

ECON 311 - Intermediate Macroeconomics (Professor Gordon)

Final Examination: Winter 2021

INSTRUCTIONS:

1. The exam lasts **2 hours**.
2. The exam is worth 100 points in total: 45 points for the multiple choice questions (Part A) and 55 points for the five analytical problems (Part B).
3. You must show your work for part B questions. There is no need to explain your answers for the multiple choice questions.
4. Round your answers to **2 decimal points**
5. Please place your answers for the multiple choice questions (Part A) in a **single page**. Don't submit your work for the multiple choice questions.

Good luck!

PART A: Multiple Choice Problems

Choose the one alternative that best completes the statement or answers the question.

- 1) In the Solow growth model, an increase in the marginal propensity to consume shifts the _____, with the implied change in the capital stock resulting in a _____ standard of living in the long run.
 - A) national saving line upward, lower
 - B) national saving line upward, higher
 - C) steady-state investment line upward, higher
 - D) steady-state investment line downward, higher
 - E) national saving line downward, lower

- 2) If disposable income increases by \$100 and saving increased by \$25, ceteris paribus, we may conclude that
 - A) the marginal propensity to consume is 0.25.
 - B) the marginal propensity to save is 0.25.
 - C) \$15 is autonomous consumption.
 - D) a change in disposable income is induced by a change in consumption.

- 3) "Okun's Law" is the _____ relation between the _____ and the difference between the actual unemployment rate and the average rate of unemployment.
 - A) negative; output ratio
 - B) implicit positive; output ratio
 - C) observed positive; price ratio
 - D) direct; output ratio

- 4) Each SP curve is drawn assuming
 - A) P^e and prices are rigid.
 - B) P^e and real wages are rigid.
 - C) P^e as embodied in wage contracts is "fixed."
 - D) None of the above.

- 5) In the neoclassical growth theory
 - A) large differences in the saving rate or population growth rate cause small variations in per capita income.
 - B) large differences in the saving rate or small differences in population growth cause large variations in per capita income.
 - C) small differences in the saving rate or population growth cause large variations in per capita income.
 - D) small differences in the saving rate or large differences in population growth cause large variations in per capita income.

- 6) The simplest calculation of the growth rate of multifactor productivity starts with the growth rate of real GDP and then
 - A) subtracts the growth rate of labor.
 - B) subtracts the growth rate of labor and some fraction of the growth rate of the capital-labor

ratio.

C) subtracts the growth rate of capital.

D) adds the growth rate of labor and then subtracts the depreciation and population growth rates.

7) The profits earned by Toyota in its factory in Kentucky _____ in U.S. GDP and _____ in U.S. GNP.

A) count, count

B) count, do not count

C) do not count, count

D) do not count, do not count

8) Which of the following regions converged to the U.S. level of per-capita income over the last three decades?

A) emerging Europe

B) sub-Saharan Africa

C) Latin America

D) Middle East and North Africa

9) The Okun's Law diagram as updated in lecture shows

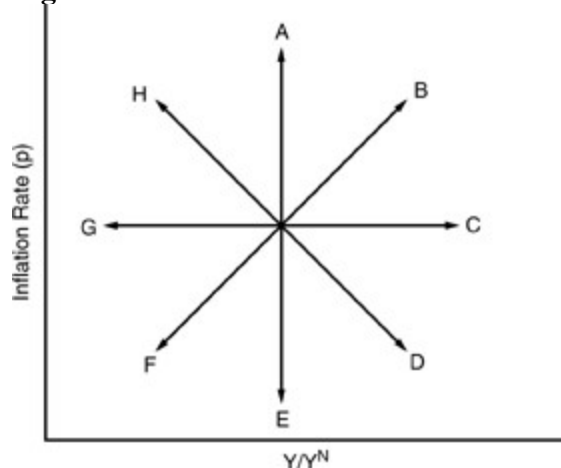
A) the output ratio was high in 1982-83 and the unemployment rate was low

B) the output ratio was low in 1999-2000 and the unemployment rate was high

C) the unemployment rate associated with a 100 percent output ratio was well above average in 2018-2019

D) the unemployment rate associated with a 100 percent output ratio was well below average in 2018-2019

Figure 1



10) In Figure 1 above, a beneficial supply shock accompanied by an accommodating policy takes us along path

A) A.

