Monetary Policy and the Natural Rate of Interest

by

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Motivation for this paper:

As banks start lending in earnest and we leave zero-bound trap, price stability will presumably become an issue again.

Fiscal retrenchments will probably continue in a staggered and unpredictable fashion for years to come; monetary policy has to adapt to this environment.

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Lesson for central banks:

don’t be tempted to react to each new bit of “fiscal news”

"One can only say that if the bank policy succeeds in stabilizing prices, the bank rate must have been brought in line with the natural rate."

Orphanides and Williams (2002)

Consider a variant of the Taylor Rule:

$i_t = i_t^n + 1.5(\pi_t - \bar{\pi})$

where i_t^n is natural rate of interest on government bonds.

(i_t^n is rate that would prevail if there were no nominal rigidities.)

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Curdia et al (2011): Fed has history of trying to track I_t^n

Laubach and Williams (2003): I_t^n not observed; very hard to estimate.

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Anyway: $\pi_t \to \bar{\pi}$ as $i_t \to i_t^n$ How does this happen?

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where i_t^n is natural rate of interest on government bonds.

Intuition: say an increase in aggregate demand pushes inflation above its target, policy rate should be raised above its natural rate, raising the real rate of interest to curb aggregate demand and inflation.

We consider 4 monetary policy rules –

Rule 1: $i_t = \bar{i} + 1.5(\pi_t - \bar{\pi})$

where i_t^n is replaced with $\bar{i}$ is steady state value of the govt bond rate

this rule is operational

We consider 4 monetary policy rules –

Rule 1: $i_t = \bar{i} + 1.5(\pi_t - \bar{\pi})$

where $\bar{i}$ is steady state value of the govt bond rate

Rule 2: $i_t = 0.8 i_{t-1} + (1 - 0.8)[\bar{i} + 1.5(\pi_t - \bar{\pi})]$

interest rate soothing rule

empirical support

used in policy studies

Note: as rule becomes more inertial ($0.8 \rightarrow 1$), less use is made of

of intercept term.

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interest rate soothing rule

Rule 3: $i_t = i_{t-1} + 1.5(\pi_t - \bar{\pi})$

first difference rule

discussed in past, especially in context of model uncertainty

not much used in studies today

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interest rate soothing rule, empirical support, used in policy studies

Rule 3: $i_t = i_{t-1} + 1.5(\pi_t - \bar{\pi})$

first difference rule, discussed in past, not much used in studies today

Rule 4: $i_t = [r_t^n + E_t(\pi_{t+1})] + 1.5(\pi_t - \bar{\pi})$

r_t^n is “real” natural rate of interest

full information rule; a benchmark case (not implementable)

like earlier equation, but shows how we calculate i_t^n

Monetary Policy Rules –

Rule 1: $i_t = \bar{i} + 1.5(\pi_t - \bar{\pi})$

Rule 2: $i_t = 0.8i_{t-1} + (1 - 0.8)[\bar{i} + 1.5(\pi_t - \bar{\pi})]$

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Basic Results –

1. G spending shocks cause large and persistent movements in r_t^n, especially when b has liquidity, especially^2 if m & b compliments; productivity shocks, not so much.
2. With Rule 1, i_t tracks i_t^n very poorly; Rule 2, better; Rule 3, very well.
3. Households would give up .25 - .50 percent of ss consumption to get Rule 3 or Rule 4 in place of Rule 1.

The “Liquid Bonds” Model and the embedded “Standard” Model –

Familiar DSGE framework except for transactions technology:

Following Schmitt-Grohe and Uribe (2004) –

transactions costs proportional to consumption

$$m_t + b_t + c_t + \tau_t c_t = w_t n_t + (m_{t-1} + I_{t-1} b_{t-1})/\Pi_t + t_t + div_t$$

$$\tau_t = \begin{cases} (A/v_t)(v_t - v^*)^2 & \text{for } v_t > v^* = \text{satiation level} \\ 0 & \text{for } v_t \leq v^* \end{cases}$$

$$v_t = c_t/\tilde{m}_t$$

can lower transactions cost by holding more $\tilde{m}_t$

We deviate from Schmitt-Grohe and Uribe in our definition of velocity:

$v_t = c_t/\tilde{m}_t$

where "effective transactions balances" are defined as

$\tilde{m}_t^{\rho} = a^{1-\rho} m_t^{\rho} + (1 - a)^{1-\rho} b_t^{\rho}$

$\xi \equiv 1/(1-\rho)$ is the elasticity of substitution

Two cases: "compliments" ($\xi = 0.75$), "substitutes" ($\xi = 1.25$).

