

# ECON 110, Prof. Hogendorn

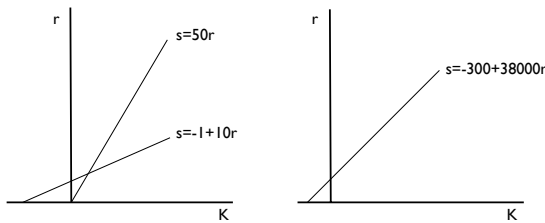
## Problem Set 8 Answers

### 1. *SmallCountry\_a.*

(a) Aggregate saving is

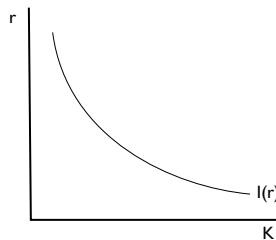
$$700 \cdot 50r + 300(-1 + 10r) = -300 + 38,000 \cdot r$$

When the interest rate is 3%, the savings of the two types and the aggregate are: 1.5, -0.7, 840. When the interest rate is 11%, these change to: 5.5, 0.1, 3880.



At the low interest rate, 30% of households borrow and 70% save. There is more than enough saving to fund the borrowing, so aggregate saving is positive. When the interest rate rises, the savers save more, and the borrowers find it more expensive to borrow and actually switch over to saving. The aggregate saving obviously rises.

(b)  $I(r) = 100i(r) = 1,000/r$ .



(c) Setting aggregate saving equal to aggregate investment gives:

$$-300 + 38,000 \cdot r = 1,000/r \Rightarrow 38,000 \cdot r^2 - 300r - 1,000 = 0$$

The root of this is  $r = 16.6\%$ .

(d) Every country has a menu of investment projects that could be undertaken. The projects with payoffs above the prevailing interest rates will be implemented; the rest will not. So all other things equal, a country with a higher interest rate will have less investment, less capital deepening, and therefore lower growth.

## 2. OldGermans\_a.

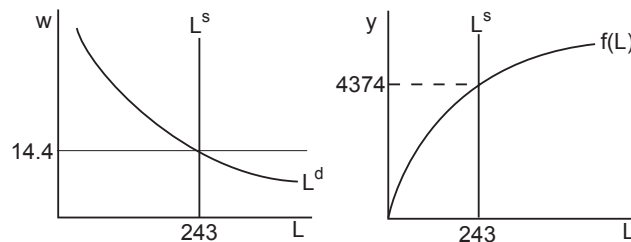
(a) We can find labor demand using  $pMP_L = w$ , so,

$$\frac{4}{5} \cdot \frac{54}{4} L^{-1/5} = w \Rightarrow L^d = \left( \frac{54 \cdot 4}{5w} \right)^5$$

Setting  $L^d = L^s = 243$  gives an equilibrium real wage of  $w = 14.4$ .

(b) The total costs of the firm are  $wL = 14.4 \cdot 243 = 3499.2$ . The total revenues are  $py = 1 \cdot f(243) = 4374$ . Thus the profits, paid as dividends, are 874.8. The firm's output is 4374.

Workers earn total wages of  $wL = 3499.2$  and total dividends of 874.8. Their total consumption of beer is thus 4374, so there is equilibrium. 80% of the workers' income is from wages, and 20% from dividends.



- (c)  $L^d$  is the same as before, but now setting  $L^d = L^s = 198$ , gives an equilibrium real wage of  $w = 15$ . Firm output is  $f(198) = 3713$ , of which the total costs are  $wL = 2970$  and the dividends are 743.

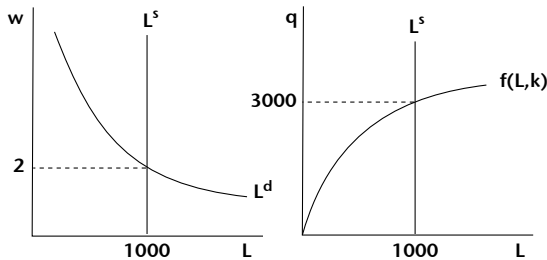
Workers' wages plus dividends sum to 3713, all of which they consume, so there is equilibrium in the goods market.

### 3. GrowingChina\_a.

- (a) We can find labor demand using  $pMP_L = w$ , so,

$$\begin{aligned} \frac{2}{3} \cdot Ah^{2/3}L^{-1/3}K^{1/3} &= w \\ \frac{2}{3} \cdot 3.33L^{-1/3}729^{1/3} &= w \\ 20L^{-1/3} &= w \Rightarrow L^d(w) = \left(\frac{20}{w}\right)^3 \end{aligned}$$

Setting  $L^d = L^s = 1000$  gives an equilibrium real wage of  $w = 2$ .



- (b) The total costs of the firm are  $wL = 2 \cdot 1000 = 2000$ . The total revenues are  $py = 1 \cdot f(1000, 729) = 3000$ . Thus the profits, paid as dividends, are 1000. The firm's output is 3000. Workers earn total wages of  $wL = 2000$  and total dividends of 1000. Their total consumption of rice is thus 3000, so there is equilibrium. Output per worker is 3.
- (c)  $L^d$  is the same as before, but now setting  $L^d = L^s = 1728$ , gives an equilibrium real wage of  $w = 1.67$ . Firm output is  $f(1728) = 4326$ , and output per worker is 2.5.

The output per worker falls because the marginal product of labor falls. Even though the additional workers produce (and consume) more, their addition on the margin is less than before. The economy is running into decreasing returns to labor and thus into a possible Malthusian trap.

- (d) An increase in  $A$  is an increase in total factor productivity, sometimes simply called technology. It would increase the marginal products of both labor and capital, thus raising the wage and output per worker.

An increase in  $K$  is called capital deepening. This raises the marginal product of labor (though it lowers the marginal product of capital) and thus raises wages. Each worker has more capital to work with.

An increase in  $h$  is called human capital formation. Although it does not change the degree of diminishing returns to *skill-adjusted* hours of labor, it does increase the marginal product of each generic hour of labor.