SIMON FRASER UNIVERSITY
Department of Economics

Econ 305   Prof. Kasa
Intermediate Macroeconomic Theory   Spring 2013

MIDTERM EXAM
(Solutions)

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

1. Increases in the CPI (Consumer Price Index) overstate increases in the 'cost of living'.

   TRUE. *The CPI compares the price of a <u>fixed</u> basket of goods over time. When not all prices rise by the same amount, consumers can substitute toward goods that become relatively cheaper. By keeping the basket fixed, the CPI ignores these substitution possibilities, and therefore overstates the rise in the cost of living.*

2. According to the simple one-period model of a competitive labor market developed in Chapter 4 of the textbook, an increase in government spending causes real wages to fall.

   TRUE. *When government spending rises, taxes must rise too, which lowers the household's wealth. Assuming the government buys things that the household would not have bought for itself, this reduces the household's leisure consumption (assuming leisure is a 'normal' good). The reduction in leisure shifts out the labor supply curve, which drives down wages. That is, since households want to work more to help pay their now higher taxes, wages must fall so that firms have an incentive to hire them.*

3. The Solow model predicts that countries that save more will grow faster.

   FALSE/UNCERTAIN. *Changes in saving only have a <u>temporary</u> effect on growth in the Solow model. So if a country suddenly starts saving more, it will grow faster for awhile, but eventually it will converge to a new steady state, where the growth is the same as it was before.*

4. According to the DMP (Diamond-Mortensen-Pissarides) model of seach unemployment, an increase in productivity lowers the equilibrium unemployment rate.

   TRUE. *In the DMP model, higher productivity increases the operating profits of firms, since with Nash bargaining wages rise by less than productivity. These higher profits provide an incentive for new firms to enter the market and create vacancies, and labor market 'tightness' rises. Labor market tightness continues to rise until higher search costs of firms lower their (expected) profits back down to zero. At the same time, a tighter labor market makes it easier for workers to find jobs, and unemployment falls.*

5. The presence of exhaustible resources (e.g., oil) means economic growth cannot go on forever.

   FALSE/UNCERTAIN. *Exhaustible resources do lower the growth rate for any given rate of technological progress, but they do not rule out growth altogether. An important consideration is how 'important' the exhaustible resources are in the production process. The model discussed in class likely overstated the growth-diminishing effects of exhaustible resources, since it implied the share of exhaustible resources was constant over time (due to the Cobb-Douglas specification of the production function). In reality, it is likely to be the case that as exhaustible resources become increasingly scarce, and their prices rise, firms will find other energy sources that can replace them, or at least reduce their importance.*

   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

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

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 household's optimality condition is:

$$\frac{U_\ell}{U_C} = w \qquad \Rightarrow \qquad \frac{\beta C}{\ell} = w \qquad \Rightarrow \qquad C = \frac{1}{\beta} w \ell$$

The household's budget constraint is, $C + w \cdot \ell = w \cdot h$, and its time constraint is $\ell + N = h$. Substituting the above solution for C into the budget constraint, and then using the time constraint to eliminate ℓ, we get the following labor supply curve:

$$N = \frac{1}{1 + \beta} h$$

What happened to the wage rate!? Remember, a change in the wage rate has both income and substitution effects. With these preferences, it just so happens that the two effects exactly offset each other, so that labor supply remains unchanged when the wage changes. If you were to graph the labor supply curve, it would be a vertical (assuming N is on the horizontal axis).

The optimality condition for firms is:

$$MPL = w \qquad \Rightarrow \qquad (1 - \alpha) z K^\alpha N^{-\alpha} = w$$

Solving for N gives the following labor demand curve

$$N = \left[\frac{(1 - \alpha) z K^\alpha}{w} \right]^{\frac{1}{\alpha}}$$

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

In equilibrium, labor supply must equal labor demand. The wage adjusts until this is true. Since labor supply is constant, we know that in equilibrium employment will just be given by $N = \frac{1}{1+\beta} h$. Equating labor supply to labor demand then gives the following equilibrium wage rate:

$$w = (1 - \alpha) z K^\alpha \left(\frac{1}{1 + \beta} \right)^{-\alpha}$$

Notice that w rises when z rises. The increase in z shifts out the labor demand curve. However, since the labor supply curve is vertical, only the wage rate rises. Employment stays the same, since the income and substitution effects exactly offset. In contrast, when β rises, notice that w rises _and_ N falls. A rise in β means that households value leisure more highly, which shifts the (vertical) labor supply curve to the left. The reduction in labor supply causes the wage rate to be bid up.