We think compliments is more relevant case.

The "Standard" model: $\tilde{m}_t = m_t$

essentially the Schmitt-Grohe and Uribe (2004) model

Household FOCs $\Rightarrow$

$$\frac{m_t}{b_t} = \frac{a}{1-a}\left(\frac{I_t^* - I_t}{I_t^* - 1}\right)^{\xi} = \frac{a}{1-a}\left(1 - \frac{i_t}{i_t^*}\right)^{\xi}$$

where I_t^* = CCAPM interest rate ($1/I_t^* = \beta E_t[(\lambda_{t+1}/\lambda_t)/\Pi_{t+1}]$)

$I_t^* - I_t > 0$, since b provides transactions services

$(I_t^* - I_t)/(I_t^* - 1)$ (= relative opt cost of b and m) = MRS of m & b in $\tilde{m}$

$G\uparrow \Rightarrow b\uparrow$, has non-Ricardian wealth effects when $I_t^* - I_t > 0$

Recall: compliments ($\xi = 0.75$), substitutes ($\xi = 1.25$)

For a given m_t/b_t, spread $I_t^* - I_t$ is bigger when m and b are compliments; wealth effects are larger in the case of compliments.

Rest of model very familiar –

Fixed, firm specific, capital; Calvo price setting.

Productivity follows AR1 process.

Fiscal Policy –

Government purchases follows AR1 process

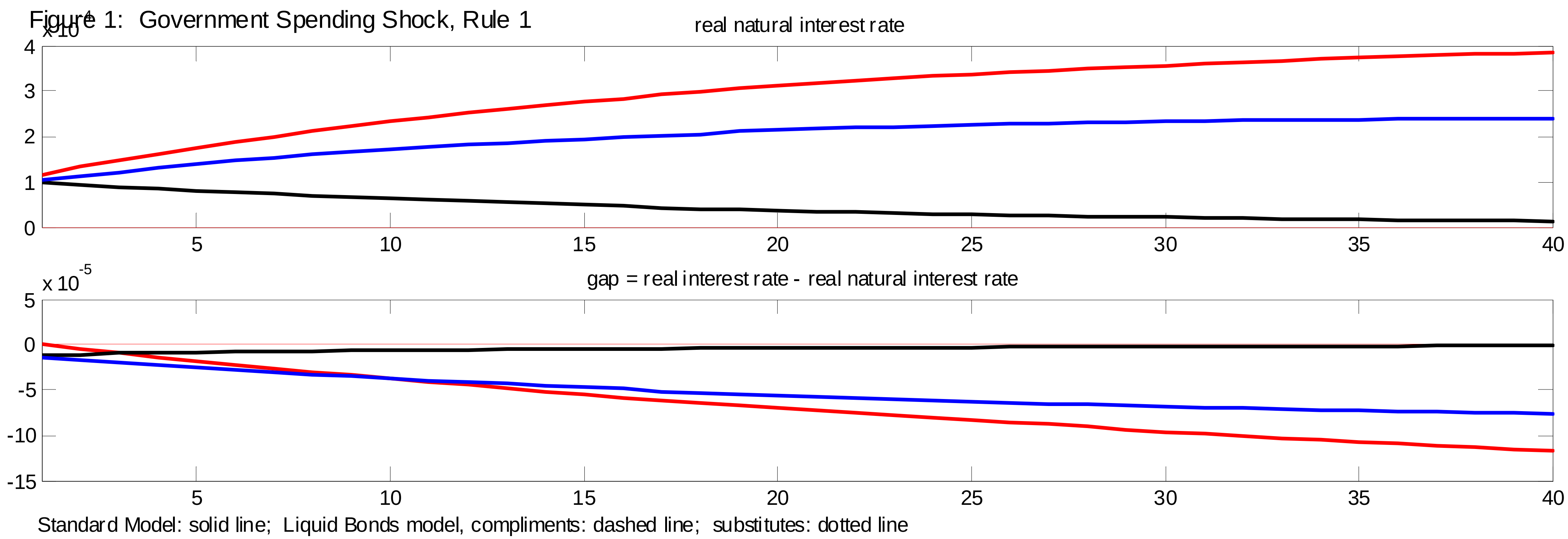
Tax Rule: $t_t = \bar{t} + \varphi_d(b_{t-1} - \bar{b})$ (t is a lump sum tax)

$\varphi_d > \bar{I}/\bar{\Pi}$ (steady state): passive rule, no FTPL here.

