ECON 815

Fiscal Policy in the RBC Model

Winter 2020

RBC Model with Policy Shocks

A *policy* is defined by

$$\{z_t\}_{t=0}^{\infty} = \{g_t, \tau_{ct}, \tau_{xt}, \tau_{kt}, \tau_{nt}, T_t\}_{t=0}^{\infty}$$

The policy is *feasible* if it satisfies a flow budget constraint

$$g_t = \tau_{ct} c_t + \tau_{xt} x_t + \tau_{kt} r_t k_t + \tau_{nt} w_t n_t - T_t$$

Public expenditures g do not provide direct utility.

There are no technology shocks, but we would like to look at

- anticipated policy changes
- unanticipated policy shocks.

Households take prices and policy as given to maximize

$$\max_{\{c_t, n_t, x_t\}_{t=0}^{\infty}} \sum_{t=0}^{\infty} \beta^t u(c_t, 1-n_t)$$

subject to

$$(1+\tau_{ct})c_t + (1+\tau_{xt})x_t \leq (1-\tau_{kt})r_t k_t + (1-\tau_{nt})w_t n_t + T_t$$

$$k_{t+1} = (1-\delta)k_t + x_t$$

k_0 given

Firms have a neoclassical production function and, taking prices as given, maximize profits

$$\begin{aligned} r_t &= F_k(k_t, n_t) \\ w_t &= F_n(k_t, n_t) \end{aligned}$$

Tax Wedges

Intratemporal distortion

$$\frac{(1-\tau_{nt})}{(1+\tau_{ct})} = \frac{u_n(c_t, 1-n_t)}{u_c(c_t, 1-n_t) F_n(k_t, n_t)}$$

Intertemporal distortion

$$\frac{u_c(c_t, 1-n_t)}{\beta u_c(c_{t+1}, 1-n_{t+1})} =$$
$$\frac{(1+\tau_{ct})}{(1+\tau_{ct+1})} \left[(1-\delta) \frac{(1+\tau_{xt+1})}{(1+\tau_{xt})} + F_k(k_{t+1}, n_{t+1}) \frac{(1-\tau_{kt+1})}{(1+\tau_{xt})} \right]$$

Steady State

The steady state is given by the solution (c^{SS}, n^{SS}, k^{SS}) to

$$1 = \beta \left[(1-\delta) + \frac{(1-\tau_k)}{(1+\tau_x)} F_k(k^{SS}, n^{SS}) \right]$$
$$\frac{u_c(c^{SS}, 1-n^{SS})}{u_n(c^{SS}, 1-n^{SS})} = \frac{(1-\tau_n)}{(1+\tau_c)} F_n(k^{SS}, n^{SS})$$
$$g + c^{SS} + \delta k^{SS} = F(k^{SS}, n^{SS})$$

We assume now that $u(c, 1-n) = u(c)$, i.e. labour is inelastically supplied. The optimal tax structure seeks to minimize distortions.

- Labour taxes are lump-sum.
- Constant consumption taxes ($\tau_c \neq 0$) are not distorting either.
- It is optimal to set $\tau_x = \tau_k = 0$ in steady state k^{SS}.

Under some additonal assumptions, even if labour taxes are distortionary, zero capital taxes in steady state are still optimal.

Variations in Policy Matter

Denote the after-tax interest rate by $1 + R_{t+1}$, i.e.,

$$1 + R_{t+1} = (1-\delta)\frac{(1+\tau_{xt+1})}{(1+\tau_{xt})} + F_k(k_{t+1}, n_{t+1})\frac{(1-\tau_{kt+1})}{(1+\tau_{xt})}$$

where the after tax return on capital is given by

$$F_k(k_{t+1}, n_{t+1})\frac{(1-\tau_{kt+1})}{(1+\tau_{xt})}.$$

From the Euler equation of the consumer we have

$$\frac{u'(c_t)}{(1+\tau_{ct})} = \beta \frac{u'(c_{t+1})}{(1+\tau_{ct+1})}(1+R_{t+1})$$

or

$$\log\left(\frac{c_{t+1}}{c_t}\right) = \frac{1}{\gamma}\left[(\tau_{ct} - \tau_{ct+1}) + \left(R_{t+1} - \bar{R}\right)\right].$$

The after-tax interest rate R_{t+1} – and, hence, savings and consumption – is influenced by variations in tax rates.

