Question 1: Short-Run and Long-Run Changes in the Basic AD-AS Macro Model.

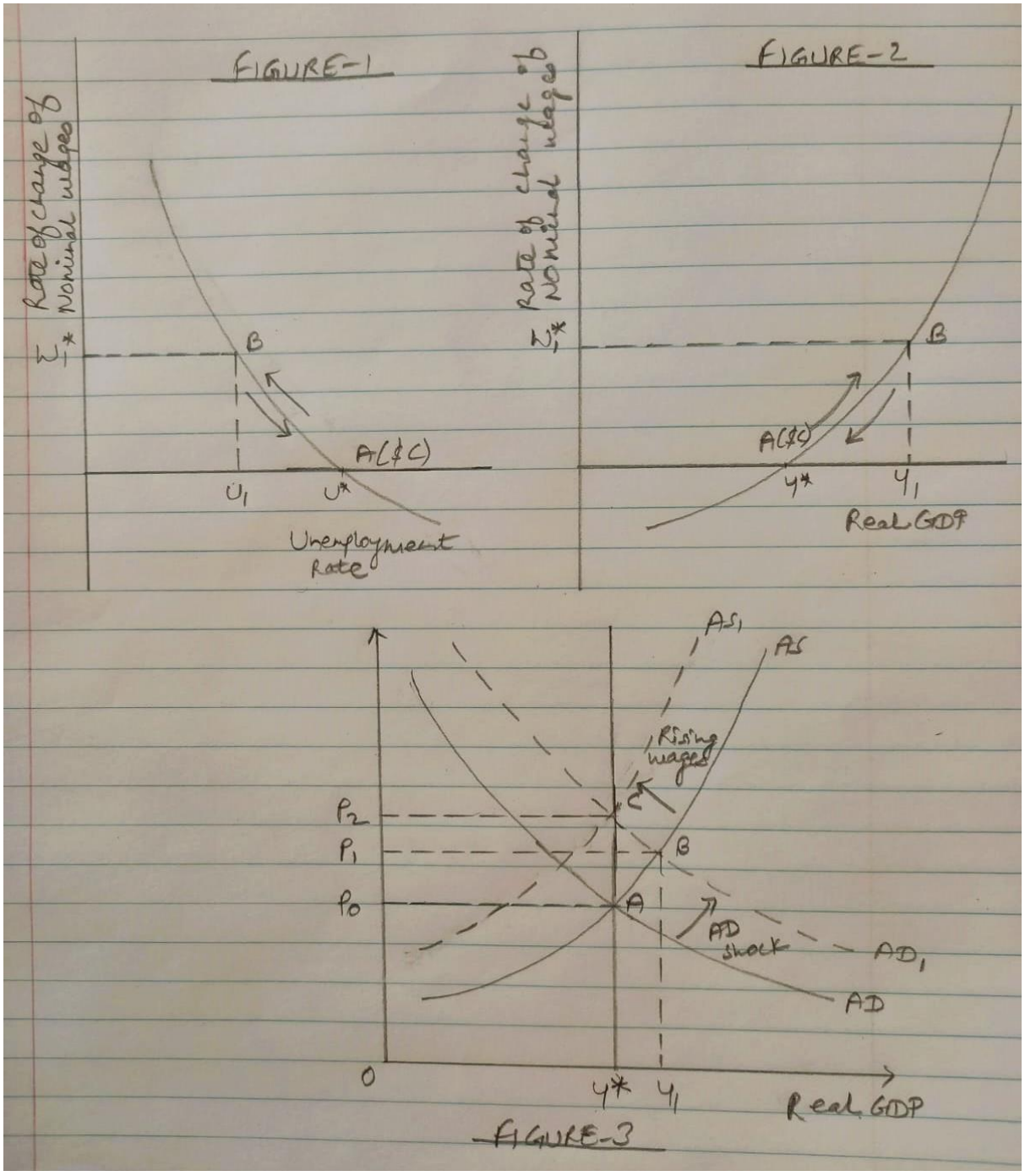
a) Explain what is meant by the Phillips Curve, and the underlying logic of the causal relationship it illustrates. Explain how the Phillips Curve determines the economy's evolution from a short-run equilibrium to a long-run equilibrium following some aggregate shock. Include relevant diagrams in your answer.

Credited to Sugandha Gupta

The Phillips Curve shows the relationship between the level of unemployment and the rate of change of nominal wages. (Fig.1) It can also be drawn to show the relationship between the output gap and the rate of change of nominal wages. (Fig.2) It describes the factor-price adjustment process when the economy transitions from short-run to long-run up by explaining the speed with which wage changes shift the AS curve by changing firms' unit costs.

The causal relationship illustrated by the Phillips Curve is that an inflationary output gap ($Y>Y^*$), or drop in unemployment below natural rate of unemployment U^*, causes an increase in nominal wages, while a recessionary gap causes wages to decrease. The underlying logic is that in the case of an inflationary (recessionary) output gap, excessive demand (supply) for labour puts upward (downward) pressure on wages, causing them to rise (fall).

