Effects of a Money-financed Fiscal Stimulus Without Irredeemability of Money

Eiji Okano
Nagoya City University

Masataka Eguchi
Nagoya City University

Roberto Billi
Sveriges Riksbank

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1 Introduction (1)

IM Making the *MF* Fiscal Stimulus Effective

- Buiter (2014, *Economics*) identifies some conditions that must be satisfied for helicopter money to always boost aggregate demand.
- One of those is that fiat base money is irredeemable and is viewed as an asset by the holder but not as a liability by the issuer, namely, irredeemability of money (IM).

1 Introduction (2)

Gali (2020) Showing the Effectiveness of the *MF* Fiscal Stimulus with the IM

- Taking over Buiter (2014), Gali (2020, *JME*) was successful in showing effectiveness of a money-financed (*MF*) fiscal stimulus, even in a liquidity trap.
- Gali (2020) assumes fiat base money is an asset (wealth) to the holder (households), but does not constitute in any meaningful sense a liability to the issuer (central bank or consolidated government).
- Fiscal policy rule in Gali (2020) does not suffice the TVC on the fiat base money.
- That is, the IM is premised in Gali (2020).

1 Introduction (3)

IM is Not Necessary to Make the *MF* Fiscal Stimulus Effective

- What we show is that the IM is not necessary to make the *MF* fiscal stimulus effective, even in a liquidity trap.
- To show the effectiveness of the *MF* fiscal stimulus without the IM, we derive a fiscal policy rule sufficing the TVC such that fiat base money is a liability to issuer (central bank).
- We are successful to show the effectiveness of the *MF* fiscal stimulus even in a liquidity trap (although its effectiveness is weaker than that with the IM).
- Our fiscal policy rule results from the FTPL advocated by Cochrane (2005, *JME*) and intends to redeem both fiscal authority's debt and central bank's debt, namely fiat base money.

1 Introduction (4)

MF Fiscal Stimulus without the IM Corresponding and Temporary or Non-permanent QE

- What is the *MF* fiscal stimulus without the IM?
- According to Buiter (2014), the *MF* fiscal stimulus with the IM corresponds to permanent or irreversible quantitative easing (QE).
- Following this context, it can be said that the *MF* fiscal stimulus without the IM corresponds to temporary or non-permanent QE.
- It can be said that what we show in this paper is the effectiveness of temporary or non-permanent QE in a liquidity trap.

1 Introduction (5)

Analysis in a Two-country Model

- We extend the analysis to a two-country model.
- Regarding the fact that the GFC spread across borders in the world, examining the effectiveness of the *MF* fiscal stimulus is very worth.
- Even in a two-country model, the *MF* fiscal stimulus without the IM is effective (although its effectiveness is weaker than that with the IM).
- Even when the *MF* fiscal stimulus is conducted simultaneously in a liquidity trap in two countries, the *MF* fiscal stimulus is effective, regardless of whether there is the IM or not (although its effectiveness is weaker than that with the IM).

1 Introduction (6)

- The reminder of the paper is organized as follows:

2. Section 2 discusses the related literature (we skip today).
3. Section 3 shows the fiscal and monetary policy framework.
4. Section 4 shows effects of a fiscal stimulus in normal times when the ZLB constraint is unavailable.
5. Section 5 considers the effects of a fiscal stimulus in a liquidity trap where the ZLB constraint is applicable.
6. Section 6 concludes the paper.

3 The Fiscal and Monetary Policy Framework

- The model consists of policy and non-policy blocks.
- The non-policy block is the same as that in Gali (2020).
- The policy block is different from Gali (2020), due to fiscal policy rule which is derived following Cochrane (2005, *JME*) and is resulting from a class of FTPL equation.

3.1 Government: Budget Constraints and Financing Regimes (1)

Consolidated Government Budget Constraint is given by:

$$G_t + \mathcal{B}_{t-1}\mathcal{R}_{t-1} = TR_t + \mathcal{B}_t + \frac{\Delta M_t}{P_t}. \qquad (2)$$

3.1 Government: Budget Constraints and Financing Regimes (2)

Iterating Eq.(2) forward j times, plugging Euler equation, taking the limit for $j \to \infty$ and imposing an appropriate TVC

$$\lim_{k\to\infty}\beta^{t+j+1}\mathcal{R}_{t+k}\left(\mathcal{B}_{t+k}+L_{t+k}\right)=0, \tag{3}$$

yields:

$$\frac{U_{c,t}Z_t\left(1+i_{t-1}\right)\left(B_{t-1}+M_{t-1}\right)}{P_t}=\sum_{k=0}^{\infty}\beta^h U_{c,t+k}Z_{t+h}SP_{t+h}$$

$$+\sum_{k=0}^{\infty}\beta^{k-1}U_{c,t+h-1}Z_{t+h-1}\left(\frac{i_{t+h-1}}{1+i_{t+h-1}}\right)L_{t+h-1}. \tag{5}$$

Note that the TVC is imposed even on the real money balance L_t.

3.1 Government: Budget Constraints and Financing Regimes

(3)

Eq.(5) means:

$$\frac{\text{Nominal Government Debt}}{\text{Price Level}} = \text{Expected Present Value of Primary Surpluses.}$$

3.1 Government: Budget Constraints and Financing Regimes (4)

- Log-linearizing Eq.(5) yields a fiscal policy rule that complies with the FTPL regime as follows:

$$\widehat{tr}_t = b\hat{i}_{t-1} + \hat{b}_{t-1} + \frac{b\,(1-\beta)^2 + \chi\beta^2}{\beta}\hat{l}_{t-1} - \beta\hat{b}_t - \beta\chi\hat{l}_t - (b+\chi\beta)\,\pi_t + \hat{g}_t, \quad (7)$$

- Eq.(7) shows that if the burden to redeem consolidated government's debt is not covered by lump-sum tax and newly issued debt including newly issued real money, the government "inflate away" as referred by Cochrane (2023).

3.1 Government: Budget Constraints and Financing Regimes (5)

- To compare, we analyze the effectiveness of *MF* fiscal stimulus with the IM.
- As in Gali (2020), in an economy with the IM, we assume the following simple tax rule throughout the analysis:

$$\widehat{tr}_t = \psi_b \hat{b}_{t-1}, \tag{8}$$

- Under Eq.(8), following TVC is satisfied:

$$\lim_{k\to\infty} \Lambda_{t,t+k} \mathcal{B}_{t+k} = 0, \tag{9}$$

instead of Eq.(3).

3.2 Experiments

An Increase in the Government Expenditure

$$\widehat{g}_t = \delta^t > 0,$$

The *MF* Scheme

$$\Delta m_t = \frac{1}{\chi}\left[\widehat{g}_t - \widehat{\varsigma}_t + (1+\rho)\, b\left(\widehat{i}_{t-1} - \pi_t\right)\right], \tag{11}$$

which suffices $\widehat{b}_t = 0$ for all t.

