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% G IN UTILITY FUNCTION
clear
disp('New')
rho=0.04;%benchmark

s =1.5; % benchmark
INTMratio=0.45; % benchmark
a=INTMratio^0.5;
theta=0.2; % weight of public consumption in utility see eq.(54)
tk0=0.25; % benchmark initial capital tax rate
GOVEXPtoGDP = 0.1;% benchmark
g=(1-INTMratio)*GOVEXPtoGDP;
TranferstoGDP=0.25;% benchmark
T=(1-INTMratio)*TranferstoGDP;
tw0=(g+T)/(1-a)-a*tk0;
C1=0.5490;%benchmark;
chi=2.0463; %benchmark;
%from here to next comment uses eq. E21 to calculate
%Lb in table 6: labor corresponding to tk0=0.25
Ln0= s*(1-theta).*(1-tw0)*(s-1)/(a*(chi-1))-rho/C1;
Ld0=(s/a)*(1+a-g/(1-a)+ (1-tw0)*(s-1)*(1-theta)/(chi-1))+tk0-1;
L0=Ln0./Ld0 %Lb in table 6: labor corresponding to tk0=0.25
Frisch0=(1-L0)/L0/(1+(chi-1)/(1-(1-theta)*(1-s)))%calculates initial Frisch
t=0.0000001:0.00001:0.9;
tw = (g+T)/(1-a)-a*t;
%from here to next comment uses eq. E21 to calculate
%labor corresponding to each tax;
Ln= s*(1-theta).*(1-tw)*(s-1)/(a*(chi-1))-rho/C1;
Ld=(s/a)*(1+a-g/(1-a)+ (1-tw)*(s-1)*(1-theta)/(chi-1))+t-1;
L=Ln./Ld;
r=C1*L;
%from here to next comment calculates optimal taxes given eq.E(22)
V1=(s+chi-2+theta*(1-s))/(1-s)./(1-L)+theta./L+C1.*(1-t)./(r.*(1-t)*(s-1)+rho);
% V1=delog(1-s)V/(1-s)deL
V2=-a; %V2=dtw/dt
DB3=C1*((1+a-g/(1-a)+(1-theta)*(s-1)/(chi-1)*(1-tw))*s/a+t-1);%DB3=dB3/dL
V3=r.*(s*(1-theta)*(s-1).*(1-L)/(chi-1)./L-1)./DB3;%V3= dL/dt
V4=- (1-theta)./(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
D=V1.*V3+V4.*V2+V5;%dlog(1-s)V/(1-s)dt;
plot (t,D)%checks its behavior
[v,i]=min (abs(D));
topt=t(i)%optimal capital tax
twopt = (g+T)/(1-a)-a*topt
Lopt=L(i)%optimal labor
gammaopt=(C1*Lopt*(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^theta*(1-tw00)^(1-theta))^(1-s)*(1-L00)^(2-chi-s-theta*(1-s)))...
/(C1*L00*(s-1)+rho)/(1-s);
%increasing transformation of welfare with zero tax on capital:
Wopt=((Lopt^theta*(1-twopt)^(1-theta))^(1-s)*(1-Lopt)^(...
(2-chi-s-theta*(1-s)))/(C1*Lopt*(1-topt)*(s-1)+rho)/(1-s);
%increasing transformation of welfare with opt taxes: from eq. 64
diff=(Wopt-W00)/abs(W00)

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%gain in welfare from optimal capital tax starting from zero capital tax