Midterm Exam

1. (24pt) Consider the following Neoclassical model of Vietnam economy. The domestic interest rate r and the world interest rate r^* are in percentage terms, the Vietnam currency is Vietnamese Dong. Show all your work.

Supply, Money, and Prices	Demand and Money
$Y = F(K, L) = \sqrt{KL}$	$C = 75 + \frac{1}{2}(Y - T)$
$K = 900; L = 100$	$I = 80 - 4r$
$r^* = 5$	$G = 60, T = 50$
$P = 10; P^* = 11; M = 1000$	$NX = 20 - 20\varepsilon$

(a) What is the level of real GDP in the economy? In a closed economy, find the equilibrium real interest rate, national saving, and investment. Show the loanable funds equilibrium in a diagram (Hint: Ignore r^*, P^* and NX here).

(b) Calculate the trade balance and net capital outflow for the small open economy. Show the trade balance on a saving-investment diagram with r measured on the vertical axis.

(c) Calculate nominal GDP in the domestic country and the velocity of money. Provide an interpretation for the velocity of money. What are the values for the real and nominal exchange rates? Contrast the two exchange rate, discussing how to interpret each.

(d) Assume the reserve-to-deposit ratio is 0.1 and the currency-to-deposit ratio is 0.2. How much does the State Bank of Vietnam (i.e., the central bank of Vietnam) need to increase the monetary base to attain a money supply equal to $M = 1050$? Explain how the State Bank accomplishes this objective.

(e) Consider the following scenario. President Trump is interested in protecting the domestic auto industry and enacts international trade legislation. This will shift the net export schedule of Vietnam to $NX = 10 - 20\varepsilon$ since US is a main importer of Vietnam. What impact does the legislation have on the real exchange rate and the trade balance? Show your results in a diagram with ε on the vertical axis and write a short paragraph explaining the results.

(f) Now assume that Vietnam President enacts legislation to balance the federal government's budget by reducing spending. Show the impact on the real exchange rate and trade balance in a diagram (using our model of a small open economy). How does the nominal exchange rate change?

Suggested Solution

(a) The real GDP is $Y = \sqrt{900 \times 100} = 300$;
National saving is $S = Y - C - G = 300 - \left[75 + \frac{1}{2}(300 - 50)\right] - 60 = 40$
The real interest rate is determined by $S = I \Longrightarrow r = 10$ and therefore the equilibrium investment is 40.
The loanable funds equilibrium is shown in Figure 1.

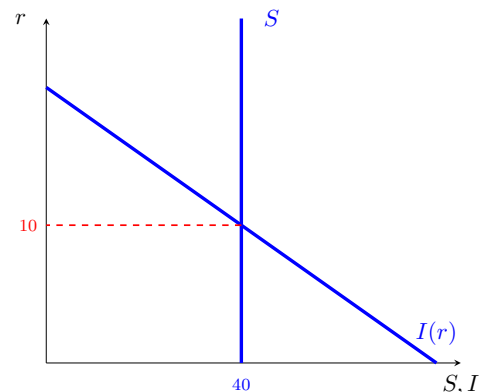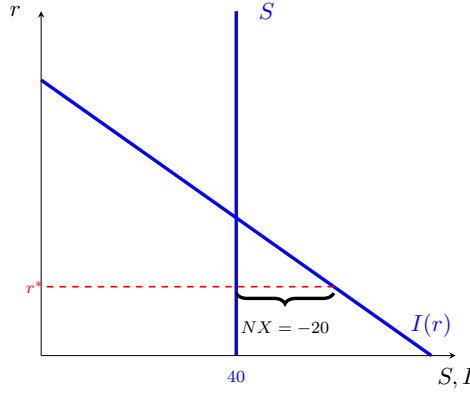

Figure 1: Loanable Funds Equilibrium

Figure 2: Trade Balance

(b) For an open economy, the trade balance and the net capital flows are given by $\text{NX} = \text{NCO} = S - I(r^*) = 40 - 60 = -20$. The figure is shown in Figure 2.

