the GM periods. Its on-impact value is greater, however, over the 1955-1985 period and the full sample period. Note that a comparison of the GM and the GFC/ZLB periods reveals a significantly longer lasting impact of government expenditure shock on output for the former period, regardless of the rule applied. Government expenditures have lower long-term impact during the GFC/ZLB than during the GM or the 1955-1985 periods.

When considering the on-impact of monetary policy shocks on investment, rules 3 and 11 lead to the highest (negatively) reaction during the GFC/ZLB period, but rule 3 does so over the GM and 1955-1985 periods. Rule 3 and 11 also (negative) dominate over the full sample (on-impact).

Interestingly, NGDP Level rules lead to the highest impact on investment following a price markup shock over all the periods.

Concerning the impact of the technology shock on investment, rules 8 and 12 lead to the strongest negative impact over all the periods while the other rules produce positive reactions. The GFC/ZLB period is characterized by a high (positive) impact of rules 3, 7, and 11. The GM period is also characterized by a high impact from rules 3, 7, and 11, but several other rules produce results that are nearly as good. Before 1985 and over the full sample period, the results are somewhat mixed.

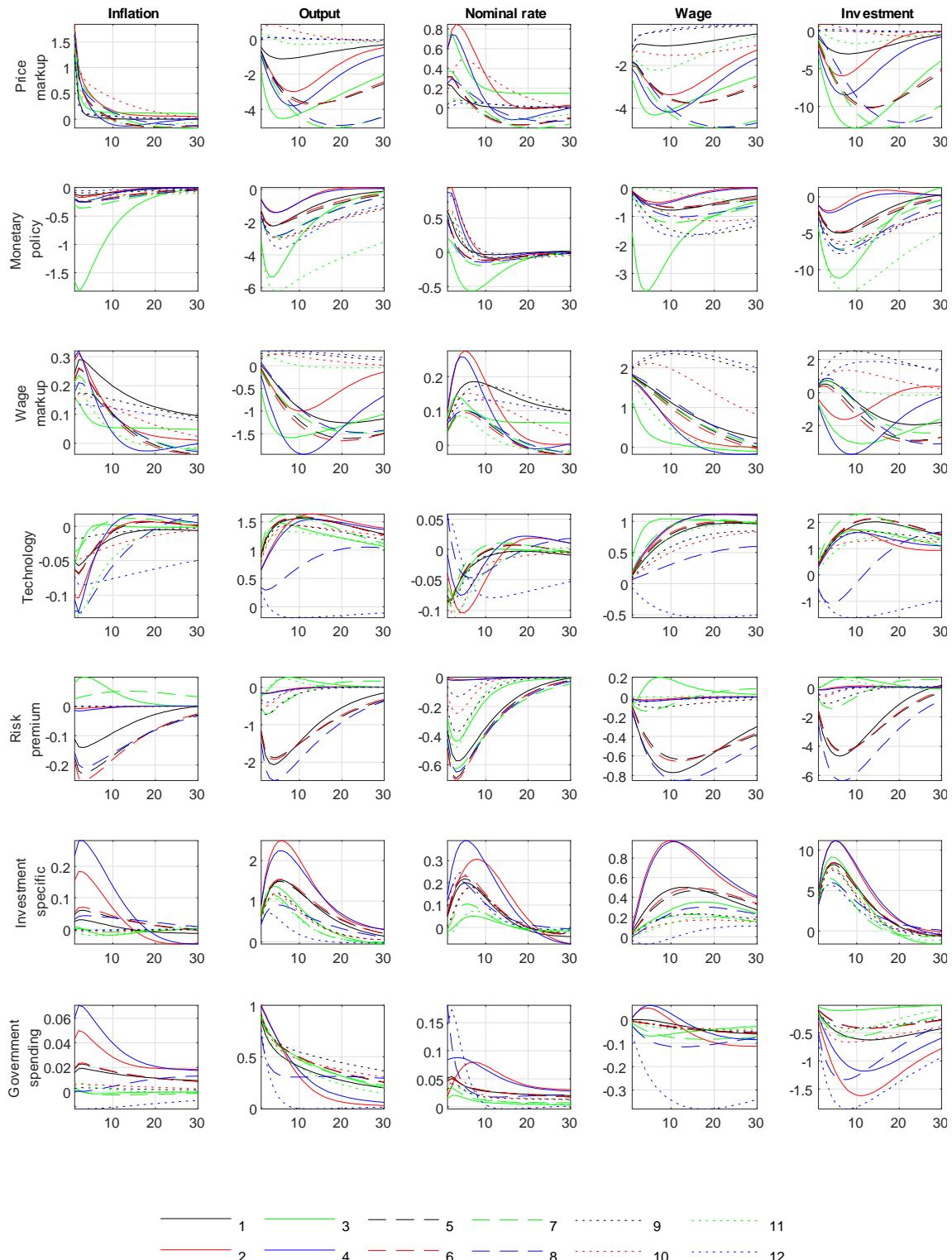


Figure 5: Response of inflation, output, interest rate, wage and investment to a 1% deviation shock between 1955 and 2017 (rules 1 to 12).

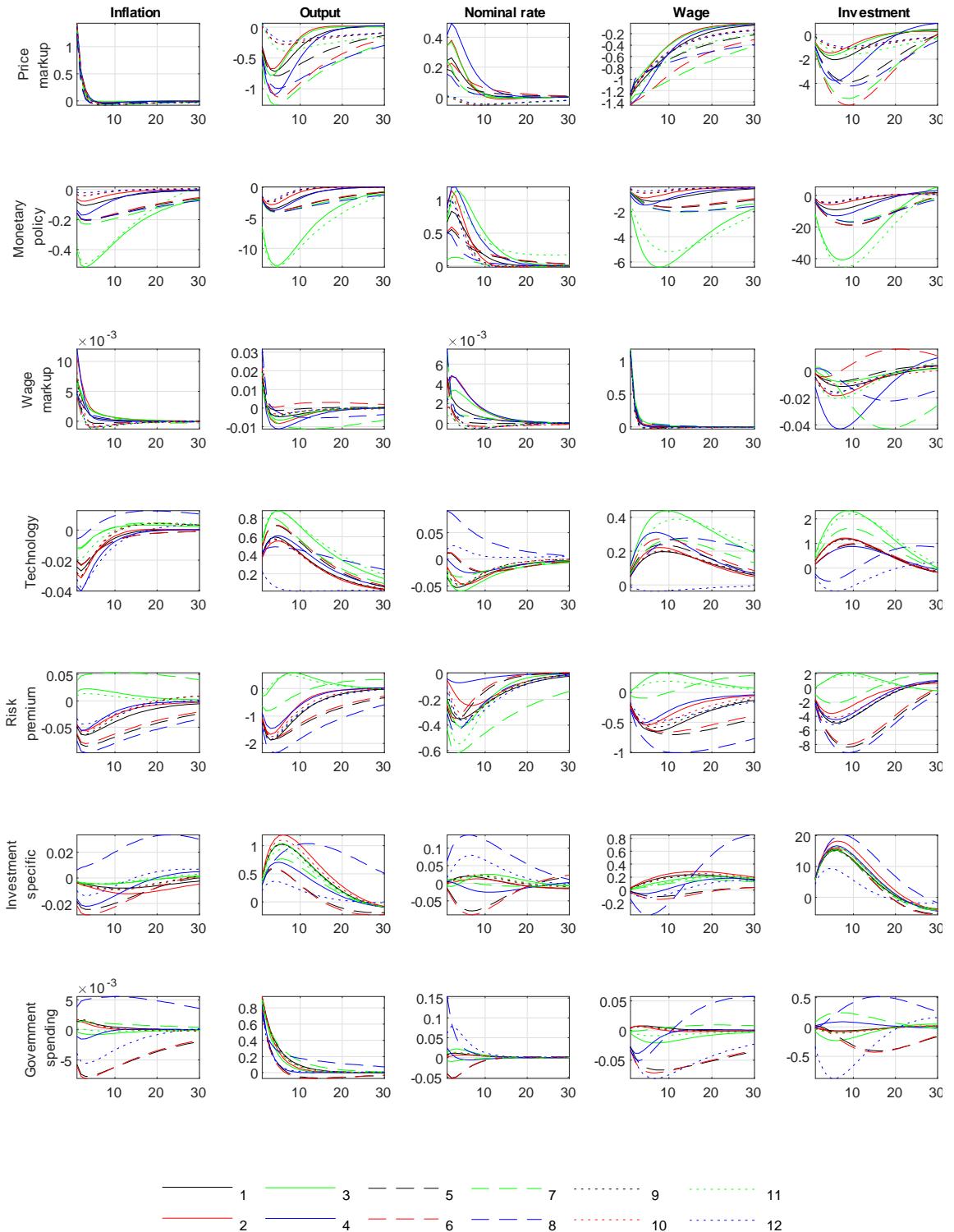


Figure 6: Response of inflation, output, interest rate, wage and investment to a 1% deviation shock between 2007 and 2017 (rules 1 to 12).