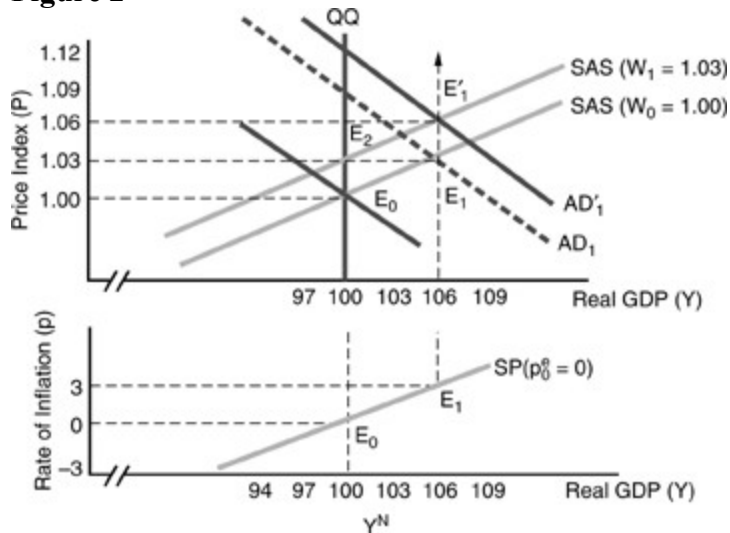
B) C.

C) D.

D) E.

- 11) The "crowding-out" effect refers to the fact that
- fiscal policy cannot be used to shift the IS curve.
 - rising interest rates tend to accompany an expansionary fiscal policy.
 - there may be a liquidity trap.
 - All of these.
- 12) Government debt places a burden on future generations if
- the debt is used to fund the current consumption of its citizens.
 - the debt is used to fund the production of investment goods.
 - the debt is used to fund schools and highways.
 - All of the above are correct.
- 13) The paradox of divergence rather than convergence of growth rates between rich and poor countries is resolved when the convergence diagram is adjusted to reflect
- real GDP levels
 - population levels
 - population growth
 - real GDP growth

Figure 2



14) In Figure 2 above, suppose that the economy traces the path E_0 to E_1 to E_1' . We might conclude that _____ fiscal or monetary policy shifted the AD curve with price expectation first _____ then _____.

- expansionary; revised upward; constant
- expansionary; constant; revised upward
- contractionary; revised upward; constant
- contractionary; constant; revised downward

15) Given that all countries have the same Cobb-Douglas production function, i.e. $Y/N = (K/N)^b$, where $b = 0.5$, then a ten-fold difference in per capita income requires a difference in capital per capita by a factor of

- 10.

- B) 100.
- C) 1000.
- D) 10,000.

16) If inflation is greater in Mexico by 10% than it is in the rest of the world then the purchasing power parity theory predicts that the

- A) Mexican peso would appreciate.
- B) Mexican peso would depreciate.
- C) Mexican peso would remain stable.
- D) U.S. dollar would weaken.

17) The article on India vs. China cited China's superiority by all of these criteria except

- A) literacy
- B) software development
- C) health care
- D) life expectancy

18) In the IS-LM Model, assuming downward sloping IS curve and upward sloping LM curve; increase in consumers' wealth is going to

- A) cause a movement along the IS curve.
- B) cause a rightward shift of the IS curve.
- C) cause a leftward shift of the LM curve.
- D) cause a rightward shift of the LM curve.

19) A lower interest rate _____ r_p and thus causes _____ the IS curve.

- A) raises, movement downward along
- B) lowers, movement upward along
- C) raises, a parallel rightward shift of
- D) lowers, a parallel leftward shift of

20) The most surprising outcome of the Solow growth model is that

- A) the capital-labor ratio has no effect on the output-labor ratio.
- B) the population growth rate has no effect on the standard of living.
- C) a higher rate of national saving does not lead to a permanently higher rate of output growth.
- D) a higher rate of depreciation lowers the capital-labor ratio, but not the output-labor ratio.

21) If the nominal interest rate on government bonds is equal to the growth rate of real GDP

- A) a primary surplus of zero causes the debt-GDP ratio to rise
- B) a negative primary surplus causes the debt-GDP ratio to shrink
- C) a positive primary surplus causes the debt-GDP ratio to shrink
- D) a positive primary surplus causes the debt-GDP ratio to rise

22) The theory of economic growth divides the causes of growth into

- A) affecting the output ratio and factors affecting inflation.
- B) elements affecting the output ratio and factors affecting population growth. elements
- C) elements affecting the amount of factor inputs available and the productivity of those inputs.
- D) None of the above.

23) After a period of sustained unexpected inflation, it is likely that the renegotiation of nominal wages will

- A) shift the SAS curve upward thereby decreasing output.
- B) shift the SAS curve upward thereby increasing output.
- C) shift the SAS curve downward thereby increasing output.
- D) shift the AD curve downward thereby increasing output.

24) The multiplier measures the

- A) number of steps it takes to move from one equilibrium to another.
- B) rise in saving resulting from a rise in income.
- C) marginal propensity to invest.
- D) rise in equilibrium GDP resulting from a one dollar rise in planned autonomous expenditures.

25) When a nation's national saving falls short of its domestic investment, it must be

- A) experiencing a government budget surplus.
- B) experiencing a government deficit.
- C) a net lender to foreign nations.
- D) a net borrower from foreign nations.

