EE312 Macroeconomic Theory
Semester 2/2015
Mid-Term Examination

Date: Wednesday 9 March 2016
Time: 11:00 – 13:00 hr.

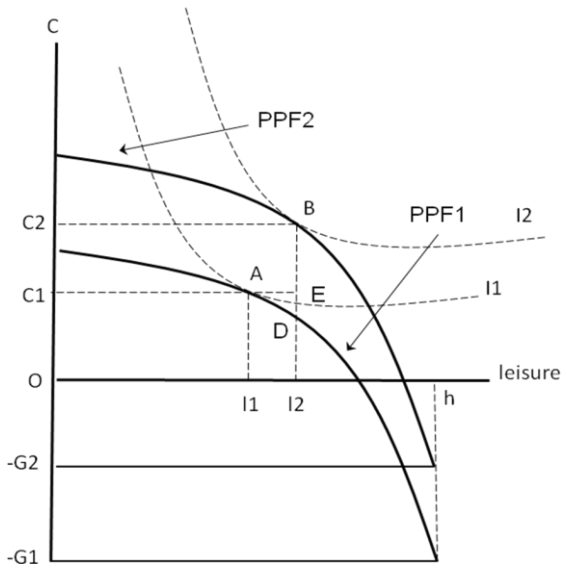
Instructions

1. There are three essay questions with a total of 30 points.
2. Write your answers in the provided booklets.
3. Books, notes, calculators and electronic devices are not allowed.
4. Use pens to write your answers; pencils are allowed for drawing only.
5. Explain the chain of effects among variables correctly. Describe your analysis in words and use diagrams accordingly.

Questions

1. Suppose the government decides to cut its current spending. Use **the Closed-Economy, One-Period Macroeconomic Model** to determine the effects of the decrease in current government spending on aggregate output, consumption, employment and the real wage. (10 points)

Answer: The initial competitive equilibrium is at point A where the firm's Production Possibility Frontier, PPF1, touches the consumer's highest indifference curve I1. At A, the optimal consumption bundle for the consumer consists of consumption goods equal to c1 and leisure equal to L1. So the consumer's working time (and labor supply) is h – L1.

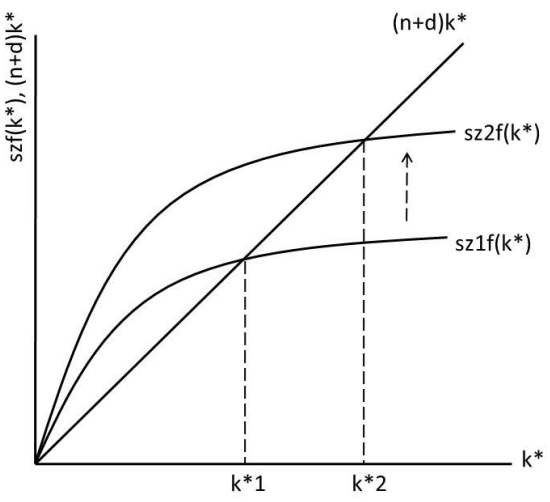


The government reduces spending (G), causing taxes to decrease (T). The consumer's non-wage income (π - T) and disposable income increase. The consumer increases demand for consumption goods (C) and leisure (l) as both are normal goods. More leisure is equivalent to a decrease in working time (h – l). So the labor supply (N^s) decreases. There is excess demand for labor by the firm at the initial real wage. So the real wage (w) increases, causing the firm to reduce its labor demand and employment. Less labor input in production results in a lower level of total output. The lower labor input also raises the marginal product of labor (MP_N) which corresponds to the higher real wage, given the capital input.

The decrease in government spending from G1 to G2 is equivalent to a positive income effect. The production possibility frontier shifts upwards from PPF1 to PPF2 as G = T is smaller. The competitive equilibrium moves from point A to point B at a higher indifference curve I2. The consumer's demand for consumption goods increases from C1 to C2 while leisure increases from l1 to l2. Consumer welfare and utility are higher. Work time drops from h – l1 to h – l2. Thus, labor supply decreases. The slope of PPF2 at point B is steeper than the slope of PPF1 at point A, so MP_N and the real wage at point B are higher.

