

SIMON FRASER UNIVERSITY
Department of Economics

Econ 305
Intermediate Macroeconomic Theory

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PROBLEM SET 2
(Due March 3)

1. (25 points). Suppose Canada's production function is $Y = A \cdot K^{1/3}L^{2/3}$, and that Canada is currently in a steady state with a savings rate of 20% (i.e., $s = .20$), a population growth rate of 1.7% (i.e., $n = .017$), and a depreciation rate of 5% (i.e., $\delta = .05$). For simplicity, suppose productivity, A , is constant.
 - (a) If per capita income in Canada is \$30,000, what must be the value of A ? (Hint: Derive a formula relating steady state per capita output to A, s, n and δ and then solve for A).
 - (b) Demographers predict that Canada's population growth rate could drop to zero soon. Use the Solow model to forecast the consequences of this demographic shift on total output, per capita output, the growth rate of total and per capita output, and the wage rate. Consider the effects in both the new steady state and in the transition to the new steady state. Illustrate your answer with a graph.
2. (25 points). Consider a Cobb-Douglas production function with three inputs: K is capital (i.e., number of machines), L is labor (e.g., number of workers), and H is 'human capital' (e.g., number of college degrees among the workers). Normalizing the scale factor A to one gives us:

$$Y = K^{1/3}L^{1/3}H^{1/3}$$

- (a) Derive an expression for the marginal product of labor. How does an increase in the amount of human capital affect the marginal product of labor?
- (b) Derive an expression for the marginal product of human capital. How does an increase in the amount of human capital affect the marginal product of human capital?
- (c) What is the income share paid to labor? What is the income share paid to human capital? In the National Income Accounts of this economy, what share of total income do you think workers would appear to receive? (Hint: Consider where the return to human capital shows up).
- (d) An unskilled worker earns the marginal product of labor, whereas a skilled worker earns the marginal product of labor plus the marginal product of human capital. Using the answers to (a) and (b), find the ratio of the skilled wage to the unskilled wage. How does an increase in the amount of human capital affect this ratio? Explain.
- (e) Some people advocate government funding of college scholarships as a way of creating a more egalitarian society. Others argue that scholarships help only those who are able to go to college. Do your answers to the above questions shed light on this debate?