The effects of a money-financed fiscal stimulus

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Contents

Background

- **limits** to conventional countercyclical policies.
  - **decline** of economic activity, through **rapid reductions** in interest rates and **substantial increases** in structural deficits
  - left policymakers out of conventional ammunition
- zero lower bound (ZLB) at a relatively early stage of the crisis
  - rising debt ratios forced widespread fiscal consolidations that likely **delayed the recovery and added to the economic pain.**
- Against that background, need to think of policies that may help stimulate a depressed economy **without relying on lower nominal interest rate** or further rises in the stock of **government debt.**

How to do ?

- I analyze the effectiveness of an alternative policy: a ***money-financed*** **fiscal stimulus.**
  - neither an increase in the stock of government debt nor higher taxes
- I study separately two types of **money-financed fiscal stimuli**
  - a **reduction** in (lump-sum) **taxes**
  - an **increase** in **government purchases.**

Literature

- Monetary and fiscal framework *(money-financed budget deficits)*
  - *Friedman, (1948); Haberler (1952)*
- Helicopter money *(money-financed fiscal transfers)*
  - *Friedman (1969);*
- A money-financed fiscal stimulus under a binding ZLB
  - *Bernanke (2003); Auerbach and Obstfeld (2005); Buiter (2014); Turner (2013, 2016); Reichlin et al. (2013); Giavazzi and Tabellini (2014)*
- Others
  - *Jung et al. (2005), Eggertsson ,Woodford (2003) and Werning (2011); Christiano et al., (2011); Eggertsson(2011); Bilbiie(2011); Davig and Leeper, (2011)*

Findings:

- In normal times
  - MF fiscal stimulus output multipliers larger than a DF fiscal stimulus.
  - Under DF, tax cut has no effect on activity and an increase in government purchases has a much smaller effect than under MF
  - Under MF, an increase in government purchases has a larger output multiplier, but a smaller consumption multiplier, than a tax cut.
- Under a binding zero lower bound
  - The difference in effectiveness between a MF fiscal stimulus and a DF one persist, though it is smaller in the case of an increase in government spending.
  - Under MF, **the differences** between a tax cut and an increase in government spending **become smaller.**

3.1. Government: budget constraints and financing regimes

The government's consolidated budget constraint is given by:

$$P_t G_t + B_{t-1}(1 + i_{t-1}) = P_t T_t + B_t + \Delta M_t \tag{1}$$

$$^{1} G_t + \mathcal{B}_{t-1}\mathcal{R}_{t-1} = T_t + \mathcal{B}_t + \Delta M_t / P_t \tag{2}$$

Equilibria near a steady state with zero inflation, no trend growth.

$$T = G + \rho\mathcal{B} \tag{3}$$

the level of seignorages[2]

$$(\Delta M_t / P_t)(1/Y) = (\Delta M_t / M_{t-1})(P_{t-1}/P_t) L_{t-1}/Y \simeq \varkappa \Delta m_t \tag{4}$$

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[1] G_t:real government purchases $\quad \mathcal{B}_t = B_t/P_t \quad \mathcal{R} = (1 + i_t)(P_t/P_{t+1})$

[2] $m_t = \log M_t$ and $\varkappa = L/Y$ $\quad L_t \equiv M_t/P_t$ denotes real balances

3.1. Government: budget constraints

A first order approximation of the consolidated budget constraint[3]

$$\hat{b}_t = (1+\rho)\hat{b}_{t-1} + b(1+\rho)(\hat{i}_{t-1} - \pi_t) + \hat{g}_t - \hat{t}_t - \varkappa \Delta m_t \qquad (5)$$

a simple tax rule:

$$\hat{t}_t = \psi_b \hat{b}_{t-1} + \hat{t}_t^* \qquad (6)$$

Combining (5) and (6) we obtain

$$\hat{b}_t = (1+\rho-\psi_b)\hat{b}_{t-1} + b(1+\rho)(\hat{i}_{t-1} - \pi_t) + \hat{g}_t - \hat{t}_t^* - \varkappa \Delta m_t \qquad (7)$$

TVC[4] $\lim_{T\to+\infty} \Lambda_{0,T}\mathcal{B}_T = 0$

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[3] $\hat{b}_t = (\mathcal{B}_t - \mathcal{B})/Y \qquad \hat{g}_t = (G_t - G)/Y \qquad \hat{t}_t = (T_t - T)/Y$

[4] $\psi_b > \rho$

3.1. financing regimes

Experiments[5]

- MF
  keep real debt unchanged($\hat{b}_t = 0$)

$$\Delta m_t = (1/\varkappa)[\delta^t + b(1+\rho)(\hat{i}_{t-1} - \pi_t)] \tag{8}$$

- DF
  the monetary authority conducts policy so that $\pi_t = 0$ for all t

Code:
(i2-1)*dp + (i2-2)*bh = 0 ;

[5] $\hat{t}_t^* = -\delta^t < 0 \qquad \hat{g}^t = \delta^t > 0$

4.1 Households

$$\text{Max:} \qquad E_0 \sum_{t=0}^{\infty} \beta^t U(C_t, L_t, N_t; Z_t) \tag{9}$$

$$\text{s.t.} \quad P_t C_t + B_t + M_t = B_{t-1}(1 + i_{t-1}) + M_{t-1} + W_t N_t + D_t - P_t T_t$$

$$^{6} \lim_{T \to +\infty} \Lambda_{0,T} \mathcal{A}_T \geq 0 \tag{10}$$

$$U(C, L, N; Z) = (U(C, L) - V(N))Z$$

$$U_{c,t} = \beta(1 + i_t)(P_t / P_{t-1}) U_{c,t+1} \tag{11}$$

$$W_t / P_t = V_{n,t} / U_{c,t} \tag{12}$$

$$h(L_t / C_t) = i_t / (1 + i_{t1}) \tag{13}$$

$^{6} \mathcal{A}_T = [B_{t-1}(1 + i_{t-1}) + M_{t-1}] / P_t$

4.1 Firms

- A representative firm

$$Y_t = \left(\int_0^1 Y_t(i)^{1-\frac{1}{\epsilon}} di\right)^{\frac{\epsilon}{\epsilon-1}}$$