Interest Rate Dynamics: movements in (real) r^n_t and $r^n_t - r_t$ depend on

1. Source of shock and whether b has liquidity value.
2. Policy rule that is in place.

G-spending shock under Rule 1, $i_t = \bar{i} + 1.5(\pi_t - \bar{\pi})$

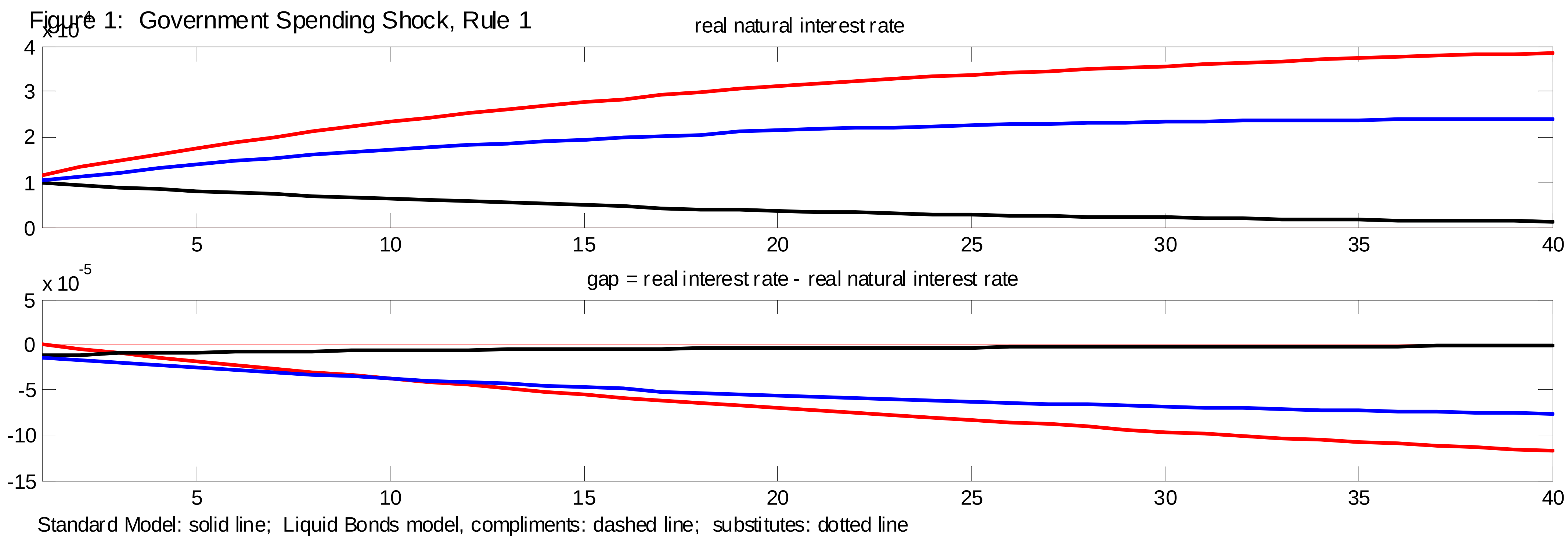


Standard: black LB compliments: red LB Model substitutes: blue

Standard Model: effects on r^n_t and r^n_t - r_t big but short lived.

Rule 1 does a fair job of tracking i^n_t.

G-spending shock under Rule 1, $i_t = \bar{i} + 1.5(\pi_t - \bar{\pi})$



Standard: black LB compliments: red LB Model substitutes: blue

LB Model: $b_t \uparrow \Rightarrow$ liquidity & wealth effects augment the demand $\uparrow$