26) In the short-run, the impact of an adverse supply shock is to

- A) reduce real GDP and increase the inflation rate if the growth of nominal GDP remains the same.
- B) reduce real GDP and leave the inflation rate unchanged if the growth of nominal GDP is reduced enough.
- C) maintain the same level of real GDP and increase the inflation rate if the growth of nominal GDP is increase enough.
- D) All of the above

27) An outside reading article attributed low U.S. inflation in the past two decades to all of the following causes except

- A) monetary policy
- B) globalization
- C) automation
- D) weaker labor unions

28) A change in nominal GDP sums up changes in

- A) prices alone.
- B) physical production alone.
- C) physical production and hours of production time.
- D) physical production and prices

29) "Headwinds" cited by the lecture that tend to reduce growth in median U.S. output per capita include

- A) rising immigration
- B) rising population growth
- C) rising inequality

D) rising global temperatures

30) A nation's foreign trade deficit implies a buildup of what _____ in allowing its imports to _____ its exports.

- A) it owes to foreigners, fall short of
- B) it owes to foreigners, exceed
- C) foreigners owe to it, fall short of
- D) foreigners owe to it, exceed

31) If labor unions negotiate an increase in the nominal wage rate the SAS curve will shift

- A) upward to the right and output will increase.
- B) downward to the right and output will increase.
- C) downward to the left and output will decrease.
- D) upward to the left and output will decrease.

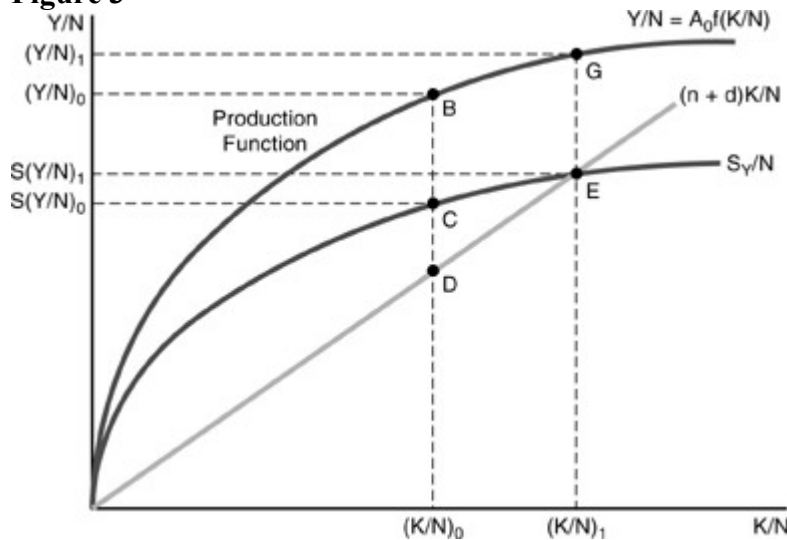
32) At every point to the right of the AD curve there is

- A) an excess demand for real balances.
- B) an excess supply of real balances.
- C) an excess demand for commodities.
- D) an excess supply of commodities.

33) Continuous inflation requires repeated _____ shifts of the SAS curve, accompanied by continuous _____ of price expectations.

- A) leftward; upward adjustments
- B) inward; downward adjustments
- C) rightward; downward adjustments
- D) None of the above, inflation is primarily a demand side phenomenon.

Figure 3



34) Initially, the economy is at point B in Figure 3 above. We may conclude that over time,
A) per person saving and investment will remain stable at points C and D respectively.
B) per person capital will grow, point D to E since per capita savings is less than investment,

point C is greater than point D.

C) per person capital will grow, point D to E since per capita savings exceed investment, point C is greater than point D.

D) per person saving and investment will remain stable at points D and C respectively.

35) Risk Premium refers to

A) the average difference over a long period of the interest rate on long-term bonds and the interest rate on the short-term federal funds rate.

B) the average difference over a long period of the interest rate on short-term financial instruments and the interest rate on the discount rates.

C) the difference between the corporate bond rate and the risk-free rate of Treasury bonds.

D) the difference between prime rate and the discount rate.

36) The fiscal stimulus introduced into the U.S. economy in March, 2020, was

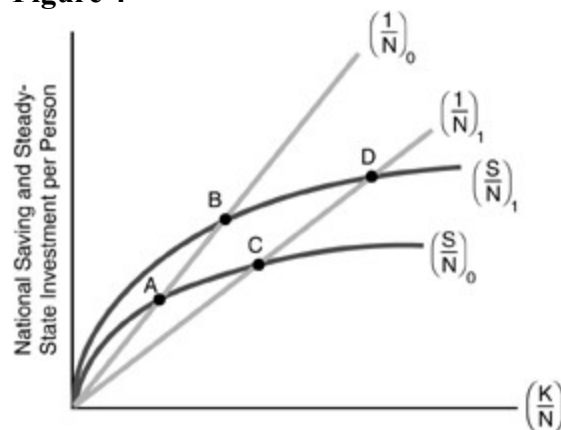
A) ineffective because of the crowding out effect

B) ineffective because all of the stimulus went into saving rather than consumption

C) effective in raising personal income above pre-pandemic levels

D) effective in raising personal consumption expenditures above pre-pandemic levels

Figure 4



37) In Figure 4 above, suppose that the level of government expenditures increases. This causes a movement of the steady-state point such as from points

A) A to B.