The *DF* Scheme

$$\pi_t \;=\; 0,$$

which is the (CPI) inflation targeting.

3.3 Non-policy Block

Similar to Gali (2020), we assume:

- A Large Number of Identical Infinitely-lived Households who Maximizes their Utility
- Single Final Good Produced with A Constant Returns Technology
- Calvo Pricing
- Flexible Wages

3.4 Steady State and Equilibrium Dynamics

- The model is log-linearized to derive equilibrium dynamics around the steady state.
- The analysis below considers equilibrium in the neighborhood of a steady state with zero inflation and zero government expenditure.
- Our parameterization is consistent with Gali (2020).

Tab. 2: Parameterization

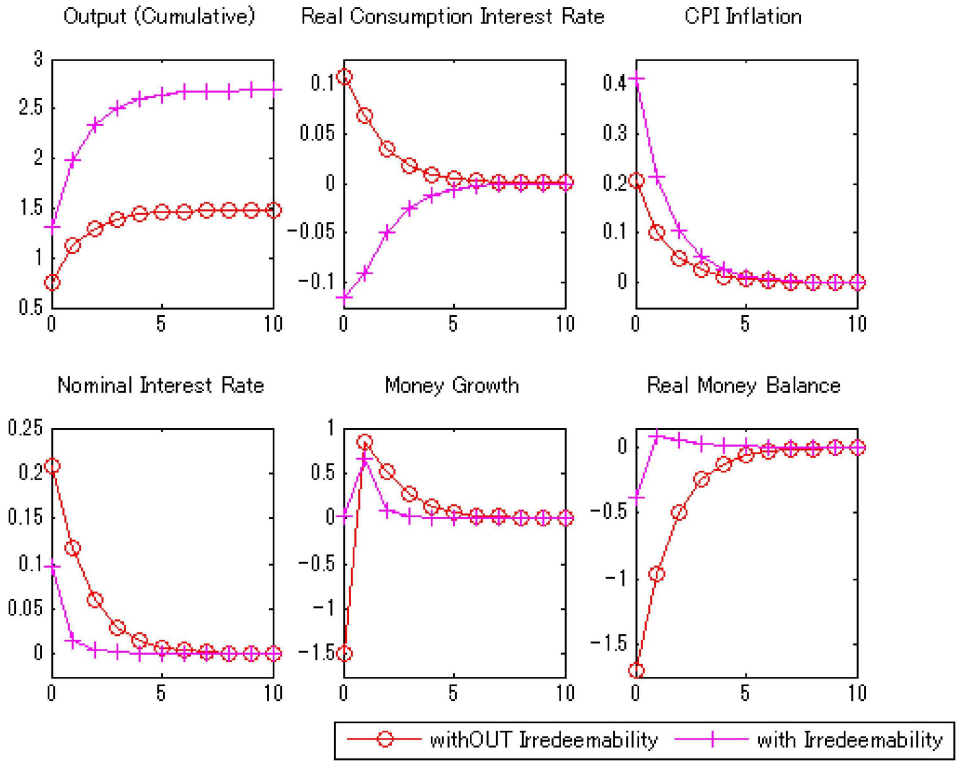
Parameter	Description	Value
σ	Relative Risk Aversion	1
β	Discount Factor	0.995
φ	Curvature of Labor Disutility	5
α	Index of Decreasing Returns to Labor	0.25
ϵ	Elasticity of Substitution among Goods	9
θ	Calvo Index of Price Rigidities	0.75
χ	Steady state Inverse Velocity	$\frac{1}{3}$
η	Semi-elasticity of Money Demand	7
υ	Separability of Real Balances	0
ψ_b	Tax Adjustment	0.02
b	Target Debt Ratio	2.4
δ	Persistence	0.5

4 Effects of the Fiscal Stimulus in Normal Times

4.1 MF Fiscal Stimulus (1)

- Fig. 1 shows the dynamic effects of an increase in government expenditure under the *MF* fiscal stimulus in normal times.
- The output and the CPI inflation increase, irrespective of whether there is the IM or not (Panels 1 and 3, Fig. 1).
- However, an increase in both is smaller in the case without IM.

Fig. 1: Dynamic Effects of an Increase in the Government Expenditure under the *MF* Fiscal Stimulus in Normal Times



4.1 MF Fiscal Stimulus (2)

- One of reasons is using lump-sum tax financing to increase government expenditure.
- Plugging $\widehat{b}_t = 0$ into fiscal policy rule which denies the IM yields:

$$\widehat{tr}_t = b\widehat{i}_{t-1} + \frac{b\left(1-\beta\right)^2 + \chi\beta^2}{\beta}\widehat{l}_{t-1} - \beta\chi\widehat{l}_t - \left(b + \chi\beta\right)\pi_t + \widehat{g}_t. \quad (13)$$

- Eq.(13) implies that the lump-sum tax varies, and an increase in government expenditure can be financed by an increase in the tax, in the case without the IM.
- In the case with the IM, $\widehat{tr}_t = 0$ replaces Eq.(13).

4.1 MF Fiscal Stimulus (3)

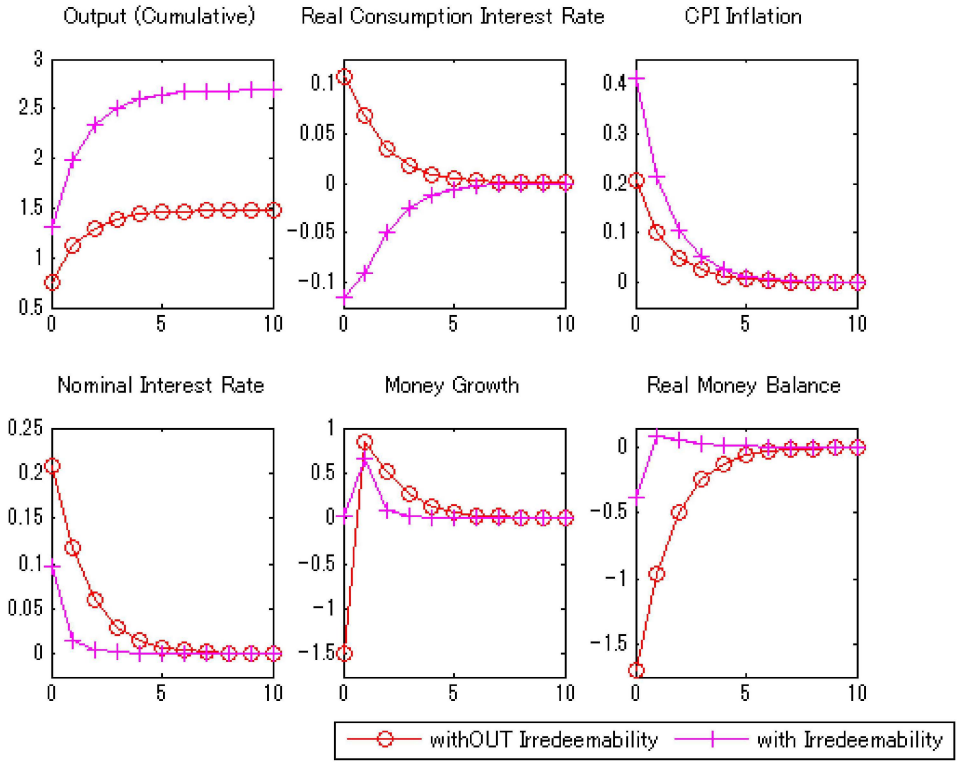
$$\widehat{tr}_t = b\hat{i}_{t-1} + \frac{b\,(1-\beta)^2 + \chi\beta^2}{\beta}\hat{l}_{t-1} - \beta\chi\hat{l}_t - (b+\chi\beta)\,\pi_t + \hat{g}_t. \quad (13)$$

