

## Problem Set 2:<sup>1</sup> Introduction

### Exercise 1: Immigration in the Solow model

Consider a closed economy with a neoclassical production function, exogenous technological progress,  $A_t$ , a fixed saving rate,  $s$ , and a constant labor force,  $L$ , as described by the following equations (the Solow model)

$$K_{t+1} - K_t = sY_t - \delta K_t \quad (1)$$

$$Y_t = K_t^\alpha (A_t L)^{1-\alpha}, \quad 0 < \alpha < 1, \quad (2)$$

$$A_{t+1} = (1 + g)A_t, \quad A_0 > 0,$$

where  $0 \leq \delta \leq 1$  is the depreciation rate of physical capital (in the lecture we have abstracted from depreciation for simplicity).

- Remove the trend from Equations (1) and (2) by writing all endogenous variables  $X_t$  in terms of efficiency units  $x_t \equiv X_t / (A_t L)$ .
- Compute the wage rate,  $w_t$ , and the rental rate of capital,  $r_t$ , (the interest rate of this economy will be  $r_t - \delta$ ) in this economy.
- Compute the stable steady-state capital stock per efficiency unit,  $k^* > 0$ , of this economy.
- Show that the capital stock per efficiency unit,  $k_t$ , is increasing over time as long as  $0 < k_t < k^*$  (hint: look at the ratio  $k_{t+1}/k_t$  in the capital accumulation equation to answer this question).
- Suppose the economy is in a steady-state. What happens to the aggregate output, the wage rate, and the rental rate on impact if the number of workers in the economy increases by  $\partial L$  due to immigration?
- What happens to aggregate output, the wage rate, and the rental rate over time after the immigration wave?
- Would the wage rate be higher in the long-run if there had been no immigration?

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