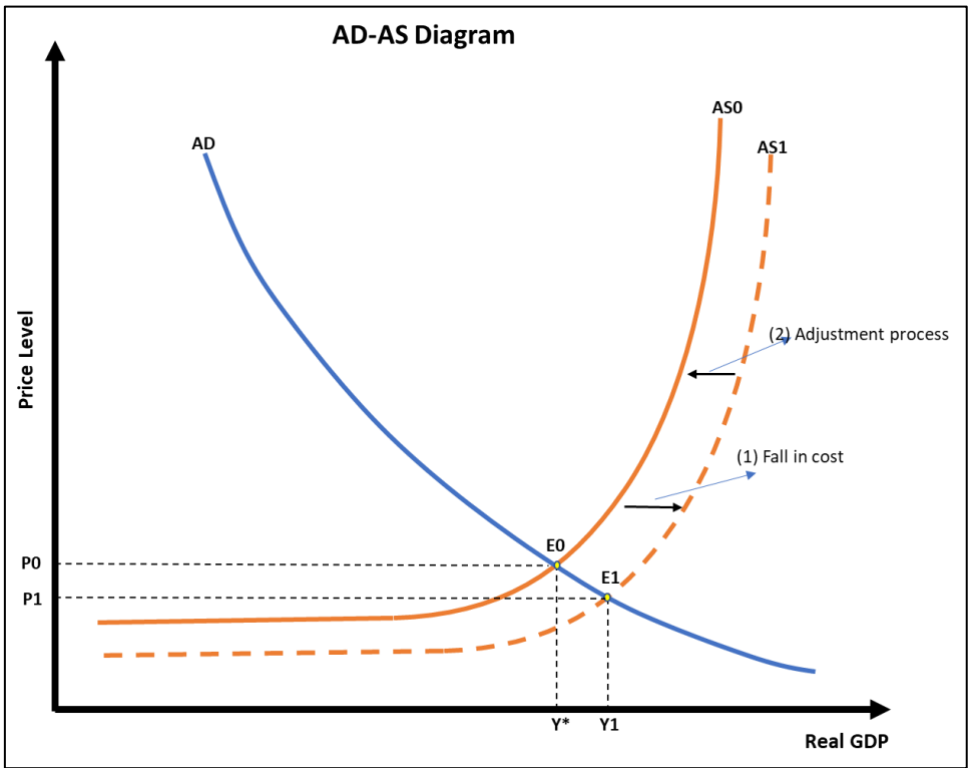
Consider an economy at full employment at point A. (Fig 3) Suppose a positive AD shock causes real GDP to increase to Y1, producing an inflationary gap. The excess demand for labour puts upward pressure on wages and the economy moves along the Phillips curve to point B where wages begin rising. The increase in wages increases firms' unit costs and shifts up the AS curve, due to which the real GDP will fall back to Y^* and inflationary gap will begin to close. Each point on Phillips curve shows the rate at which AS curve is shifting. The economy moves back to point A on Phillips curve and the wages continue to rise but at slower rate. When the adjustment process is complete, the new equilibrium is at point A (or C) and output at Y^*, but the price level and nominal wages are higher than initially.



b) In the basic AD-AS macro model (with a constant Y*), explain the short-run and long-run effects of a sharp reduction in the price of raw materials (which are crucial inputs to the production processes in many industries). Assume for simplicity that the country is not a producer of such raw materials. Use a relevant diagram to illustrate your argument.

The reduction in the world price of raw materials is a positive supply shock. (Since the country is not assumed to produce such raw materials, there is no demand shock.) **The reduction in the price of raw materials reduces unit costs for firms that use them as an input**. Thus, the AS curve shifts to the right to AS_1. As a result, real GDP rises to Y_1 and the price level falls to P_1(short run equilibrium).

At Y_1, there is an inflationary output gap. Factors of production are used more intensively than normal, and so there is excess demand for factors. This excess demand forces factor prices to rise, thereby increasing firms' costs and shifting the AS curve upward and to the left, reversing the initial shift. The AS curve eventually shifts back to AS_0, where output has returned to Y^* and the price level has returned to P_0(long run equilibrium). (Note, however, that the rise in wages means that real wages are higher in the new long-run equilibrium than was the case in the initial long-run equilibrium.)



c) What is meant by the "neutrality" of money? In a standard AD-AS macro model with a constant value of Y*, show and explain, using relevant diagrams, how a monetary expansion is not neutral in the short run but is neutral in the long run.

Credited to Sugandha Gupta

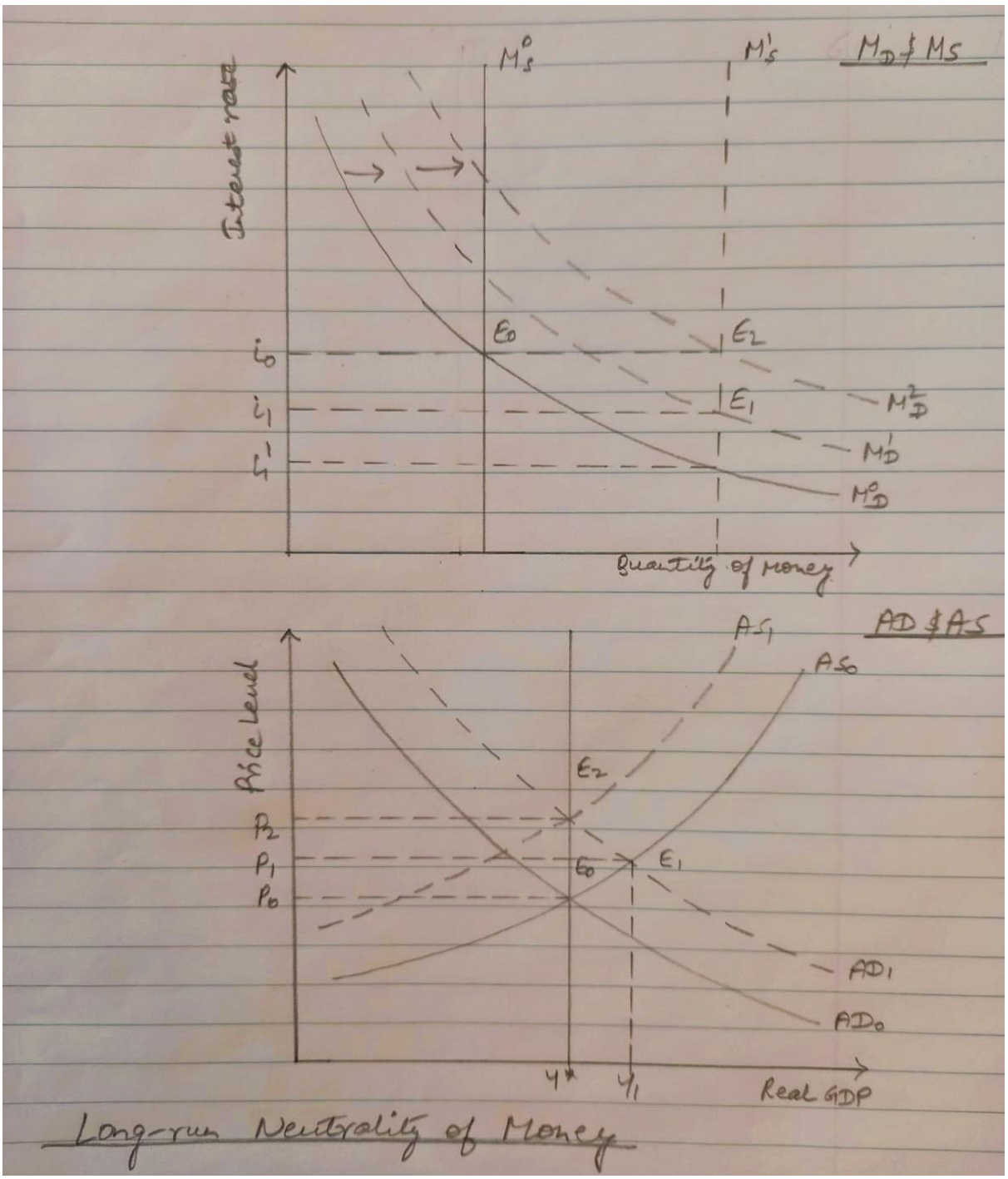
Neutrality of money states that a change in the money supply has no effect on the real variables such as potential GDP, real employment, etc. in the long run; and only affects nominal variables.