B) A to C.

C) A to D.

D) D to B.

E) D to C.

38) From an initial situation where $P = 1.00$ and $Y = 100$, 6 percent nominal GDP growth that causes P to go to 1.10 also causes Y to go to

A) 116.

B) 96.

C) 104.

D) 94.

39) Suppose that we interpret N as the "effective" labor supply. A "labor-augmenting"

technological improvement, when graphed in the Solow growth model, causes (Y/N) to _____ and real GDP per person to _____.

- A) rise, rise
- B) rise, fall
- C) fall, fall
- D) fall, rise
- E) fall, remain unchanged

40) The invention of the mainframe computer was part of the

- A) first industrial revolution
- B) second industrial revolution
- C) third industrial revolution
- D) fourth industrial revolution

41) The lectures on growth used satellite images to illustrate the difference in output between _____ and between _____.

- A) North and South Korea; eastern and western U.S.
- B) Philippines and South Korea; North and South Korea
- C) Philippines and South Korea; eastern and western U.S.
- D) East and West Germany; North and South Korea

42) When the actual inflation rate is equal to the expected inflation rate the economy will be _____ and the SP curve will _____.

- A) in long-run equilibrium; shift upward
- B) in short-run equilibrium; shift
- C) upward in disequilibrium, at an output level less than the natural rate of output; shift upward
- D) in short- and long-run equilibrium; be stable

43) Our business cycle experiences suggest that a macroeconomic policy designed to lower the average rate of inflation will require _____ in actual real GDP and an accompanying _____ in the unemployment rate.

- A) an increase, increase
- B) an increase, decrease
- C) a reduction, increase
- D) a reduction, decrease

44) The introduction of human capital to the Solow neoclassical growth model _____ the predicted rate of return on investment in rich countries relative to poor countries.

- A) reduces
- B) increases
- C) may either increase or reduce
- D) has no effect on

45) Suppose we are initially at a long-run SP/LP equilibrium with $x = p = p_e = 4$. Then an adverse supply shock adds 3 percentage points to the inflation necessary to produce each level of output. An "accommodating" policy response _____ the level of nominal GDP growth so that inflation is _____ percent while (Y/YN) _____.

- A) lowers, 7, remains at 100
- B) lowers, 4, falls
- C) holds constant, 4, falls
- D) raises, 7, remains at 100
- E) raises, 4, remains at 100

Multiple Choice Questions Solution

1. E
2. B
3. A
4. C
5. A
6. B
7. B
8. A
9. D
10. D
11. B
12. A
13. B
14. B
15. B
16. B
17. B
18. B
19. A
20. C
21. C
22. C
23. A
24. D
25. D
26. D
27. A
28. D
29. C
30. B
31. D
32. D
33. A
34. C
35. C
36. C
37. E
38. B
39. D
40. C
41. A
42. D
43. C
44. B
45. D

QUESTION 1: SP-DG Model (15 points):

Suppose that the following equations describe an economy currently at long-run equilibrium:

$$\begin{aligned} p_t &= p_t^e + 0.25 \cdot \widehat{Y}_t + z_t \\ p_t^e &= 0.6 \cdot p_{t-1}^e + 0.4 \cdot p_{t-1} \\ \widehat{Y}_0 &= 0, \widehat{x}_0 = 4, p_0^e = 4, p_0 = 4, z_0 = 0. \end{aligned}$$

- (a) Write down the SP and DG equations using the information above. Substitute the DG equation into the numerical SP equation and solve for p_t as a function of $p_{t-1}, p_{t-1}^e, \widehat{Y}_{t-1}, \widehat{x}_t$, and z_t . (3 points)

| | |
|-------|---|
| SP | $p_t = 0.6 \cdot p_{t-1}^e + 0.4 \cdot p_{t-1} + 0.25 \cdot \widehat{Y}_t + z_t$ |
| DG | $\widehat{Y}_t = \widehat{Y}_{t-1} + \widehat{x} - p_t$ |
| p_t | $p_t = 0.8 * (0.6 \cdot p_{t-1}^e + 0.4 \cdot p_{t-1} + 0.25 \cdot (\widehat{Y}_{t-1} + \widehat{x}) + z_t) =$ $0.48 \cdot p_{t-1}^e + 0.32 \cdot p_{t-1} + 0.2 \cdot (\widehat{Y}_{t-1} + \widehat{x}) + 0.8z_t$ |