- Another one stems from the salient feature of the FTPL.
- Eq.(13) implies that the inflation negatively relates to the current real money balance in the case without the IM.
- An increase in government expenditure applies pressure to increase the CPI inflation, which mitigates the burden of redeeming consolidated government's debt.
- Renewal of its debt is not necessary.
- The current real money balance corresponds to the renewal of its debt.

4.1 MF Fiscal Stimulus (4)

- Then, the current real money balance is reduced through a decrease in the money growth (Panels 5 and 6).
- This decrease applies pressure to suppress the CPI inflation (Panel 3).
- The real consumption interest rate increases and an increase in the output is less than that in the case with the IM (Panels 1 and 2).

Fig. 1: Dynamic Effects of an Increase in the Government Expenditure under the *MF* Fiscal Stimulus in Normal Times



4.4 An Extension: A Two-country Economy in Normal Times

- The GFC spread across borders in the world.
- Therefore, examining the effectiveness of the *MF* in a two-country economy model is worth.
- We extend a closed economy model in Gali (2020) to a two-country economy model following Benigno and Benigno (2008, *MD*).

4.4.2 Non-policy Blocks

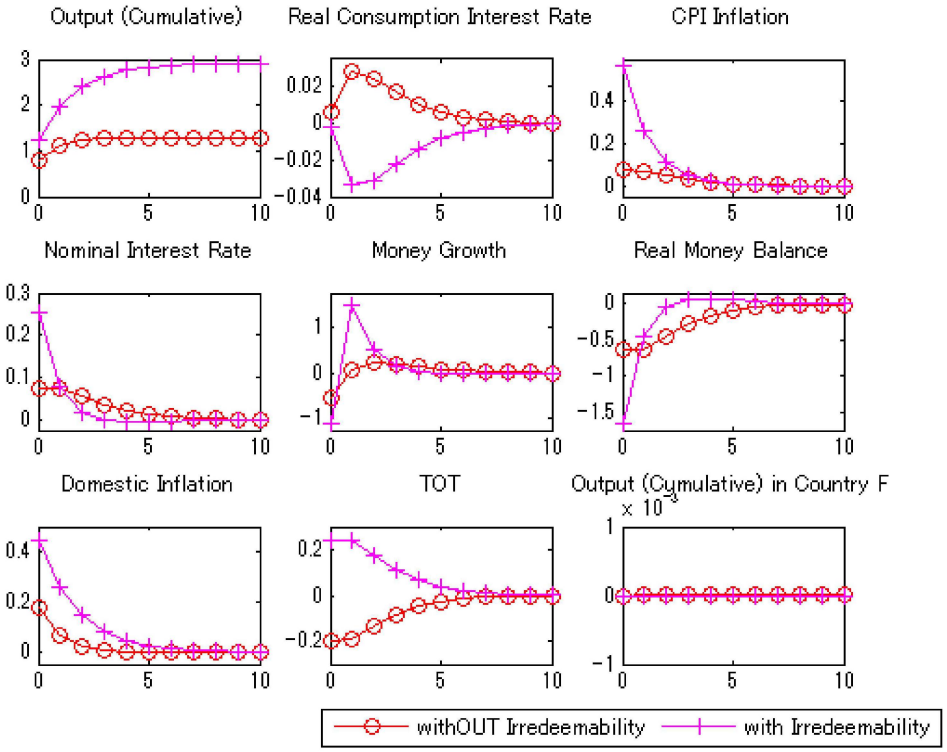
Similar to Benigno and Benigno (2008), we additionally assume:

- Perfect Substitution between Goods Produced in Two Countries
- Perfect Financial Market at the International Level (The UIP).
- All Goods being Tradable
- LOOP (so that the PPP)
- Equally Sized Countries

4.4.4 MF Fiscal Stimulus (1)

- Fig. 4 shows the dynamic effects of an increase in government expenditure under the *MF* fiscal stimulus in normal times.
- Irrespective of whether there is the IM or not, the CPI inflation and the output increases.
- An increase in domestic inflation applies pressure to depreciate the nominal exchange rate because domestic inflation is part of the CPI inflation.

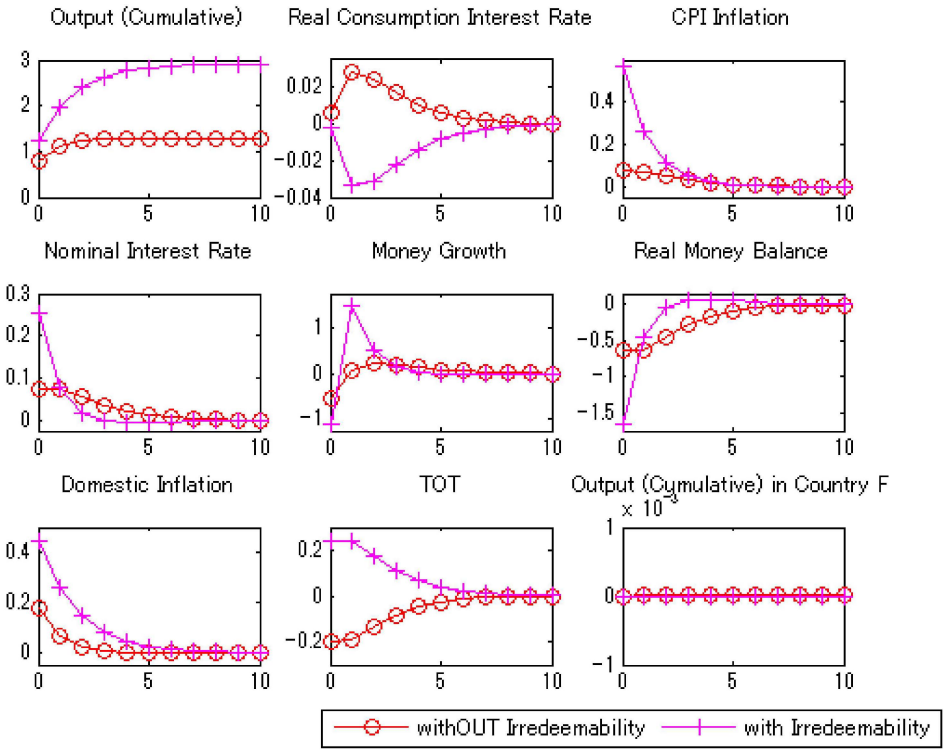
Fig. 4: Dyn. Effects of an Increase in the Gov. Exp. under the *MF* Fiscal Stimulus in the NT in a Two-country Economy



