

BSc in International Business and Politics
Copenhagen Business School

Macroeconomics
Final exam - retake

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Exercise 1 – Fiscal policy in the IS-LM model

- a) Read the text by economist Alan Manning “Monetary financing: why the government should not be worrying about the deficit”. This article talks about the British government’s response to the Covid-19 crisis. Summarize in your own words Manning’s arguments for why the British government is making a mistake in not spending more money (max. 3 sentences).

Alan Manning believes that the British government is under-stimulating their economy in this crisis, because they too narrowly focus on debt financing stimulus, while ignoring the possibility of monetizing deficits. This failure to increase spending, stimulus and deficit through “printing money” will cause the pandemic and the lockdown to have a worse economic and health outcome than needed to.

- b) Manning writes in paragraph 3, “if a government pays for a deficit by printing money in a situation where demand is running ahead of supply, it leads to inflation [...]” Evaluate this statement. Do you agree/disagree with the mechanism he describes? Do you see any flaws in his argument?

If the government increases money printing, this would all else equal decrease the real interest rate, shifting the LM curve downwards. This would mean that we would move upwards of the Phillip’s curve and increase the inflation rate, just as Manning states. However, if we are in a situation where the pandemic has hit hard and lowered consumption. The IS curve might have shifted leftwards and the inflation rate could be below target inflation. This would mean that the increase in inflation is welcome and could work as a “free” source of stimulus.

c) Consider a model economy which is characterized by the following equations

$$C = 13 + 0.2(Y - T)$$

$$I = 15 + 0.3Y - 1000i$$

and you know that the fiscal multiplier is 2, equilibrium output is 100, $G = T = 50$. Public debt is 0. Derive the nominal interest rate. Full derivation of the goods market equilibrium is required.

We start by stating the goods market equilibrium condition and derive an expression where the nominal interest rate can be found

$$Y = C + I + G$$

$$Y = 13 + 0,2(Y - T) + 15 + 0,3Y - 1000i + G$$

$$Y = 13 + 0,2Y - 0,2T + 15 + 0,3Y - 1000i + G$$

$$Y - 0,2Y - 0,3Y = 13 + 15 - 0,2T - 1000i + G$$

$$0,5Y = 28 - 0,2T - 1000i + G$$

$$Y = 56 - 0,4T - 2000i + 2G$$

We insert the values given

$$100 = 56 - 0,4 \cdot 50 - 2000i + 2 \cdot 50$$

$$2000i = 36$$

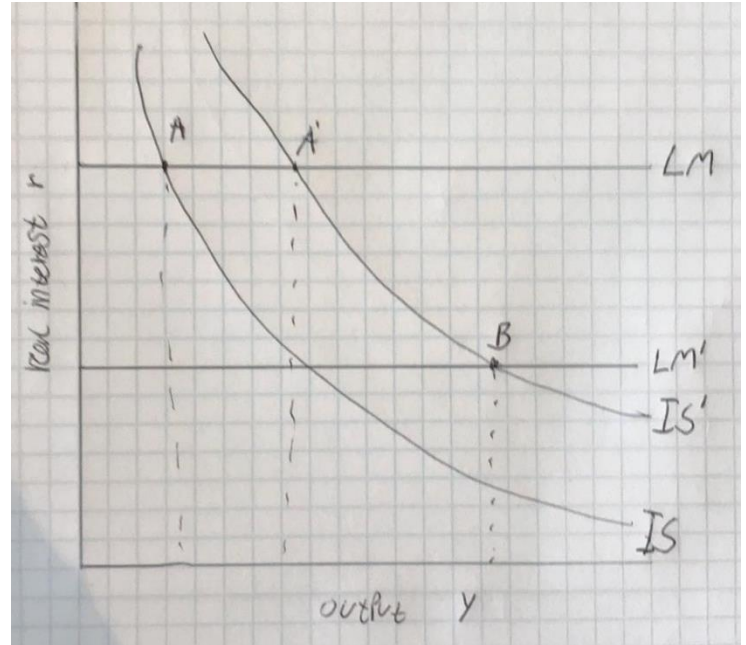
$$i = 0,018 = 1,8\%$$

- d) Following Manning's suggestion, two measures are taken to boost the economy: government spending is increased to 60 and the nominal interest rate is decreased to 0.08%. Derive the new equilibrium output. Show the effect of the policies in an IS-LM diagram.