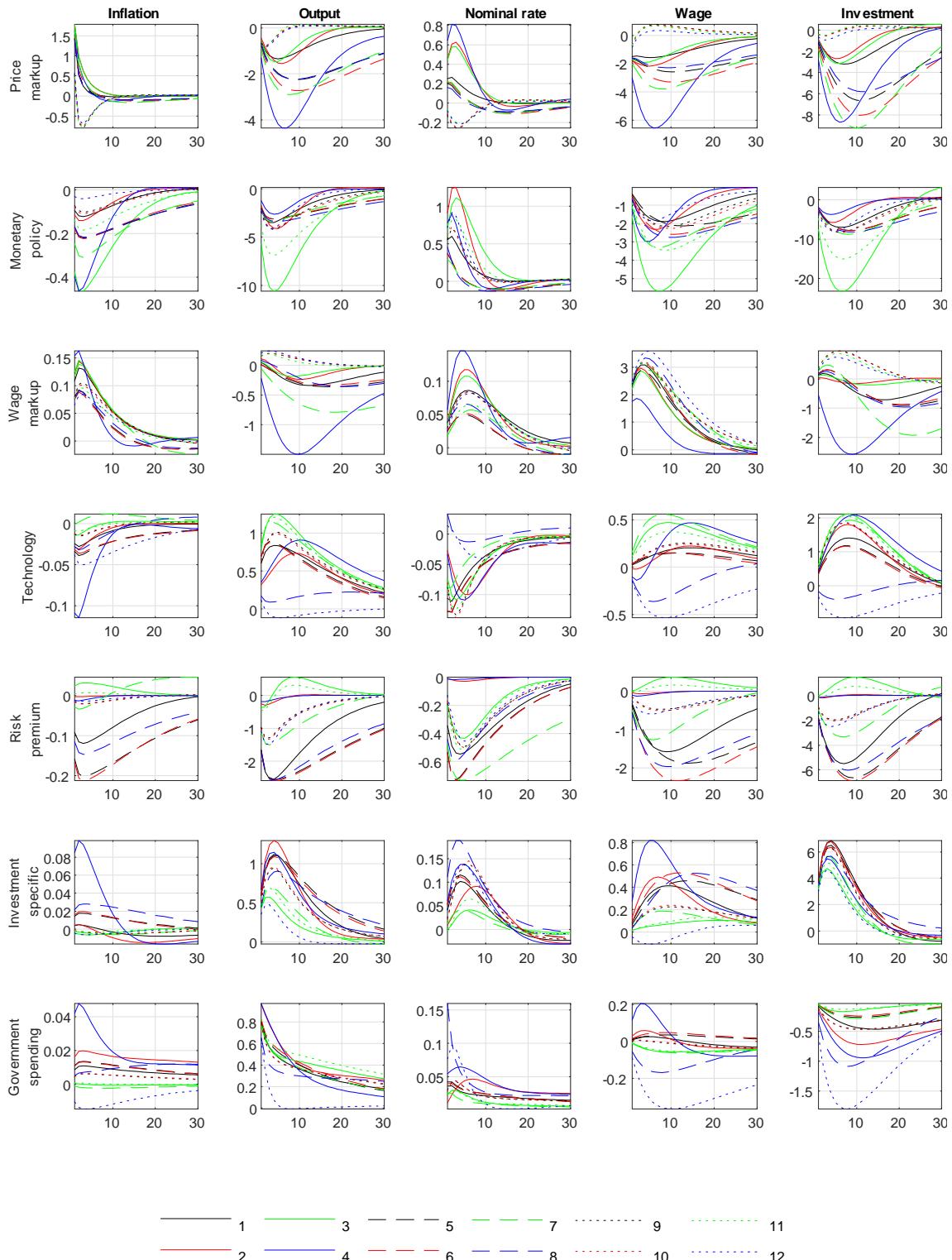


Figure 7: Response of inflation, output, interest rate, wage and investment to a 1% deviation shock between 1985 and 2007 (rules 1 to 12).

