Non-Neutrality of Open-Market Operations

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Motivation

- "Old-Style" vs "New-Style" Central Banking
- Several central banks around the world (Bank of England, Bank of Japan, ECB, Fed, Riksbank) are holding **risky** securities in their balance sheets (*unconventional* monetary policy).
- **Main question**: Do these policies have any effect at all on the economy?
  1. Is unconventional policy an additional dimension of monetary policy?
  2. Are there any consequences on equilibrium *output* and *inflation* of the possible income losses on risky securities?
- A negative answer to the above questions points toward the irrelevance ("*neutrality*") of open-market operations.

Neutrality Property

- **Neutrality Property**
  Given a conventional monetary policy, all alternative CB balance-sheet compositions are consistent with the same equilibrium output and prices.

$\Rightarrow$ Open-market operations are irrelevant for equilibrium output and inflation.

- *Main intuition*: if the central bank bears some risk that was before in the hands of the private sector, the materialization of that risk does not affect equilibrium output and inflation if it is ultimately borne by the private sector.

- Neutrality granted by specific transfer policies:
  1. between central bank and treasury (key is the separation of treasury and central bank balance sheets);
  2. between treasury and private sector.

Real Bills Doctrine 2.0

- **RBD 1.0:** the CB holds "Real Bills" (safe short-term assets, thereby CB always profitable) and sets the discount rate on these assets by open-market operations in order to control the value of money (inverse of the price level).

$\Rightarrow$ Real Bills provide the backing of the value of currency

- **RBD 2.0:** if neutrality holds, the CB can still control the value of money by setting the discount rate on safe securities *independently* on what it holds in its balance sheet. How is it possible?

$\Rightarrow$ Taxpayers provide the backing of the value of currency

Main results

1. Discuss monetary and fiscal policy regimes under which the Proposition of Neutrality holds:
   - passive fiscal policy, and
   - passive remittances' policy (or full treasury's support)
2. Under a passive fiscal policy, but in absence of treasury's backing of central bank's losses, Proposition of Neutrality does not hold unless losses are
   - limited in time, and
   - limited in size.
3. Under an active fiscal policy, Proposition of Neutrality never holds.
4. Trade-off between *financial* independence and *target* independence.

Related Literature

- Propositions of Neutrality (Wallace, 1981, Sargent and Smith, 1987, Eggertsson and Woodford, 2003, Robatto, 2014);
- Relationship between central bank's financial strength and objectives of monetary policy (Sims, 2000, 2005, Del Negro and Sims, 2014, Stella 1997, 2005, Reis 2015);
- Implications of accounting procedures and remittance policies for central bank's solvency (Bassetto and Messer, 2013; Hall and Reis 2013);
- Fiscal Theory of the Price Level (Sargent and Wallace, 1981, Sargent, 1982, Leeper, 1991; Sims, 1994,2013; Woodford, 1995,1995).

Intuition

Equilibrium in the money market:

$$\frac{M_t}{P_t} \geq L(Y_t, i_t, \mathbf{z}_t); \tag{1}$$

Aggregate demand:

$$Y_t = E_t \Gamma(Y_{t+1}, i_t, \Pi_{t+1}, \mathbf{z}_t); \tag{2}$$

Aggregate supply:

$$\Pi_t = E_t \Upsilon(Y_t, \Pi_{t+1}, \mathbf{z}_t). \tag{3}$$

- **Conventional monetary policy** specifies one between $\{i_t, M_t\}$ (possibly as functions of other variables)
- *"REE":* a collection of stochastic processes $\{Y_t, \Pi_t, i_t, M_t\}$ satisfying equations (1)-(3) consistently with the specification of *conventional monetary policy* and subject to $i_t \geq 0$, given exogenous process $\{\mathbf{z}_t\}$.
- Given the "equilibrium" $\{Y_t, \Pi_t, i_t, M_t\}$, one can evaluate the pricing kernel $\tilde{R}_{t,T}$, the price of long-term securities Q_t and their return $1 + r_t$.

Intuition

- Consider an "equilibrium" allocation $\left\{ Y_t^*, \Pi_t^*, i_t^*, M_t^*, Q_t^*, r_t^*, \tilde{R}_{t,T}^* \right\}$ that satisfies equations (1)–(3) and asset-pricing conditions, for a given *conventional monetary policy*

- and consider alternatively $\left\{ B_t^C, D_t^C \right\}$ and $\left\{ \tilde{B}_t^C, \tilde{D}_t^C \right\}$, where
  - B_t^C : treasury bills held by the CB
  - D_t^C : long-term risky securities held by the CB (private or public)

- These alternative *balance-sheet policies* are said to be "neutral" if $\left\{ Y_t^*, \Pi_t^*, i_t^*, M_t^*, Q_t^*, r_t^*, \tilde{R}_{t,T}^* \right\}$ is still an equilibrium for the same *conventional monetary policy*.

- How could it not be, if nothing has changed in (1)–(3) or in the policy rule?

- Other conditions need to be satisfied for the allocation to be an equilbrium.