The new equilibrium output with increased government spending and lowered nominal interest rate is given by the following formula

$$Y = 56 - 0,4 \cdot 50 - 2000 \cdot 0,0008 + 2 \cdot 60 = 154,4$$

The equilibrium output increases from 100 to 154,4. This is seen in our IS-LM model to the right. Here, the increase in government spending G , shifts the IS curve rightwards to the IS' curve. The decrease in the nominal interest rate, decreases the real interest rate and shifts the LM curve downwards to the LM' curve. Creating equilibrium output B instead of A.



- e) If you want to achieve the same level of output only by increasing government expenditure, how large will the primary deficit need to be? What is the debt-to-GDP ratio after the policy?

To calculate the level of government spending needed to achieve an output of 154,4 while keeping the real interest rate at 1,8% we use the following formulas:

$$Y = 56 - 0,4T - 2000i + 2G$$

$$154,4 = 56 - 0,4 \cdot 50 - 2000 \cdot 0,018 + 2G$$

$$154,4 - 56 + 20 + 36 = 2G$$

$$154,4 = 2G$$

$$77,2 = G$$

The primary deficit would need to be $50 - 77,2 \approx -27,2$

The initial debt was 0, and the new primary deficit is 27,2, with an output of 154,4, so the debt to GDP ratio must be

$$\frac{27,2}{154,4} \approx 0,17617 = 17,6\%$$

- f) To keep things simple, assume that inflation is zero (which is admittedly not very realistic). If the economy grows at a rate of 3% year, the government follows the policies of e) during the pandemic and the country runs a balanced budget in the future, what will be the debt-to-GDP ratio in the next year?

The next years debt to GDP ratio can be calculated as follows:

First we calculate the actual debt to be paid in period 2, which is the primary deficit from period 1, plus an interest

$$B_t = (1 + r)B_{t-1} + G_t - T_t$$

Since the government runs a balanced budget in period t $G_t - T_t = 0$

$$B_t = (1 + 0,018)27,2 \approx 27,69$$

Now we can calculate the debt to GDP ratio in period 2

$$\frac{B_t}{Y_t} = (1 + r - g) \frac{B_{t-1}}{Y_{t-1}} + \frac{G_t - T_t}{Y_t}$$

$$\frac{B_t}{Y_t} = (1 + 0,018 - 0,06) \frac{27,2}{154,4} + 0 \approx 0,16877$$

The debt to GDP ratio in period 2 is 16,9%

- g) Based on your answers in the previous parts of this exercise, provide one argument for and one argument against monetary financing. As an advisor to the British government, would you recommend the policy?

Through question e and f we can see that debt financed economic stimulus through increased government spending works great to increase the output from 100 to 154,4 and as the economy grew 3% and had an interest rate of 1,8% the deb to GDP ratio actually decreased, therefore there seems to be no need to risk out of control inflation from monetary financing.

On the other hand, the assumption of 0% inflation and 3% stabile economic growth can seem a bit far fetched in an economy hit by the covid-19 crisis. So as more realistically the economy would not grow, the increased debt, would be multiplied with the interest, resulting in a higher debt to GDP ratio, to be paid back by future generations. Therefore, it would be smarter to utilize monetary financing, consequently not having to establish even more debt, but still stimulating the economy.

Exercise 2 – IS-LM-PC model

In the US, markets have become more and more concentrated over the last decades, which is why competition authorities are currently discussing a new antitrust law. In this exercise, we will study the potential consequences.

a) Suppose that the markup in the US economy is initially 6%. Using the standard price-setting and wage-setting equations, derive the real wage and the natural level of unemployment. From the price setting equation, we can compute the real wage in this economy

$$\frac{W}{P} = \frac{1}{1 + m}$$

$$\frac{W}{P} = \frac{1}{1 + 0,06} \approx 0,943$$

The natural unemployment rate is where the real wage set by the price setting equation equals the real wage from the wage setting equation. The wage setting equation is generally given as

$$\frac{W}{P} = F(u, z)$$

(-,+)

Since the exercise gives us, no specific wage setting equation to calculate the natural rate of unemployment, it is assumed that the wage setting equation is $W = P(1 - u)$

$$\frac{W}{P} = 1 - u$$

$$0,943 = 1 - u$$

$$u = 0,057$$

$$u_n = 5,7\%$$

b) What happens to the natural rate of unemployment when markups decrease to 4%? Explain the logic behind your answer and show the effect of the policy graphically.