- The set of demand conditions

$$Y_t(i) = (P_t(i)/P_t)^{-\epsilon} Y_t \qquad all \quad i \in [0,1] \tag{14}$$

- Each firm produces a differentiated intermediate good with a technology

$$Y_t(i) = N_t(i)^{1-\alpha}$$

- NKPC

$$\pi_t = \beta \pi_{t+1} - \lambda(\mu_t - \mu)$$

$$\mu_t = \log \frac{(1-\alpha)P_t}{W_t N_t^{\alpha}} \qquad \lambda = \frac{(1-\theta)(1-\beta\theta)(1-\alpha)}{\theta(1-\alpha+\alpha\epsilon)}$$

5. Steady state and equilibrium

$\widehat{y}_t \equiv \log(Y_t/Y)$, $\widehat{c}_t \equiv \log(C_t/C)$, $\widehat{l}_t \equiv \log(L_t/L)$, $\widehat{\xi}_t \equiv \log(U_{c,t}/U_c)$, $\widehat{i}_t \equiv \log((1+i_t)/(1+\rho))$, and $\widehat{\rho}_t \equiv -\log(Z_{t+1}/Z_t)$, $\widehat{g}_t = G_t/Y$

$$\widehat{y}_t = \widehat{c}_t + \widehat{g}_t \tag{15}$$

$$\widehat{\xi}_t = \widehat{\xi}_{t+1} + (\widehat{i}_t - \pi_{t+1} - \widehat{\rho}_t) \tag{16}$$

$$\widehat{\xi}_t = -\sigma \widehat{c}_t + \upsilon \widehat{l}_t \tag{17}$$

$$\pi_t = \beta \pi_{t+1} - \lambda \widehat{\mu}_t \tag{18}$$

$$\widehat{\mu}_t = \widehat{\xi}_t - \left(\frac{\alpha+\varphi}{1-\alpha}\right)\widehat{y}_t \tag{19}$$

$$\widehat{l}_t = \widehat{c}_t - \eta \widehat{i}_t \tag{20}$$

$$\widehat{l}_{t-1} = \widehat{l}_t + \pi_t - \Delta m_t \tag{21}$$

$$\widehat{b}_t = (1+\rho-\psi_b)\widehat{b}_{t-1} + b(1+\rho)(\widehat{i}_{t-1} - \pi_t) + \widehat{g}_t - \widehat{t}_t^* - \varkappa \Delta m_t, \tag{22}$$

MF: $$\Delta m_t = (1/\varkappa)\left(\delta^t + b(1+\rho)(\widehat{i}_{t-1} - \pi_t)\right) \tag{23}$$

DF: $$\pi_t = 0 \tag{24}$$

5.1 Calibration

Value	Describe
$\beta = 0.995$	discount factor
$\phi = 5$	inverse labor supply elasticity
$\alpha = 0.25$	capital share in production
$\epsilon = 9$	price markup
$\theta = 3/4$	price rigidity
$\varkappa = 1/3$	inverse velocity of money
$\eta = 7$	interest semi-elasticity of money demand
$\nu = 0$	separability of real balance
ψ_b=0.02	tax adjustment parameter
$b = 2.4$	target debt ratio
$\delta = 0.5$	persistence parameter
$\sigma = 1$	coefficient of risk aversion