Policy Experiments

We look at announced policy changes in period 0 that will take effect in period T.

There is a response to the announcement. The economy will react before the shock happens based on rational expectations about future policy changes.

There is a transient response after the shock to go back to the (possibly new) steady state.

We still can distinguish between permanent and temporary policy changes.

Lump-sum transfers are always available to satisfy the government's budget constraint.

- Take labour to be inelastically supplied.
- We explicitly vary taxes or expenditures.
- We implicitly need to adjust lump-sum transfers.

Experiment I – Surprise in g

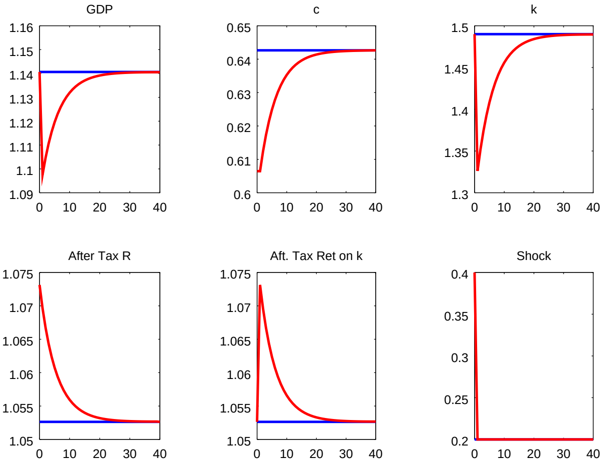

Figure: Temporary increase in $t = 0$ from $g = 0.2$ to $g = 0.4$

Experiment II – Announcement of increase in g

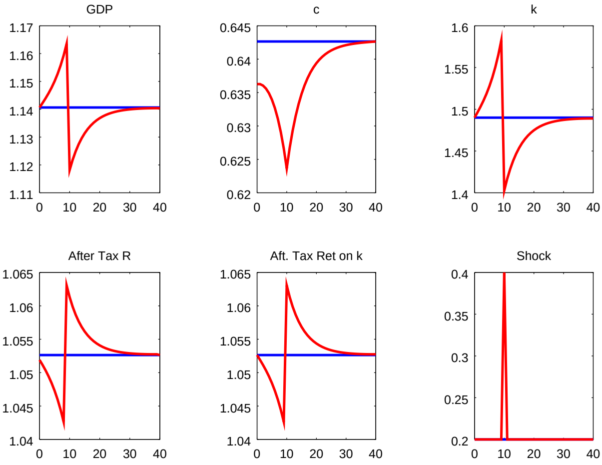