When the mark-up decreases the real wage increases

$$\frac{W}{P} = \frac{1}{1 + 0,04} \approx 0,962$$

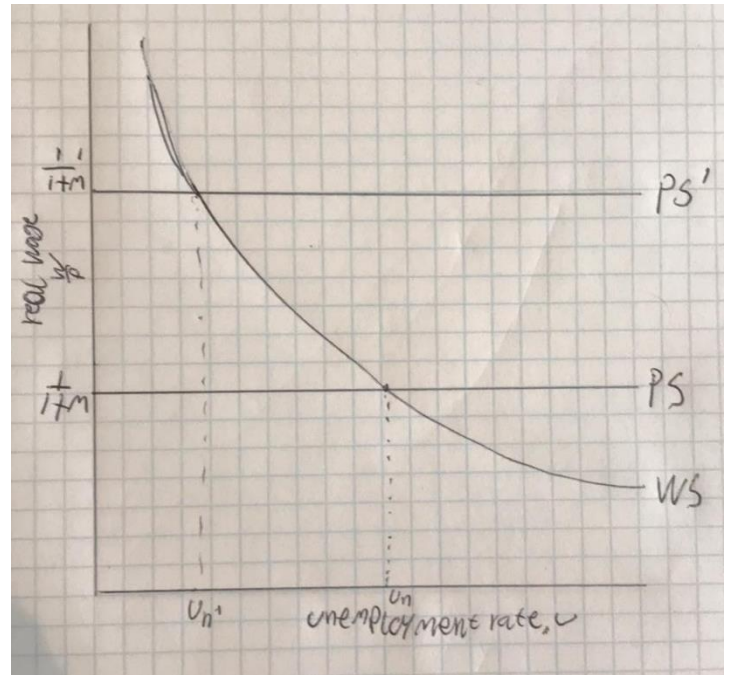
$$0,962 = 1 - u$$

$$u = 0,038$$

$$u_n = 3,8\%$$

And the unemployment decreases to 3,8%.

The logic behind this effect is that as a decrease in m , has reduced prices, the real wages for a given level of unemployment is now higher, the PS curve shift upwards from PS to PS'. Because firms now are paying a higher real wage, the real wage would rise above some unemployed's reservation wage, and more workers would want to work and the unemployment decreases, which increases the workers bargaining power, and result to higher real wages. This is shown in the graph to the right.

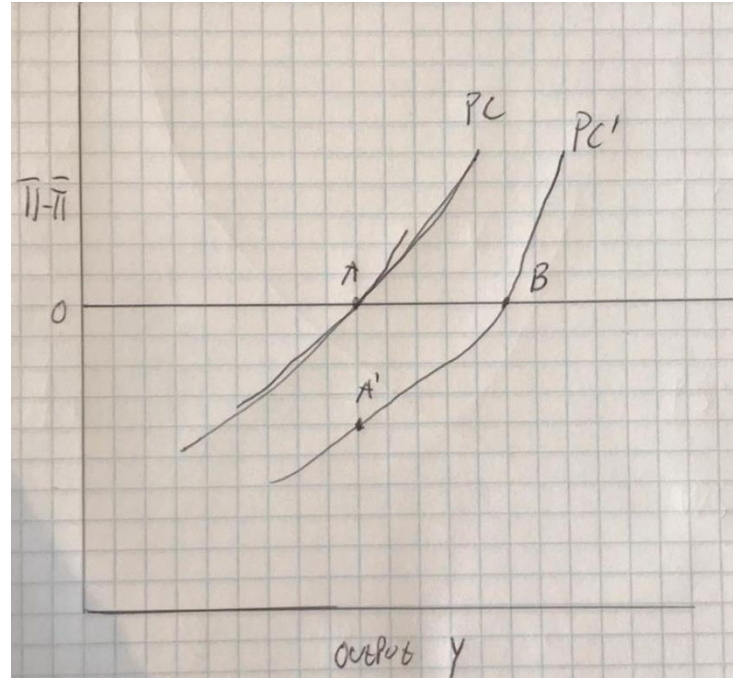


c) Show the effect of the decrease in markups on the Phillips curve. Describe in words.

The decrease in the markup m , shifts the PC curve to the right because at this new lower natural level of unemployment we have a higher level of natural output.