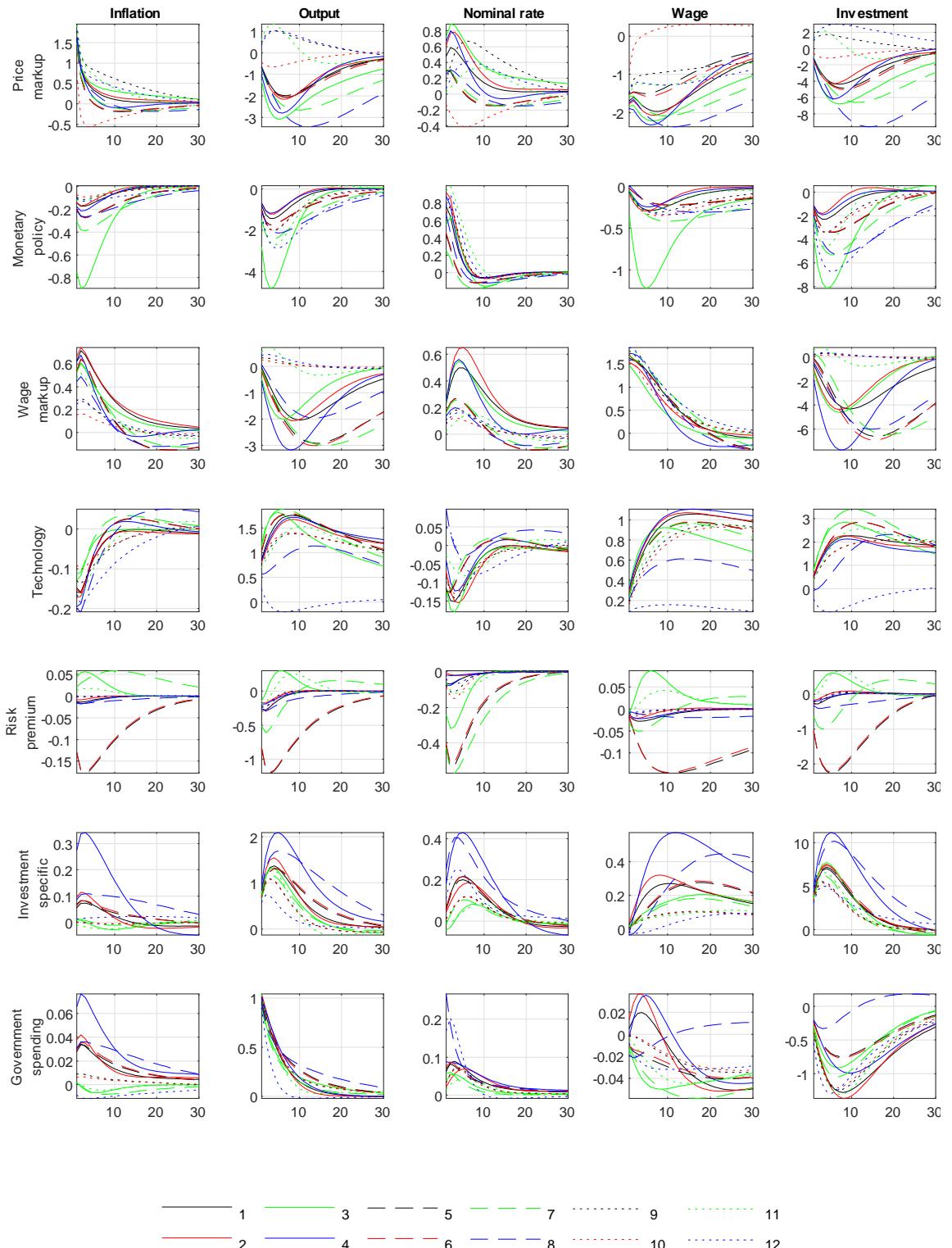


Figure 8: Response of inflation, output, interest rate, wage and investment to a 1% deviation shock between 1955 and 1985 (rules 1 to 12).

## 5.4 Variance decompositions

Fig. 9 to Fig. 12 show the variance decompositions of inflation and output with respect to all shocks, in the short and long runs.