Figure: Temporary increase in $t = 10$ from $g = 0.2$ to $g = 0.4$

Experiment III – Announcement of increase in g

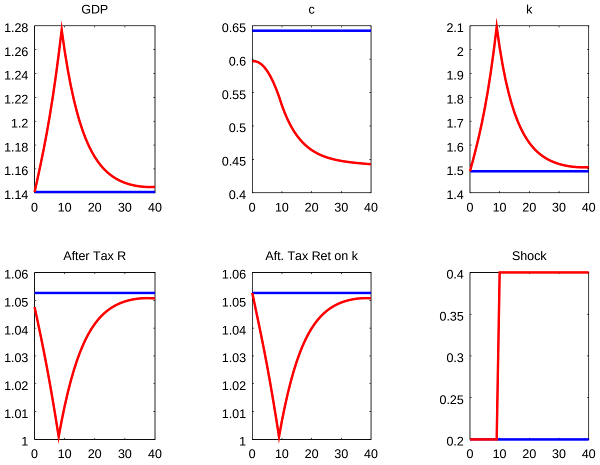

Figure: Permanent increase in $t = 10$ from $g = 0.2$ to $g = 0.4$

Experiment IV – Announcement of increase in τ_c

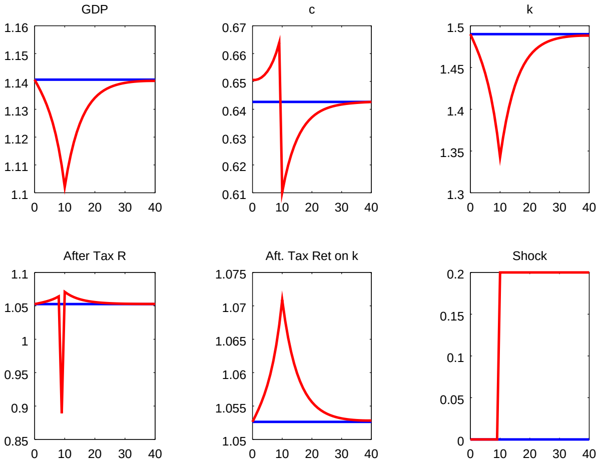

Figure: Permanent increase in $t = 10$ from $\tau_c = 0$ to $\tau_c = 0.2$

Experiment V – Announcement of increase in $-\tau_i$

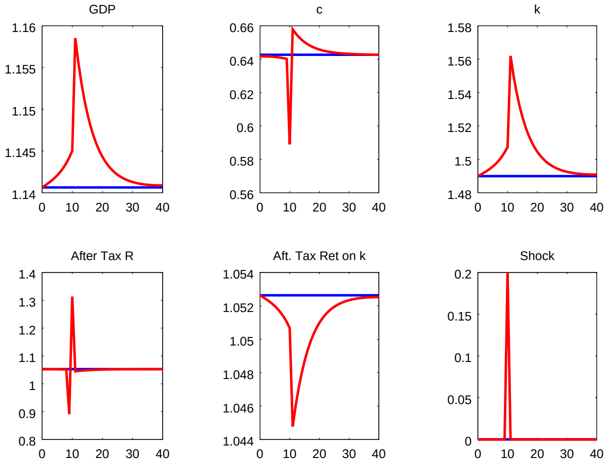

Figure: Temporary increase in $t = 10$ from $\tau_i = 0$ to $\tau_i = -0.2$

Experiment VI – Announcement of increase in $-\tau_i$

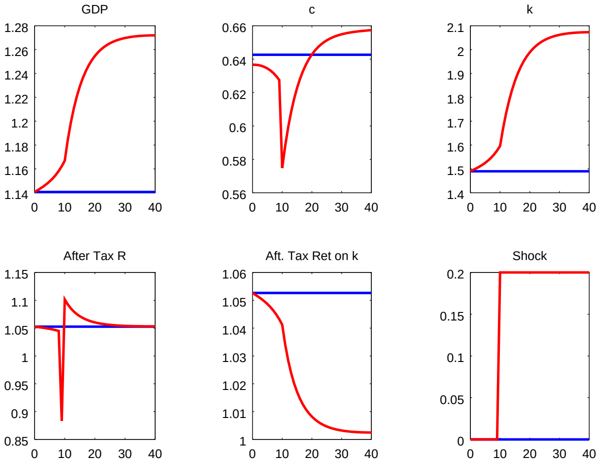

Figure: Permanent increase in $t = 10$ from $\tau_i = 0$ to $-\tau_i = 0.2$

Experiment VII – Announcement of increase in τ_k

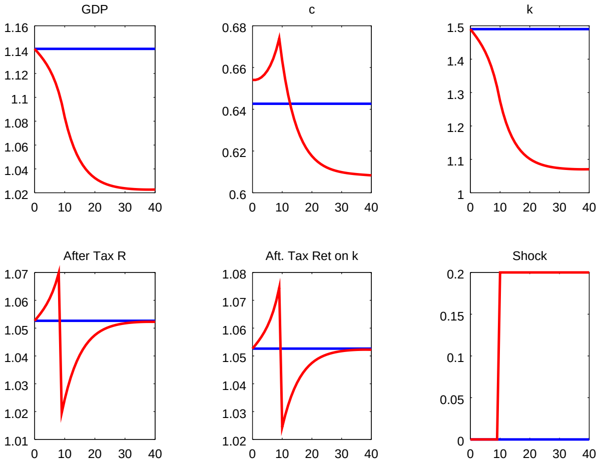

Figure: Permanent increase in $t = 10$ from $\tau_k = 0$ to $\tau_k = 0.2$