4.4.4 MF Fiscal Stimulus (2)

- This depreciation in the nominal exchange rate increases import inflation which has no price stickiness.
- Thus, in the case with the IM, an increase in the CPI inflation is higher than that in a closed economy with the IM (Panel 3).

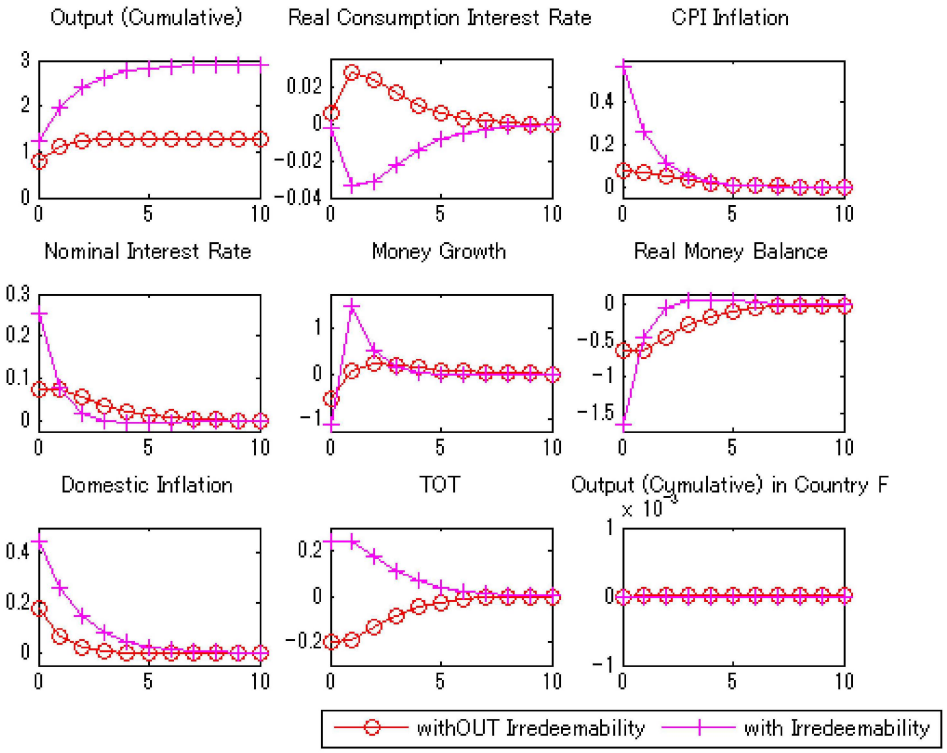
Fig. 4: Dyn. Effects of an Increase in the Gov. Exp. under the *MF* Fiscal Stimulus in the NT in a Two-country Economy



4.4.4 MF Fiscal Stimulus (3)

- In the case without the IM, an increase in the CPI inflation is less than that in the case with the IM (Panel 3).
- This increase is less than that in the case with the IM.
- In the case without the IM, money is viewed as debt even by consolidated government.

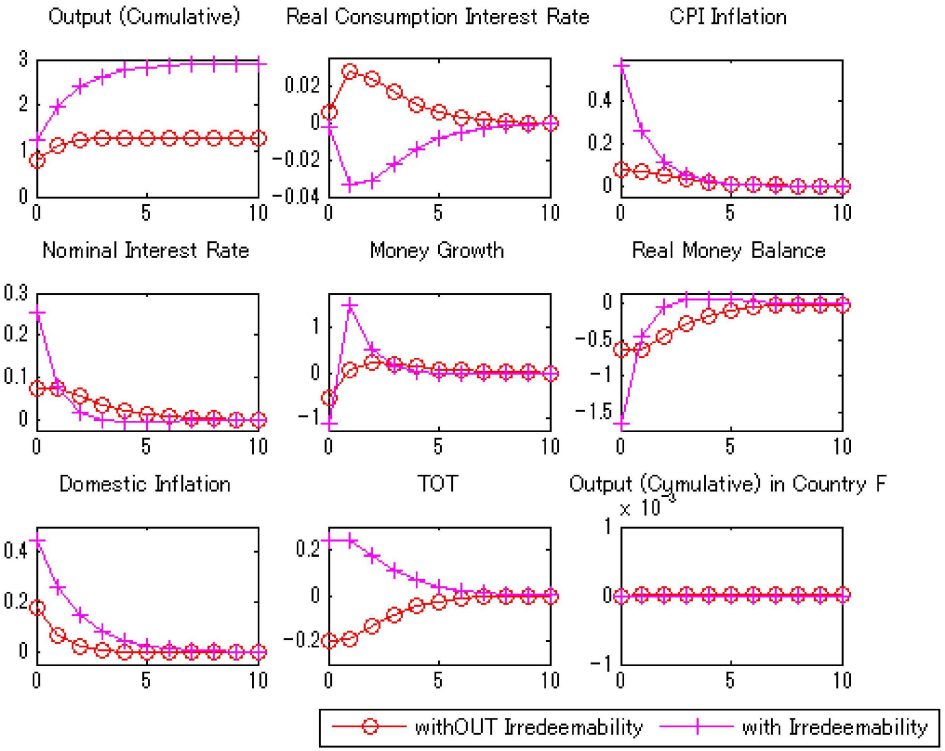
Fig. 4: Dyn. Effects of an Increase in the Gov. Exp. under the *MF* Fiscal Stimulus in the NT in a Two-country Economy



4.4.4 MF Fiscal Stimulus (4)

- In a two-country economy, pressure to increase the CPI inflation resulting from an increase in the government expenditure is less than that in a closed economy (Remember $\pi_t = \nu\pi_{H,t} + (1-\nu)\,\pi_{F,t}$).
- Thus, a decrease in the real money balance is less in the case without the IM (Panel 6).