Intuition

- Transversality condition for households:

$$\lim_{T \longrightarrow \infty} E_t \left[R_{t,T} \left(M_T + \frac{B_T + X_T}{1 + i_T} + Q_T D_T \right) \right] = 0 \tag{4}$$

where

  - M_t : currency, carrying non-pecuniary return
  - B_t : treasury bills, carrying the risk-free rate i_t
  - X_t : CB reserves, carrying the risk-free rate i_t
  - D_t : long-term securities (private or public), bearing default risk

- Treasury's flow budget constraint

$$Q_t D_t^G + \frac{B_t^G}{1 + i_t} = (1 + r_t) Q_{t-1} D_{t-1}^G + B_{t-1}^G - A_t - T_t^C \tag{5}$$

where

  - A_t : primary surplus
  - T_t^C : remittances from CB

Intuition

- CB's balance sheet:

$$N_t + M_t + \frac{X_t}{1+i_t} = Q_t D_t^C + \frac{B_t^C}{1+i_t} \tag{6}$$

- CB's profits:

$$\Psi_t = i_{t-1}(N_{t-1} + M_{t-1}) + (r_t - i_{t-1}) Q_{t-1} D_{t-1}^C \tag{7}$$

- Law of motion of net worth

$$N_t = N_{t-1} + \Psi_t - T_t^C \tag{8}$$

- Equilibrium requires

$$B_t^G = B_t + B_t^C \tag{9}$$

$$D_t^C = D_t^G - D_t \tag{10}$$

Intuition

- Under Neutrality, equations (5)–(10) determine

$$\left\{ B_t, B_t^G, B_t^C, D_t, D_t^G, D_t^C, A_t, T_t^C, X_t, N_t, \Psi_t \right\}$$

given the allocation

$$\left\{ Y_t^*, \Pi_t^*, i_t^*, M_t^*, Q_t^*, r_t^*, \tilde{R}_{t,T}^* \right\}$$

if we specify:

1. **Transfer Policies (TP):**
   specify both $\left\{ A_t,\ T_t^C \right\}$ (possibly as functions of other variables)

2. **Balance-sheet Policies (BSP):**
   specify three processes among $\left\{ B_t^C,\ D_t^C,\ B_t^G,\ D_t^G \right\}$ (possibly as functions of other variables)

Central Bank's solvency condition

Solvency of central bank requires:

$$\frac{X_{t-1}}{P_t^*} + \frac{M_{t-1}^*}{P_t^*} - \frac{B_{t-1}^C}{P_t^*} - (1 + r_t^*)\frac{Q_{t-1}^* D_{t-1}^C}{P_t^*} = E_t \sum_{T=t}^{\infty} \tilde{R^*}_{t,T} \left[\frac{i_T^*}{1 + i_T^*} \frac{M_T^*}{P_T^*} - \frac{T_T^C}{P_T^*} \right], \quad (11)$$

$\Rightarrow$ the *candidate* equilibrium $\{Y_t^*, \Pi_t^*, i_t^*, M_t^*, Q_t^*, r_t^*, \tilde{R}_{t,T}^*\}$ is a feasible allocation if it is also consistent with (11) given some balance-sheet policy.

$\Rightarrow$ the **Neutrality Property** requires consistency for *any BSP*.

$\Rightarrow$ Critical is the specification of the **transfer policy** between CB and treasury.

Remittances' policies

- Consider a transfer policy $T_t^C / P_t = \bar{T}^C$, it follows:

$$\frac{X_{t-1}}{P_t^*} + \frac{M_{t-1}^*}{P_t^*} - \frac{B_{t-1}^C}{P_t^*} - (1 + r_t^*) \frac{Q_{t-1}^* D_{t-1}^C}{P_t^*} = E_t \sum_{T=t}^{\infty} \tilde{R}^*{}_{t,T} \left[\frac{i_T^*}{1 + i_T^*} \frac{M_T^*}{P_T^*} - \bar{T}^C \right],$$

$\Rightarrow$ price (and quantity) determination through the solvency condition of the CB.

- Consider a rule in the class of "passive" remittances' policies

$$\frac{T_t^C}{P_t} = \bar{T}^C + \frac{\Psi_t^C}{P_t} + \psi_t \frac{N_{t-1}}{P_t},$$

where $1 - \Pi_t < \psi_t \leq 1$ for each t

$\Rightarrow$ CB is solvent, *at the candidate equilibrium*, for any BSP.

$\Rightarrow$ However, there are fiscal consequences of the above rule...

Fiscal consequences of central-bank income losses

The candidate equilibrium should also be consistent with solvency of the treasury:

$$\frac{B^G_{t-1}}{P^*_t} + (1+r^*_t)\frac{Q^*_{t-1}D^G_{t-1}}{P^*_t} = E_t \sum_{T=t}^{\infty} \tilde{R}^*_{t,T}\left[\frac{A_T}{P^*_T} + \frac{T^C_T}{P^*_T}\right],$$

$\Rightarrow$ Lower remittances should be offset by a higher primary surplus, otherwise prices and quantities should adjust (FTPL).

- Consider a rule in the class of "passive" fiscal policies

$$\frac{A_t}{P_t} = \bar{a} - \frac{T^C_t}{P_t} + \phi\left[\frac{(1+r_t)Q_{t-1}D^G_{t-1} + B^G_{t-1}}{P_t}\right]$$

for some $\bar{a}$ and ϕ, with $0 < \phi < 1$

$\Rightarrow$ Treasury is solvent, *at the candidate eq.m*, for any composition of liabilities

Proposition of Neutrality

Irrelevance of balance-sheet policies requires a combination of passive fiscal policy and passive remittances' policy (or full treasury's support):

$$\frac{A_t}{P_t} = \bar{a} - \frac{T_t^C}{P_t} + \phi \left[\frac{(1+r_t) Q_{t-1} D_{t-1}^G + B_{t-1}^G}{P_t} \right] \tag{12}$$

$$\frac{T_t^C}{P_t} = \bar{T}^C + \frac{\Psi_t^C}{P_t} + \psi_t \frac{N_{t-1}}{P_t}, \tag{13}$$

- (13) ensures that the treasury transfers resources to the central bank in the case of negative profits;
- (12) ensures that the treasury gets these resources from the private sector through higher lump-sum taxes:

$\Rightarrow$ risk remains in the hands of the private sector.