6.1. A money-financed tax cut

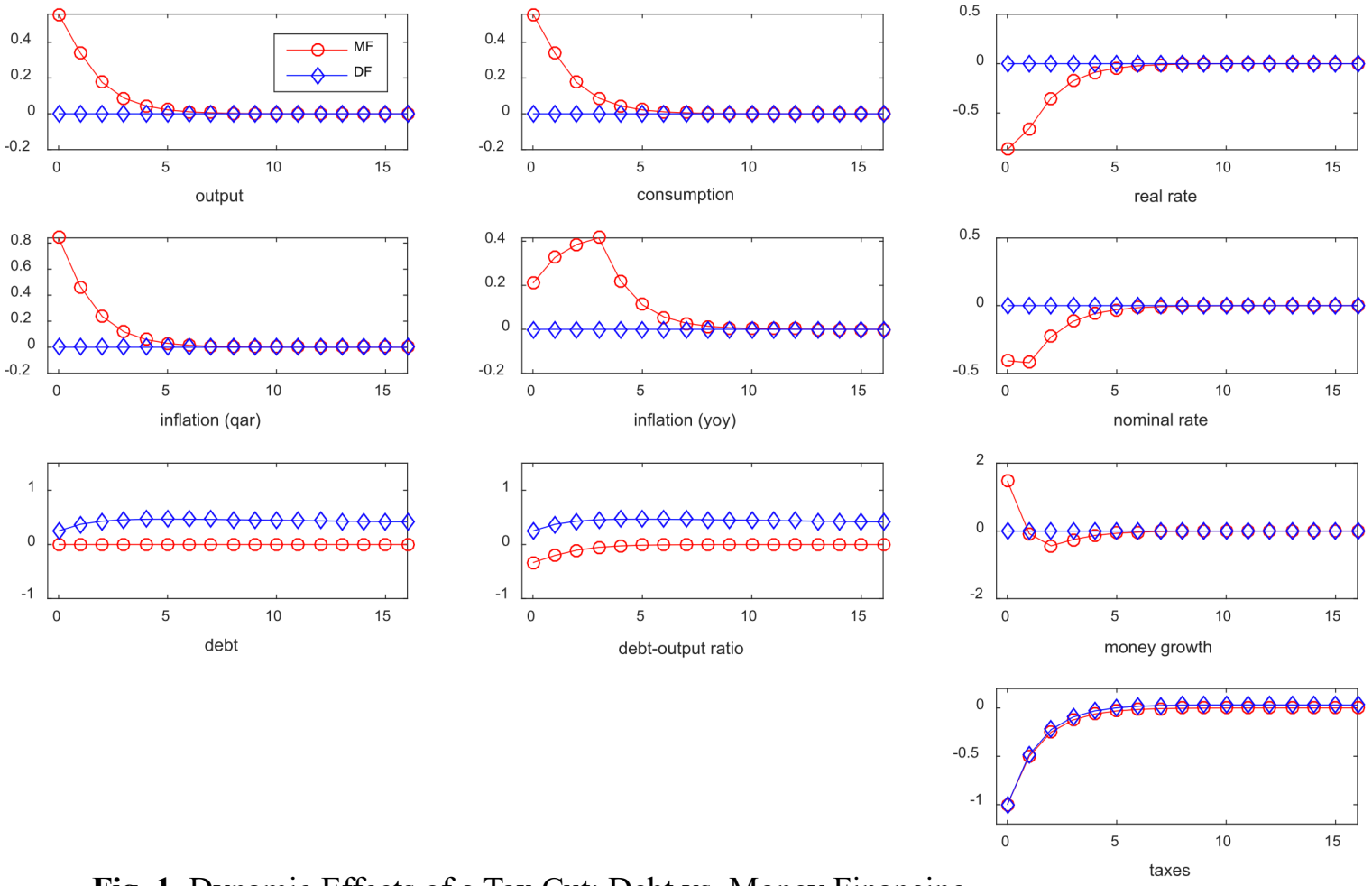


Fig. 1. Dynamic Effects of a Tax Cut: Debt vs. Money Financing

DF: $\pi = 0$

$$tax \downarrow \Rightarrow D \uparrow$$

MF: $D = 0$

$$tax \downarrow \Rightarrow \Delta M \uparrow \Rightarrow \begin{cases} c \uparrow \Rightarrow y \uparrow \Rightarrow \tilde{y} \uparrow \Rightarrow \pi \uparrow \\ i \downarrow (\pi \uparrow) \Rightarrow r \downarrow \Rightarrow c \uparrow \end{cases}$$

6.1 Ricardian equivalence

- Why does the Ricardian equivalence property apply to the debt-financed tax cut but not to the money-financed one?

Recall the household's period budget constraint:

$$P_t C_t + M_t + B_t = B_{t-1}(1 + i_{t-1}) + M_{t-1} + W_t N_t + D_t - P_t T_t \tag{32}$$

Letting $Y_t \equiv (W_t N_t + D_t)/P_t$ denote real income, and defining $\mathcal{A}_t \equiv (B_{t-1}(1 + i_{t-1}) + M_{t-1})/P_t$, the previous constraint can be rewritten as:

$$C_t + \frac{i_t}{1 + i_t} L_t + \frac{1}{\mathcal{R}_t} \mathcal{A}_{t+1} = \mathcal{A}_t + Y_t - T_t \tag{33}$$

Solving (33) forward from period zero onward and using the transversality condition $\lim_{T \to \infty} \Lambda_{0,T} \mathcal{A}_T = 0$ yields

$$\sum_{t=0}^{\infty} \Lambda_{0,t} \left(C_t + \frac{i_t}{1 + i_t} L_t \right) = \mathcal{A}_0 + \sum_{t=0}^{\infty} \Lambda_{0,t} (Y_t - T_t) \tag{34}$$

where $\Lambda_{0,t} \equiv \mathcal{R}_0^{-1} \mathcal{R}_1^{-1} \ldots \mathcal{R}_{t-1}^{-1}$.

6.1 Ricardian equivalence

- The government's *consolidated* budget constraint:

$$G_t + \mathcal{B}_{t-1}\mathcal{R}_{t-1} = T_t + \mathcal{B}_t + \Delta M_t/P_t$$

On the other hand, solving the consolidated government budget constraint (2) forward from period 0 onwards yields:

$$\sum_{t=0}^{\infty} \Lambda_{0,t} G_t + \frac{B_{-1}(1+i_{-1})}{P_0} = \sum_{t=0}^{\infty} \Lambda_{0,t}\left(T_t + \frac{\Delta M_t}{P_t}\right) \tag{35}$$

where the transversality condition $\lim_{T\to\infty} \Lambda_{0,T}\mathcal{B}_T = 0$ has been imposed, as implied by $\lim_{T\to\infty} \Lambda_{0,T}\mathcal{A}_T = 0$ combined with the non-negativity constraint on money holdings.

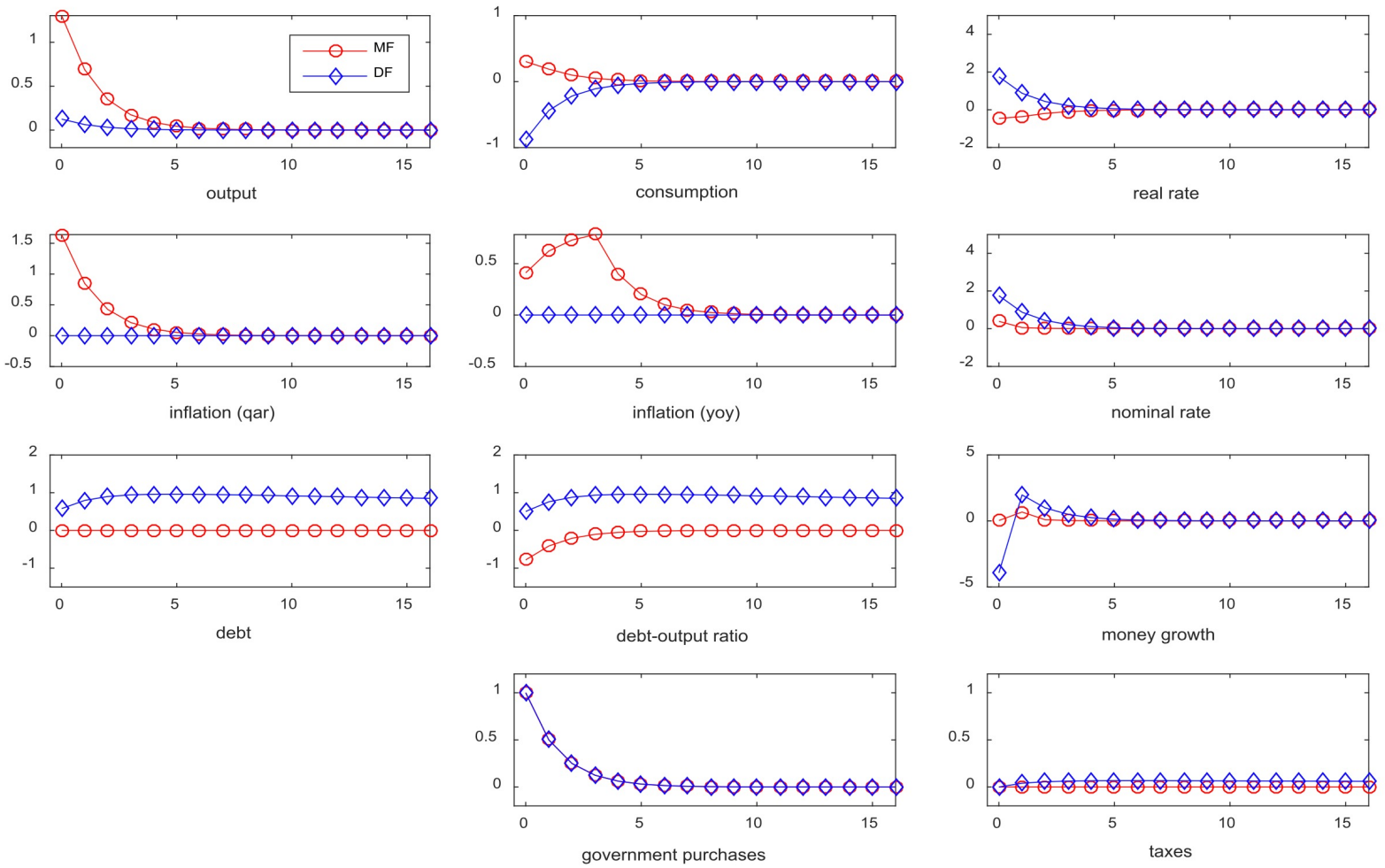
Combining (35) and (34), we obtain:

