

EconS 502: Macroeconomic Theory II
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 Due: In Class, Monday, 2nd February

PROBLEM SET 2

1. Consider the U.S. economy. Suppose that there is a new government which wants to tax more heavily on the rich. Since the rich tend to have more assets, the government has decided to raise the tax rate on physical capital income. But every policy has a side effect, and the new President is concerned about what will happen to long-run growth of the U.S. economy as a result of this policy. So he/she is asking for your opinion. Write a report for the U.S. president, incorporating all of the following questions.

To address this question seriously, we have to introduce all types of taxes (such as labor income tax, property tax, ...) and government transfers. That would be almost worth a research paper. Here, to make our task simple, assume that taxes on physical capital income are 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 will not change any results below.)

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 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.

Hint: In this problem, the only difference that τ makes is the first-order condition. All other constraints are essentially the same as before. So all calibration results will still hold, and the only difference would be β .

- (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, as a result of this new fiscal policy. 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)? If you want, generate figures to help the President to understand your argument better.

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 ?