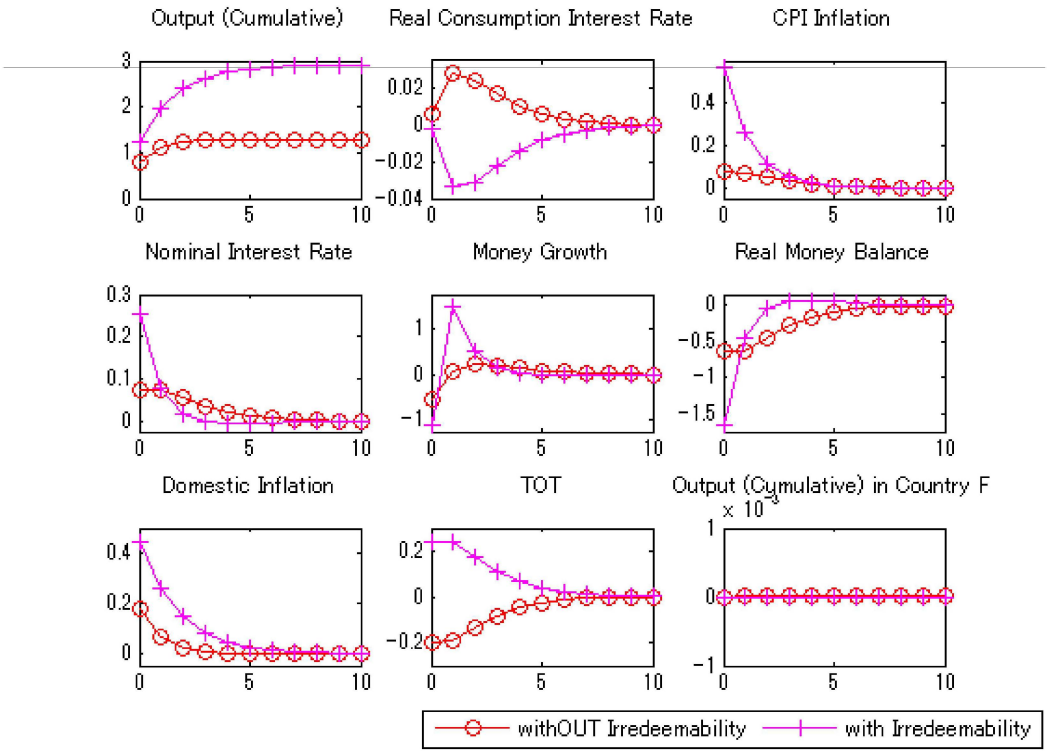
Fig. 4: Dyn. Effects of an Increase in the Gov. Exp. under the *MF* Fiscal Stimulus in the NT in a Two-country Economy



4.4.4 MF Fiscal Stimulus (5)

- To "Inflate away" is not necessary so that an increase in the CPI inflation is less in the case without the IM.
- This less increase in the CPI inflation makes the *MF* fiscal stimulus less effective.

Fig. 4: Dyn. Effects of an Increase in the Gov. Exp. under the *MF* Fiscal Stimulus in the NT in a Two-country Economy



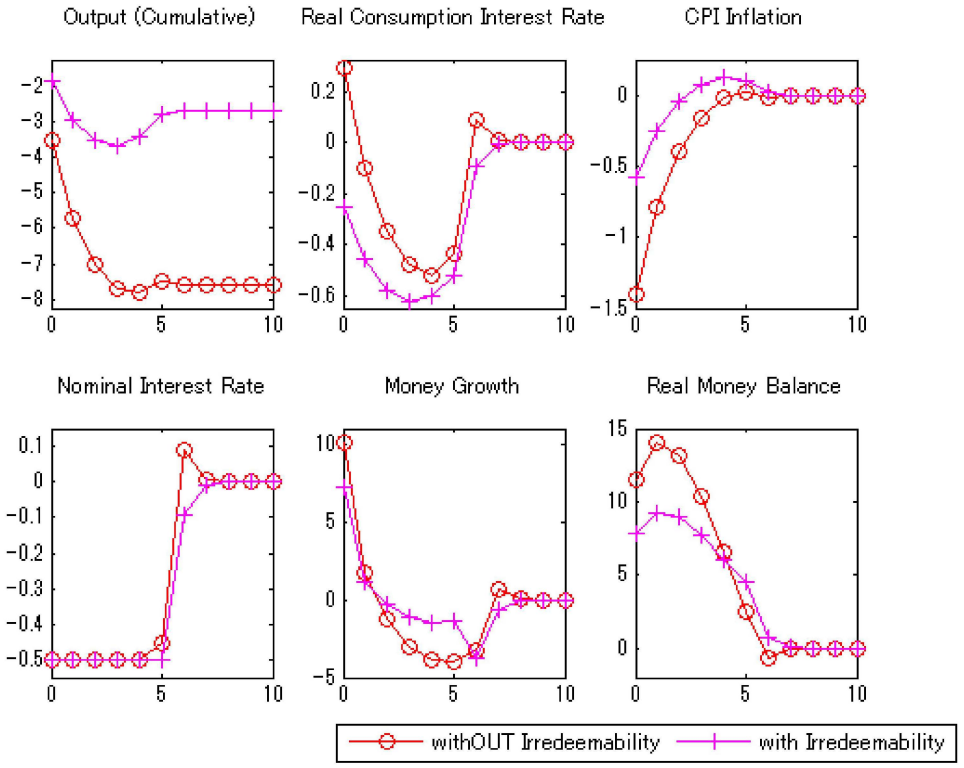
5 The Effects of the Fiscal Stimulus in a Liquidity Trap

- This section explores the effectiveness of the *MF* fiscal stimulus in a liquidity trap.
- Similar to Gali(2020), the ZLB constraint takes the form $\widehat{i}_t \geq \log\beta$ and we assume temporary adverse demand shock that takes the natural interest rate to negative territory up to period five (from period zero).

5.2 MF Fiscal Stimulus (1)

- Fig. 6 shows the dynamic effects of an increase in government expenditure under the *MF* fiscal stimulus in a liquidity trap.
- An adverse demand shock decreases the CPI inflation, which causes revenue shortfall through a decrease in the inflation tax.
- This shortfall is financed by money injection, and the real money balance increases (Panel 6).