$$\sum_{t=0}^{\infty} \Lambda_{0,t}\left(C_t + \frac{i_t}{1+i_t}L_t\right) = \frac{M_{-1}}{P_0} + \sum_{t=0}^{\infty} \Lambda_{0,t}\left(Y_t - G_t + \frac{\Delta M_t}{P_t}\right) \tag{36}$$

...

$$\Rightarrow \quad C_0 = \frac{1-\beta}{1+\chi}\left(\frac{M_{-1}}{P_0} + \sum_{t=0}^{\infty} \Lambda_{0,t}\left(Y_t - G_t + \frac{\Delta M_t}{P_t}\right)\right)$$

6.2. A money-financed increase in government purchases



DF: $\pi = 0$

$$G\uparrow \Rightarrow \begin{cases} y\uparrow (tiny), i\uparrow (\pi = 0) \Rightarrow \begin{cases} r\uparrow \Rightarrow c\downarrow \\ \Delta M\downarrow \end{cases} \\ D\uparrow \end{cases}$$

MF: $D = 0$

$$G\uparrow \Rightarrow \begin{cases} y\uparrow \Rightarrow \tilde{y}\uparrow \Rightarrow \pi\uparrow \\ \Delta M\uparrow \Rightarrow \begin{cases} c\uparrow \Rightarrow y\uparrow \Rightarrow \tilde{y}\uparrow \Rightarrow \pi\uparrow \\ i\downarrow \Rightarrow r\downarrow \Rightarrow c\uparrow \end{cases} \end{cases}$$

Fig. 2. Dynamic Effects of an Increase in Government Purchases: Debt vs. Money Financing

6.2. comparsion

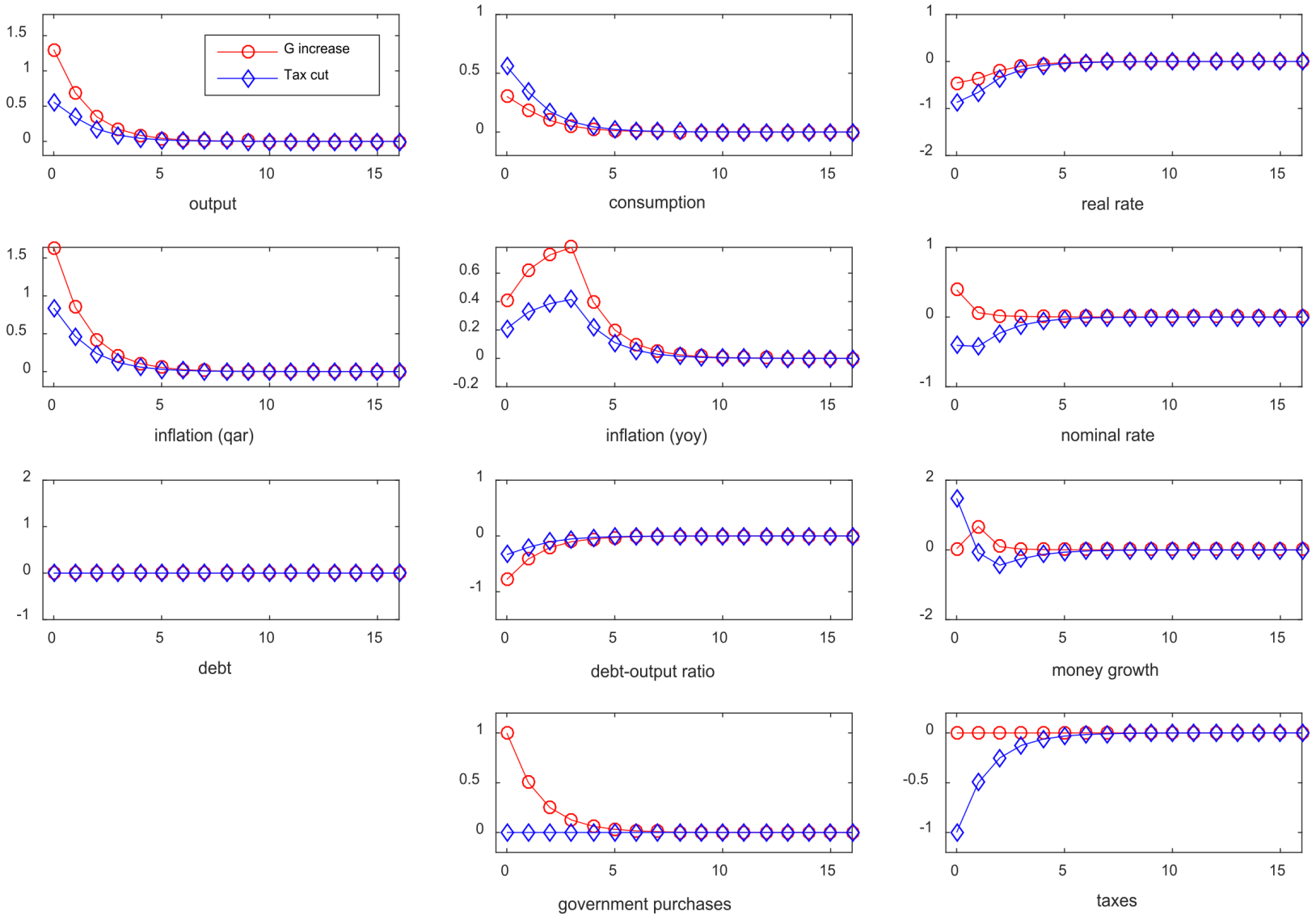


Fig. 3. Dynamic Effects of Money-Financed Fiscal Stimuli: Tax cut vs. Increase in Government Purchases

