

EE312 Macroeconomics
Semester 2/2013

Mid-Term Examination

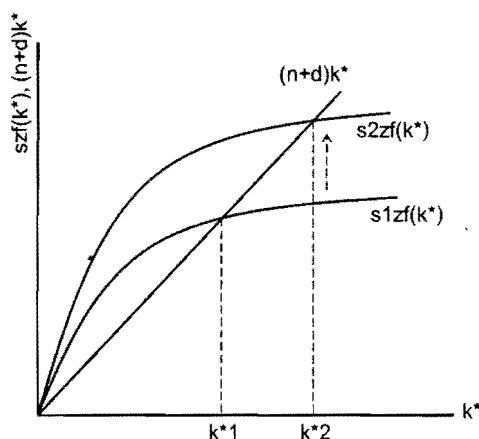
Date: Wednesday 5 March 2014

Time: 11:00 – 13:00 hr.

Questions:

1. In the Solow growth model, suppose the saving rate (s) in the economy increases. Analyze the effects of such increase on the quantity of capital per worker and output per worker in the steady state. Give the economic reason of why such output growth is said to be transitory. (10 point)

Answer:



Assume the initial saving rate is s_1 so that saving per worker is $s_1zf(k^*)$. At equilibrium, saving per worker equals steady-state investment per worker. So the initial steady-state capital per worker is k^*1 .

As the saving rate increases to s_2 , saving per worker also increases to $s_2zf(k^*)$. The saving per worker curve rotates upwards from $s_1zf(k^*)$ to $s_2zf(k^*)$ which is equal to the steady-state investment at the new level of steady-state capital per worker k^*2 . Higher capital per worker results in higher output per worker at y^*2 , given the per

worker production function.

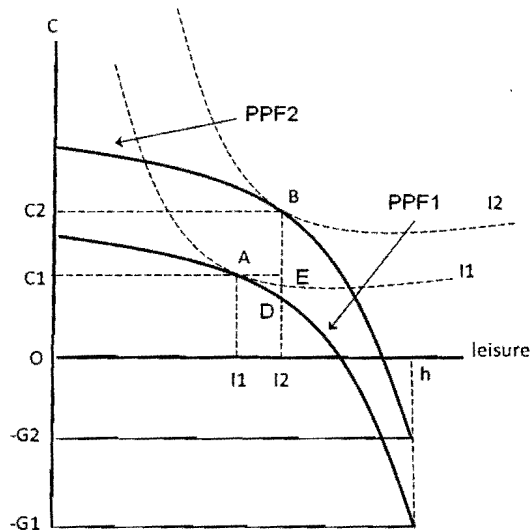
At the initial steady-state capital per worker of k^*1 , aggregate output (Y) and aggregate capital (K) are growing at the rate of population growth (n). As the saving rate increases, aggregate saving and aggregate investment are also increasing. The rising aggregate investment causes aggregate capital (K) to grow at a higher rate than n , resulting in aggregate output (Y) also growing at a higher rate than n .

However, the aggregate production function is characterized by diminishing returns to capital, given the labor input. The marginal product of capital is falling as the capital input is increasing, so that aggregate output is growing at a decreasing rate. The high aggregate output growth will slow down towards the rate of population growth (n) at the new steady-state of k^*2 . The high aggregate output growth is said to be transitory because the economy

will experience a period of such high growth only in the transition from k^*1 to k^*2 where it will drop to the initial growth rate of n .

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

Answer:



The government reduces spending (G), causing taxes to decrease (T). Non-wage income ($\pi - T$) 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) to correspond 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.