(b) Starting in the long-run equilibrium described above in period 0, assume that in period $t=1$ we observe a temporary shock to z_t . In particular, $z_1 = 1$, $z_2 = 0$. Fill in the following table assuming that the central bank is following an **accommodating policy**. (2 points)

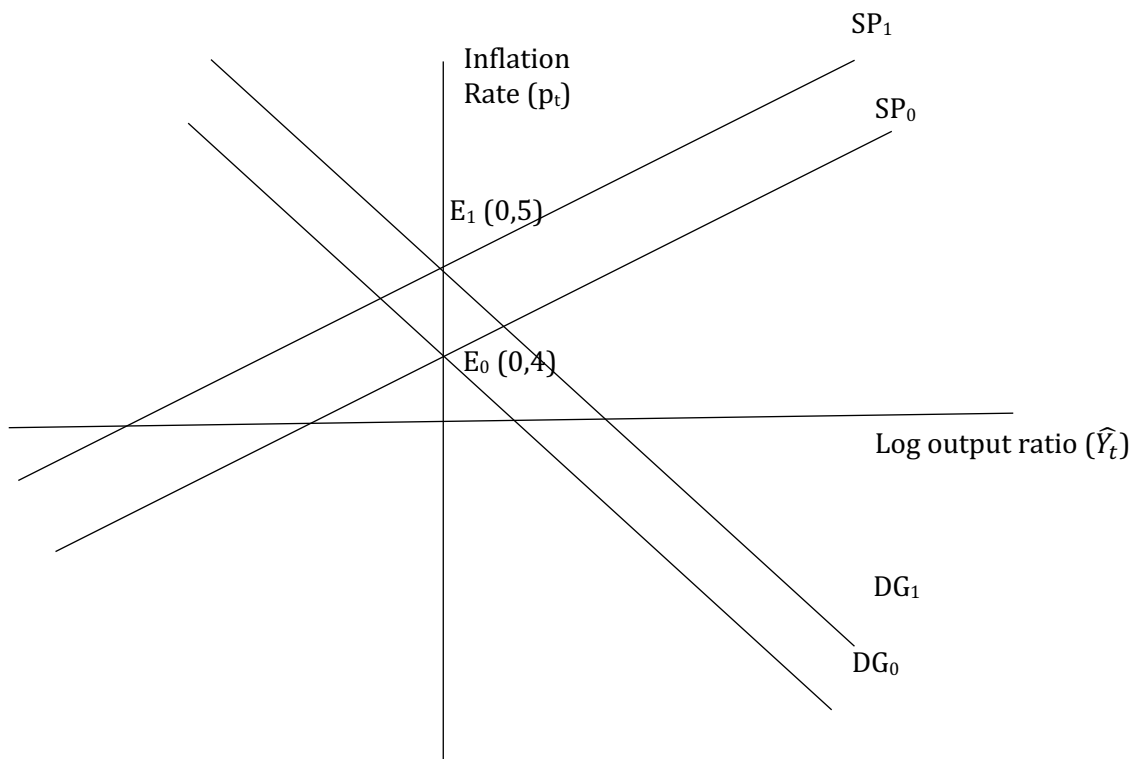
Plot period 1 SP and DG curves on the graph below, which illustrates period 0 economy with initial equilibrium at the point E. Indicate new equilibrium. (2 points)

| t | p_t^e | \hat{Y}_t | \hat{x}_t | p_t | z_t |
|-----|---------|-------------|-------------|-------|-------|
| 0 | 4 | 0 | 4 | 4 | 0 |
| 1 | 4 | 0 | 5 | 5 | 1 |

Accommodating policy: Y_t is constant. Hence,

$$\hat{x}_t = p_t$$

Simplify equation for the inflation and find p_t , then solve for output gap. For the graph, SP moves up by 1, DG up by 3, s.t. new equilibrium at the same output and higher inflation.