Consider an economy in initial equilibrium at Eo with real GDP at Y* and price level at Po. The initial interest rate is at io.

Short run: An increase in money supply from Mso to Ms1 reduces the interest rate from io to i1' and stimulates aggregate demand through increase in interest-sensitive expenditures such as investment, durable consumption, etc. AD shifts to AD1 and new short-run equilibrium occurs at E1 with real GDP at Y1. This increases the demand for money where interest rates rise from i1' to i1.

Long run: The increase of real GDP to Y1 open the inflationary gap where due to excess demand of factors, the factor prices increase. This drives up the unit costs of firms which shifts the AS curve up to AS1. The adjustment process continues until Y is back to Y* and price reaches P2. The long-run equilibrium occurs at E2 where high price level increases the money demand to Md2 and interest rate to i0.

Hence, the long run effect of increase in money supply is to wipe put the initial effect on real variables that occurred in the short run, rendering money as neutral.



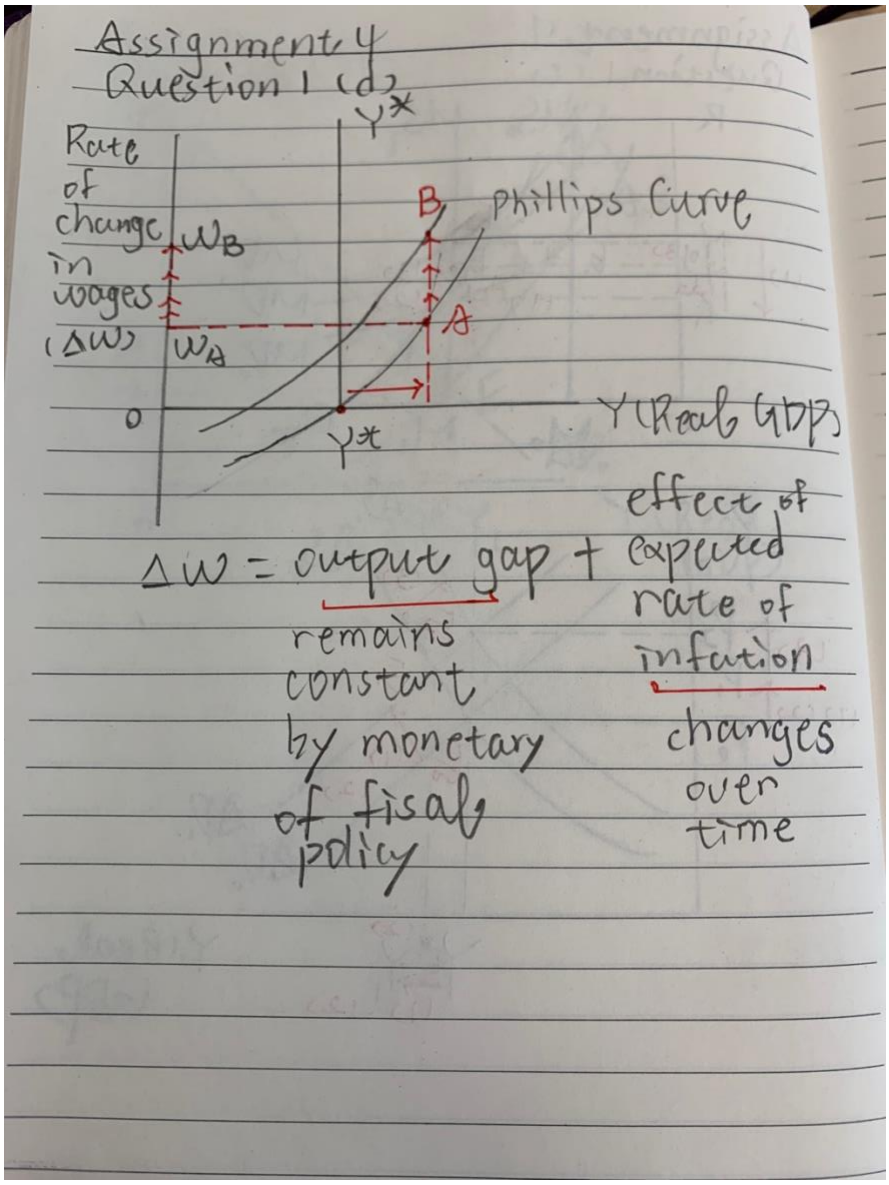
d) Most economists believe that policymakers, whether of the fiscal or monetary variety, cannot choose a preferred point on the Phillips Curve and expect the economy to remain there for long. Explain the essence of this argument. (P742-743, BOX 29-1, Version 16; P362-363, BOX14-1, Version 17)

Credited to Pangying Peng

The argument that policymakers cannot choose a preferred point on the Phillips Curve and expect the economy to remain there for long originates from **the rise of inflationary expectations**. Since the late 1960s, data have revealed that wage and inflation associated with any given level of unemployment began rising. That is, instead of being stable, the Phillips curves actually shift upward.

In fact, before the 1960s, the original Phillips Curve concerned only the influence of the output gap on wages and **left out inflationary expectations**. This was because the data used to build the original Phillips Curve are from the 19th century, when the price level was relatively constant, so expected inflation was negligible. Under this circumstance, when any output gap is closed, there should not be any pressure for changes in wages. Therefore, it was generally believed that if policymakers were willing to tolerate a very high inflation rate, they could maintain a quite low unemployment rate forever.

After economists (mainly led by Milton Friedman) realized that the Phillips Curve has shifted upwards in many countries over time, they start arguing that policymakers cannot choose a preferred point on the Phillips Curve. In the long run, the factor of inflation expectations kicks in. When inflation arises because of expansionary monetary and fiscal policies, as shown in the diagram below (economy moves to A), workers and firms change the way they formed expectations about inflation. They start assuming that, if inflation is high last year—which pushes their wages to A—it is likely to be high this year as well, which makes it necessary to get their wages up, say, to B. This therefore adds more upward pressure on wages. As a result, the economy cannot remain in the long run at A because the Phillips Curve shifts upward to reflect that expected rate of inflation.



e) Most economists argue that fiscal policy involves an interesting paradox. A fiscal expansion (say an increase in G) is likely to increase employment and real GDP in the short run but have little or no effect in the long run. Indeed, they often go so far as to say that the same fiscal expansion can reduce the economy's long-run growth rate. Explain this apparent paradox.

