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% Comparative statics of fiscal policies

% Parameter values
tau_k=0.276: % Capital income tax rate
tau_w=0.224: % Labor income tax rate
tau_c=0.08: % Consumption tax rate
g_I=0.035: % Ratio of government investment to output
g_C=0.160: % Ratio of government consumption to output
g_W=0: % Ratio of wasteful government expenditure to output
beta=1.4: % Weight of leisure in utility
etha=0.12: % Weight of real balances in utility
phai=0.22: % Weight of government consumption in utility
share=0.6: % Labor share in output
effic=0.9: % TFP
rho=0.04: % Time preference
gamma=-1.5: % Elasticity of intertemporal substitution in consumption
epsilon=0.6: % Geometric weight of average externalities derived from private capital
kusai=1.10: % Bonds-money ratio
t_ss=0.0137: % Lump-sum-tax-wealth ratio

% Steady state values
fun = @rootGT1;
x0 = [0.7, 0.7];

param=[tau_k tau_w tau_c g_I g_C g_W beta etha phai share effic rho gamma epsilon];

x = fsolve(fun, x0, optimset, param);

zss=x(1) % Steady state public-private capital ratio, z*
100*(zss-0.5759)/0.5759

lss=x(2) % Steady state value of leisure, l*
100*(lss-0.7101)/0.7101

% Balanced growth equilibrium values

css=((1-tau_w)/(1+tau_c))*share*effic*(1-lss)^(share-1)*zss^(share*(1-epsilon))*lss/beta: % Consumption-capital ratio

yss=effic*(1-lss)^share*zss^(share*(1-epsilon)) % Output-capital ratio
(1-g_I-g_C-g_W)*yss:
(share*tau_w+(1-share)*tau_k-g_I-g_C)*yss: % (tax revenue-expenditure)/capital

rss=(1-share)*effic*(1-lss)^share*zss^(share*(1-epsilon)): % Before-tax return on private capital
(1-tau_k)*rss:
Pai=1-gamma-etha*gamma-phai*gamma:
Gss=((1-tau_k)*rss-rho)/Pai % Balanced growth rate
100*(Gss-0.0228)

mss=((tau_c+etha*(1+tau_c))*css+(tau_k*(1-share)+tau_w*share-g_I-g_C-g_W)*yss-t_ss)/((t_ss+(1-1/Pai)*(1-tau_k)*rss+rho/Pai)*(1+kusai)) % Real
balances-capital ratio
100*(mss-0.2908)/0.2908

mss/css:

theta=(etha*(1+tau_c)*css/mss-((1-1/Pai)*(1-tau_k)*rss+rho/Pai)): % Money growth rate

infl=etha*(1+tau_c)*css/mss-(1-tau_k)*rss % Inflation rate
100*(infl-0.0174)

Piketty=(Pai-1)*(1-tau_k)*rss/Pai-rho/Pai: % (1-tau_k)rss-Gss

% Local stability
theta_L=((1-share)*(1-gamma-phai*gamma)+phai*gamma)*lss/(1-lss)+(1-gamma-beta*gamma): %  $\Theta$  in the dynamics of leisure

y_z=share*(1-epsilon)*yss/zss: % dy/dz
y_l=-share*yss/(1-lss): % dy/dl

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c_z=share*(1-epsiron)*css/zss: % dc/dz
c_l=((1-share)*lss/(1-lss)+1)*css/lss: % dc/dl

r_z=share*(1-epsiron)*rss/zss: % dr/dz
r_l=-share*rss/(1-lss): % dr/dl

G_k=(1-g_l-g_C-g_W)*yss-css: % Growth rate of K (private capital)
G_kp=g_l*effic*(1-lss)^share*zss^(share*(1-epsiron)-1): % Growth rate of K_g (Public capital)

G_kl=-share*(1-g_l-g_C-g_W)*yss/(1-lss)-((1-share)*lss/(1-lss)+1)*css/lss: % d(G_k)/dl
G_kz=share*(1-epsiron)*G_k/zss: % d(G_k)/dz

G_kpz=-(1-share*(1-epsiron))*G_kp/zss: % d(G_kp)/dz
G_kpl=-share*G_kp/(1-lss): % d(G_kp)/dl

a_31=mss*((g_l+g_C-(1-share)*tau_k-share*tau_w)*y_l+(1-tau_k)*r_l*(1+kusai)*mss-(tau_c+etha*(1+tau_c))*c_l)/((1+kusai)*mss)-G_kl*mss:
a_32=mss*((g_l+g_C-(1-share)*tau_k-share*tau_w)*y_z+(1-tau_k)*r_z*(1+kusai)*mss-(tau_c+etha*(1+tau_c))*c_z)/((1+kusai)*mss)-G_kz*mss:
a_33=-((g_l+g_C-(1-share)*tau_k-share*tau_w)*yss-(tau_c+etha*(1+tau_c))*css+t_ss)/((1+kusai)*mss):

a_21=(G_kpl-G_kl)*zss:
a_22=(G_kpz-G_kz)*zss:
a_23=0:

a_11=(etha*gamma*a_31/mss-Pai*G_kl-share*(1-epsiron)*(1-gamma-phai*gamma)*a_21/zss+(1-tau_k)*r_l)*(lss/theta_L):
a_12=(etha*gamma*a_32/mss-Pai*G_kz-share*(1-epsiron)*(1-gamma-phai*gamma)*a_22/zss+(1-tau_k)*r_z)*(lss/theta_L):
a_13=(etha*gamma*a_33/mss)*(lss/theta_L):