(c) Nominal GDP is given by $P \times Y = 10 \times 300 = 3000$. Velocity can be calculated from the quantity equation as $V = \frac{P \times Y}{M} = \frac{3000}{1000} = 3$. So each dollar turns over an average of 3 times per year to carry out all the transactions in the economy. The real exchange rate can be calcuated from the net export schedule: $NX = 20 - 20\varepsilon$. Since $NX = -20$, the equilibrium real exchange rate must be $\varepsilon = 2$. The nominal exchange rate is $e = \varepsilon \times \frac{P^*}{P} = 2 \times \frac{11}{10} = 2.2$. The real exchange rate says that the relative price of foreign goods relative to Vietnam domestic goods is 2. In other words, you can get 2 units of foreign goods for 1 unit of Vietnam goods. The nominal exchange rate says that one Vietnamese Dong is worth 2.2 units of the foreign currency.

(d) First of all, the money multiplier is $m = \frac{1+cr}{cr+rr} = \frac{1+0.2}{0.2+0.1} = 4$. To attain a new money supply of $M = 1050$, the State Bank needs to increase the money supply by 50: $\Delta M = 50$. Using the equation $\Delta M = m \times \Delta B$, the necessary change in the base is $\Delta B = 12.5$. The State Bank would accomplish this by buying government securities or government bonds.

(e) Using our classical model of a small open economy, the trade legislation would shift the net exports schedule to the left. One way to interpret this, is a decrease in the demand for Vietnam Dong on the international currency market. However, since net capital outflows (i.e., supply of Vietnam Dong) are fixed at $S - I = -20$, the legislation will only decrease the price of the Vietnam Dong (i.e., the Vietnam Dong will depreciate), but the trade balance will remain unchanged. The result is shown in Figure 3.
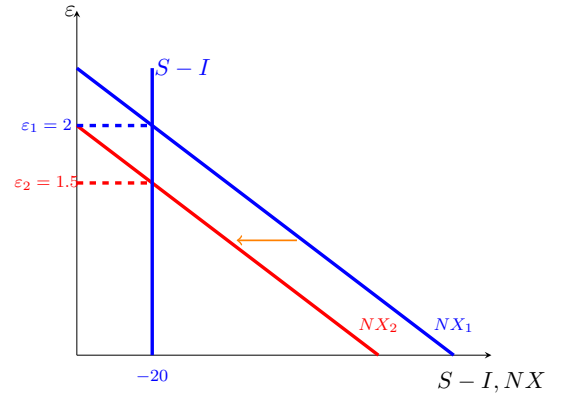

Figure 3: Trade Legislation

(f) To balance the government budget, the president would need to reduce the spending to $G = 50$. This reduction in government will cause national savings to increase to $S = 300 - 200 - 50 = 50$. Net capital outflows and the trade balance would then increase to $NX = S - I(r^*) = -10$. The real exchange would decrease to $\varepsilon = 1.5$ and the new nominal exchange is $e = 1.5 \times \frac{11}{10} = 1.65$. The result is shown in Figure 4.
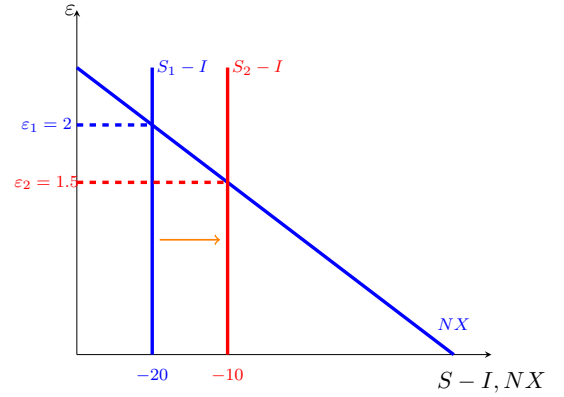

Figure 4: Reduce Governmen Spending

2. (16pt) Consider the following economy:

$$C = 42 + 0.3Y$$
$$I = 18 + 0.3Y - 80r$$
$$T = 0.2Y + 40$$
$$G = 580$$
$$\left(\frac{M}{P}\right)^d = 0.15Y - 30r$$
$$\left(\frac{M}{P}\right)^s = 150$$

(a) Derive the IS curve and LM curve.

(b) Calculate the equilibrium real interest rate, income, public saving and private saving. Does the government has fiscal deficit or fiscal surplus?

(c) If the government wants to balance the budget, it has monetary policy and fiscal policy. If the government wants to take monetary policy, how to implement the monetary policy? If the government wants to take fiscal policy, how to implement the fiscal policy?