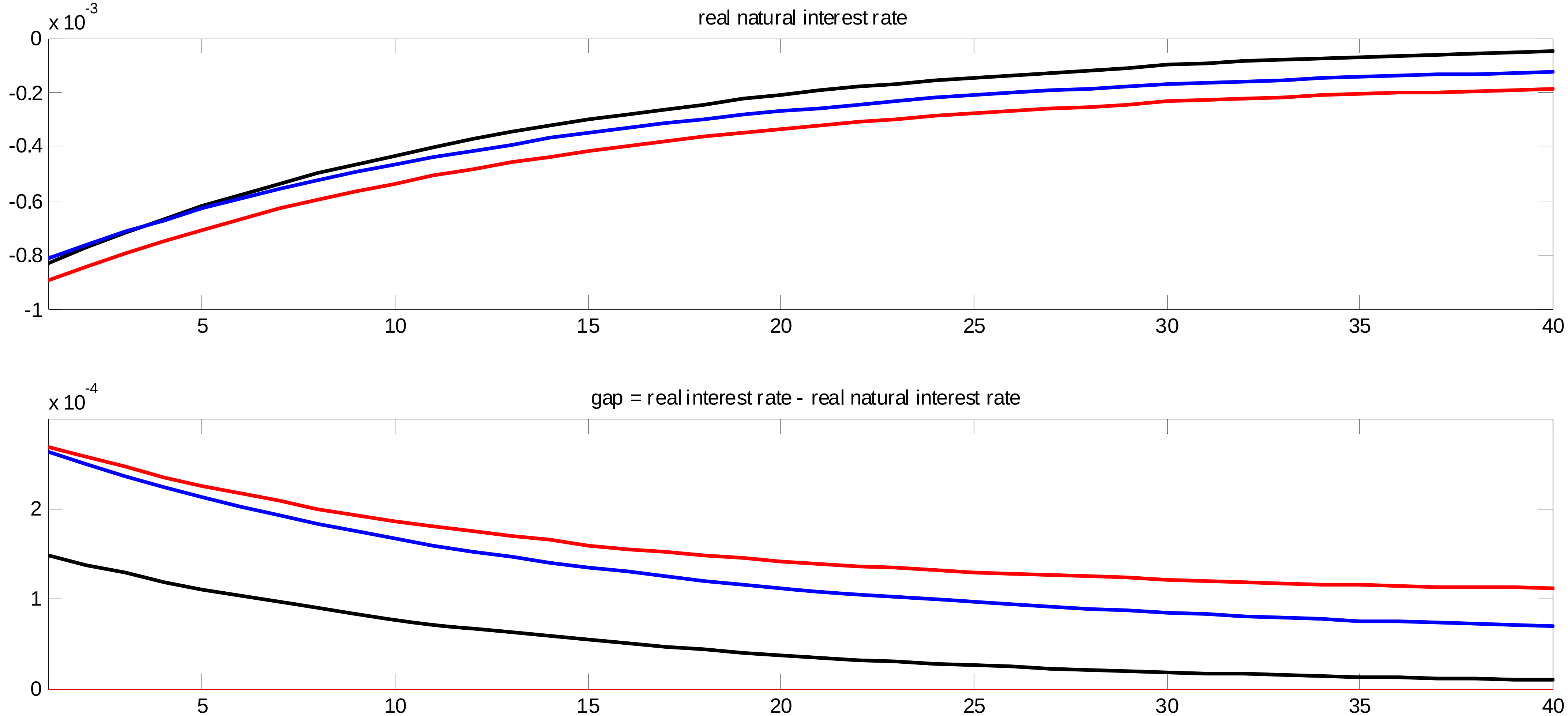
effects on r_t^n and $r_t^n - r_t$ get larger and are very long lived.

more so when m and b are compliments.