Credited to Jack Burnham, Anmol Gupta, Caroline Wilson

The paradox of fiscal policy can be explained by the fact that potential output tends to act as an "anchor" for the economy. While in the short-run, an increase in government spending will lead to a rightward shift in the aggregate demand curve and a short-term increase in GDP through the multiplier. In the long run, factor prices will adjust (as the output gap generates excess demand for labour, leading to rising nominal wages), shifting the aggregate supply curve to the left (as firms' per unit costs increase), raising the price level and closing the output gap (as output declines and eventually equals potential output).

Further, it is also possible that a fiscal expansion reduces the economy's long-run growth rate due to a "crowding out" of **private** investment. As government spending increases and the price level and real GDP rises, the demand for money increases (due to a growth in the number of transactions occurring across the economy), raising interest rates (assuming that there is no accompanying monetary expansion). This increase in the interest rate raises the cost of borrowing, leading particularly to a decline in investment (which is often done with borrowed money) over the long term. The reduction in private investment caused by the fiscal expansion implies that the economy's capital stock is not rising by as much as it otherwise would have. Thus, the long-run growth path of Y* will be reduced. One such example of inefficient spending can be the traffic circle in Manitoba, which is hindering traffic more than it is helping.

Question 2. A Potpourri of Macro Policy.

a) Suppose you want to determine (econometrically) the causal impact on GDP of a policy induced change in the level of government purchases, and your sample period includes both recessions and booms. Explain why this empirical exercise is difficult, especially dealing with Omitted Variables Bias (OVB).

Credited to Jack Burnham, Anmol Gupta, Caroline Wilson

It is difficult to empirically determine the causal impact of a change in government purchases using the model:

Y_t = a + bG_t + E_t, where Y is GDP, G is government spending, E is error term

During any period of measurement, there may be moments of economic booms and economic recessions. These fluctuations affect GDP and may be the result of factors other than a change in government purchases, such as changes in private investment, changes in consumer spending, or monetary policy action from the central bank, and so on. If these occur while there is a concurrent change in government spending, it can be difficult to determine how a resulting change in GDP is attributed to the change in government spending vs. another factor affecting GDP because these factors are not explicit in the model above. Since these factors are not accounted for in the model, then the estimated causal impact of a change in government purchases on GDP is likely to be biased.

For example, suppose that a policy induced change in the level of government purchases coincides with a boom in private investment, which is not included in the regression above. Then the estimated effect of government purchases on GDP is likely to be overestimated, as the positive effect of private investment on GDP will be mistakenly attributed to the policy-induced increase in government purchases.

b) A central tenet of "Modern Monetary Theory" is that federal governments should direct their central banks to finance large fractions of their expenditures (with newly printed money) and then use adjustments in taxation and spending to control inflation. Comment on whether this is likely to be an effective way to keep inflation low and stable.

Credited to Aftab Ahmed, Megan Warsame and Harshini VN Ramesh)

Financing government expenditures by printing new money and using adjustments in taxation and spending to control inflation has been suggested by Modern Monetary Theory (MMT). The idea is that when the government spends money into the economy, the increase in aggregate demand will stimulate economic growth and generate higher income. Then raising taxes can be used to reduce aggregate demand and prevent inflation from rising to unacceptable levels.

However, this approach's effectiveness depends on various factors – such as the level of inflation expectations, the responsiveness of inflation to changes in aggregate demand, and the credibility of the central bank in keeping inflation low, stable, and predictable.

One of the main concerns, however, is that increasing government spending by printing new money can lead to inflation, particularly when the economy is operating near full capacity or potential output. Excess demand can lead to higher prices and inflation (via an increased output gap), which can be challenging to control. Another risk is that this approach could lead to an extreme case of hyperinflation, resulting in a rapid reduction in purchasing power of money and severe economic consequences.

Additionally, the government may become over-reliant on printing new money to finance its spending, leading to challenges in controlling inflation and resorting to measures like devaluing the local currency (or in extreme circumstances: debt defaulting). Alternatively, the conventional or traditional view of monetary policy emphasizes the importance of maintaining the independence of the central bank and fostering transparent mechanisms to manage inflation.

Relying on printed money may not be sustainable or effective in controlling inflation in the long run. It is crucial to have sound management of fiscal and monetary policy (a combination) to promote economic growth while maintaining low and stable inflation.

c) Some economists and policy-makers argue that high levels of government debt tend to depress a country's rate of growth of real GDP. What is the apparent relationship in the data, and what is one likely causal linkage from debt to growth?

Credited to Pangying Peng

According to the 2010 study "Growth in a Time of Debt" conducted by Reinhart and Rogoff, the data showed that while the link between growth and debt seems relatively weak at normal debt levels (debt-to-GDP ratio below 90%), median growth rates for countries with public debt-to-GDP ratio over 90 percent are about one percent lower than otherwise; average (mean) growth rates are several percent lower. This relationship between public debt and growth is similar across advanced economies and emerging markets. The result demonstrates that **after debt-to-GDP ratio rises**

above a threshold, it is associated with lower growth outcomes (However, this is only correlation, not causation).

Three causal links can be used to explain the relationship between government debt and economic growth.

- First, the presence of high-level government debts may reduce the government bondholders' confidence in the issuing government's ability to repay its debts. Then the negative expectations self-fulfil and affect growth. For example, during the European debt crisis, the public debts in Greece, Portugal, Spain, and some other countries were so high that bondholders came to believe that these governments were effectively bankrupt, and would be unable to repay or even service their existing debts. Expectations for debt defaults by these governments led to massive sell-off in their bonds and created great uncertainty within the Eurozone. This situation considerably decreased the prices of their bonds, increased their bond yields and interest rates. The high interest rates in turn disincentivized the investment (and consumption) within these countries. Therefore, **rising interest rates induced by loss of confidence from government bondholders may curb domestic investment**.
- Second, if taxpayers are **forward-looking**, they might believe that high level of government debt signals a future increase in government tax. In this scenario, households and firms will reduce their consumption and investments, which reduces aggregate demand and thus the rate of growth of real GDP.
- Third, high-level debts also significantly curbed a **government's ability to use monetary and fiscal policies** to stimulate the economic growth, because these policies could cause either inflation ("debt monetization" problems), or perceptions of the government's fiscal sustainability (as more debts are added on).

d) In the fall of 2008, the G20 countries agreed to implement a major and (more-or-less) coordinated fiscal expansion for the next two years. Explain why many economists believe that the stimulative effect of a fiscal expansion in a single country will be larger if other countries are following the same policy at the same time.