(d) Now suppose the government wants to change the government expenditure to balance the budget, what G the government should have?

Suggested Solution

(a) The IS curve is

$$Y = C + I + G = 42 + 0.3Y + 18 + 0.3Y - 80r + 580 \Longrightarrow r = 8 - \frac{1}{200}Y$$

The LM curve is
$$0.3Y - 300r = 1500 \Longrightarrow r = \frac{1}{200}Y - 5$$

(b) From IS curve and LM curve, we can see that the equilibrium income is $Y = 1300$, the real interest rate is $r = 1.5$. Given this, the tax income is

$$T = 0.2 \times 1300 + 40 = 300.$$

So the public saving is
$$s_g = T - G = 300 - 580 = -280$$
So the government has fiscal deficit.

The private saving is

$$s_p = Y - C - T = 1300 - (42 + 0.3 \times 1300) - 300 = 568.$$

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(c) Since the government has fiscal deficit, it should increase the tax or decrease the government spending to balance the budget. Or the government can implement the expansive monetary policy, such as purchase the government securities and government bonds through the market operation. This will shift the LM curve right, and increase the equilirium income, which in turn will increase the tax income of the government.

(d) Suppose the government expenditure is G, given this, the IS curve is

$$Y = C + I + G = 42 + 0.3Y + 18 + 0.3Y - 80r + G \Longrightarrow r = 0.75 + \frac{G}{80} - \frac{1}{200}Y$$

Combining this with the LM curve and we can find the equilibrium income:

$$Y = 575 + \frac{5}{4}G$$

So the government income is

$$T = 155 + \frac{1}{4}G$$

To attain the balanced budget, there is

$$155 + \frac{1}{4}G = G \Longrightarrow G = \frac{620}{3}$$

3. (20pt) In March 2019, Mueller investigation finds no evidence of Russian collusion in US election. However, let us do one thought experiment. Suppose, on the contrary, that the Mueller investigation finds hard evidence of Russian collusion. Then the actions to follow creat political and economic uncertainty, which in turn causes consumers to reduce their consumption and firms to reduce their investment. Suppose the short-run aggregate supply curve is upward-sloping. According to this, answer the following questions.

(a) Use the IS-LM model and AD-SRAS-LRAS diagram to discuss the predicted short- and long-run impacts on the price level, real GDP, unemployment, and real interest rate. Clearly label your graph and write a concise paragragh to accompany your graph.

(b) Discuss the possible fiscal and monetary responses to the adverse consumption and investment shock described in part (a). Use an AD-SRAS-LRAS diagram to support your discussion. Use two IS-LM diagrams to show the effects of the fiscal and monetary responses on the real interest rate, respectively.

Suggested Solution

(a) The reduction in consumption and investmetn will shift the IS curve and AD curve to the left. In the short run, the economy will experience a lower price level and real interest rate. This is a movement from point A to point B in Figures 5 and 6, the real GDP is lower and the unemployment is higher. Over time, accumulated inventories and higher unemployment will force firms to lower prices and decrease the wages, gradually shifting the SRAS down and to a new long-run equilibrium at point C in Figure 6; with a gradually lowering price, the LM curve will be shifting down to a new long-run equilibrium at point C in Figure 5. Real GDP and unemploymen will return to their natural levels, but the price level and real interest rate will be lower.