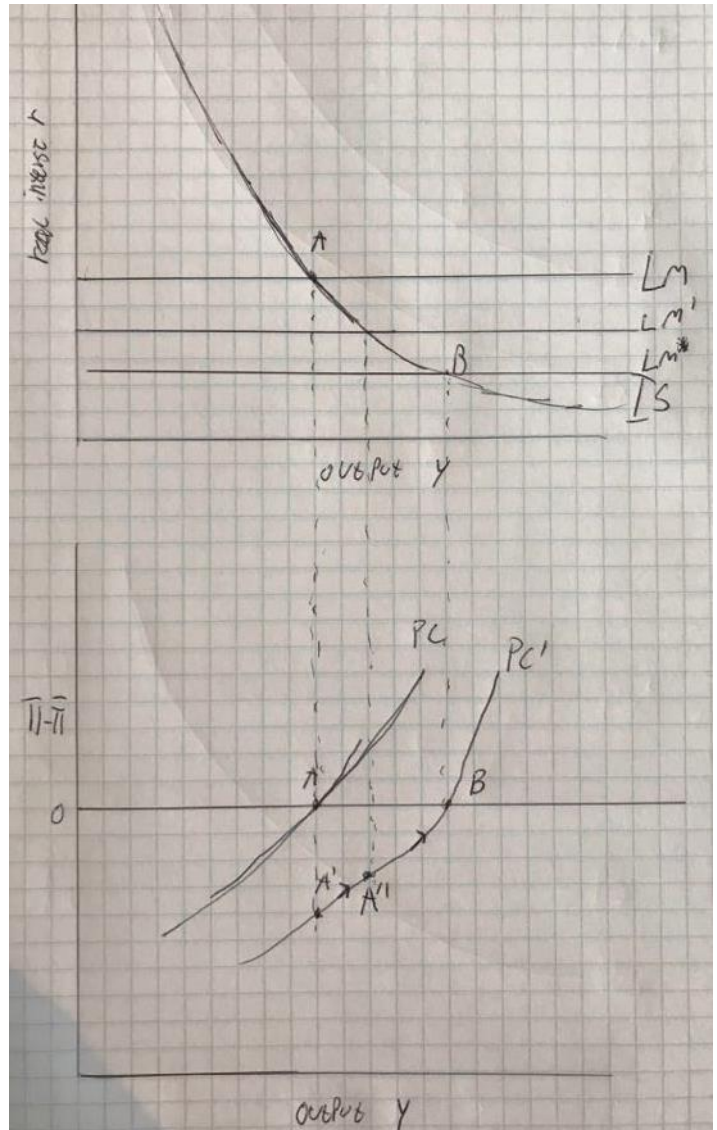
$$\pi - \bar{\pi} = -\frac{\alpha}{L}(Y - Y_n)$$

As the natural level of output has increased, then for a given level of Y , this would lead to a decrease in $\pi - \bar{\pi}$. This shift rightwards of the PC to the PC' is seen in the graph to the right,



d) In reality, the natural rate of unemployment cannot be directly calculated but needs to be estimated. Assume that the central bank underestimates the effect, i.e. it thinks that the change in the natural rate of unemployment is less pronounced than in reality. Therefore, its response is too weak. Show the effect of the wrong policy response in an IS-LM-PC diagram. Explain what happens to output, the real interest rate and inflation.

If the central bank underestimates the effect, they will reduce the real interest rate too little, meaning that they shift the LM curve downwards, but not enough. This is seen in the graph from the LM to the LM' curve. We see that this indeed does move inflation closer to target inflation, as we move from A' in the PC diagram to A''. However we do not get fully back to target inflation at B. This would require the central bank to lower the real interest rate down to LM*. But as they underestimated the effect, they will not do so immediately. The underestimation of the central bank will entice a lower level of output at point A'' than at B, the real interest rate will be higher than optimal and the inflation rate will be below target, at A'' is below the 0 line.



- e) If the central bank does not realize its mistake and keeps on pursuing the policy described in
- d), would people adjust their inflation expectations?

Yes, if the central bank for long enough time does not correct its mistakes, the inflation rate will become de-anchored and people will start forming expectations based on previous years inflation instead of the goal set by the central bank.

Exercise 3 – Solow model with technological progress An economy is characterized by

the following per-capita production function: $f(K) = AK^{\frac{1}{4}}$. The

savings rate in the economy is $s = 0.3$, the depreciation rate is $\delta = 0.13$ and the rate of technological progress is $g_A = 0.02$

- a) Derive the expression for capital per effective worker along the balanced growth path. Calculate the balanced growth values of capital, output and consumption per effective worker.