The stimulative effect of a fiscal expansion in a single country can be larger if other countries are following the same policy at the same time for several reasons:

1. Avoiding currency appreciation: Fiscal expansion (either through an increase in government spending or a reduction in taxes) causes a rightward/upward shift in the aggregate demand curve because there is an increase in demand for goods and services, resulting in an inflationary output gap in the short-run ($Y > Y^*$). This increase in aggregate demand causes an increase in the demand for money so that consumers/firms can satisfy the increase in demand for goods/services. With an increase in the demand for money, the cost to obtain money rises (and this is represented by a rise in the interest rate). A rise in the interest rate attracts foreign investors and there is more foreign demand for the country's currency to

invest in the country's interest-earning assets. The demand for the currency increases causing its value to appreciate. This appreciation can have negative impacts, one being that the cost to buy the country's exports is now higher for foreign consumers while the cost of imports is lower for domestic consumers, and thus the country's net exports will decline. However, if many countries are coordinating and engaging in the same fiscal expansion, then all the country's currencies will, in theory, appreciate together. Because currencies are exchanged for one another on the foreign exchange markets, if all countries' currencies appreciate together, then the real difference in the exchange rate between any two currencies is effectively null or unchanged and thus there is little change in the flow of exports and imports. (**Credited to** Jack Burnham, Anmol Gupta, Caroline Wilson

2. Spillover effects: If all countries are expanding fiscal policy at the same time, this can lead to increased aggregate demand for goods and services – which can benefit exporters in other countries and stimulate economic growth globally. (**Credited to** Aftab Ahmed, Megan Warsame and Harshini VN Ramesh)
3. Reduced uncertainty and increased confidence: A coordinated fiscal expansion policy can reduce uncertainty and increase confidence among investors and consumers in the global economy, as it demonstrates a collective effort to address economic challenges. This can then lead to increased investment and consumption, as businesses and individuals are more likely to spend and invest when they have greater confidence in the overall economic environment. (**Credited to Ankitha Cheerakathil, Zhumin Xu, and Coreen Enos)**

Another sample answer: Credited to Jimy Beltran, Linda Bui and Abigail Jackson

Many economists felt that a coordinated fiscal expansion over two years would result in positive spillover effects between countries, with positive outcomes to international trade (i.e. propensity to import/export) and a multiplier effect through greater aggregate demands and stimulated consumption and investments globally.

There's also the fact that a fiscal expansion can lead to higher interest rates, which can lead to an inflow of capital and currency appreciation. This crowds out net exports. However, if countries coordinate their fiscal expansions then there is less pressure for any one currency to appreciate. So there is a smaller effect on net exports and a higher multiplier.

More specifically, a fiscal expansion in one country can lead to an increase in demand for goods and services, which is positive for other countries that export to that country. This leads to higher output and employment in other countries, thus, from the initial fiscal expansion. This impact is amplified when more countries coordinate their fiscal expansion, which signals to firms and households/individuals that economic growth is likely to come in the near future. This enables a self-fulfilling prophecy whereby the expectations of improved economic conditions lead to increased confidence among firms and households/individuals to increase their consumption and investment spending, which in turn actually spurs the economic growth needed to improve the initial conditions. Finally, it is sensible for economists to believe that coordination may also deter countries from engaging in competitive behaviour that may dissuade mutual growth (i.e. trade protectionist policies) that would counter global growth.

e) Some economists argue that highly indebted governments should direct their central banks to generate higher inflation for several years, and then return to a lower rate of inflation. What is their logic, and what do you think of the general idea?

Credited to Jack Burnham, Anmol Gupta, Caroline Wilson

The debt of a government is denominated in nominal terms, but the real value of currency is always changing given the current rate of inflation. The argument for having several years of high inflation when a government is currently holding a lot of debt is that the high rate of inflation causes the value of a single unit of the currency to fall which in turn causes the value of the debt held to fall in real terms. By generating higher inflation, governments can reduce the real value of their debt (nominal value remains constant while purchasing power of the currency declines); this helps governments service their debt over time as the debt burden becomes smaller.

In theory this idea works and has been attempted before (Germany did this after WWI to pay reparations), however it carries significant risks. First, prolonged high inflation can cause a loss of confidence in the country's currency and cause an outflow of capital to other foreign currencies that are perceived to be more stable in value. Second, high inflation is associated with volatile inflation, and volatility can further erode confidence and create increased uncertainty that makes consumers and firms more cautious about spending and investing. Third, when inflation causes a rise in the price level, there is generally a higher demand for the currency, resulting in a rise in the interest rate that makes the currency appreciate but also makes exports more expensive, causing a decrease in a country's net exports. So, for all these reasons, we do not "love" this idea as a feasible policy approach.

Question 3. Issues in Monetary Policy

a) Milton Friedman argued that monetary policy cannot be used successfully to target real variables (such as real GDP growth or the unemployment rate) in the long run. Explain his argument, and how it relates to the Phillips Curve. (Could also use 1d) answer in above)

Credited to Emily Nickerson, Amr Soliman, and Ellen Rowe

Friedman argued that inflationary expectations were absent from the Phillips Curve and that's why it is impossible to stay at one point on the Phillips curve, with a stable trade-off between unemployment and inflation. This concept is better known as the expectations augmented Phillips curve. He introduced the concept of inflation expectations, accounting for the fact that consumers are forward-looking.

Friedman realized that people come to expect wage inflation, where components of actual inflation = output gap inflation plus expectations inflation that then accelerates inflation. This shifts the whole Phillips curve up. If the central bank tries to hold output above potential, the price level will continue to increase since inflation expectations will continue to grow. Attempts to maintain an output level higher than potential leads to an acceleration of nominal wages and prices. Therefore, a stable point on the curve is not possible, and it will simply create sustained inflation.

The attempt to remain at Y >Y* creates an acceleration of nominal wages and prices, also known as the "acceleration hypothesis". The instability of the Phillips Curve and the inability of the CB to keep Y above Y*is almost fully accepted by economists and explains why most CBs target inflation, rather than real GDP and/or unemployment which generates an acceleration in inflation.

b) State the "Taylor Rule" precisely and explain its underlying logic. Explain what the Taylor Rule prescribes for the appropriate policy response to aggregate demand and aggregate supply shocks, and why there are differences between the two responses.