(b) The government can take expansive fiscal policy, such as increasing the government expenditure or decreasing the tax. This will shift the IS curve to the right, and the real interest rate return to its original level. This is depicted in Figure 7. The government can also take expansive monetary policy and this will shift the LM curve to the right, and the real interest rate will decrease. This is depicted in Figure 8. Both policies will shift the AD curve to the right and the production returns to its natural level. This is depicted in Figure 9.
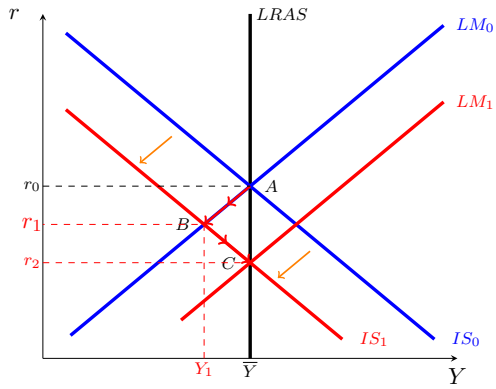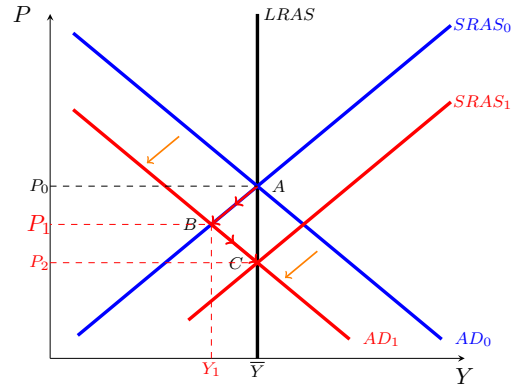
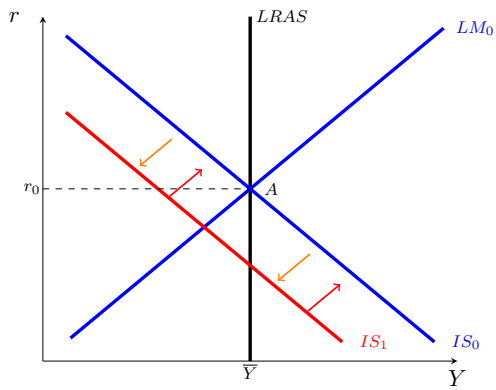Figure 5: IS-LM Model

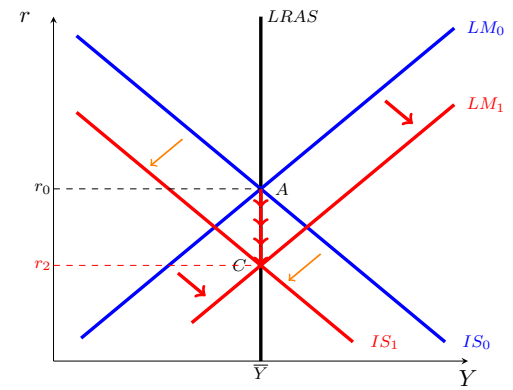Figure 6: AD-SRAS-LRAS

Figure 7: Expansive Fiscal Policy

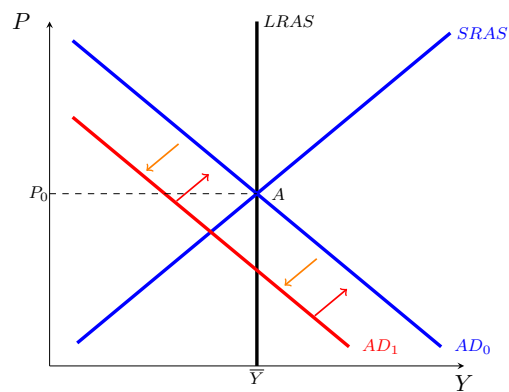Figure 8: Expansive Monetary Policy

Figure 9: The Expansive Monetary and Fiscal Policy

4. (10pt) In April 22, 2019, US State Secretary Mike Pompeo announces that as of May 2, 2019 the U.S. will no longer grant sanctions waivers to countries importing Iranian oil. Affected by this announcement, the petro price rises by more than 3%. Suppose China is one closed economy and the petro is one important production inputs in modern economy. Apply the IS-LM model and AD-SRAS-LRAS model to predict the short- and long-run impacts of this announcement on China's price level, real GDP, unemployment and real interest rate. Clearly label your graph and write a concise paragraph to accompany your graph. In the analysis, assume SRAS curve us upward sloping.