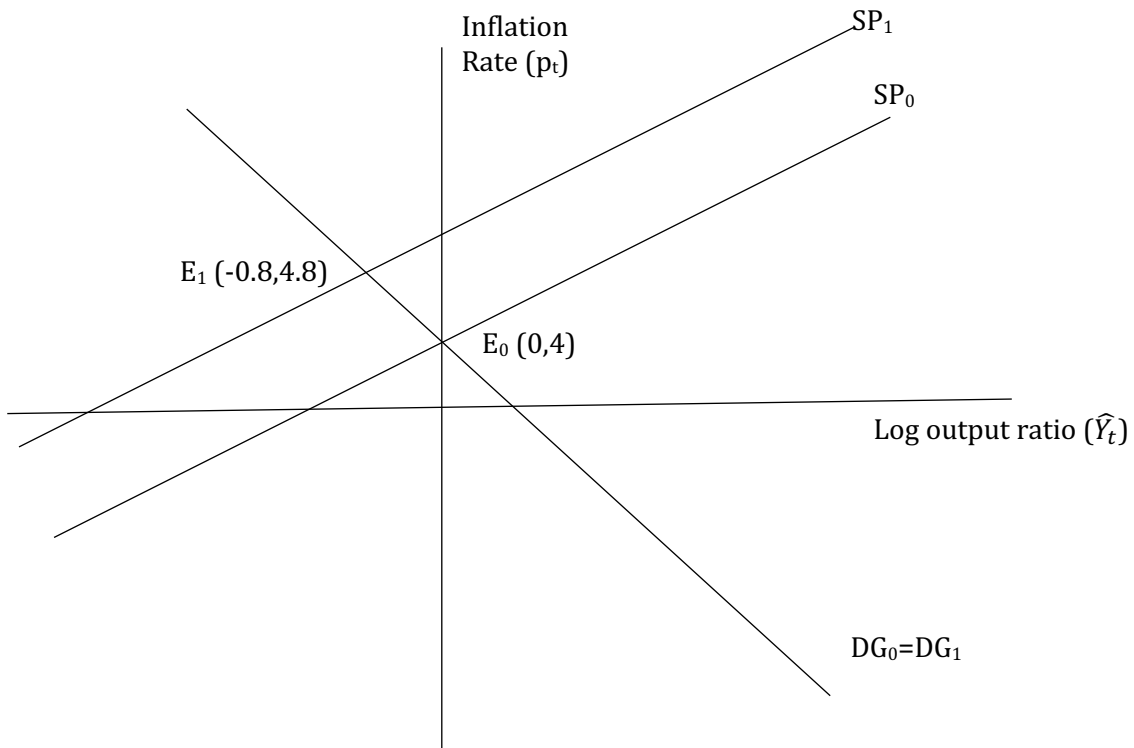


(c) Using the setting from part (b) but now assuming that the central bank is following a **neutral policy** fill in the following table assuming. (2 points)

Plot period 1 SP and DG curves on the graph below, which illustrates period 0 economy with initial equilibrium at the point E. Indicate new equilibrium. (2 points)

| t | p_t^e | \hat{Y}_t | \hat{x}_t | p_t | z_t |
|-----|----------|-------------|-------------|------------|-------|
| 0 | 4 | 0 | 4 | 4 | 0 |
| 1 | 4 | -0.8 | 4 | 4.8 | 1 |

Neutral policy: \hat{x}_t is constant. Solve for the inflation (everything is known now), then for Output gap
 For the graph, SP moves up by 1, DG doesn't move s.t. new equilibrium at lower output and higher inflation.



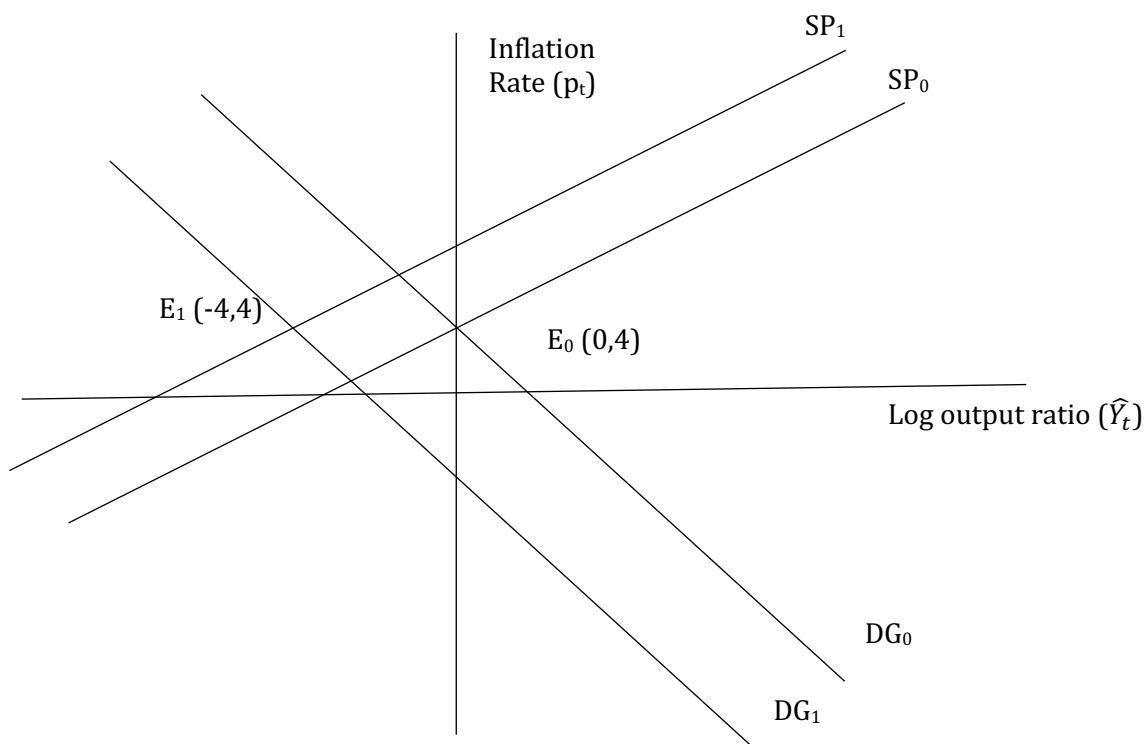
(d) Using the setting from part (b) but now assuming that the central bank is following an **extinguishing policy** fill in the following table assuming. (2 points)