Rule 1 does a poor job of tracking i_t^n, especially in compliments case

Productivity shock under Rule 1, $i_t = \bar{i} + 1.5(\pi_t - \bar{\pi})$

Figure 3: Productivity Shock, Rule 1



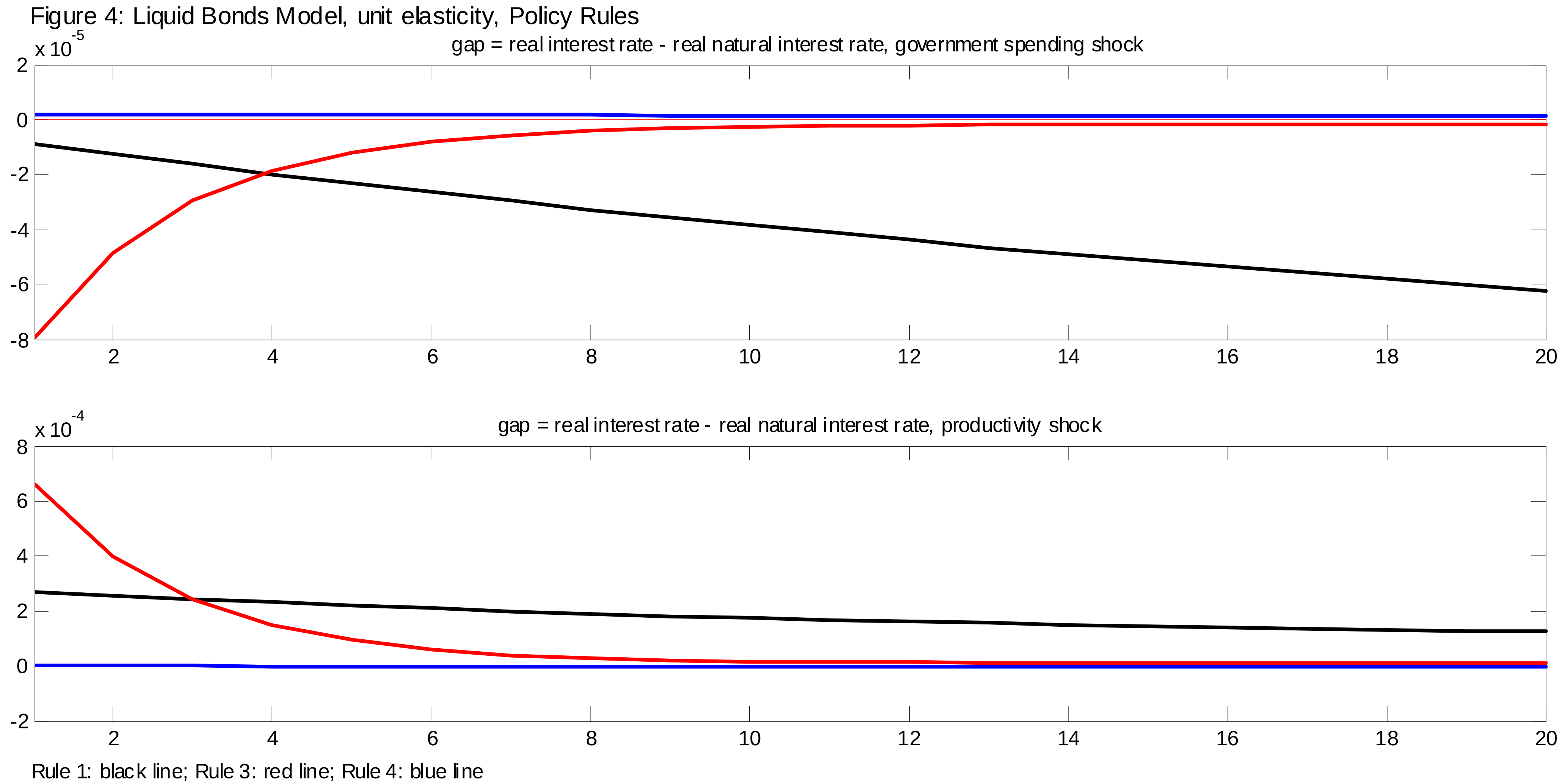
Standard Model: black line; Liquid Bonds model, compliments: red line; substitutes: blue line

Standard Model: effects on r_t^n and r_t^n - r_t big but short lived.

LB Model: effects on r_t^n and r_t^n - r_t big but short lived.

For this shock there is no added liquidity/wealth effect.