1. Passive Fiscal Policy

Implications of full treasury's support

Full treasury's support $T_t^C = \Psi_t^C$ implies

1. Net worth is constant (and stationary)

$$N_t = N_{t-1} + \Psi_t^C - T_t^C = N_{t-1} = \overline{N}$$

2. Interest-bearing reserves adjust appropriately

$$Q_t^* D_t^C + \frac{B_t^C}{1 + i_t^*} - M_t^* - \frac{X_t}{1 + i_t^*} = \overline{N}$$

for any appropriately bounded processes $\left\{ B_t^C, D_t^C \right\}$.

3. Paying interest on reserves expands the set of neutrality cases

Policy experiment I

Credit-Risk due to partial default on long-term securities:

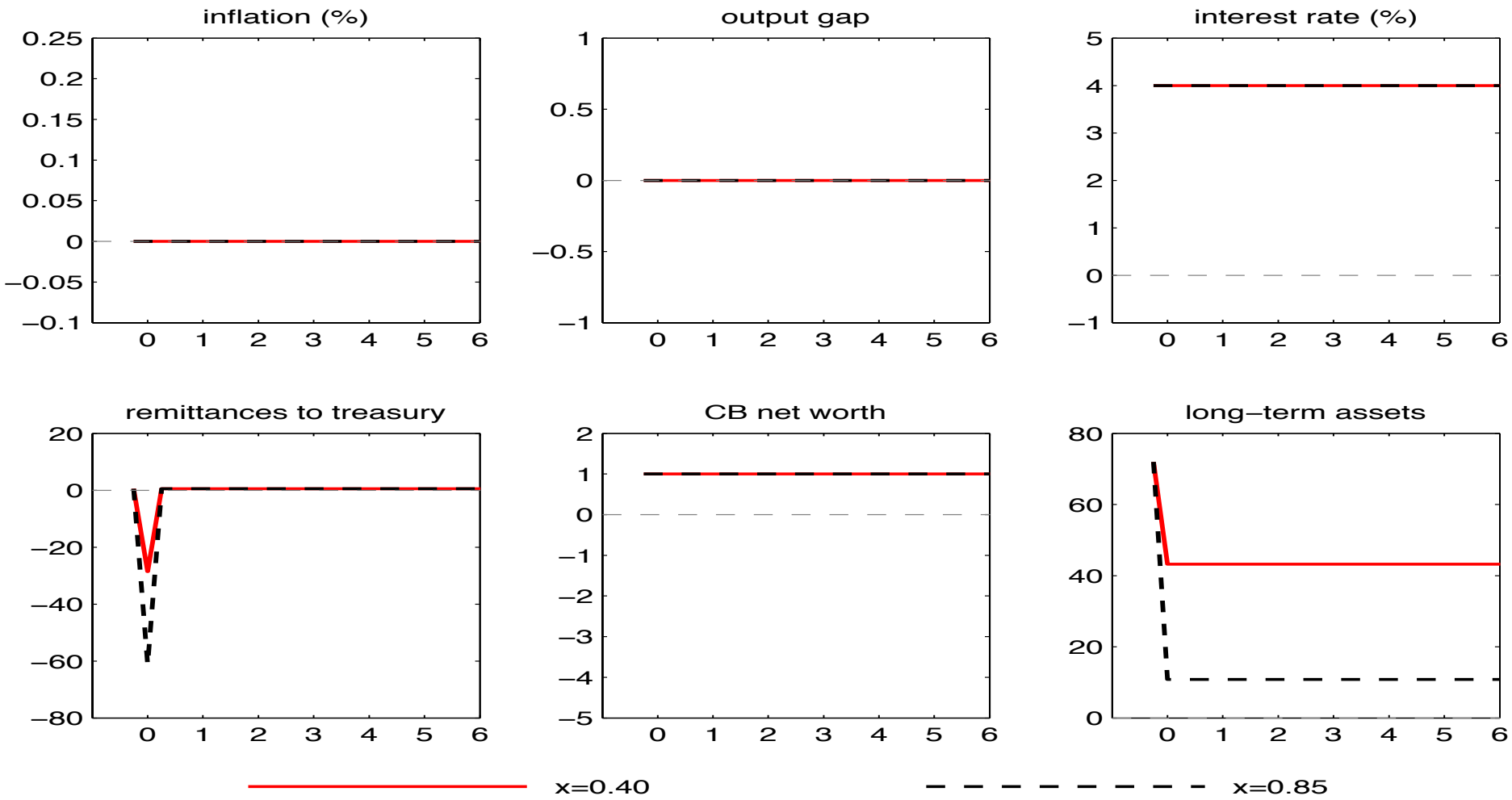
- Shock hits unexpectedly at time 0;
  1. "Mild" credit event, haircut of 40%;
  2. "Strong" credit event, haircut of 85%;