7. (25 points). This question asks you to use the Solow model to analyze the effects of fiscal policy. As usual, suppose that output is produced with the production function $Y = AK^\alpha L^{1-\alpha}$. Capital depreciates at rate δ, and productivity, A, is assumed constant. For simplicity, suppose L is constant too, and normalize it so $L = 1$. The key difference here is that there is a government. Suppose that government purchases, G, are a fixed fraction, λ, of output, so that $G = \lambda Y$. Also suppose the government balances its budget each period by levying lump-sum taxes. As usual, the saving rate, s, is assumed to be constant, but now households must first deduct their taxes from their income before they can save and consume.

(a) Given the above assumptions, write down this economy's capital accumulation equation. Illustrate how the economy's capital stock and output evolve over time. Calculate the economy's steady state capital stock as a function of A, s, δ, and λ. How does government spending influence steady state (per capita) income? Illustrate your answer with a graph, by comparing two economies with different values of λ. Explain intuitively.

Since this is a closed economy, the national income accounting identity is:

$$C_t + I_t + G_t = Y_t$$

where I_t is (gross) investment. Changes in the capital stock are related to investment as follows:

$$K_{t+1} - K_t = I_t - \delta K_t$$

In other words, investment this period causes the capital stock to increase <u>next</u> period (this lags reflects the presence of 'installation lags'. Sometimes it is assumed that these lags are longer, but the Solow model assumes a one-period lag). Also note that depreciation is assumed to be <u>proportional</u> to the current capital stock, so that the capital stock only increases if investment is large enough to offset depreciation.

Now, if we use this to sub out I_t in the national income accounting identity, and use the assumption that $G_t = \lambda Y_t$, we get the following

$$C_t + K_{t+1} - K_t + \delta K_t = (1 - \lambda)Y_t$$

Finally, using the fact $C_t = (1-s)(Y_t - T_t)$, where s is the saving rate, along with the facts, $T_t = G_t$ and $G_t = \lambda Y_t$, we get

$$
\begin{aligned}
K_{t+1} - K_t &= s(1-\lambda)Y_t - \delta K_t \\
&= s(1-\lambda)AK_t^\alpha - \delta K_t
\end{aligned}
$$

Notice that without a government, $\lambda = 0$, and we have the exact same expression as in class. In a steady state, the capital stock is constant, $K_{t+1} - K_t = 0$, so we can solve the above equation for the steady state capital stock:

$$K^* = \left[\frac{(1-\lambda)sA}{\delta}\right]^{\frac{1}{1-\alpha}}$$

Notice that K^* is lower when λ is higher. If government spending increases (as a share of GDP), this leaves less disposable income for the private sector. As a result, they save and invest less, which then reduces the steady state capital stock. This, in a nutshell, is the Republicans' argument against Big Government.

(b) What does your answer to part (a) suggest about the growth promoting effects of fiscal 'stimulus' plans (e.g., Canada's 'Action Plan'). Can you think of any caveats to your answer in part (a), which might produce a different prediction?

The above result suggests that 'stimulus' plans are a bad idea. However, there are (at least) two important caveats to this result:

(a) *The above growth model assumed perfectly functioning competitive markets, with full employment at all times. In reality, fiscal stimulus plans are based on the presumption that there are <u>unemployed</u> resources, due to some sort of market imperfection, and the goal is to use the stimulus to facilitate the economy's adjustment back to full employment. This is the whole idea behind Keynesian economics, which we will discuss in more detail later.*

(b) *Even without market failures, there is another reason to be skeptical of the above result. Implicitly, the above result assumed that government spending did <u>not</u> increase the capital stock. That is, it was just consumption, not investment. In reality, a lot of government fiscal policy is aimed at improving infrastructure (eg., roads, bridges, airports, etc) which either increases physical capital directly, or increases its productivity (ie., A). If this is the case, then government spending could actually <u>increase</u> the steady state capital stock (especially if these infrastructure projects are public goods, and so are underfunded by the private sector).*