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%G as an input in final good production
clear
disp('New')
s =1.5;%s: sigma in the paper
beta=0.985;
a=0.6708;%benchmark value
INTMratio=a^2/beta %share of intermediates
sl=(1-a)/(1-a^2/beta)% labor income share
ell=(1-a)/(beta-a) %elasticity to labor in aggregate PF. moves with sl
mu=beta/a % mark up
tk0=0.25;% initial capital tax rate
GOVEXPtoGDP = 0.1;% share of government expenditures over GDP
g = (1-INTMratio)*GOVEXPtoGDP;
TranferstoGDP=0.25;%share of transfers over GDP
T=(1-INTMratio)*TranferstoGDP;
tw0 = (1-a)^(-1)*(g+T -tk0*(a-a^2/beta))
chi=2.0463;%benchmark value
eta=0.0790;%benchmark value
rho=0.04;%benchmark value
C3=(beta-a)*a^((a+beta)/(beta-a))*beta^(beta/(a-beta))*g^((1-beta)/(beta-a))/eta
%C3 in the paper(eq.E11)
L=[];
for t=0.01:0.00001:0.9;
    tw = (1-a)^(-1)*(g+T -t*(a-a^2/beta));%from eq.E(12)
    Lss=@(x)rho*x.^((1-a)/(a-beta))/C3+s*(1-a^2/beta-g-(1-a)*(s-1)*(1-tw)).*(x.^(-1)-1)/\
(chi-1)/(a-a^2/beta)+t-1;
    x=fzero(Lss,0.17);%solves B2(L)=0 (eq.E13)
    L=[L,x];
end

Ltk0=L(1)%initial labor
gammatk0=(C3*L(1)^((1-a)/(beta-a))*(1-tk0)-rho)/s%initial growth
Frisch0=(1-L(1))/L(1)/(1+(chi-1)/s)% initial Frisch
%what follows to next comment calculates optimal taxes
t=0.01:0.00001:0.9;
tw = (1-a)^(-1)*(g+T -t*(a-a^2/beta));
r=C3*L.^((1-a)/(beta-a));
V1=L.^(-1)*(1-beta)/(beta-a)-(2-s-chi)./((1-s).*(1-L)).\
+((1-a)/(beta-a))*(1-t).*C3.*L.^((1-beta)/(beta-a))./(r.*(1-t)*(s-1)+rho);
%V1=de(log(1-s)V/(1-s))deL
V2=-(a-a^2/beta)/(1-a);%V2=dtw/dt
V4=-1./(1-tw);%V4=delog(1-s)V/(1-s)detw
V5=-r./(r.*(1-t)*(s-1)+rho);%V5=delog(1-s)V/(1-s)det
%what follows to next comment also checks indeterminacy
V3N=((beta-a)/(1-a))*(s*(s-1)*(1-L)/(chi-1)-L);
V31D=s/(a-a^2/beta);
V32D=1-a^2/beta-g+((s-1).*(1-tw)/(chi-1)).*(1-a-(1-beta)./L);
V3D=V31D*V32D+t-1;
V3=V3N./V3D;
if V3 > 0 %B2'(L)> 0:as expressed in denominator of dL/dt,first eq. page 49
    %from last comment to here checks indeterminacy
D=V1.*V3+V4.*V2+V5;%dlog(1-s)V/(1-s)dt
plot (t,D)%checks its behavior
[v,i]=min (abs(D));

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topt=t(i)%optimal capital tax
twopt = (1-a)^(-1)*(g+T -topt*(a-a^2/beta))%optimal labor tax
%from last comment to here calculates optimal taxes
Lopt=L(i)%optimal labor
gammaopt=(C3*Lopt^((1-a)/(beta-a))*(1-topt)-rho)/s%optimal growth
tw00=(g+T)/(1-a);% labor tax with no tax on capital
L00=L(1)%labor with no tax on capital
W00=((L00^((1-beta)/(beta-a))*(1-tw00))^(1-s)*(1-L00)^(2-chi-s))...
    /(C3*L00^((1-a)/(beta-a))*(s-1)+rho)/(1-s);
%increasing transformation of welfare with zero tax on capital
Wopt=((Lopt^((1-beta)/(beta-a))*(1-twopt))^(1-s)*(1-Lopt)^(2-chi-s))...
    /(C3*Lopt^((1-a)/(beta-a))*(1-topt)*(s-1)+rho)/(1-s);
%increasing transformation of welfare with opt taxes.
diff=(Wopt-W00)/abs(W00)
%gain in welfare from optimal capital tax starting from zero capital tax
else disp ('Error: Indeterminacy')
end

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