Suggested Solution

The increases in petro price will shift the SRAS curve upwards and LM curve to the left. In the short run, China's economy will experience a higher price level and real interest rate. This is a movement from point A to point B in Figures 10 and 11, the real GDP is lower and the unemployment rate is higher. Over time, accumulated inventories and higher unemployment will force firms to lower prices and decrease the wages, gradually shifting the SRAS down and to the original long-run equilibrium at point A in Figure 11; with a gradually lowering price, the LM curve will be shifting down to the original new equilibrium at point A in Figure 10. The price level and real interest rate will return to their original levels, and Real GDP and unemployment rate will return to their natural levels.
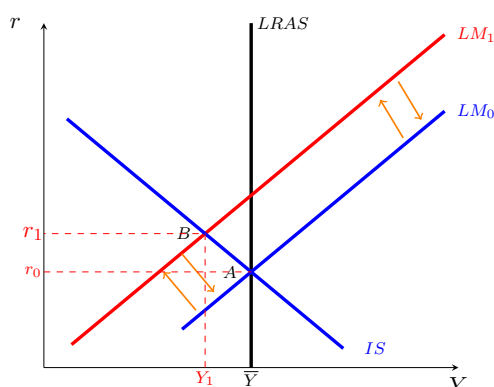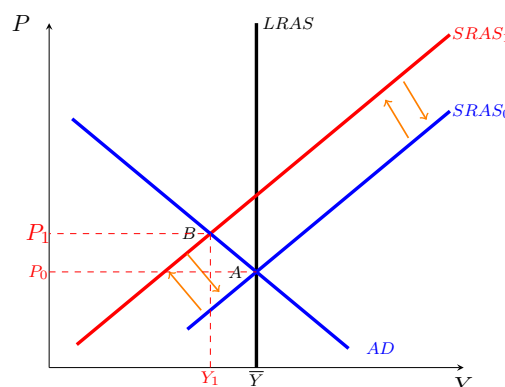

Figure 10: IS-LM Model

Figure 11: AD-SRAS-LRAS

4. (15pt) Given our general assumptions, IS curve is downward sloping while LM curve is upward sloping. Now given the following unusual assumptions, discuss what changes IS curve or LM curve have respectively. Write a concise paragraph to accompany your diagram. In the diagram, you only need to draw the curve that has changes given each assumption.

(a) investment is independent of real interest rate

(b) $MPC = 0$

(c) money demand is independent of interest rate

(d) money demand is independent of income

(e) money supply increases in the interest rate

Suggested Solution

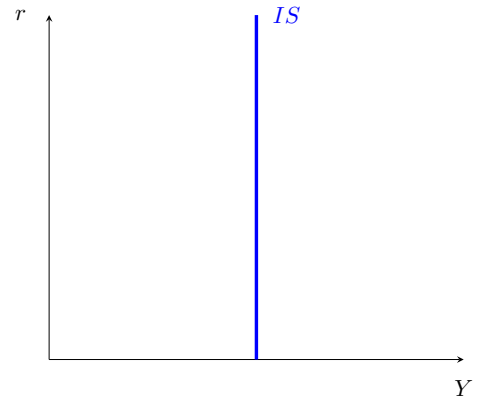(a) *IS* curve is vertical since changes in r will not induce changes in any kind of expenditure.

Figure 12: I independent of r

(b) *IS* curve is still downward sloping but steeper than the usual one. The reason is that $MPC = 0$ implies that investment multiplier equals to 1; therefore, when r increases, Y still decreases, but less than that when MPC is between 0 and 1.
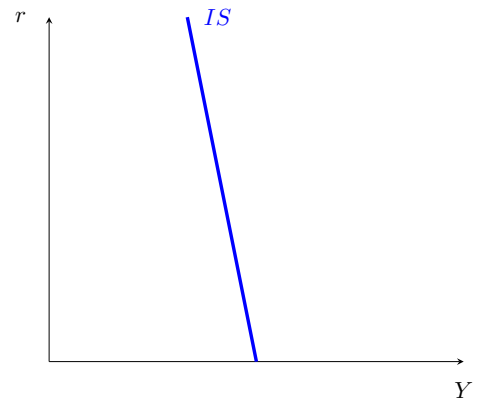

Figure 13: $MPC = 0$

(c) *LM* curve is vertical since there exists one unique Y satisfying the monetary equilibrium and r cannot affect the equilibrium.
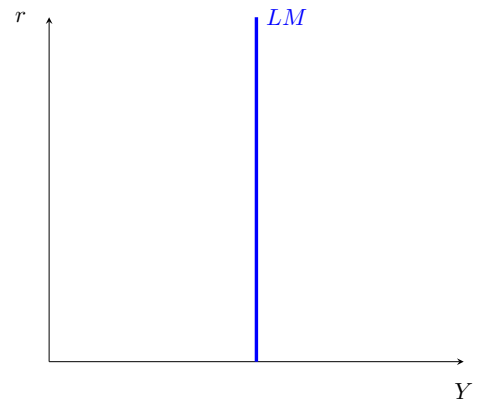