A comparison between the GFC/ZLB and the GM periods is interesting. In the short and the long run, inflation is explained almost entirely by the mark-up shock. Output variance is impacted by the three shocks we focus on (monetary policy, technology, government spending) but also by the risk premium shock. The impact of each shock depends on the monetary rule. The impact of the monetary shock is generally greater during the period of 2007-2017 than between 1985 and 2007. It is significant for both periods but more so during the GFC/ZLB than the GM period. Specifically, during the former period, and under rules 3, 7 and 11, the monetary policy shock explains about 50% of the output variance in the short run and 70% in the long run, whereas it is significantly lower when applying the other rules (except rule 1 that also explain a significant share of long run output dynamics). But, in both periods, the technology and the government expenditure shocks (as well as the risk premium shock) have their role to play. Note further that whatever the shock, it is always rules 3, 7 and 11 that lead to the highest variance decomposition for output during the GFC/ZLB period, other than following a risk premium shock.

Note also that the government expenditure shock has a relatively lower impact during the GFC/ZLB period than during the GM period.

Output in the long run is also substantially impacted by the technology shock in the 1955-1985 period and over the full sample period. These impacts are more or less significant depending on the monetary rule being applied.

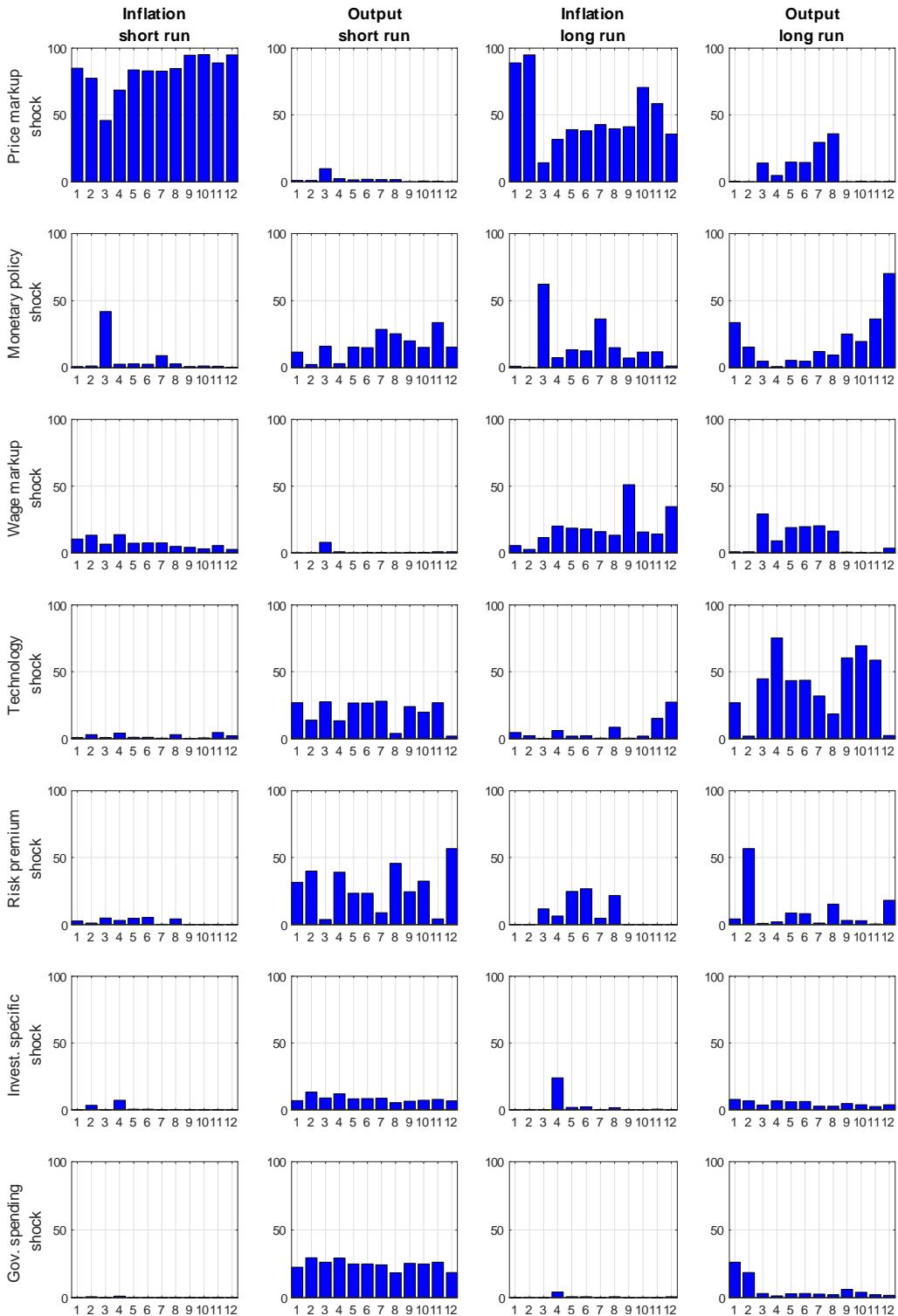


Figure 9: Variance decompositions of inflation and output between 1955 and 2017 (rules 1 to 12).

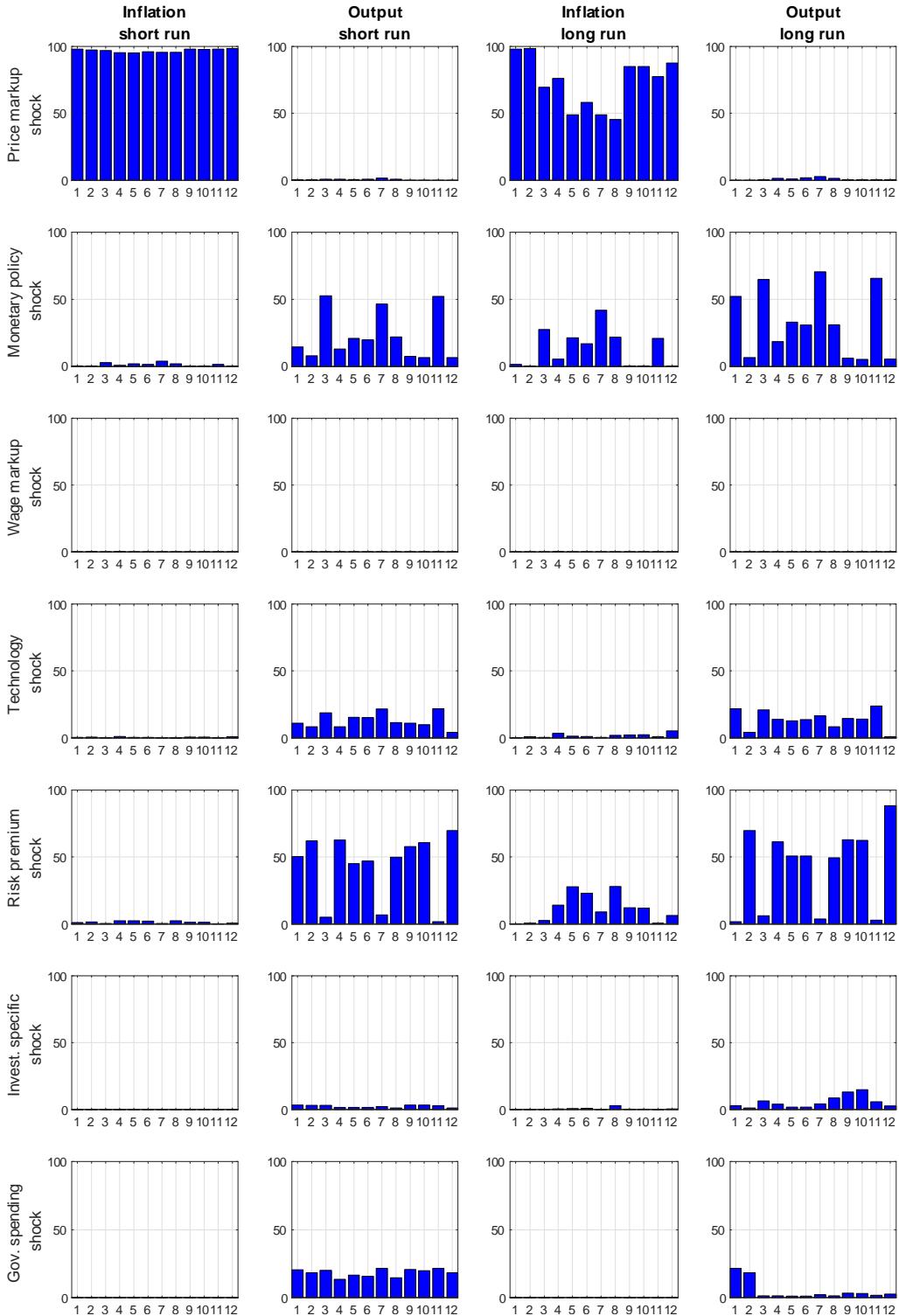


Figure 10: Variance decompositions of inflation and output between 2007 and 2017 (rules 1 to 12).

