

EconS 502: Macroeconomic Theory II, Spring 2010

Professor: S. Choi

Due: In Class, Tuesday, 26th January

PROBLEM SET 2

Form a group of 1-4 students. A group can submit one solution.

1. Consider the U.S. economy. Suppose that the government wants to tax more heavily on the rich. Since the rich tend to have more financial assets, the government has decided to raise the tax rate on physical capital income. But every policy has a side effect, and the government is concerned about what will happen to long-run growth of the U.S. economy.

To address this issue seriously, we have to introduce all types of taxes (such as labor income tax, property tax, ...) and subsidies (to education, health care, ...). Here, assume that the tax on physical capital income is the only type of taxation. The government throws away all tax revenue to the ocean. (Or we may assume that all tax revenue is lump-sum-transferred to the representative consumer. But this alternative assumption does not change any results.) That is, we consider the following model. The representative consumer solves

$$\max_{\{C_t, I_t\}_{t=0}^{\infty}} \sum_{t=0}^{\infty} \beta^t \log(C_t/L_t) \times L_t, \quad 0 < \beta < 1$$

s.t.

$$K_{t+1} = I_t + (1 - \delta)K_t, \quad 0 < \delta < 1, \quad K_0 \text{ given,}$$

$$Y_t = C_t + I_t + \tau\alpha Y_t, \quad 0 < \tau < 1,$$

$$Y_t = K_t^\alpha (A_t L_t)^{1-\alpha}, \quad 0 < \alpha < 1,$$

$$L_{t+1} = L_t(1 + g_L), \quad L_0 \text{ given,}$$

$$A_{t+1} = A_t(1 + g_A), \quad A_0 \text{ given.}$$

Notice that $\tau\alpha Y_t$ is the amount of tax paid to the government. τ is a flat tax rate on physical capital income, αY_t . The representative consumer takes τ as exogenous (because it is the government that controls it). All notations are the same as in class. Notice that I further simplified the set-up by assuming the log utility (i.e., $\sigma = 1$).

(a) Calibrate δ , α , g_A and β in the model, assuming a balanced growth path (in which all variables grow at constant rates). Use the following observations:

- $\tau = 36\%$: McGrattan and Prescott (Federal Reserve Bank of Minneapolis Quarterly Review, 2000), Table 2.
- $s \equiv I_t/Y_t = 0.20$: 1960-2005, NIPA Table 1.1.5.
- $g_L = 1.1\%$: 1960-2005, NIPA Table 7.1.
- $g_Y = 3.3\%$: 1960-2005, NIPA Table 7.1.
- $\delta K/Y = 0.12$: 1960-2005, NIPA Table 1.1.
- (before-tax income share of K) = 0.32: 1960-2005, NIPA Table 1.12.

(b) In January 2010, the government raised the tax rate τ from 36% to 50%. After several years, the economy has reached a new balanced growth path (in which all variables grow at constant rates). Discuss what happens to the level of per-worker GDP and the growth rate of per-worker GDP. Provide numbers: What would be the level of Y_t/L_t on the new balanced growth path under $\tau = 50\%$ (Scenario 2), compared to the level on the old balanced growth path if $\tau = 36\%$ were maintained (Scenario 1)? Draw the time-series paths of Y_t/L_t under these two scenarios.

Hint: All parameter values, including g_A and g_L , are exogenously given. They do not change no matter what happens to τ . But the consumer's decision may be affected, causing the levels of, e.g., s , K/Y and g_Y , to change. To think about what will happen to the level of Y_t/L_t , try to use $Y_t/L_t = (K/Y)^{\alpha/(1-\alpha)} A_t$.

(c) If the physical income tax is completely eliminated (i.e., if τ becomes 0), then what will happen to the level of Y_t/L_t on the new balanced growth path (Scenario 3), compared to the old one if $\tau = 36\%$ were maintained (Scenario 1)? To the growth rate of Y_t/L_t ?