Figure 14: L independent of r

(d) *LM* curve is horizontal since there exists one unique r satisfying the monetary equilibrium and Y cannot affect the equilibrium.
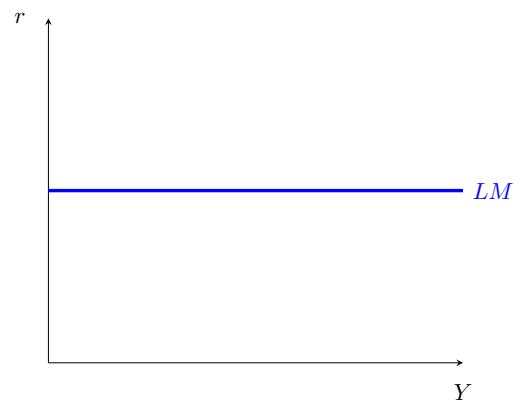

Figure 15: L independent of Y

(e) LM curve is still upward sloping but flatter than the usual LM curve. The reason is when money supply increases in r, the interest rate will not increase so much as the usual assumptions for any given increases in Y.
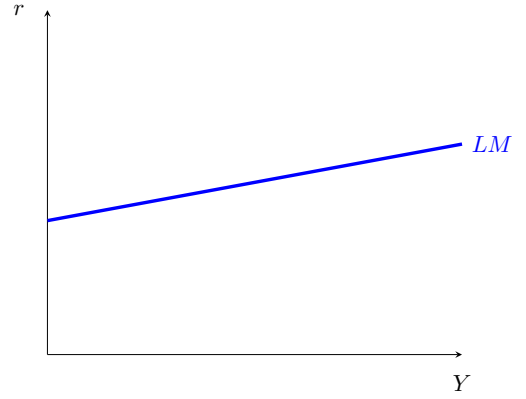

Figure 16: Money supply increases in r

5. (15pt) In 1980 China implemented the so-called "One-Child Policy", which reduced its population growth rate. Use the Solow diagram to illustrate the predicted effects of this policy. (Assume that China was initially in a steady state). According to the Solow model, what happens to the growth rate of output in steady state? What happens to the level of per capita income? Suppose that China's production function is $Y = K^{1/3}L^{2/3}$. Assume that initally the population growth rate was $n = 0.03$, and that the policy reduced it to $n = 0$. Finally, suppose that the depreciation rate is $\delta = 0.01$. Assuming that the only thing that changed was the population growth rate and there is no technological progress, calculate the predicted long-run effect on per capita incomes in China.

Suggested Solution

A reduced population growth rate reduces the slope of the breakeven investment line, $(n + \delta)k$. As a result, the steady state capital/labor ratio and per capita income level increase. However, the growth rate of the level of income drops from 3% to 0. This is depicted in Figure 17.
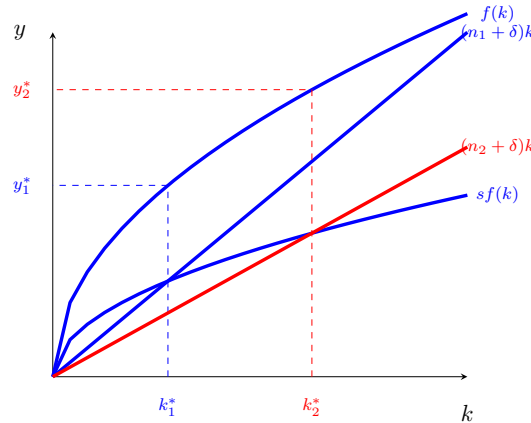

Figure 17: Solow Model

To calculate the steady-state increase in per capita income, use the following steady-state condition:

$$sy = sk^\alpha = (n + \delta)k$$

where in this case, $\alpha = 1/3$. This implies the following steady-state condition for per capita output,

$$y^* = \left(\frac{s}{n+\delta}\right)^{1/2}$$

Let y_1^* be initial steady-state per capita income, and let y_2^* be the new steady-state per capita income. We can get (since s stays the same)

$$\frac{y_2^*}{y_1^*} = \left(\frac{n_1 + 0.01}{n_2 + 0.01}\right)^{1/2} = \left(\frac{0.04}{0.01}\right)^{1/2} = 2$$

Hence, the Solow model predicts that per capita income will double.