

## Problem 1 (40%)

President Trump has imposed a 20% tariff on the majority of goods imported from China.

a) Assume that workers cannot switch industries (i.e. a short-run analysis). Discuss the effect of these tariffs on U.S. (i) industry structure (employment and output), (ii) prices and (iii) living standards for skilled and unskilled workers. To guide the discussion, you can assume that:

- there are two goods produced, toys and computers.
- there are two factors of production, unskilled and skilled labor.
- there are two countries, U.S. and China.
- the number of skilled relative to unskilled workers is higher in U.S. than China.
- computer production is relatively skilled labor intensive.

b) Now, assume that workers can freely switch industries (i.e., a long-run analysis). Is the impact on living standards for skilled and unskilled workers different in the long run compared to the short run? Explain why or why not. You should explain the economic mechanisms and intuition with words and diagrams. You may also refer to, and explain, theorems that we have reviewed in class. You can also use math, but it is not a requirement.

## Problem 2 (30%)

Consider the following data on output, physical capital and human capital per worker.

	Output per worker $Y_t/L_t$	Physical capital per worker $K_t/L_t$	Human capital $h$
2000	1.00	1.00	1
2010	1.10	1.10	1.10
2020	1.21	1.32	1.32

Assume that the production function in year  $t$  is

$$Y_t = A_t K_t^\alpha (h_t L_t)^{1-\alpha},$$

where  $Y_t$  is output,  $A_t$  is productivity,  $K_t$  is physical capital,  $h_t$  is human capital and  $L_t$  is employment.  $\alpha$  is assumed to be  $1/2$ .

a) Derive the intensive form of the production function (i.e., output relative to employment,  $Y_t/L_t$ ).

b) Calculate growth rates in  $y_t = Y_t/L_t$ ,  $k_t = K_t/L_t$  and  $h_t$  from (i) 2000 to 2010 and (ii) 2010 to 2020.

c) Using the method of growth accounting, calculate growth in productivity from (i) 2000 to 2010 and (ii) 2010 to 2020.

d) Policymakers claim that growth in output per worker over the 2000-2020 period was mainly coming from factor accumulation. Evaluate this claim.

e) New information reveals that schooling quality deteriorated between 2010 and 2020. The statistical office therefore adjusts their estimate of  $h$  in 2020 down to 0.99. Explain how this would affect your answer in c) and d).

### Problem 3 (30%)

Consider a closed economy model where productivity growth is determined by the number of R&D workers in the economy:  $\dot{A} = L_A/\mu$ , where  $L_A$  is the number of R&D workers and  $\mu$  is a constant. The production function is  $Y = AL_Y$ , where  $L_Y$  is the number of manufacturing workers. There is full employment and total employment is  $L = L_Y + L_A$ .

The prime minister of Norway stated in her 2019 new year speech that Norway needs more kids in order to sustain the Norwegian welfare state. In the context of the model, evaluate whether an increase in  $L$  helps raise living standards (i.e., the level and growth rate of GDP per capita). Will the policy have a different impact on GDP per capita in the short run compared to the long run?