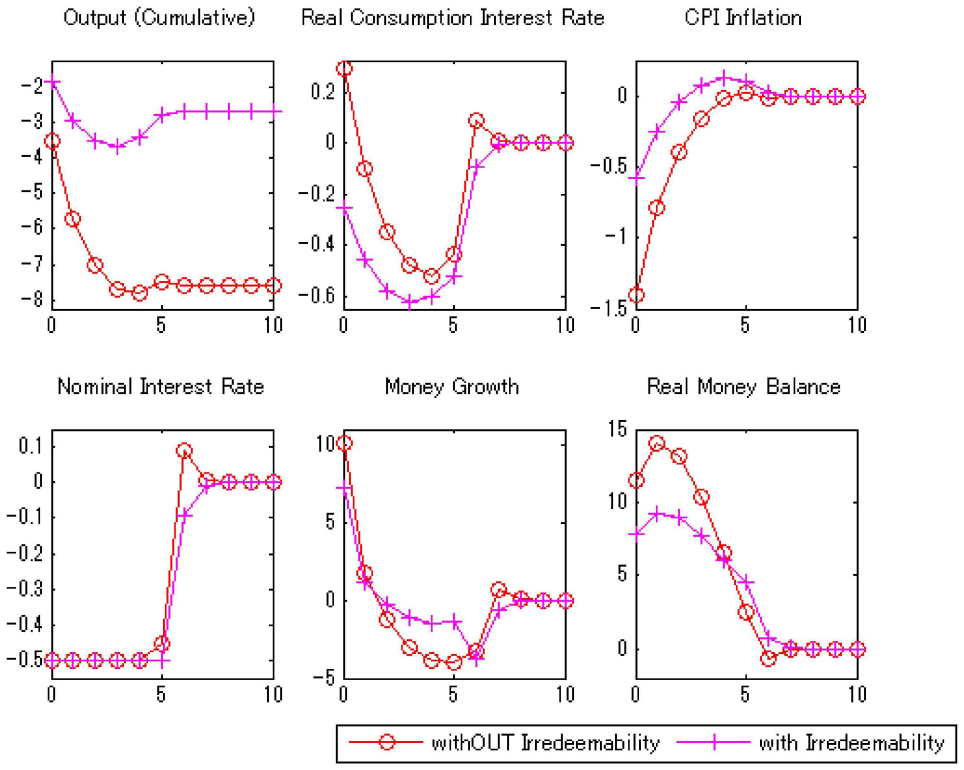
Fig. 6: Dynamic Effects of an Increase in the Government Expenditure under the MF Fiscal Stimulus in a Liquidity Trap



5.2 MF Fiscal Stimulus (2)

- In the case without the IM, an increase in the real money balance removes incentive to "inflate away" so that a decrease in the CPI inflation is more severe (Panel 3).
- The effectiveness of the *MF* is less effective in the case without the IM.

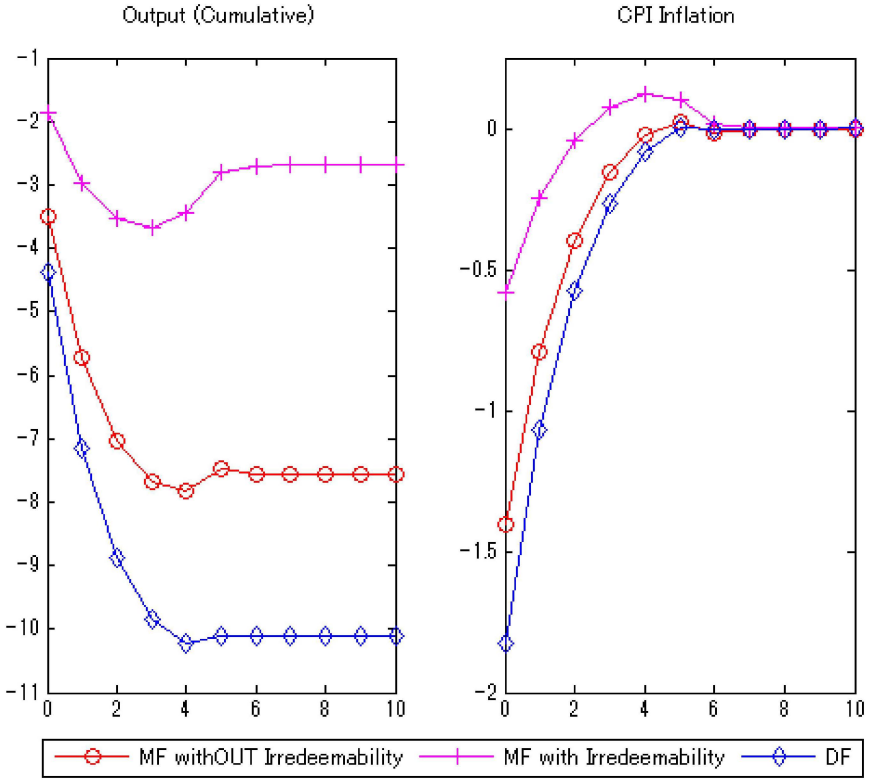
Fig. 6: Dynamic Effects of an Increase in the Government Expenditure under the MF Fiscal Stimulus in a Liquidity Trap



5.4 Comparing the Effects of the MF Fiscal Stimulus with the DF Fiscal Stimulus in a Liquidity Trap

- Fig. 7 compares the effectiveness of the *MF* fiscal stimulus with the *DF* fiscal stimulus in a liquidity trap.
- *MF* fiscal stimulus without the IM is less effective than that with the IM.
- However, the *MF* fiscal stimulus without the IM is still more effective than the *DF* fiscal without the IM.

Fig. 7: Dyn. Effects of an Increase in Gov. Exp. in the LT: Comparison of the *MF* scheme and *DF* scheme



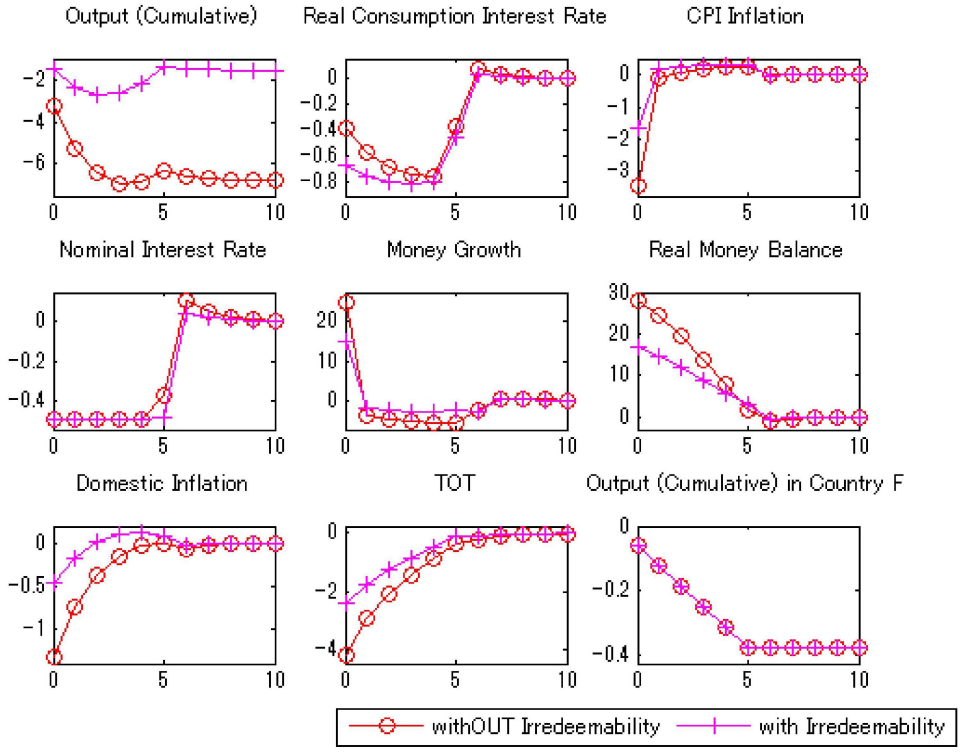
5.5 An Extension: A Two-country Economy in a Liquidity Trap