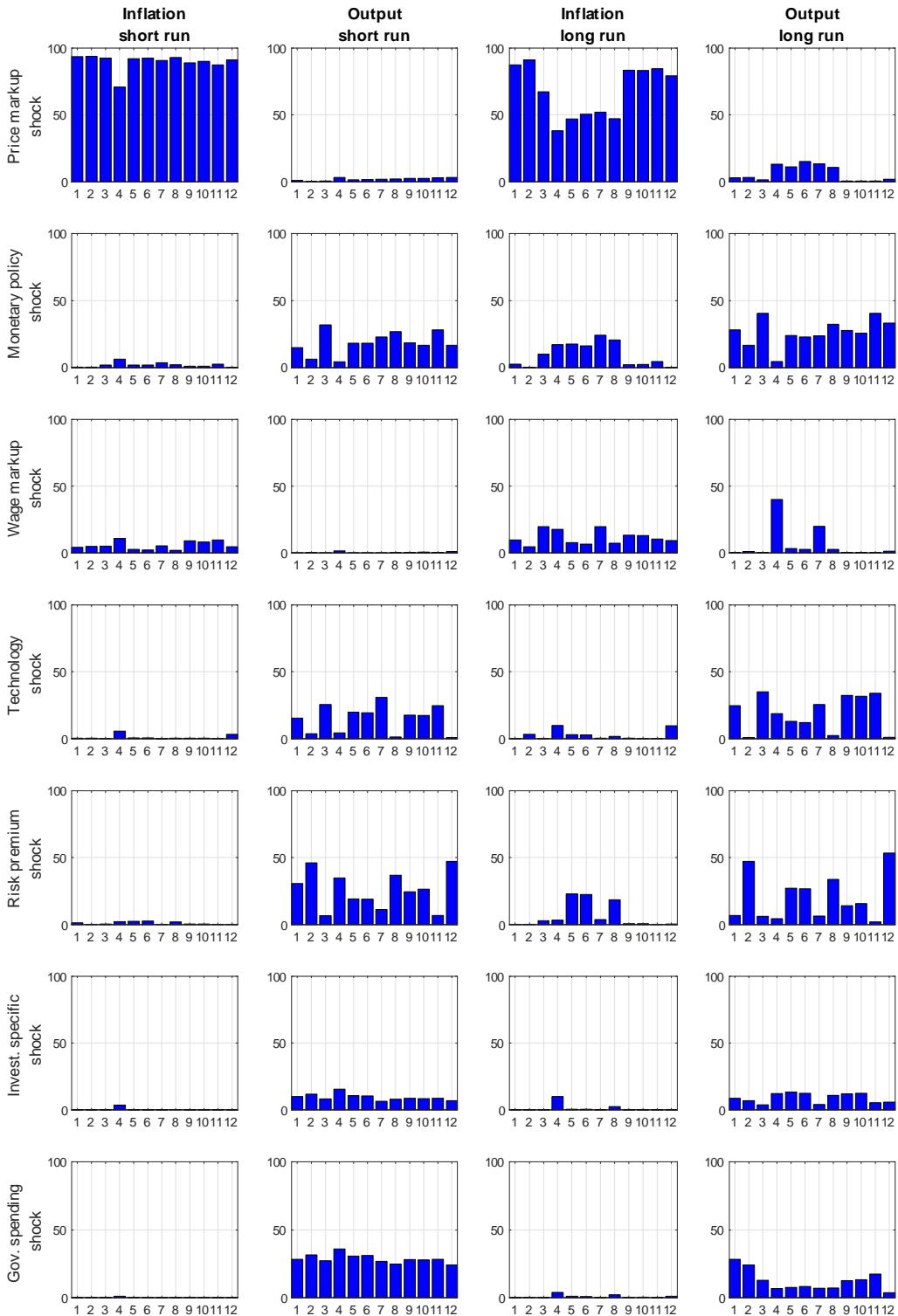


Figure 11: Variance decompositions of inflation and output between 1985 and 2007 (rules 1 to 12).