First, we state the balanced growth state equation with technology

$$\frac{K}{AN} = (\delta + g_A) \frac{K \cdot sf(\frac{K}{AN})}{AN}$$

We insert our production per capita function

$$\frac{K}{AN} = (\delta + g_A) \frac{K^{\frac{1}{4}} \cdot s}{AN}$$

Then we solve for balanced growth capital per effective worker.

$$\frac{s}{\delta + g_A} = \left(\frac{K}{AN}\right)^{\frac{4}{4}} \cdot \left(\frac{K}{AN}\right)^{-4} \quad 1$$

$$\frac{s}{\delta + g_A} = \left(\frac{K}{AN}\right)^{\frac{3}{4}}$$

$$\left(\frac{s}{\delta + g_A}\right)^{\frac{4}{3}} = \frac{K^*}{AN}$$

The value of balanced growth capital per effective worker is

$$\frac{K^*}{AN} = \left(\frac{s}{\delta + g_A}\right)^{\frac{4}{3}}$$

$$\frac{K^*}{AN} = \left(\frac{0,3}{0,13 + 0,02}\right)^{\frac{4}{3}} \approx 2,52$$

The value of balanced growth output per effective worker is:

$$f\left(\frac{K}{AN}\right) = \left(\frac{K}{AN}\right)^{\frac{1}{4}}$$

$$f\left(\frac{K^*}{AN}\right) = \frac{Y}{AN} = (2,52)^{\frac{1}{4}} \approx 1,26$$

$$AN \quad AN$$

The value of balanced growth consumption per effective worker is:

$$\frac{C^*}{AN} = (1 - 0,3) \cdot 1,26 \approx 0,882$$

- b) Assume that in the current year, the level of technology is $A = 2$. What is the level of technology in the next year?

$$g_A = \frac{\Delta A}{A}$$

$$g_A \cdot A = \Delta A_{next\ year}$$

$$0,02 \cdot 2 = 0,04$$

$$A + \Delta A = 2 + 0,04 = 2,04$$

The level of technology next year would be 2,04

- c) Calculate the level of capital and output per worker for this year and next year, assuming that the economy is on the balanced growth path in both periods. Based on your findings, would you argue that this model is a good representation of economic growth in Denmark? Capital per worker for this year and next year is calculated

$$\frac{K}{AN} = 2,52$$

$$\frac{K}{N} \text{ This year} = 2,52 \cdot 2 = 5,04$$

$$\frac{K}{N} = \text{next year} = 2,52 \cdot 2,04 \approx 5,141 N$$

Output per worker for this year and next year is calculated

$$K \frac{1}{4}$$

$$\left(\frac{Y}{AN}\right) = 1,26$$

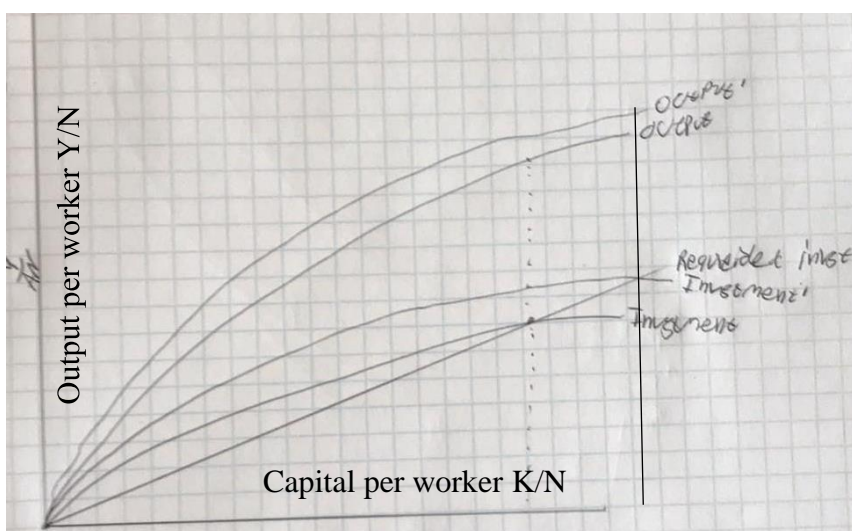
$$\frac{Y}{N} \text{ this year} = (5,04)^{\frac{1}{4}} \cdot 2 \approx 3,0$$

$$\frac{Y}{N} \text{ next year} = (5,141)^{\frac{1}{4}} \cdot 2,04 \approx 3,072 N$$