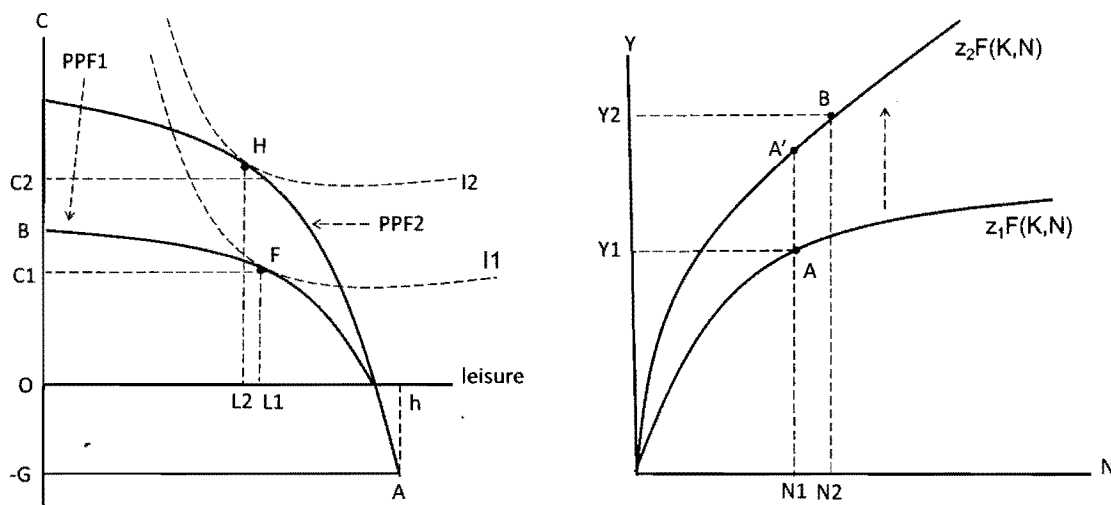
The slope of $PPF2$ at point B is steeper than the slope of $PPF1$ at point A , so MP_N at point B is higher. The real wage increases, inducing the firm to reduce labor demand and employment.

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.

3. Assume that total factor productivity increases in **the Closed-Economy, One-Period Macroeconomic Model**. Analyze the effects of the productivity increase on aggregate output, consumption, employment and the real wage. (10 points)

Answer:

The initial competitive equilibrium is at point F where the firm's Production Possibility Frontier, PPF1, touches the consumer's highest indifference curve I1. At A, the firm maximizes profit and the consumer maximizes utility at the real wage rate equal to the slope of the PPF ($MRT_{C,L}$) and I1 ($MRS_{C,L}$). The optimal consumption bundle for the consumer is consumption goods equal to c_1 and leisure equal to L_1 . So the consumer's working time (and labor supply) is $h - L_1$.



The increase in total factor productivity (z) from z_1 to z_2 causes the production function to rotate upwards from $Y_1 = z_1 F(K, N^d)$ to $Y_2 = z_2 F(K, N^d)$, given capital (K) and labor (N^d) inputs. The slope of the production function at A increases to A' at the initial level of labor input. The marginal product of labor (MP_N) is higher, inducing more demand for labor by the firm which offers a higher real wage ($MP_N = w$).

The upward rotation of the production function causes the PPF1 to shift upwards to PPF2. The competitive equilibrium changes from F to H. The real wage increases as the slope of PPF2 at H is steeper than the slope at F.

The increase in the real wage has the substitution effect and income effect. **The substitution effect** causes the consumer to increase consumption goods and reduce leisure (because the cost of leisure has become higher). **The income effect** causes the consumer to increase both consumption goods and leisure (both are normal goods). In short, consumption goods will increase from c_1 on PPF1 to c_2 on PPF2, but the change in leisure (and labor supply) is unclear.

Here we assume a **stronger substitution effect**. So leisure decreases from $L1$ to $L2$ and labor supply increases from $(h - L1)$ to $(h - L2)$. Employment increases from $N1$ to $N2$ and, through the production function, output increases from $Y1$ to $Y2$. The real wage is still higher at the new competitive equilibrium as the slope of the production function at C is still steeper than at A .

In conclusion, the increase in total factor productivity results in higher consumption, lower leisure, higher employment, higher output and income and a higher real wage (assuming the stronger substitution effect).

Note: students may assume a stronger income effect or equal substitution and income effects.