Credited to Jack Burnham, Anmol Gupta, Caroline Wilson

The Taylor Rule provides a framework for what central banks should set as the nominal interest rate to effectively target the real interest rate, accounting for output and inflation. The Taylor Rule equation is:

$i = r^* + \pi + a(\pi - \pi^T) + b(Y - Y^*)$,

Where i is the nominal interest rate, r^* is the neutral real rate (real interest rate in long-run equilibrium), $\pi - \pi^T$ is the difference between current inflation and the target rate of inflation, and $Y - Y^*$ is the output gap.

The Taylor Rule tells us that when there is a demand shock, there is a change to the difference in the actual and targeted rate of inflation as well as the creation of an output gap. For example, with a positive demand shock, inflation will rise ($\pi > \pi^T$) due to a rise in the price level and an output gap ($Y > Y^*$) given the rightward shift in the AD curve. With a negative demand shock (leftward shift in AD curve), then inflation will fall ($\pi < \pi^T$) as the price level falls and a negative output gap ($Y < Y^*$) opens up. In both demand shocks, we can see that π and Y move in the same direction. Thus, for central banks that implement monetary policy, there is a clear solution provided by the Taylor Rule to maintain the real interest rate. For a positive demand shock when π and Y both rises, then the central bank should increase the nominal interest rate (i) to reduce π and Y. Similarly for a negative demand shock when both π and Y fall, then the Taylor Rule indicates that central banks should lower the nominal interest rate (i) to raise π and Y to maintain the r^*. The movement of π and Y in the same direction allows monetary policy targeted at one variable to also stabilize the other (a phenomenon sometimes called the "divine coincidence").

The Taylor Rule is less effective for aggregate supply shocks, because π and Y will move in opposite directions and hence there can be no "divine coincidence". For example, with a positive AS shock (rightward shift of AS curve), there will be an increase in Y such that $Y > Y^*$ but a fall in the price level (reduction in π). For a negative AS shock (leftward shift of AS curve), there is a fall in Y such that $Y < Y^*$ with a corresponding rise in the price level ($\pi > \pi^T$). Because Y and π move in opposite directions, it is unclear per the formula above how the central bank should change the nominal interest rate (i) and may depend on the net difference between the change in the inflation component of the Taylor Rule ($\pi - \pi^T$) and the output gap ($Y - Y^*$). Thus the Taylor Rule alone is not an appropriate tool to dictate monetary policy for an aggregate supply shock.

c) Explain why there are "long and variable" lags in monetary policy. Explain why such lags imply that monetary policy must be forward looking in order to keep inflation relatively stable in response to various economic shocks.

Credited to Emily Nickerson, Amr Soliman, and Ellen Rowe

In the short-run, monetary policy changes interest rates very quickly. The subsequent changes in desired spending occur much more slowly. Government cannot force the private sector to react to changing interest rates; it can only facilitate a change. It takes time for households and firms to adjust their spending and borrowing plans in response to the change in interest rates. Further, the effect on net exports also takes more time as purchasers of internationally traded goods and services switch to lower-cost suppliers.

The multiplier process also takes time. As changes in consumption, investment, and net export expenditures are brought about by a change in monetary policy, we begin to see the multiplier process and how the shift begins to affect national income. This process takes some time to work through so, although the end result is fairly predictable, the speed with which process works itself through the economy can vary.

Finally, inflation adjust gradually to output gaps. This gradual change would also mean the real GDP changes and unemployment is impacted. The Bank of Canada believes a change in monetary policy, to impact the real GDP, can take up to a year and a subsequent year for the policy to impact the rate of inflation. These lags mean that monetary policy must be forward-looking, and anticipate changes in the economy 2-4 years in advance so it does not overstimulate or under-stimulate the economy.

The lags in monetary policy increase the difficulty of stabilizing the economy. Monetary policy may have a destabilizing effect if the Central Bank is reversed by other factors shocks before the change in policy has time to take full effect. Monetary policy must thus be forward planning, and keep inflation relatively stable in response to various shocks. Therefore, it is important that this is well-communicated to the public.

d) Explain why some economists are worried that high government indebtedness may lead to a sustained period of higher inflation.

Credited to Alison Clement, Isabel Diavolitsis, Dominique Garreaud

Some economists are worried that high government indebtedness may lead to a sustained period of higher inflation because it will increase the money supply, impact inflation expectations and reduce consumer and business confidence in the economy. To pay off debt, governments may have the central bank print more money. This would increase the money supply and could lead to inflation as the value of money decreases relative to the goods and services it can buy. High government indebtedness can also limit the ability of central banks to control inflation. If governments pressure central banks to keep interest rates low to reduce the cost of paying off their debt, this can lead to higher inflation as monetary policy is too accommodative. Lastly, if consumers and businesses expect inflation to continue, prices and wages will need to increase to keep up with the rising cost of living. This can create a cycle of inflation, which will slow ultimately down economic growth.

e) Some economists argue that low inflation is likely to lead to a higher rate of growth of real (or real per capita) GDP. What does the evidence say about this idea?

Credited to Aftab Ahmed, Megan Warsame and Harshini VN Ramesh; and Danielle Appavoo, Mariel Aramburu and Anil Wasif

The idea that low inflation can lead to higher real GDP growth rates could be possibly explained through the following channels. First, low inflation reduces uncertainty about future price levels, which can make it easier for businesses to plan and invest. Second, low inflation can lead to lower interest rates, which can stimulate

investment and consumption. Third, low inflation can lead to greater productivity growth by reducing the costs associated with price-level adjustments and reducing the need for nominal wage increases.

But the empirical evidence seems to be mixed. Some studies have found a positive relationship between low inflation and economic growth, while others have found no significant relationship.

In 1998, Christopher Thomas Southgate Ragan addressed the potential benefits of low inflation in a working paper for the Bank of Canada. In his paper, he gathers theoretical and empirical evidence on the idea that low inflation leads to a higher rate of real GDP growth which proves that *"Neither the time-series evidence nor the international cross-section evidence is robust. There is a robust negative relationship between inflation and growth in high-inflation countries, but this evidence will hopefully remain irrelevant for the industrialized countries for some time to come.".*

Over the last 35 years, there's been a fairly controversial set of research papers that try to detect this relationship between inflation and GDP growth, in **two different ways**:

i) Taking a time series data on GDP growth and inflation in order to check for a causal relationship between inflation and GDP growth. However, when doing so, it's very difficult to separate out the short run from the long run relationship when looking at time series data and as a result the short run relationships between the two variables create a lot of noise, which leads to any causal relationships put forward by regressing time-series data to be uncompelling.

ii) To circumvent the issue of short run distractions, many have tried to look at cross-sectional data for a number of countries instead, and by taking decadal averages that got rid of the short run business cycle fluctuations in the data. The decadal points from the cross sectional data tends to reveal a very small empirical relationship between inflation and growth rate of real GDP in countries with high inflation. For example, if inflation is reduced from 30% to 5% then there's a relationship, but if inflation drops from 4% to 2%, there's no evidence in the data.