$\Rightarrow$ Optimal monetary policy stabilizes inflation and output gap when credit risk is in the hands of the private sector ($D_t^C = 0$, for all t);

$\Rightarrow$ Optimal monetary policy *is the same* if CB holds risky securities ($D_t^C > 0$, for some t) and if there is

- ✓ full treasury's support, and
- ✓ passive fiscal policy

Credit risk


inflation (%)
output gap
interest rate (%)
remittances to treasury
CB net worth
long−term assets
x=0.40
x=0.85

Policy experiment II

Interest-rate risk due to exit strategy from liquidity trap:

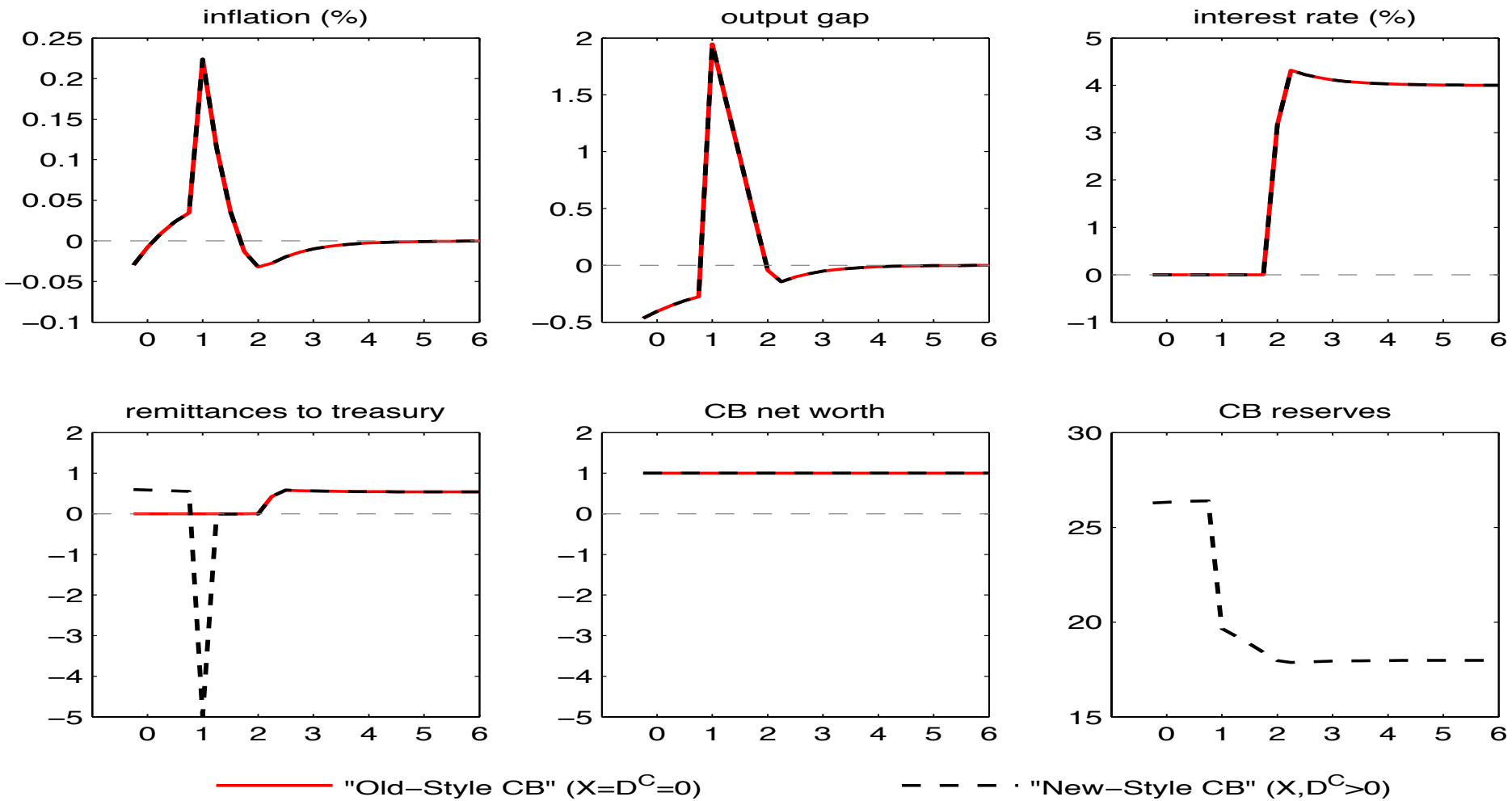
- Economy is in trap with natural rate of interest to -2% (annual);
- Probability of 10% of reversal to a normal value of 4% (annual);
- Ex-post duration: 4 quarters (time at which there is the unexpected movement in the yield curve);

$\Rightarrow$ Optimal monetary policy is to exit from liquidity trap after 6 quarters when interest-rate risk is in the hands of the private sector ($D_t^C = 0$, for all t);

$\Rightarrow$ Optimal monetary policy *is the same* if CB holds risky securities ($D_t^C > 0$, for some t) and if there is

- ✓ full treasury's support, and
- ✓ passive fiscal policy

Interest-rate risk



No treasury's support ($T_t^C \geq 0$)