6.3. Sensitivity analysis

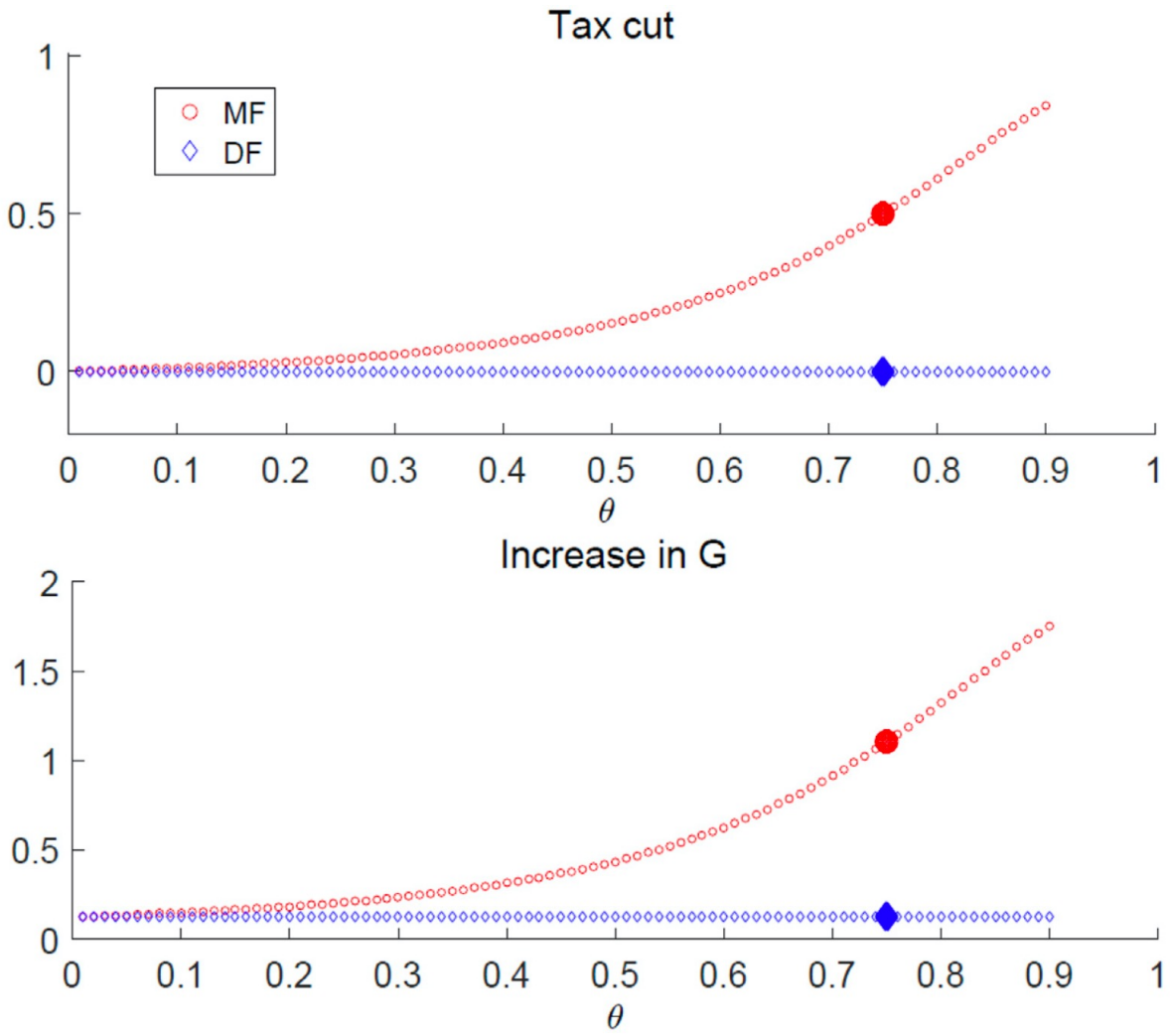


Fig. 4. Fiscal Multipliers: The Role of Price Stickiness

- **在一种完全竞争与灵活价格经济中，货币融资的财政刺激对产出和就业的影响非常小，但是对通胀则有巨大影响，私人消费会下降。另一方面，由于通胀导致的债务实际价值缩水而使得债务比率下降。**
  - 因此，在这种“古典”经济环境下，货币融资的财政刺激计划并没有什么吸引力。

- **当经济处在不完全竞争、粘性工资和价格环境下，货币融资的财政刺激计划则对经济活动具有强烈的作用，而对通胀的影响则相对温和。**
  - 这是因为由于更高的通胀预期，使得利率持续降低，从而导致了私人消费的**挤入效应**。
  - 由于更低的利率，债务-GDP比率也会随着时间而下降；
  - 如果产出低于其有效水平太多，即使政府支出是一种纯浪费，货币融资的财政刺激也可以提高福利。