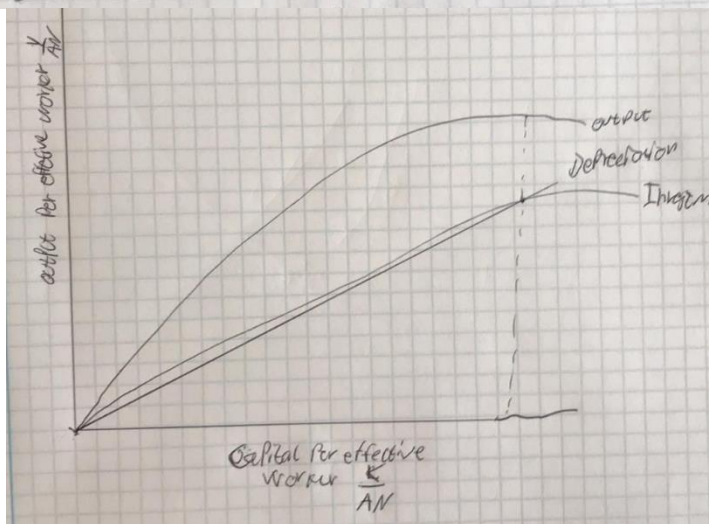
Yes, a modern economy as the Danish could reasonably be described to be at the balanced growth path, and only increase by the state of technology, not an increase in capital per worker.

- c) In the Solow diagram with technological progress, show the economy in this year and next year.

To the right we see that an increase in technology A, shifts both the investment and output curve upwards. The move from the dotted line to the full line shows the shift from the first year to the next.



In the bottom graph, the per effective worker diagram is shown. Where the output per effective worker and capital per effective worker, stays constant and equal to each, however, at the equilibrium marked with the dotted line. Output per worker and capital per worker grows at the rate of technology growth



- d) Imagine you are an advisor to the Danish prime minister and should help her design a policy that increases economic growth. Here are three options: (1) increase spending on universities, (2) make large investments in infrastructure, e.g., build new roads and railways, (3) encourage Danes to save a larger share of their income. Explain the effect of these policies in one sentence each and argue which one you would recommend.

The increase in university spending would hopefully increase the rate of technology growth g_A in the future.

The large infrastructure investments would increase G in the IS curve, and create a higher output in the short run, but would not be able sustain long term growth.

The increase of the Danes savings rate, would move the savings / investment curve in the Solow model upwards, creating an excess of capital to depreciation and increase in output, but only until the steady state is reached again, consequently not sustaining long term growth.

I would advise her to choose a higher investment in universities, as an increase in the rate of technology growth is the only thing that can sustain a long term economic growth,

Essay question 1

Covid-19 and the recent trade wars have led firms to reconsider their supply chains. Some Danish firms have moved offshored production sites back home, and others have exchanged foreign for domestic suppliers of intermediate goods. In max. 200 words, and referring to the concepts studied in class, elaborate on the following: What is the effect on Danish GDP? When measuring inflation, will the two measures that we discussed in class become more similar or diverge?

The GDP is the sum of all final goods and service produced within an economy. And since the Danish firms have relocated production sites and changed suppliers of intermediate goods, this will have no effect on the Danish GDP. The only way it could affect the Danish GDP, would be if the Danish companies who have now chosen Danish suppliers or moved their production home, see an increase in costs and pushes this onto customers. This would increase the nominal GDP of Denmark since prices would now be higher. However, this is assuming that the quantities sold of the companies remain constant.

When measuring inflation, we look to nominal GDP and real GDP. As argued previously, if we expect quantities sold to remain constant and the change in the supply chains do result in an increase in prices, then the nominal GDP would increase, while the real GDP would stay constant. Consequently, they would diverge.

Essay question 2

“To enhance and sustain welfare and consumption in the economy, we should promote policies that maximize output.” In max. 200 words, and referring to the concepts studied in class, evaluate this statement.

Output is maximized differently in the short-run, medium-run and long run. However, promoting the different policies that maximize output in all time horizons must be considered desirable. Assuming that welfare is produced by the government, these welfare services are financed by government revenue of taxes T . There are two ways to enhance the welfare services, either increasing T to allocate

more money to these services, or increase the total output Y , so that T , which is a percentage of Y increases numerically. If we also want to sustain and enhance consumption in the economy, option one of increasing T , does not work, as this reduces consumption $C = c_0 + c_1(Y - T)$. So if T increases, consumption decreases. However, if we chose the second option, to maximize Y , both consumption and welfare is enhanced, as consumption can be seen in the previous formula to depend positively on Y .