- Similar to Section 4.4, we show the effectiveness of the *MF* fiscal stimulus in a liquidity trap in a two-country economy.
- The scenario of a liquidity trap is the same as above.

5.5.1 MF Fiscal Stimulus (1)

- Fig. 8 shows the dynamic effects of an increase in government expenditure under the *MF* fiscal stimulus in a liquidity trap in a two-country economy.
- We assume that just country H falls into a liquidity trap and increases a government expenditure under the *MF* fiscal stimulus.
- A decrease in the CPI inflation in the case without the IM is more significant than that with the IM (Panel 3).

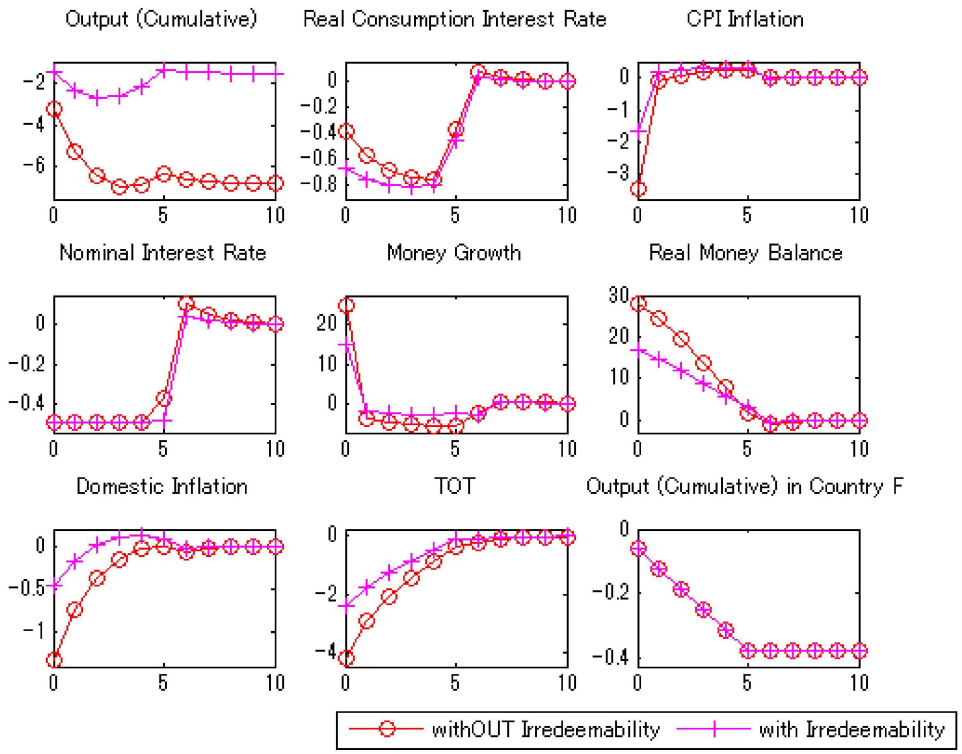
Fig. 8: Dyna. Effects of an Increase in the Gov. Exp. under the *MF* Fiscal Stimulus in the LP in a Two-country Economy



5.5.1 MF Fiscal Stimulus (2)

- An increase in the real money balance removes incentive to "inflate away".
- Thus, a decrease in the CPI inflation in the case without the IM is more significant than in that with the IM.
- The *MF* fiscal stimulus without the IM is less effective even in a two-country model.

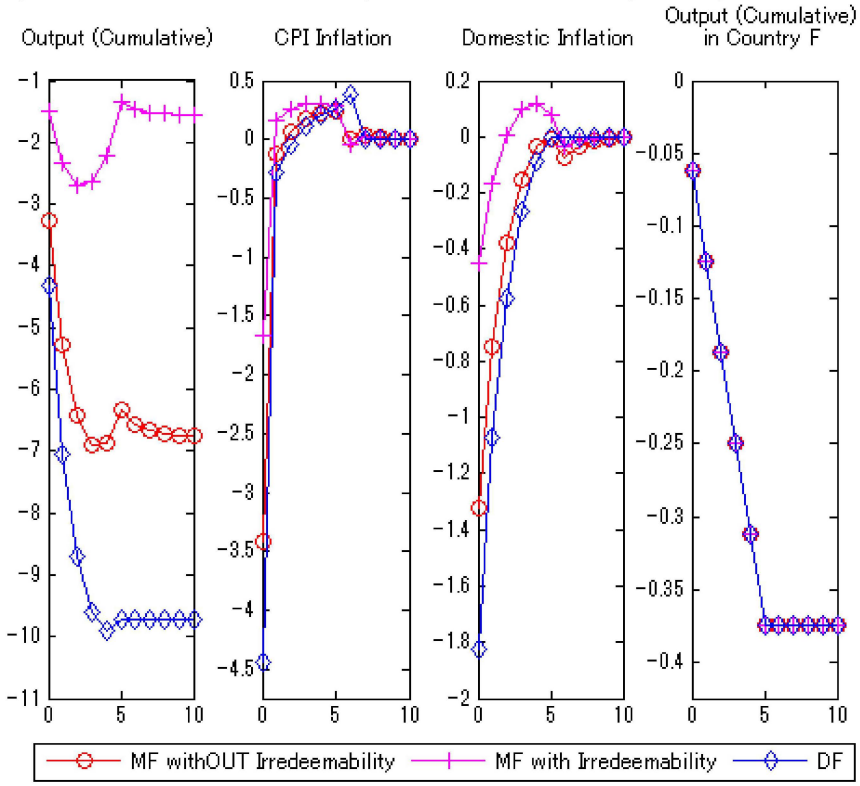
Fig. 8: Dyna. Effects of an Increase in the Gov. Exp. under the *MF* Fiscal Stimulus in the LP in a Two-country Economy



5.5.3 Comparing the Effects of the MF Fiscal Stimulus with the DF Fiscal Stimulus in a Liquidity Trap in a Two-country Economy (1)

- Fig. 10 compares the effectiveness of the *MF* fiscal stimulus with that of the *DF* fiscal stimulus in a liquidity trap in just country H.
- The *MF* fiscal stimulus is more effective, irrespective of whether there is the IM or not.
- Even when the IM is denied, the *MF* fiscal stimulus is more effective.

