# Sample Problems - Solow Model

## Problem 1

Consider a Solow economy that is on its balanced growth path. Assume for simplicity that there is no technological progress. Now suppose that the rate of population growth falls.

(a). What happens to the balanced-growth-path values of capital per worker, output per worker, and consumption per worker? Sketch the paths of these variables as the economy moves to its new balanced growth path.

(b). Describe the effect of the fall in population growth on the path of output (that is, total output, not output per worker).

## Problem 2

Let's examine the role of taxes in the Solow-Swan model. Imagine that the behavior of an economy may be summarized by the following three equations:

$$\begin{aligned} K_{t+1} &= I_t + (1-\delta) K_t \\ I_t &= s(1-\tau) Y_t \\ Y_t &= K_t^{\alpha} (A_t L_t)^{1-\alpha} \end{aligned}$$

Assume that population grows at rate $n$ and technology at rate $g$, so that $L_{t+1}/L_t = N_{t+1}/N_t = 1+n$ and $A_{t+1}/A_t = 1+g$, respectively. Income in this economy is taxed with rate $\tau$ and the tax revenues are used for government consumption which is useless from the point of view of households.

(a). Transform the three equations into per effective labor form, i.e. divide them by $A_t L_t$. Make use of notational convention $\hat{x}_t \equiv X_t/(A_t L_t)$.

(b). Find the balanced growth path level of capital per effective labor $\hat{k}^*$ in this economy.

(c). Discuss the effects of changes in parameters $\delta$, $n$, $g$, $s$, $\tau$ on the economy's balanced growth path level of capital per effective labor $\hat{k}^*$.

(d). Discuss the effects of changes in parameters $\delta$, $n$, $g$, $s$, $\tau$ on the economy's balanced growth path level of consumption per effective labor $\hat{c}^*$.

(e). Households care about the level of consumption per capita, i.e. $c_t$. This variable grows at rate $g$ once the economy reaches its balanced growth path. Discuss whether low $g$ or high $g$ is better from the point of view of households.

## Problem 3

Consider an economy with technological progress but without population growth that is on its balanced growth path. Now suppose there is a one-time jump in the number of workers without change in the population growth rate (e.g., due to an immigration inflow)

(a). At the time of the jump, does output per unit of effective labor rise, fall, or stay the same? Why?

(b). After the initial change (if any) in output per unit of effective labor when the new workers appear, is there any further change in output per unit of effective labor? If so, does it rise or fall? Why?

(c). Once the economy has again reached a balanced growth path, is output per unit of effective labor higher, lower, or the same as it was before the new workers appeared? Why?