

SIMON FRASER UNIVERSITY
Department of Economics

Econ 305
Intermediate Macroeconomic Theory

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MIDTERM EXAM
(Solutions)

Answer the following questions True, False, or Uncertain. Briefly explain your answers. No credit without explanation. (10 points each).

1. In the Solow model, a higher savings rate increases the economy's growth rate.

UNCERTAIN. *A higher savings rate will produce a temporary increase in the economy's growth rate, but not a permanently higher growth rate.*

2. The growth rate of nominal GDP always exceeds the growth rate of real GDP.

FALSE. *If prices are falling on average (ie, deflation), then the growth of real GDP will exceed the growth of nominal GDP. (Think this could never happen? Ask someone from Japan!)*

3. An increase in government spending increases output.

TRUE/UNCERTAIN. *This is actually quite a complicated question in general. In principle, the answer could depend on a lot things (eg, what the government spends the money on, how it's financed, whether its expected to temporary or permanent, etc). We will examine some of these complications later. For now, all I was looking for was what the static model in chapter 4 predicts. Here there is a negative wealth effect, which increases labor supply and output. In a dynamic model, there could be changes in the interest rate, which produce further changes in labor supply and intertemporal substitution effects on demand. However, they do not need to mention these for full credit. (Of course, don't penalize them if they do!)*

4. Fiscal deficits cause current account deficits.

UNCERTAIN. *We know from National Income Accounting that*

$$\text{Current Acct Deficit} = \text{Fiscal Deficit} + (I - S_p)$$

where I is investment, and S_p is private saving. Clearly, if neither I nor S_p change, then fiscal deficits will produce current account deficits. (In this case, the two are sometimes called 'Twin Deficits'). Essentially, the government would be borrowing the money from foreigners. However, it could well be the case that both I and S_p respond to the fiscal deficit. For example, if Ricardian Equivalence holds, then an increase in the fiscal deficit will simply be offset by a rise in S_p , and there would be no effect on the current account.

5. Economies with older populations will have higher savings rates.

UNCERTAIN. *It depends on what you're comparing to. The simple life-cycle model of Modigliani predicts that people have low savings rates when they are young and old, and high savings rates when they are middle-aged. So this would be true if you're comparing a country with a high proportion of middle-aged people against against a country with a lot of young people (as in many poor, developing*

countries). However, it would be false if you're comparing to a country with a high proportion of old people (eg, Japan), with a country that has a high proportion of middle-aged people.

The following questions are short answer. Briefly explain your answer. Clarity will be rewarded.

6. (25 points). Consider a static one-period economy as discussed in Chapter 4. Output is produced using the production function: $Y = zK^\alpha N^{1-\alpha}$. The representative household's preferences are given by

$$U(C, \ell) = \ln C + \beta \ell$$

where β is a fixed parameter, and $\ln(\cdot)$ is the natural log function. As discussed in class, the household's time constraint is $h = \ell + N$. For simplicity, suppose there is no government in this economy.

- (a) Derive the labor supply and labor demand curves. How does labor supply depend on the wage rate? Explain intuitively.

The labor supply curve can be derived by combining the household's optimality condition with its budget and resource constraints. The optimality condition is,

$$\frac{U_\ell}{U_c} = w$$

With the given utility function this just becomes

$$\beta C = w$$

Notice that the labor supply curve is horizontal at $w = \beta C$. This is because the marginal utility of leisure is constant. From the budget constraint, we know $C = w \cdot N^s$, where $N^s = h - \ell$. Substituting this into the optimality condition yields,

$$N^s = \frac{1}{\beta}$$

Not surprisingly, the household works less when it values leisure more (ie, when β increases).

The firm's labor demand curve can be derived from its profit-maximizing optimality condition. This is just

$$(1 - \theta)zK^\theta N^{-\theta} = w$$

Solving for N gives the labor demand curve

$$N^d = \left[\frac{(1 - \theta)zK^\theta}{w} \right]^{1/\theta}$$

which is clearly a decreasing function of w .

- (b) Compute the competitive equilibrium wage rate and employment for this economy. How does β affect the equilibrium wage and output level? Illustrate your answer with a labor supply/labor demand graph.

The equilibrium wage is simply where the two curves intersect, (ie, where $N^s = N^d$). To find w , we can just substitute $N^s = 1/\beta$ into the firms optimality condition

$$w = (1 - \theta)zK^\theta (1/\beta)^{-\theta} = (1 - \theta)z(K \cdot \beta)^\theta$$

Notice that w increases when β increases. This can be visualized by an upward shift in the horizontal labor supply curve, with an unchanged labor demand curve.

7. (25 points). Classical economists often categorized people into different ‘classes’, where people of different classes were assumed to behave differently. A common categorization was between ‘capitalists’ and ‘workers’. Here’s an example. Suppose capitalists own all the capital. Also suppose capitalists save all their income, and do not supply any labor. Conversely, suppose workers consume all their income (ie, they do not save), and supply all the economy’s labor. Finally, as usual suppose the aggregate production function is Cobb-Douglas, $Y = K^\alpha L^{1-\alpha}$, and that factor markets are competitive.

- (a) Compute the steady state level of per capita income in this economy. For simplicity, suppose there is no population growth or productivity growth, and that capital depreciates at the fixed rate, δ . Note that now it is important to distinguish per capita income from per worker income. To compute per capita income, first compute per worker income, and then assume that workers comprise a fraction γ of the total population.

This was really the only tricky question on the exam, so please be generous with partial credit. (This question is supposed to sort the right tail of the distribution).

Since there is no population growth or productivity growth, the steady state occurs where savings and investment just compensate for depreciation. As usual, depreciation is just $\delta \cdot K$. What’s new here is how savings is determined. Since capitalists save all their income, and workers save nothing, we just need to calculate the income of capitalists. Since they own all the capital, their income is just

$$MPK \cdot K = \alpha K^{\alpha-1} L^{1-\alpha} \cdot K = \alpha K^\alpha L^{1-\alpha}$$

(Keep in mind that L now represents the number of workers, not the total population, since capitalists don’t supply labor). Therefore we have the steady state condition

$$\alpha K^\alpha L^{1-\alpha} = \delta K$$

which we can use to solve for the steady state capital-per-worker ratio, $k = K/L$,

$$k^* = \left(\frac{\alpha}{\delta}\right)^{1/(1-\alpha)}$$

Now, from the production function, we know output per worker, $y = Y/L$, is just

$$y = k^\alpha$$

Substituting in the previous expression k^ gives steady state output per worker*

$$y^* = \left(\frac{\alpha}{\delta}\right)^{\alpha/(1-\alpha)}$$

Finally, since workers are a fraction, γ , of the population, steady state output per capita, y_{pc} , is just

$$y_{pc}^* = \frac{Y}{Pop} = \frac{L}{Pop} \cdot \frac{Y}{L} = \gamma \cdot y^* = \gamma \left(\frac{\alpha}{\delta}\right)^{\alpha/(1-\alpha)}$$

- (b) Show that this economy automatically satisfies the Golden Rule.

At the Golden Rule we know, $\alpha k^{\alpha-1} = \delta$ (remember that $n = 0$ here). Let’s sub in our previous calculation of k^ , and see if this is true*

$$\alpha \left[\left(\frac{\alpha}{\delta}\right)^{\frac{1}{1-\alpha}} \right]^{\alpha-1} = \alpha \cdot \frac{\delta}{\alpha} = \delta$$

It works! This economy may be wildly unfair and unjust, by some definition, but it does satisfy the Golden Rule.