6.3. Sensitivity analysis

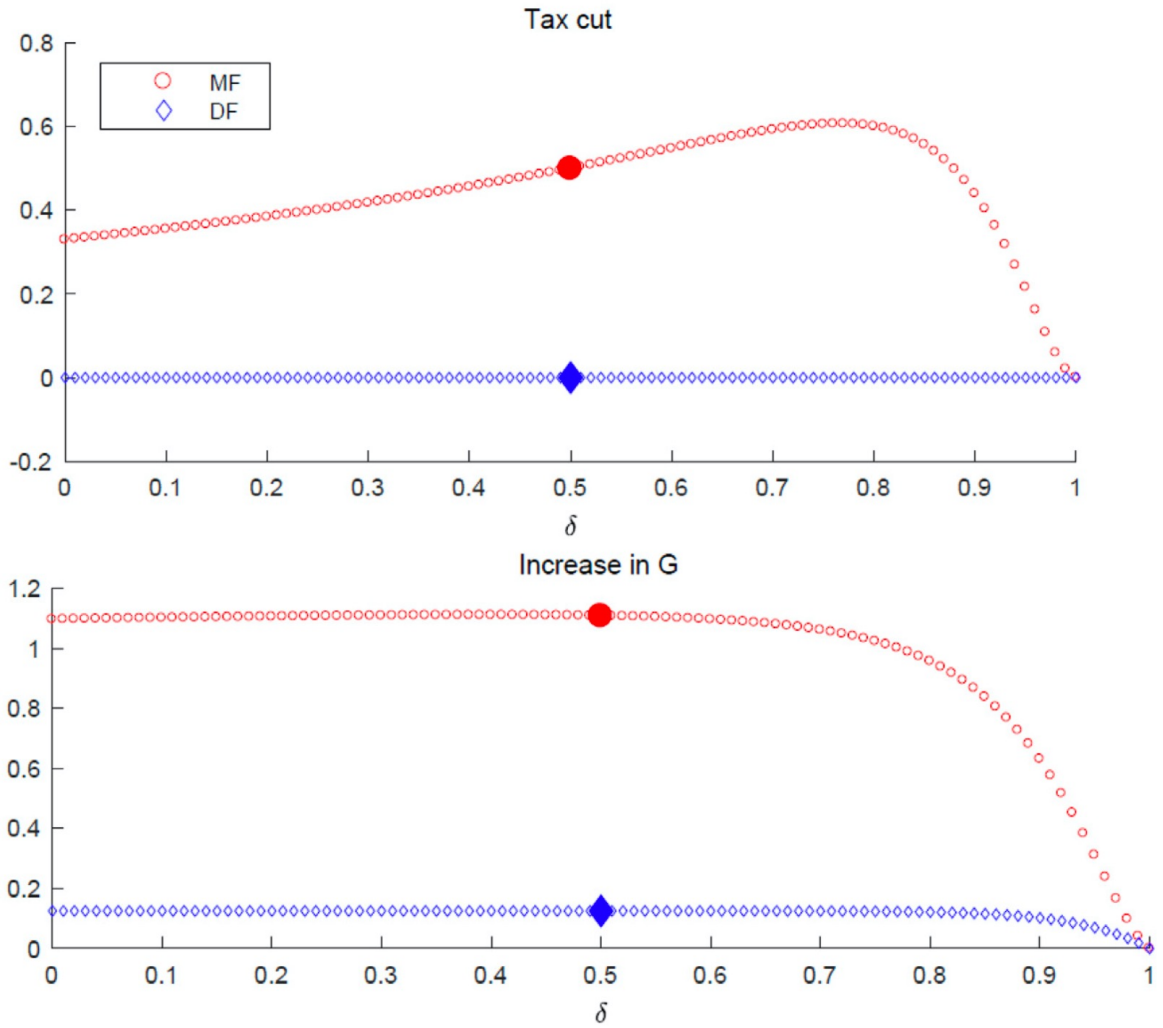


Fig. 5. Fiscal Multipliers: The Role of Shock Persistence

that money-financed fiscal stimuli are **more effective than** their debt-financed counterparts, and that the output multipliers for a money-financed increase in government purchases **are larger than** that of a money-financed tax cut.

7. The effects of a money-Financed fiscal stimulus in a liquidity trap

- The ZLB constraint can be incorporated formally in the set of equilibrium conditions above by replacing (20) with the complementarity slackness condition:

$$(\widehat{i_t} - \log\beta)(\widehat{l_t} - \widehat{c_t} + \eta\widehat{i_t}) = 0$$

for all *t*, where $\widehat{i_t} \geq \log\beta$ is the ZLB constraint and $\widehat{l_t} \geq \widehat{c_t} - \eta\widehat{i_t}$ represents the demand for real balances.

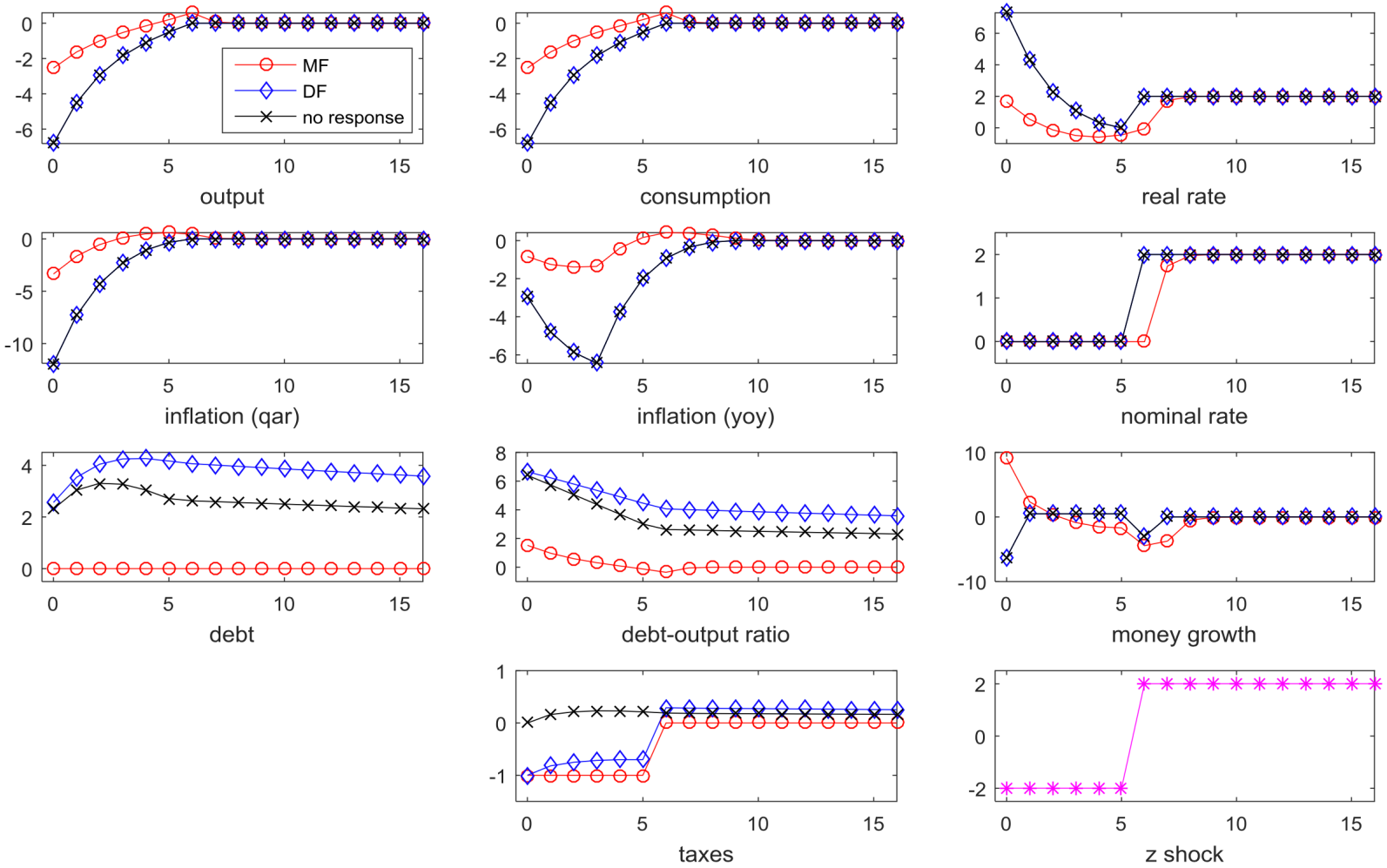
- In the case of debt-financed fiscal stimulus(replace(24))