Thus empirical evidence tells us that there is no existence of a reasonably robust relationship between low inflation and the growth rate of real GDP.

f) In 2020 and 2021, many central banks embarked on policies of Quantitative Easing (QE)—the large-scale purchases of government bonds. Some people are concerned that these asset purchases, financed with freshly created money, will certainly lead to significant increases in inflation. Provide your assessment of this issue.

Credited to Jimy Beltran, Linda Bui and Abigail Jackson

The process of quantitative easing contributed to increased inflation in the context of 2020-21. In this case, through QE, Central Banks lowered interest rates resulting in long term bonds providing lower yields. In turn, investment and consumption increased. Investors seeking for alternative sources of assets, invested large sums of capital in stocks which in turn generated increased wealth and higher aggregate demand. We observed this during the rapid increases in the stock market in 2020 and 2021, coinciding with CB's QE applications. This created an environment of higher confidence, which led to more consumption not just in

the stock market but in real estate, which ballooned during this same period of time in Canada and other countries where QE was used to boost the economy during the first year of the pandemic. This over consumption ultimately led to higher prices in the economy, particularly in housing.

However, QE needs to be placed in an appropriate context. In the context of 2020-21, inflation was the result of multiple sources of inflation such as food and energy. QE contributed to this inflation but it was not the only cause. In other contexts, where QE was applied such as the 2008 financial crisis, we did not experience rising inflation in the aftermath of the recession. This is because banks were less likely to lend money at the same rates as in 2020 and 2021. Thus, assessing whether QE will *certainly increase inflation* needs to be contextual.

Credited to Jack Burnham, Anmol Gupta, Caroline Wilson

QE increases the money supply as central banks will use newly printed money to buy back government issued bonds. Bond holders now have new money which they can use for consumption purposes or invest in other assets. In macro terms, this increase in the money supply will lead to a decrease in the equilibrium interest rate (the cost of money), increasing investment, consumption of durables, and net exports, all of which will shift aggregate demand to the right, pushing up the price level.

QE, however, may not always be immediately inflationary because of the nature of the new money that is created. QE is rarely done with new printed currency but rather by crediting financial institutions' accounts at the central bank. Commercial banks that now hold this new money then get to decide if/when they want to lend out that money. Depending on when and how quickly these institutions begin to lend out the money will determine the sharpness and duration of inflation from QE.

Question 4. Fiscal Versus Monetary Policy. (Credited to Pangying Peng)

For these questions assume we are using a standard AD-AS macro model, with a constant level of Y*. We begin in a long-run equilibrium with Y = Y*.

a) Explain in what sense monetary policy affects aggregate demand "indirectly" whereas fiscal policy (especially changes in G) affect aggregate demand "directly".

Monetary policy affects aggregate demand indirectly in the sense that it takes effects though the **monetary transmission mechanism**. That is, changes in money supply by central banks affects interest rates of the economy first, which then affects investment and consumption.

Fiscal policy affects aggregate demand directly in the sense that the government steps in

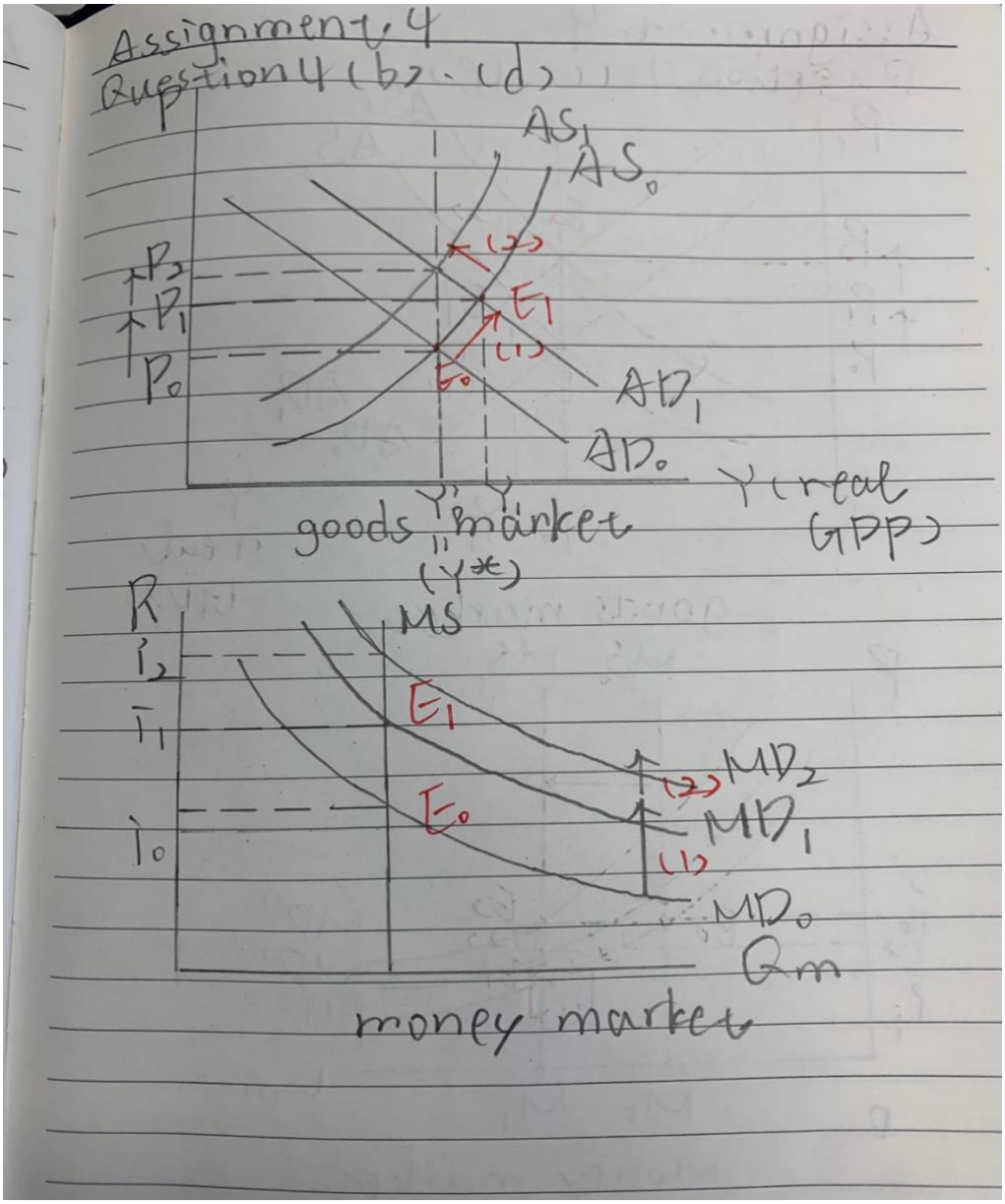
to **purchase goods and services in the economy or cut tax rates**, which directly stimulates the aggregate demand. For example, the government finances the building of transport infrastructure which facilitates the delivery of goods and reduce freight. This stimulates overall economic activities and thus the aggregate demand.