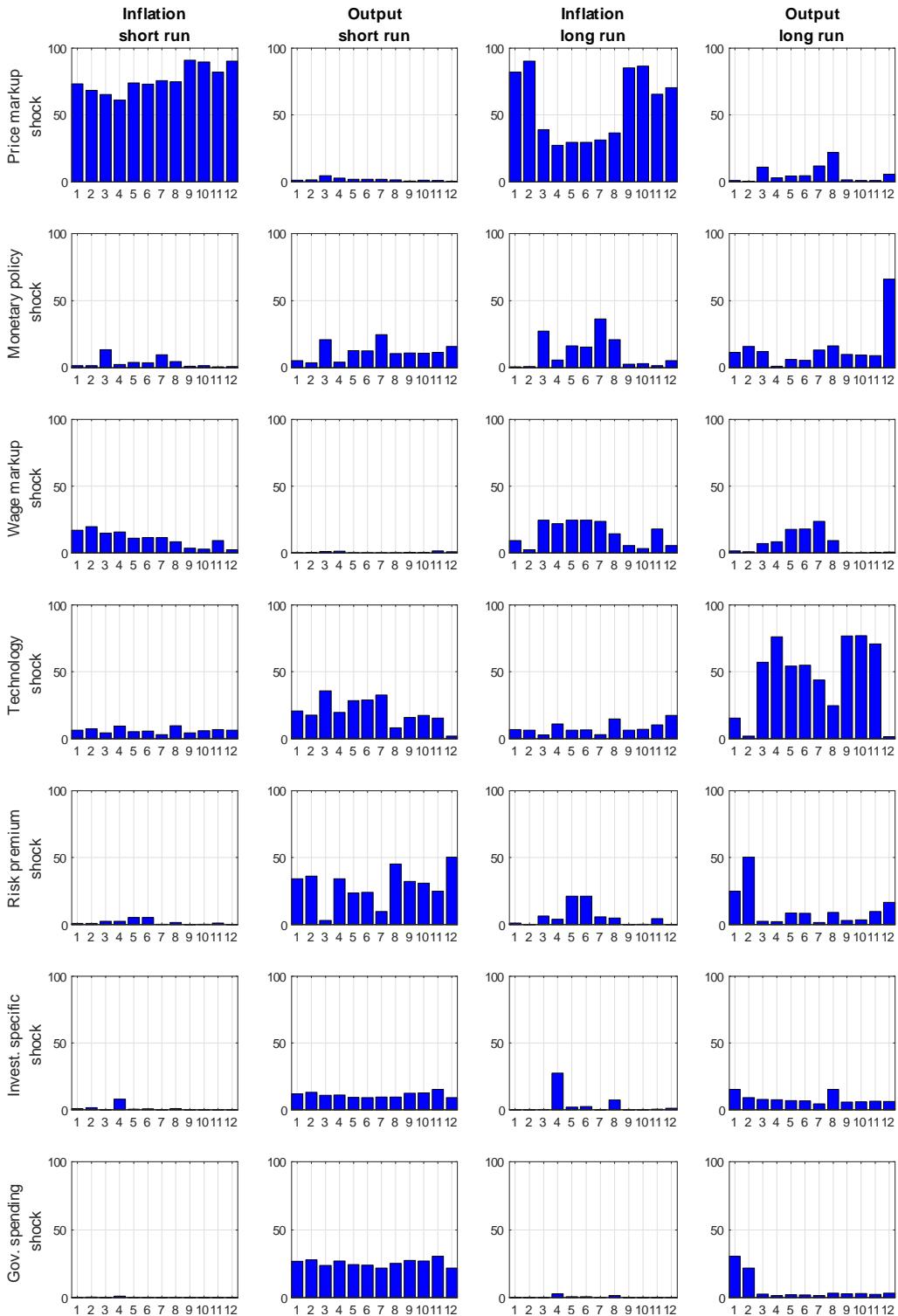


Figure 12: Variance decompositions of inflation and output between 1955 and 1985 (rules 1 to 12).

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