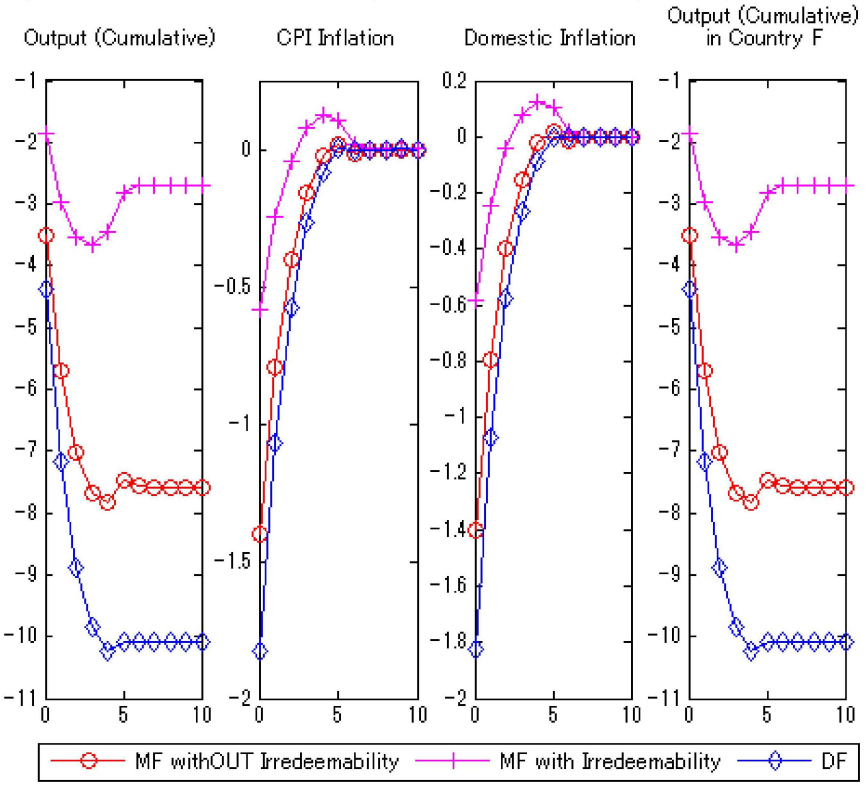
Fig. 10: Dyna. Effects of an Increase in Gov. Exp. in the LT in a Two-country Economy



5.5.3 Comparing the Effects of the MF Fiscal Stimulus with the DF Fiscal Stimulus in a Liquidity Trap in a Two-country Economy (2)

- Fig. 11 compares the effectiveness of the *MF* fiscal stimulus with that of the *DF* fiscal stimulus in a liquidity trap in both countries.
- We assume that both countries fall into a liquidity trap and increase government expenditure under the *MF* fiscal stimulus.

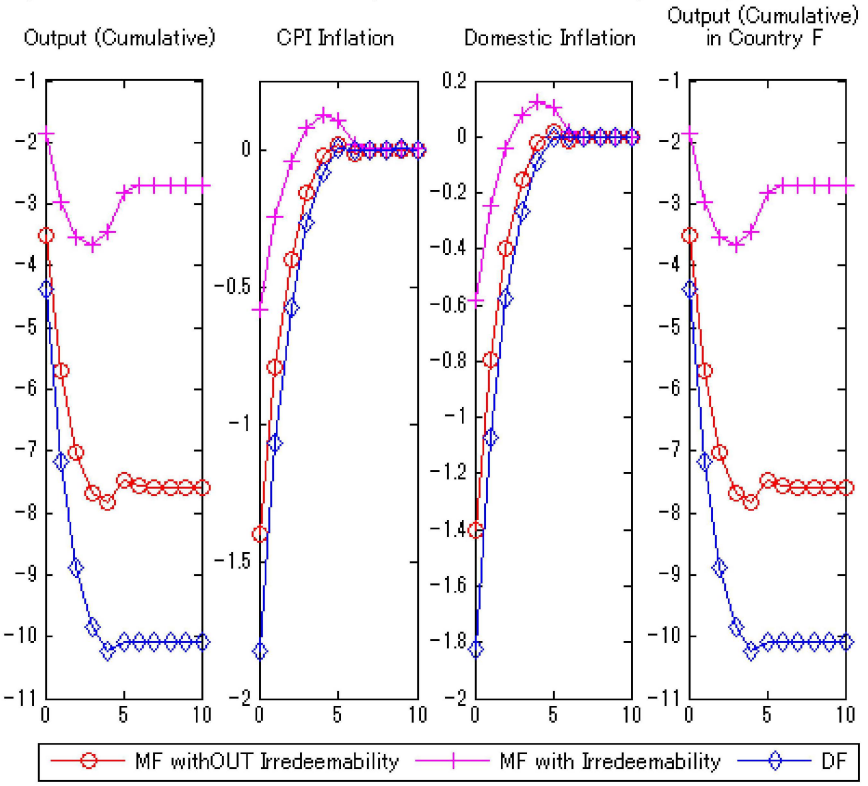
Fig. 11: Dyna. Effects of an Increase in Gov. Exp. in the LT in a Two-country Economy



5.5.3 Comparing the Effects of the MF Fiscal Stimulus with the DF Fiscal Stimulus in a Liquidity Trap in a Two-country Economy (3)

- The effectiveness of the *MF* fiscal stimulus to bolster the output is still more substantial than that of the *DF* fiscal stimulus, even if there is not the IM.
- Global *MF* fiscal stimulus is worth conducting amid a liquidity trap.

Fig. 11: Dyna. Effects of an Increase in Gov. Exp. in the LT in a Two-country Economy



6 Conclusion

- While Gali (2020) implicitly admitted that the IM is necessary, we show that the IM is not required to make the *MF* fiscal stimulus effective.
- Although the effectiveness of the *MF* fiscal stimulus without the IM is weaker than that of the *MF* fiscal stimulus with the IM, that of the *MF* fiscal stimulus without the IM is stronger than the *DF* fiscal stimulus.
- This finding is applicable either in normal times or in a liquidity trap.
- Also, this finding is applicable even in a two-country economy.