- Negative profits translate into declining net worth:

$$N_t = N_{t-1} + \Psi_t^C - T_t^C < N_{t-1}.$$

- Rewrite solvency condition of CB as

$$\underbrace{\frac{N_t}{P_t^*} + E_t \sum_{T=t}^{\infty} \tilde{R}_{t,T}^* \left(\frac{i_T^*}{1+i_T^*} \frac{M_T^*}{P_T^*} \right)}_{\text{real net worth + expected PV of future seigniorage revenue (value of CB)}} = \underbrace{E_t \sum_{T=t+1}^{\infty} \tilde{R}_{t,T}^* \left(\frac{T_T^C}{P_T^*} \right)}_{\text{expected PV of real transfers to and from the Treasury (dividends)}}.$$

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$\Rightarrow$ With treasury's support: RHS adjusts for given, constant, net worth

$\Rightarrow$ Without treasury's support: lower bound on net worth

Implications of Deferred-Asset Regime

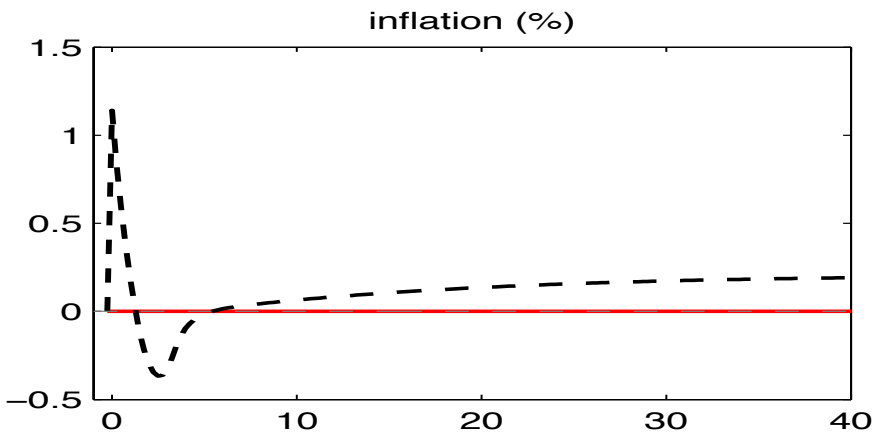
- The CB absorbs losses by reducing capital and retains future profits until capital returns to the initial level.

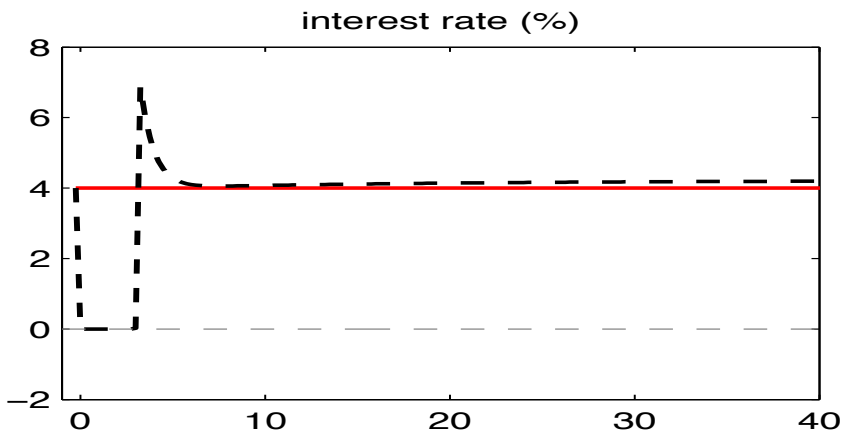
- If fiscal policy is passive, Proposition of Neutrality does not hold unless central-bank losses are limited in:

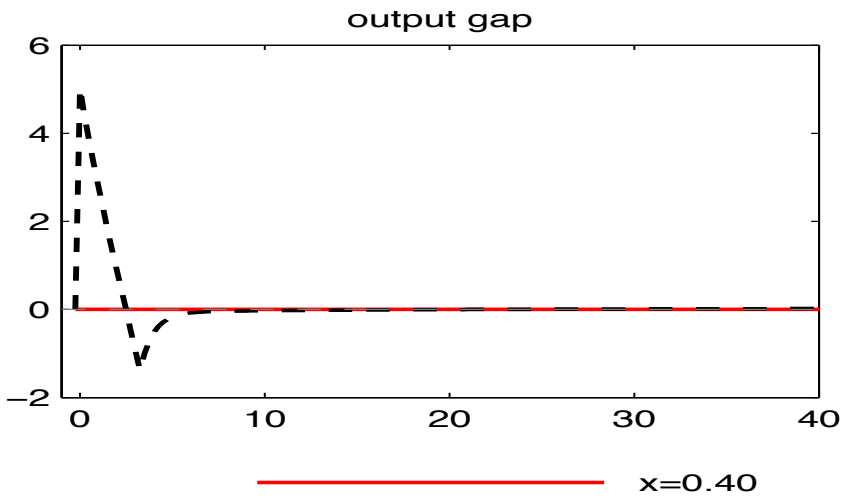
  1. **time**
     otherwise CB may not have room to shift losses to the private sector
  2. **size**
     otherwise lower-bound on net worth may be violated, or
     profitability be permanently impaired (if $N_t + M_t < 0$: assets less than interest-bearing liabilities).