Plot period 1 SP and DG curves on the graph below, which illustrates period 0 economy with initial equilibrium at the point E. Indicate new equilibrium. (2 points)

| t | p_t^e | \hat{Y}_t | \hat{x}_t | p_t | z_t |
|-----|---------|-------------|-------------|-------|-------|
| 0 | 4 | 0 | 4 | 4 | 0 |
| 1 | 4 | -4 | 0 | 4 | 1 |

Extinguishing policy: p_t is constant and equal to expectations. Simplify inflation equation to express x_t in terms of known variables, solve for x_t and then find output gap.

For the graph, SP moves up by 1, DG moves down by 4 s.t. new equilibrium at much lower output, but the same inflation.



QUESTION 2: Growth Rates (10 points)

The following table summarizes nominal GDP and the GDP growth rate for two countries A and B in 2020:

| | GDP | GDP growth rate (annual) |
|-----------|------|--------------------------|
| Country A | 1500 | 1% |
| Country B | 1000 | 1.5% |

(a) If both countries continue to grow at the same rate, which country will first reach a GDP level of at least 3000? (3 points)

To reach a level of 3000, country A has to double its GDP while country B has to triple the GDP.
Doubling time
country A: $\ln 2 / 0.01 = 69.3$ years
Tripling time country
B: $\ln 3 / 0.0015 = 73.2$ years \rightarrow Country A

(b) Now in addition to the data from part (a) assume that real GDP in country A in 2020 using 2015 as base year was 1250. Using the GDP Deflator, what was the average annual inflation rate between 2015 and 2020 in Country A? (3 Points)

GDP Deflator in 2020: $1500/1250 = 1.2$
Inflation rate
between 2015 and 2020: $\ln(1.2/1) = 0.182 = 18.2\%$
Annualized growth rate = $18.2\%/5 = 3.64\%$

(c) In addition, you know that nominal GDP in 2015 for country A was 800. Using all available information, calculate the average annual growth rate of real GDP of country A between 2015 and 2020. (2 Points)

Annual Growth rate of real GDP = $100 * \ln(1250/800)/5 = 8.93\%$

(d) Finally, assume that economy of country A will grow at the annual rate of 1 percent starting from the year 2021 and onwards. How long will it take for country A to reach nominal GDP of 2000? (2 Points)

Years = $100 * \ln(2000/1500)/1 = 28.77$ Years

QUESTION 3: Government deficits (7 points)

Consider an economy described as follows:

$$C = C_a + c(Y - T) = 300 + 0.8(Y - T)$$

$$T = T_a + t^*Y = 200 + 0.25Y$$

$$NX = NX_a - n_x^*Y = 100 - 0.1Y$$

$$I_p = 200, G = 300.$$

(a) Assume that the economy as described above is at natural GDP. What is the value of the structural government deficit/surplus? (3 points)

$$A_p = 300 - 0.8(200) + 200 + 300 + 100 = 900 - 160 = 740$$

$$k = 1 / (0.2(1 - 0.25) + 0.25 + 0.1) = 2$$

$$Y = K^*A_p = 1480$$

$$T = 200 + 0.25 * 1480 = 570$$

$$T - G = 570 - 300 = 270$$

(b) Suppose that I_p temporarily increases to 300 and we are no longer at natural GDP. What is the value of the actual deficit? (2 points)

$$A_p = 840$$

$$Y = K^*A_p = 1680$$

$$T = 200 + 0.25 * 1680 = 620$$

$$T - G = 620 - 300 = 320$$

(c) Suppose that monetary policy is used to bring A_p back to the initial value. What is the new value of actual deficit? (2 points)

Same as part A) 270

QUESTION 4: Open IS-LM model (10 points):

Let the following represent the structure of a **small open economy** with **perfect capital mobility**. Suppose the economy starts with a **flexible exchange rate** regime.

$$\begin{aligned}C &= C_a + 0.75(Y-T), \\C_a &= 150, T = 60 + 0.2Y, \\G &= 50, \\I_p &= 100 - 5r, \\NX &= 80 - 0.1Y - 5e, \\(M/P)^d &= 0.3Y - 6r, \\M^s/P &= 150.\end{aligned}$$