$$(\widehat{i_t} - \log\beta)\pi_t = 0$$

for all t, together with

$$\pi_t = 0$$

7. The effects of a money-Financed fiscal stimulus in a liquidity trap



Z shock:

$$Z\downarrow\Rightarrow\begin{cases} c\downarrow\Rightarrow y\downarrow \\ r^{n}\downarrow\Rightarrow \tilde{y}\downarrow\Rightarrow\begin{cases} y\downarrow \\ \pi\downarrow(i=0)\Rightarrow r\uparrow\Rightarrow \Delta M\downarrow \end{cases} \end{cases}$$

DF: $\pi = 0$ ➡ 无效

$$tax\downarrow\Rightarrow D\uparrow$$

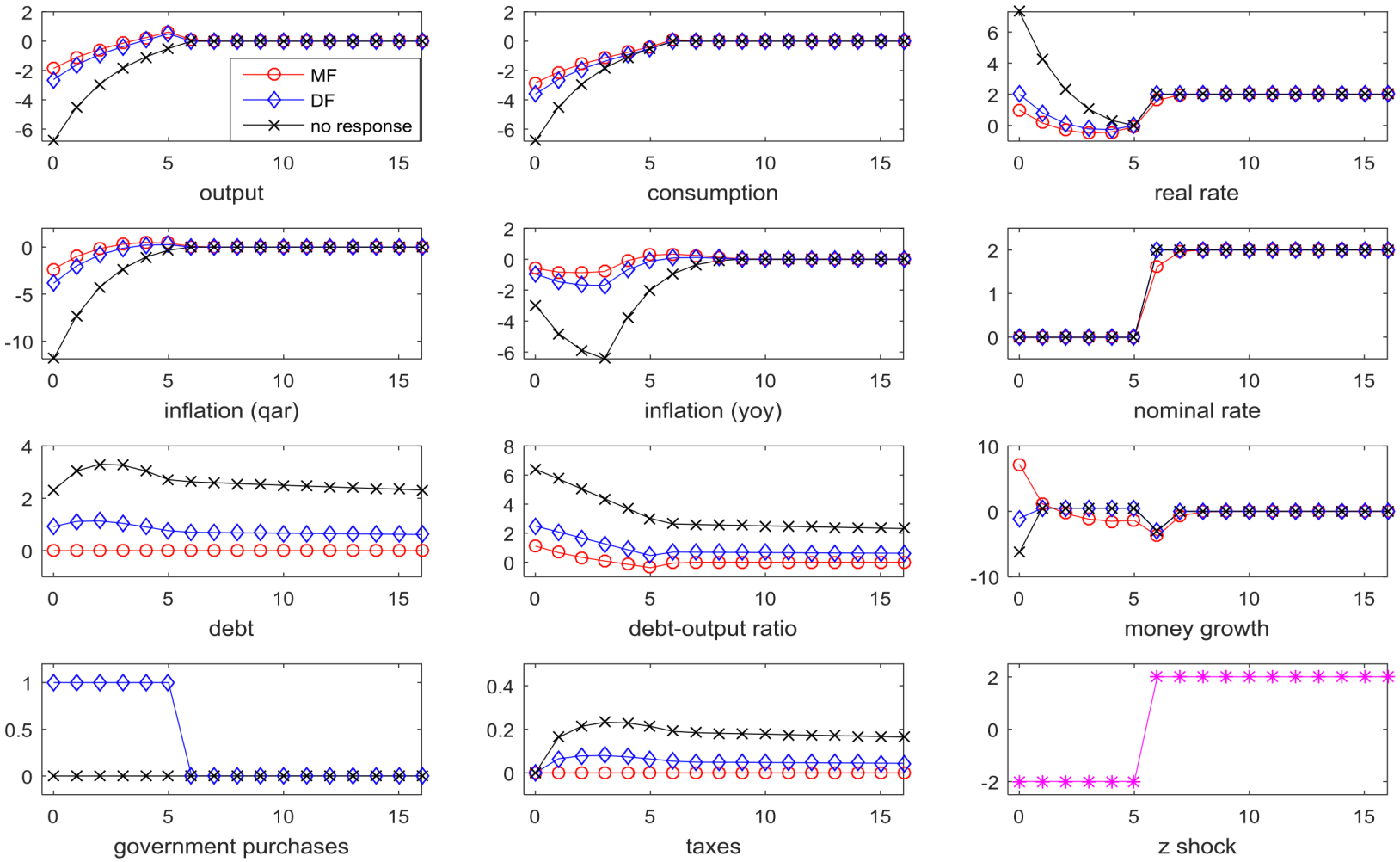
MF: $D = 0$

$$tax\downarrow\Rightarrow \Delta M\uparrow\Rightarrow y\uparrow(i=0)\Rightarrow \tilde{y}\uparrow\Rightarrow \pi\uparrow$$
$$\Rightarrow r\downarrow(i=0)\Rightarrow c\uparrow$$