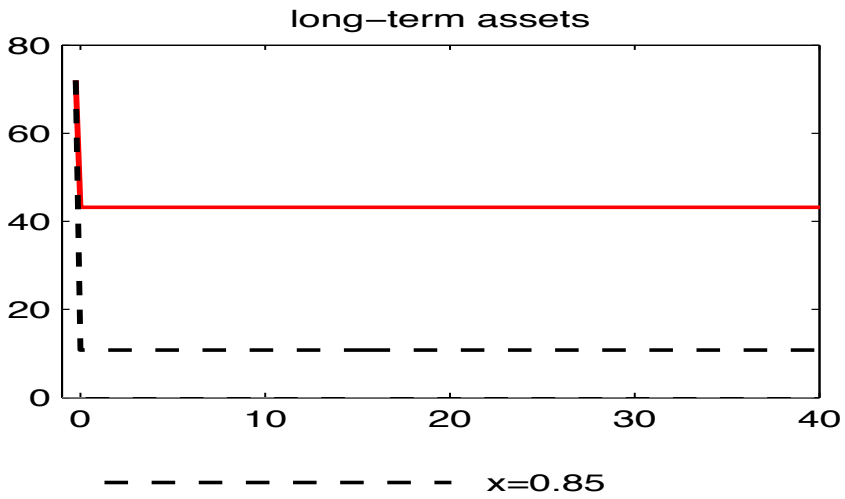
$\Rightarrow$ QE can be inflationary: losses only absorbed in the long run if CB raises price level to push up private currency holdings and increase seigniorage.

Credit risk

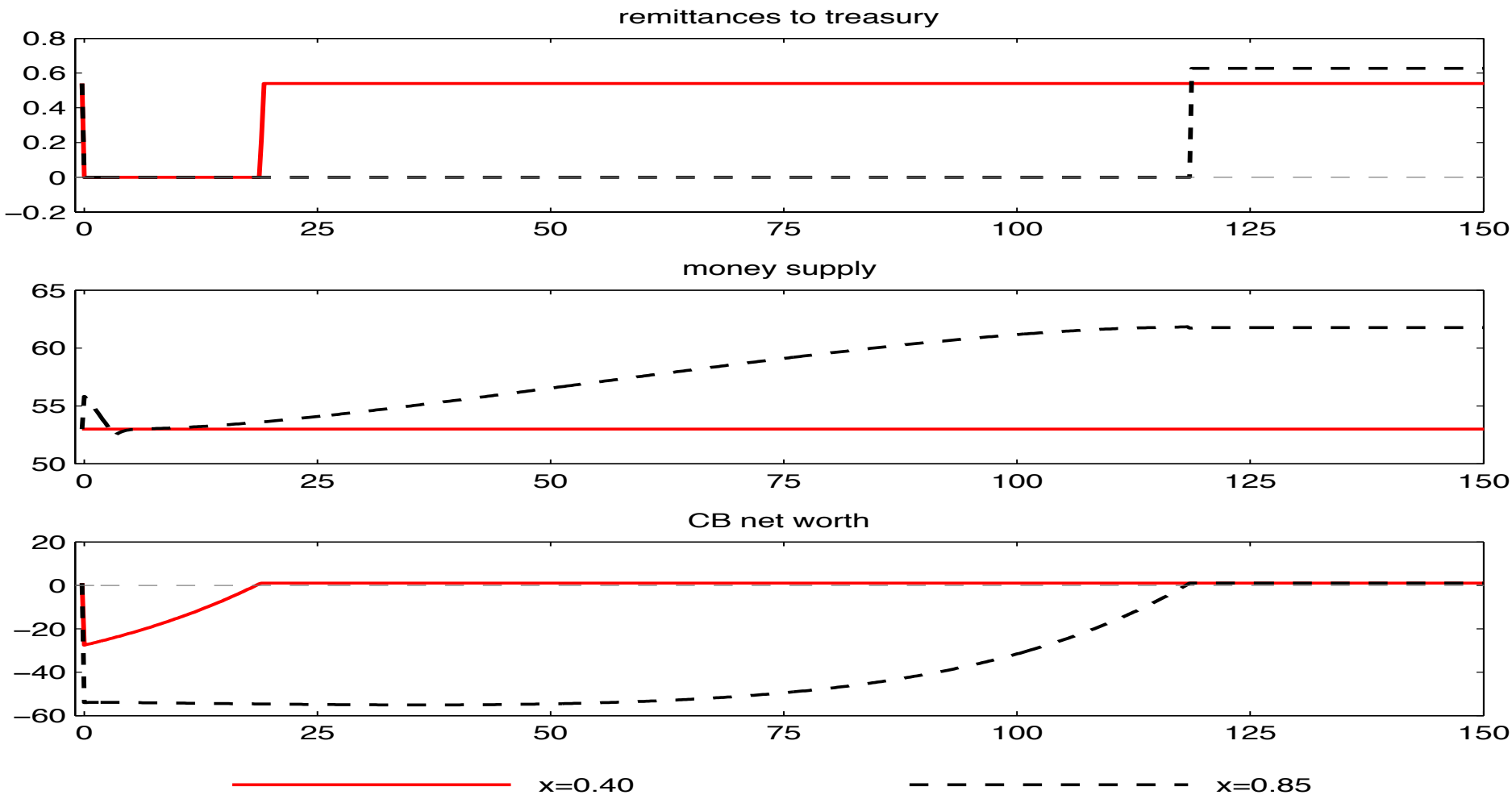

inflation (%)
1.5
1
0.5
0
−0.5
0
10
20
30
40


interest rate (%)
8
6
4
2
0
−2
0
10
20
30
40


output gap
6
4
2
0
−2
0
10
20
30
40
x=0.40


long−term assets
80
60
40
20
0
0
10
20
30
40
x=0.85

Credit risk


remittances to treasury
0.8
0.6
0.4
0.2
0
−0.2
0
25
50
75
100
125
150
money supply
65
60
55
50
0
25
50
75
100
125
150
CB net worth
20
0
−20
−40
−60
0
25
50
75
100
125
150
x=0.40
x=0.85