A=[a_11 a_12 a_13; a_21 a_22 a_23; a_31 a_32 a_33];
e=eig(A);

% Saddle path
Meig=sort(e);
lambda=diag(Meig);
lambda(1,1):

A_1=(lambda(1,1)-a_22)/a_21;
A_2=a_32+a_31*A_1;
A_3=lambda(1,1)-a_33:

z0=0.5759;
l0=lss+A_1*(z0-zss) % Initial value of leisure, l(0)
100*(l0-0.7101)/0.7101

m0=mss+(A_2/A_3)*(z0-zss) % Initial value of real balances-capital ratio, m(0)
100*(m0-0.2908)/0.2908

y0=effic*z0^(share*(1-epsiron))*(1-l0)^share: % Initial value of GDP-capital ratio

c0=((1-tau_w)/(1+tau_c))*share*effic*(1-l0)^(share-1)*z0^(share*(1-epsiron))*l0/beta: % Consumption-capital ratio

r0=(1-share)*effic*(1-l0)^share*z0^(share*(1-epsiron)): % Before-tax return on private capital

infl_0=etha*(1+tau_c)*c0/m0-(1-tau_k)*r0 % Inflation rate
100*(infl_0-0.0174)

G_y0=-share*lambda(1,1)*(l0-lss)/(1-l0)+share*(1-epsiron)*g_l*effic*(1-l0)^share*z0^(share*(1-epsiron)-1)+(1-share*(1-epsiron))*((1-g_l-g_C-g_W)*y0-c0) % Growth rate of Y at an initial period
100*(G_y0-0.0228)

% Inequality in a bairnaced growth path
nyu=beta/(1+beta+etha):
wss_tild=share*effic*(1-lss)^(share-1)*zss^(share*(1-epsiron)): % w*/K*, Real wage-private capital ratio in a balanced growth
w0_tild=share*effic*(1-l0)^(share-1)*z0^(share*(1-epsiron)):

alpha_0=1+(1-tau_w)*(wss_tild/(1+(1+kusai)*mss))*(1-l0/lss)/(-lambda(1,1)-(1-tau_w)*(wss_tild/(1+(1+kusai)*mss))*(1-lss/nyu)): % Adjustment speed
of wealth in the period 0:
omega_0=1+(m0/(1+kusai*m0))*(alpha_0-1+nyu/lss)/alpha_0: % Ratio of (i's private capital+real bonds) to i's total wealth in the period 0
omega_ss=1+(mss/(1+kusai*mss))*(nyu/lss): % Ratio of i's (private capital+real bonds) to i's total wealth in a baalnced growth
kapper=0.406: % (bonds+money)/wealth

sigma_aa=1+((2*kapper-1)*(1-kapper)*kapper/((1-kapper)^2+kapper^2))*((1+kusai)*m0/0.6835-1) %Initial value of sigma_a(0)
100*(sigma_aa-1-1)
b_=(1+kusai)*m0:

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sigma_va=omega_0*sigma_aa      % Initial value of  $\sigma_v(0)$ 
100*(sigma_va/1.1634-1)

sigma_ass=sigma_aa/alpha_0      % Balanced growth value of  $\sigma_a$ , i.e.,  $\sigma_{ass}$ 
100*(sigma_ass/1-1)

sigma_vss=omega_ss*sigma_ass     % Balanced growth value of  $\sigma_v$ , i.e.,  $\sigma_{vss}$ 
100*(sigma_vss/1.1634-1)

sigma_u=(1-nyu/lss)*sigma_ass    % welfare variance
100*(sigma_u/0.2176-1)

fey_ss=(rss*(1+kusai*mss)/(rss*(1+kusai*mss)+wss_tild*(1-lss))*omega_ss-(wss_tild*lss/(rss*(1+kusai*mss)+wss_tild*(1-lss)))*(1-nyu/lss): % Ratio
of i's before-tax income to i's (private capital+real baonds) in a balanced growth path
sigma_yss=fey_ss*sigma_ass      % Balanced growth value of  $\sigma_y$ 
100*(sigma_yss/0.2837-1)

fey_0=(r0*(1+kusai*m0)/(r0*(1+kusai*m0)+w0_tild*(1-l0))*omega_0-(w0_tild*l0/(r0*(1+kusai*m0)+w0_tild*(1-l0)))*(1-nyu/lss)/alpha_0:
sigma_y0=fey_0*sigma_aa
100*(sigma_y0/0.2837-1)

pusai_ss=((1-tau_k)*rss*(1+kusai*mss)/((1-tau_k)*rss*(1+kusai*mss)+(1-tau_w)*wss_tild*(1-lss))*omega_ss-((1-tau_w)*wss_tild*lss/((1-
tau_k)*rss*(1+kusai*mss)+(1-tau_w)*wss_tild*(1-lss)))*(1-nyu/lss): % Ratio of i's after-tax income to i's private capital in a balanced growth
sigma_yss_a=pusai_ss*sigma_ass % Balanced growth value of  $\sigma_{ya}$ 
100*(sigma_yss_a/0.2544-1)

pusai_0=((1-tau_k)*r0*(1+kusai*m0)/((1-tau_k)*r0*(1+kusai*m0)+(1-tau_w)*w0_tild*(1-l0))*omega_0-((1-tau_w)*w0_tild*l0/((1-
tau_k)*r0*(1+kusai*m0)+(1-tau_w)*w0_tild*(1-l0)))*(1-nyu/lss)/alpha_0: % Ratio of i's after-tax income to i's private capital in a balanced growth
sigma_y0_a=pusai_0*sigma_aa
100*(sigma_y0_a/0.2544-1)

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