➡ 有效

Fig. 6. Dynamic Effects of a Tax Cut in a Liquidity Trap

7. The effects of a money-Financed fiscal stimulus in a liquidity trap



Z shock:

$$Z\downarrow\Rightarrow\begin{cases} c\downarrow\Rightarrow y\downarrow \\ r^{n}\downarrow\Rightarrow \tilde{y}\downarrow\Rightarrow\begin{cases} y\downarrow \\ \pi\downarrow(i=0)\Rightarrow r\uparrow\Rightarrow \Delta M\downarrow \end{cases} \\ tax\uparrow \end{cases}$$

DF: $\pi = 0$

$$G\uparrow\Rightarrow\begin{cases} y\uparrow\Rightarrow \tilde{y}\uparrow\Rightarrow \pi\uparrow\Rightarrow r\downarrow(i=0)\Rightarrow \Delta M\uparrow \\ D\uparrow \end{cases}$$

MF: $D = 0$

$$G\uparrow\Rightarrow\begin{cases} y\uparrow\Rightarrow \tilde{y}\uparrow\Rightarrow \pi\uparrow\Rightarrow r\downarrow(i=0)\Rightarrow \Delta M\uparrow \\ \Delta M\uparrow \end{cases}$$

Fig. 7. Dynamic Effects of an Increase in Government Purchases in a Liquidity Trap

7.comparsion

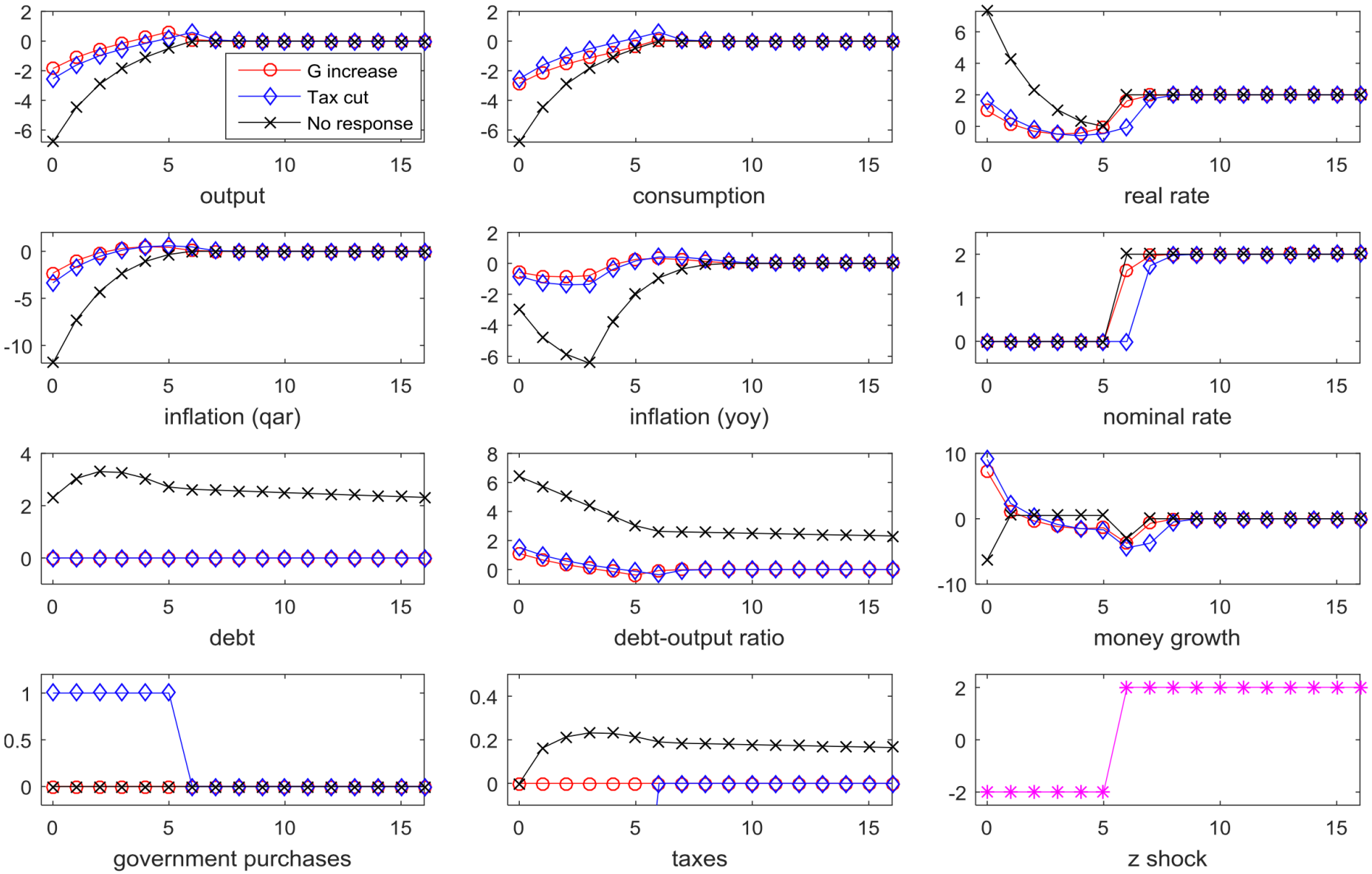


Fig. 8. Dynamic Effects of Money-Financed Fiscal Stimuli in a Liquidity Trap

8. Concluding remarks

- The effects of a **money-financed fiscal stimulus** vs **conventional debt-financed stimulus.**
- A number of results from that analysis are worth stressing.
  - a money-financed fiscal stimulus, in the form of **a tax cut or an increase in government purchases**, provides a way to **boost economic activity effectively**, as long as prices are reasonably sticky.
  - money-financed fiscal stimuli appear to be **more effective** than their debt-financed counterparts.
  - a money-financed increase in government purchases has a **larger output multiplier** than a money-financed tax cut.
  - money-financed tax cuts also appear to be **more effective countercyclical policies** than their debt-financed counterparts when the ZLB is binding
- A number of issues that are beyond the scope of the present paper.
  - the fact that monetary policy is (at least temporarily) driven by the requirements of the fiscal authority may be perceived as an outright violation of the principle of **central bank independence**
  - would likely be a source of an **inflation bias** and bring about changes in individual behavior likely to under- mine their effectiveness (e.g. **indexation or greater price flexibility**).

Thanks!