LB model: G-spending & Productivity Shocks under different Rules

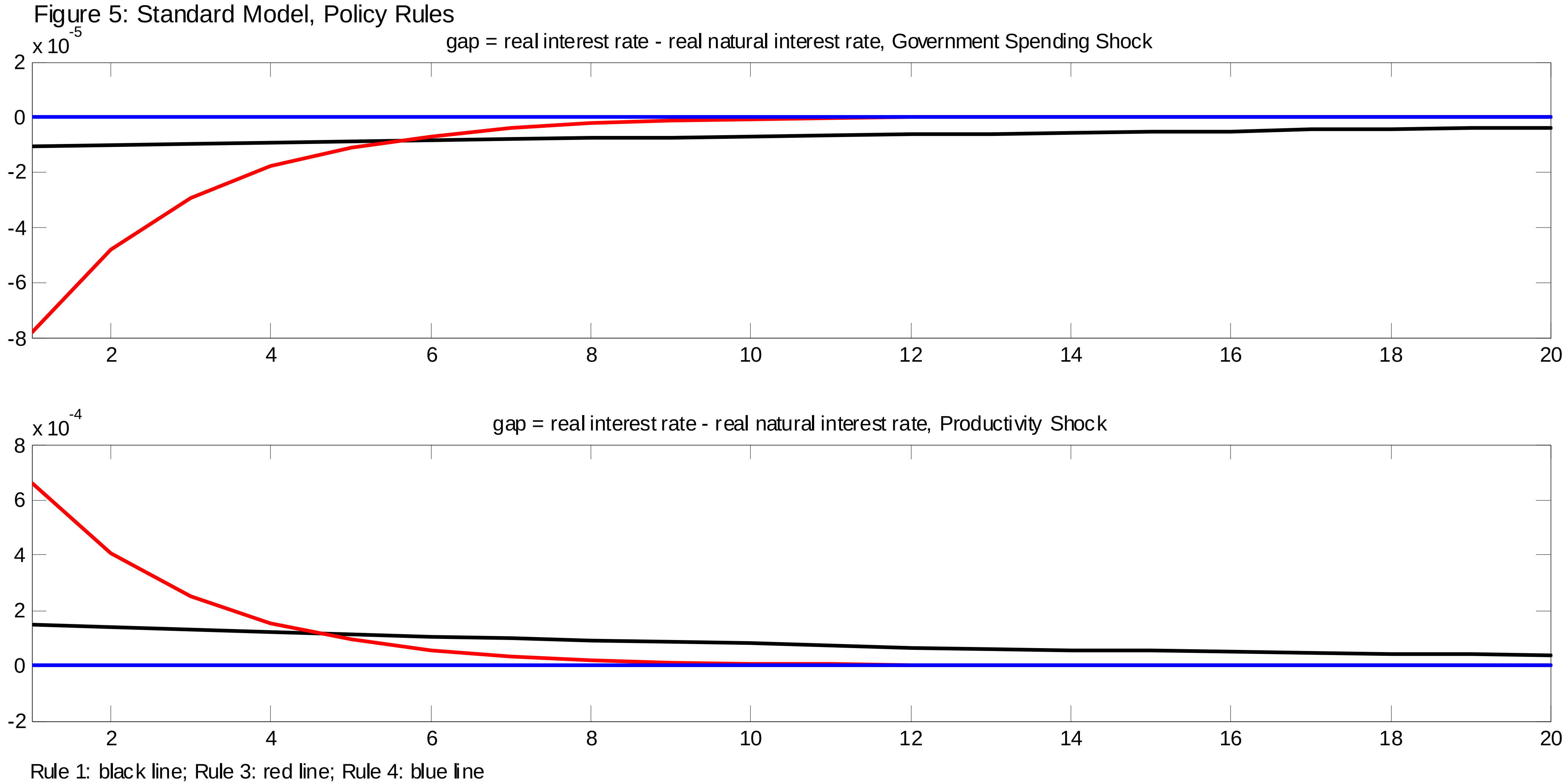


Rule 1: $i_t = \bar{i} + 1.5(\pi_t - \bar{\pi})$ — no attempt to track i_t^n

Rule 3: $i_t = i_{t-1} + \bar{i} + 1.5(\pi_t - \bar{\pi})$ — unit root for long deviations

Rule 4: $i_t = [r_t^n + E_t(\pi_{t+1})] + 1.5(\pi_t - \bar{\pi})$ — benchmark, can't implement

Standard model: G-spending & Productivity Shocks, different Rules



Rule 1: $i_t = \bar{i} + 1.5(\pi_t - \bar{\pi})$	Does better, no new liquidity
Rule 3: $i_t = i_{t-1} + \bar{i} + 1.5(\pi_t - \bar{\pi})$	unit root
Rule 4: $i_t = [r_t^n + E_t(\pi_{t+1})] + 1.5(\pi_t - \bar{\pi})$	benchmark

So, some rules track the natural rate better than others.

How important is all of this anyway?

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Table 1: Welfare Comparisons, percent of steady state consumption gained over Rule 1

	LB model substitutes	LB model compliments	Standard model
Rule 1	x	x	x
Rule 2	0.11	0.13	0.06
Rule 3	0.25	0.51	0.29
Rule 4	0.25	0.50	0.29

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