Financial Independence

- CB averse to periods of declining net worth:

$$T_t^C = \Psi_t^C \geq 0$$

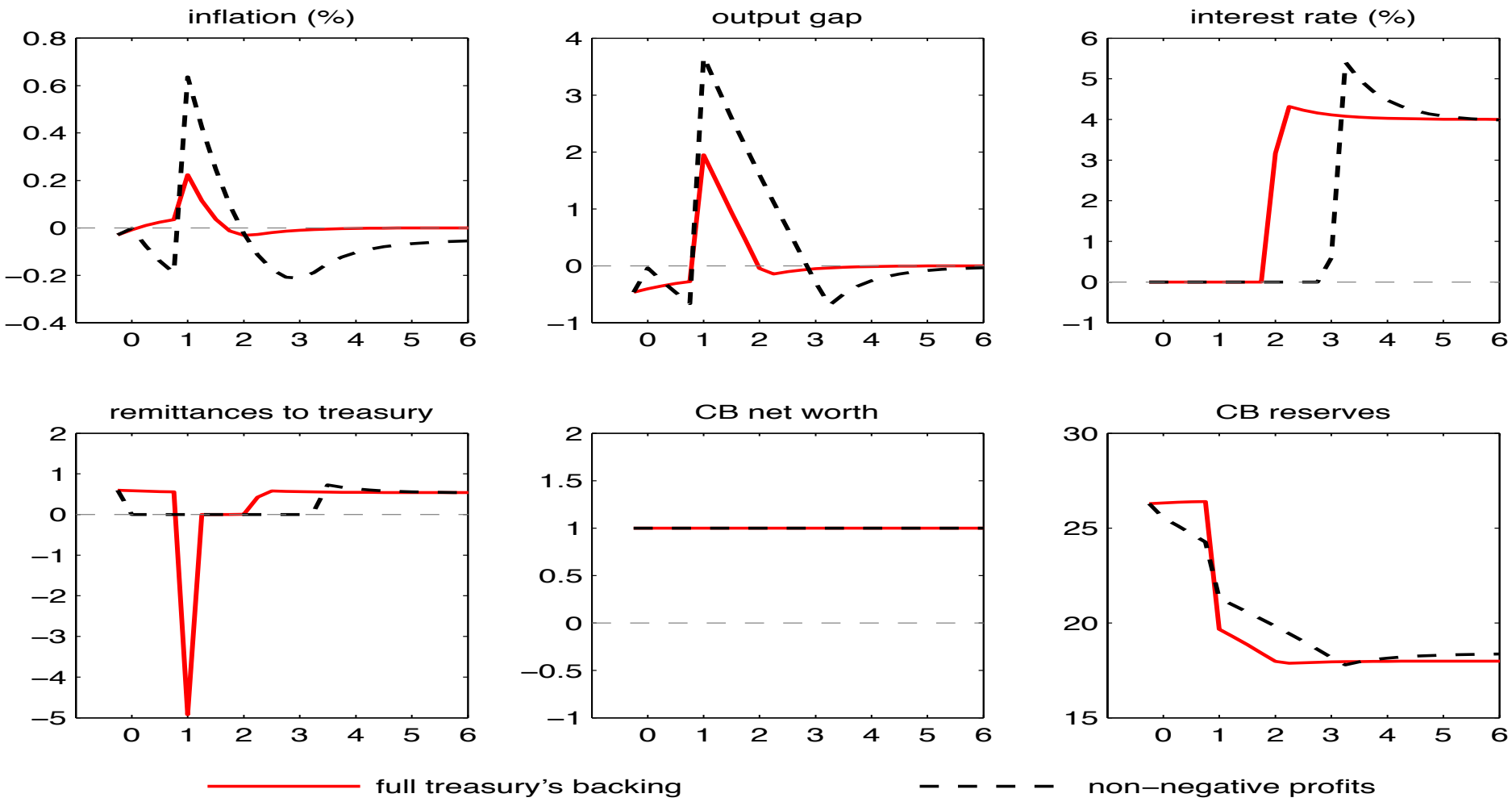
- If CB holds only short-term risk-free assets ($D_t^C = 0$, for all t) the lower-bound constraint on profits is never binding

$\Rightarrow$ Proposition of Neutrality never holds: CB changes *conventional* MP stance to satisfy constraint on profits

$\Rightarrow$ *Unconventional* MP signals a change in *conventional* MP stance: higher inflation and delayed exit from liquidity trap when there is interest-rate risk.

- **Note**: Trade-off between *financial* independence and *target* independence.