In conclusion, a decrease in government spending results in higher consumption, lower employment, a higher real wage and lower total output. The decrease in government spending raises consumption despite the lower output because lower taxes cause disposable income to increase.

2. In **the Solow growth model**, analyze the effect of an increase in total factor productivity on the quantity of capital per worker and output per worker at the steady state. Give the economic reason of why capital per worker and output per worker in the steady state change in that way. And what are the growth rates of aggregate capital and aggregate output at the new steady state? (10 point)



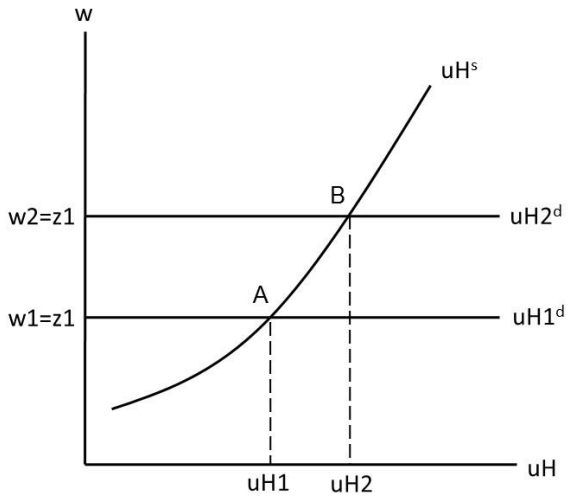
Answer: Assume the initial total factor productivity is z1 so that saving per worker is sz1f(k*). At the initial equilibrium, saving per worker equals steady-state investment per worker. So the initial steady-state capital per worker is k*1 and the initial steady-state output per worker is y*1.

As total factor productivity increases to z2, saving per worker also increases to sz2f(k*). The saving per worker curve rotates upwards from sz1f(k*) to sz2f(k*) which is equal to the steady-state investment at the new level of steady-state capital per worker k*2. Higher capital per worker k*2 results in higher output per worker at y*2, given the per worker production function.

At the initial steady-state capital per worker of k*1, aggregate output (Y) and aggregate capital (K) are growing at the rate of population growth (n). The higher total factor productivity causes the per worker production function to rotate upwards. The marginal product of capital per worker is higher and enables the initial capital per worker to yield more output per worker and more saving per worker. Hence, investment per worker is rising, causing aggregate investment, aggregate capital and aggregate output to grow at a higher rate than n in the transition period.

However, the aggregate production function is characterized by diminishing returns to the capital input, given the labor input. The marginal product of capital is falling as the capital input is increasing. So aggregate output, aggregate saving, aggregate investment and aggregate capital are all growing at a decreasing rate. The growth rate of aggregate capital and aggregate output will slow down towards the initial rate of population growth (n) at the new steady-state of k*2. The high aggregate output growth is transitory because the economy will experience a period of such high growth only in the transition from k*1 to k*2.

3. In **the endogenous growth model**, assume that the marginal product of the efficiency units of labor (z) increases. What are the effects of such increase on the real wage rate, the levels of output and consumption, and the equilibrium growth rates of output and consumption? (10 points)



Answer: At the initial equilibrium, the firm maximizes profits at point A where the marginal product of the efficiency units of labor (z1) equals the real wage (w1) and the firm's demand ($uH1^d$) equals the consumer's supply of the efficiency units of labor ($uH1^s$).

When the marginal product of the efficiency units of labor increases from z1 to z2. The firm has incentives to hire more labor and has to offer a higher real wage. The demand curve shifts upwards to $uH2^d$. The consumer supplies more efficiency units of labor to $uH2^s$. The firm and the consumer reach the new equilibrium at point B where the real wage is higher at w2.

The production function is $Y = zuH^d$. More employment of labor (uH) results in the higher level of output. Consumption is $C = wuH^s$. The higher real wage (w) and more employment (uH) raise the level of consumption.

At the new equilibrium, the growth rate of consumption is still b(1 - u). Output is also growing at the same rate of b(1 – u) because consumption equals output in every period.

$$\frac{C'}{C}-1=\frac{z_2 uH'}{z_2 uH}-1=\frac{H'}{H}-1=b(1-u)-1$$

In conclusion, the higher marginal product of the efficiency units of labor results in the higher levels of the real wage, output and consumption. The equilibrium growth rates of output and consumption remain the same at b(1 – u).