(a) Assume that initially foreign and domestic interest rates are equal so that $r = r^f$ and let the foreign exchange rate $e=2$. Find the IS and LM equations. (3 points)

$$\begin{aligned}k &= 1/0.25 * (1 - 0.2) + 0.2 + 0.1 = 1/0.5 = 2 \\A_p &= 150 - 0.75 * 60 + 50 + 100 - 5 * r + 80 - 5 * e = 325 - 5r \\IS: Y &= 2 * (325 - 5r) = 650 - 10r \\LM: 150 &= 0.3Y - 6r \rightarrow Y = 500 + 20r\end{aligned}$$

(b) Find the equilibrium income, interest rate and net exports. (2 points)

$$\begin{aligned}500 + 20r &= 650 - 10r \\ \rightarrow 30r &= 150 \\ \rightarrow r &= 5; Y = 600 \\ NX &= 80 - 0.1 * 600 - 5 * 2 = 10\end{aligned}$$

(c) Suppose government expenditure suddenly goes up from 50 to 70.

(c1) Write down the new IS curve, after the shift in autonomous consumption. Keep in mind that this is a small open economy with **perfect capital mobility** and **flexible exchange rates**. *Hint: Express both A_p and Y in terms of r and e ; don't solve for e* (2 points)

$$A_p = 150 - 0.75 \cdot 60 + 70 + 100 - 5 \cdot r + 80 - 5 \cdot e = 355 - 5r - 5e$$
$$\text{New "IS": } Y = k \cdot A_p = 710 - 10e - 10r$$

(c2) Use the new IS curve and the LM curve to calculate the new output and exchange rate.
Hint: because this is an open economy with perfect capital mobility, the interest rate does not change from what you calculated in part (b). Use the LM curve to calculate real GDP and from this calculate the new value of the exchange rate. (3 points)

$$\text{LM: } Y = 500 + 20r \rightarrow r=5, Y=600$$
$$\text{"IS": } Y = 710 - 10e - 10r = 660 - 10e = 600$$
$$10e = 60 \rightarrow e = 6$$

QUESTION 5: Solow model (13 points):

Consider two countries **Poorland** and **Richland** (we will call them **P** and **R**, respectively). Both countries have the same Cobb-Douglas production function given by $Y = AK^bN^{1-b}$, with $b = \frac{1}{3}$.

a) Suppose that the real GDP per person in **R** is 5 times that of **P** and that $A = 1$. What is the ratio of capital per capita of country **R** to the capital per capita of country **P**? (4 points)

Hint: you can normalize the real GDP per person of country P to 1

Note that: $\frac{K}{N} = \left(\frac{Y}{AN}\right)^{1/b} = \frac{1^{1/b}}{A} \left(\frac{Y}{N}\right)^{1/b}$

For P define $\frac{Y_P}{N_P} = 1$, **we have:** $\frac{K_P}{N_P} = \frac{1^{1/b}}{A} = \left(\frac{1}{A}\right)^3$

For R we have: $\frac{K_R}{N_R} = \frac{1^{1/b}}{A} 5^{1/b} = \frac{1^3}{A} 5^3$

Thus, $\frac{\frac{K_R}{N_R}}{\frac{K_P}{N_P}} = 5^3 = 125$

b) Suppose that the real GDP per person in **R** is 5 times that of **P** and that $A = 1$. Find the ratio of the marginal product of capital of **R** to the marginal product of capital of **P**. (4 points)

Hint: the marginal product of capital is the derivative of the production function with respect to capital.

We have $MPK = \frac{dY}{dK} = Ab \left(\frac{K}{N}\right)^{-(1-b)} = \frac{A}{3} \left(\frac{K}{N}\right)^{-\frac{2}{3}}$

For P we have: $MPK_P = \frac{A}{3} \left(\frac{1}{A}\right)^{-2} = \frac{A^3}{3}$

For R we have: $MPK_R = \frac{A}{3} \left(\frac{1}{A}\right)^{-2} (5^3)^{-\frac{2}{3}} = \frac{A^3}{3} 5^{-2} = \frac{A^3}{3} 0.04$

Thus, $\frac{MPK_R}{MPK_P} = 0.04$

c) Suppose the population growth rate is 0.1, the depreciation rate of capital is 0.1 and $A = 1$ in both countries. Assume that in **P** the savings rate is $s_P = 0.2$ and in **R** it is $s_R = 0.4$. Find the steady state values of capital per capita in both countries. (3 points)

We have that $\frac{K}{N} = \left(\frac{sA}{n+d}\right)^{3/2} = \left(\frac{s}{0.2}\right)^{3/2}$

Then in P we have $\frac{K}{N} = 1$

In R we have $\frac{K}{N} = 2^{3/2} = 2.83$

d) Using the information in c), find the steady state values of output per capita in both countries. (2 points)

We have that $\frac{Y}{N} = A \left(\frac{K}{N}\right)^{1/3}$

Then in P we have $\frac{Y}{N} = 1$

In R we have $\frac{Y}{N} = \left(2^{3/2}\right)^{1/3} = 2^{1/2} = 1.41$