Financial Independence: interest rate risk



2. Active Fiscal Policy

Implications of active fiscal policy

- Exogenous primary surplus:

$$\frac{A_t}{P_t} = a_t,$$

$\Rightarrow$ a consolidated intertemporal budget constraint holds:

$$\frac{B^G_{t-1}}{P^*_t} + (1 + r^*_t)\frac{Q^*_{t-1}D^G_{t-1}}{P^*_t} - \frac{N_{t-1} + \Psi^C_t}{P^*_t} = E_t \sum_{T=t}^{\infty} \tilde{R}^*_{t,T}\left[\frac{i^*_T}{1+i^*_T}\frac{M^*_T}{P^*_T} + a_T\right]$$

$\Rightarrow$ CB's income losses ($\Psi^C_t < 0$) require an adjustment somewhere else (prices, output or seigniorage revenues)

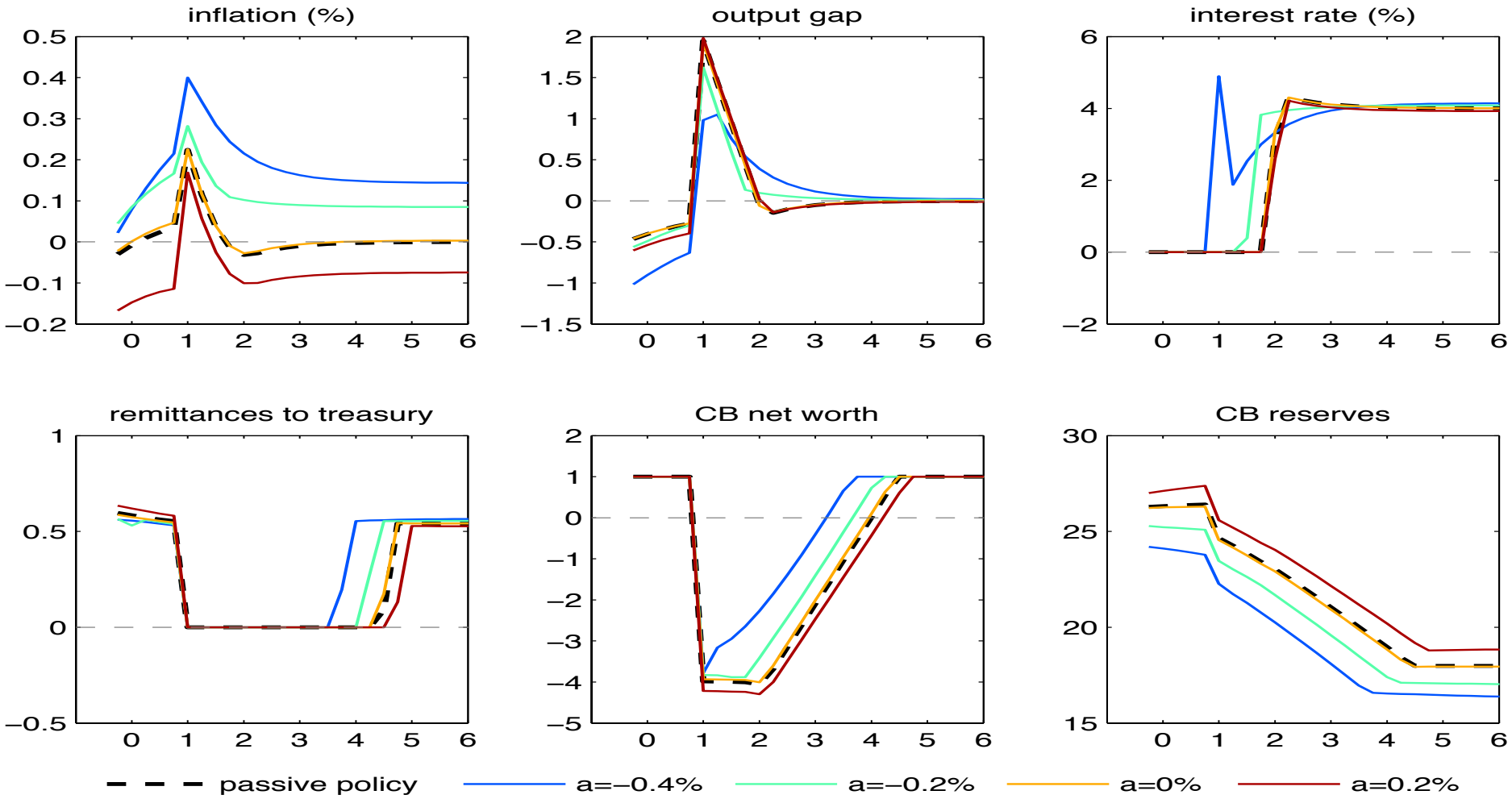
Implications of active fiscal policy

⇒ Proposition of Neutrality never holds:

- a reallocation of risks in the economy has fiscal consequences
- the treasury is not passing CB's losses to the private sector
- private sector therefore experiences a positive wealth effect

⇒ Inflationary consequences affect the duration of declining net worth and the stay at the zero-lower bound

Active Fiscal Policy and Deferred-Asset Regime



Conclusions

- Study relevance of BSP under alternative fiscal and monetary regimes: irrelevance of QE policy seems quite pervasive given current inst settings
- Balance-sheet policies can be effective if
  1. they signal a change in **conventional** monetary policy
  2. implied losses are recurrent or sizable, requiring a change in **conventional** policy to restore solvency
  3. central bank averse to income losses (financial independence)
  4. active fiscal policy
- Should be extended to nest models with direct benefits of unconventional monetary policy (limits of arbitrage, or relaxation of liquidity constraints).
- Caveat to consider: CB accounting procedures.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Chiusura 03/09 ---- 1.0999
Massimo 03/10 18:41 1.1217
Media 1.1032
Minimo 03/10 14:39 1.0823
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+0.0180
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