b) Explain, and show using relevant diagrams of the goods and money markets, the short-run effects of a fiscal expansion (either an increase in G or a reduction in T) on real GDP and the price level. Explain the concept of "crowding out" of private investment, and why it might be important.

The short-run effects of a fiscal expansion will **increase the real GDP and price level**. When the government engages in fiscal expansion, it directly stimulates the aggregate demand of the economy. Therefore, an inflationary gap will be opened in the short run. At the initial price, there will also be excess aggregate demand over aggregate supply, so the price level must rise. In addition, in the money market, since the stimulated aggregate demand increases firms' and households' desire to hold more money, the rising money demand makes them shift away from asset-earning bonds, which then pushes down bond prices and up the interest rates.

As shown in the first diagram below, this short-run process is shown as a rightward shift (1) of the AD curve (from AD_0 to AD_1). The real GDP rises from Y_0 to Y_1, the price level rises from P_0 to P_1, and the equilibrium moves from E_0 to E_1. In the second diagram, the upward shift of the MD curve (MD_0 to MD_1)—which reflects (1) in the first diagram—pushes up the interest rate from i_0 to i_1.

Basically, the higher interest rate means that the cost of borrowing will increase for the private sector which will negatively impact private investment. This is why fiscal expansion is said to 'crowd out' private investment. This is important since the intended positive government impact of increased aggregate demand could be partially undermined by the reduction in desired investment expenditure.

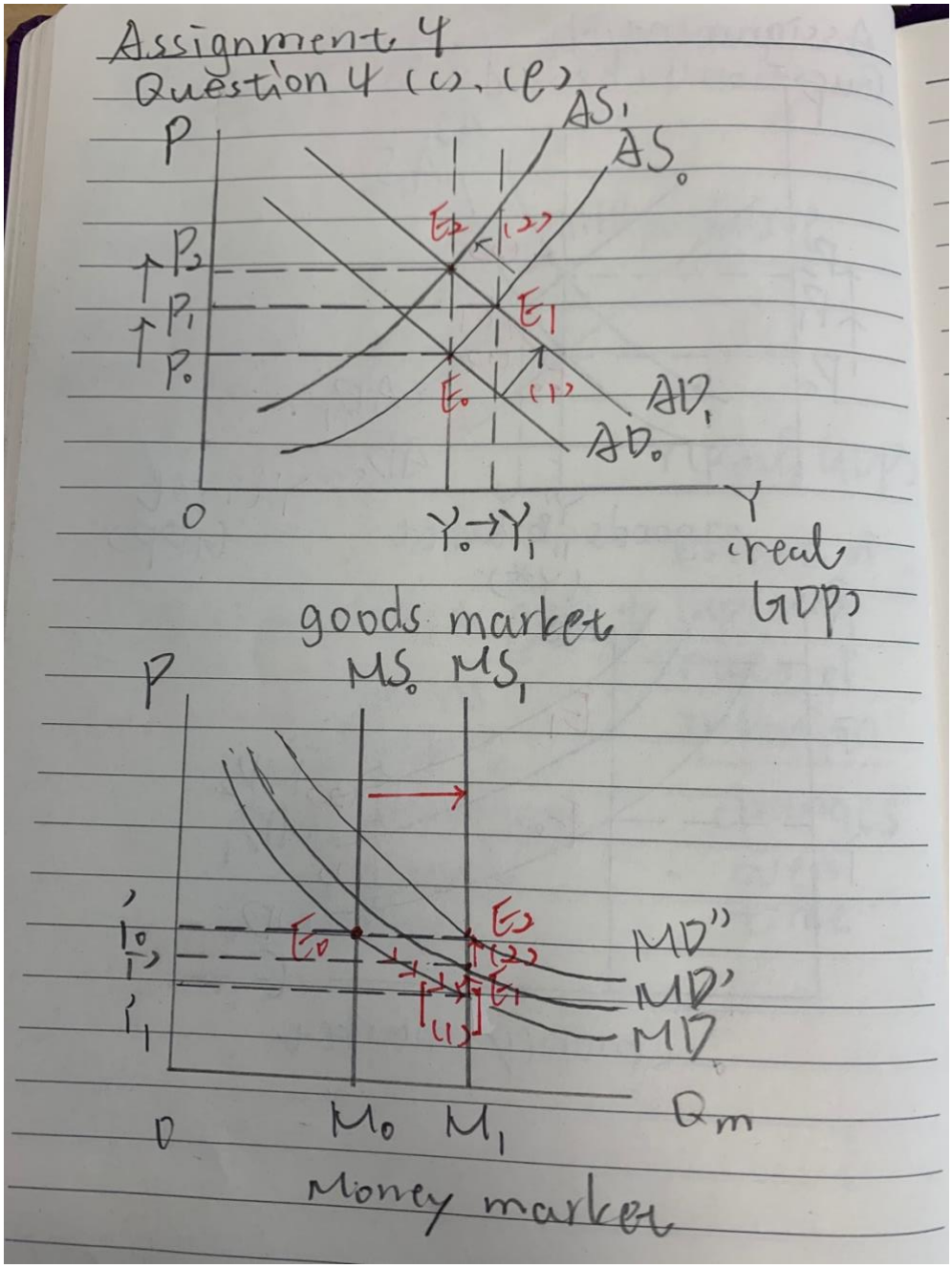

Assignment 4
Question 4 (b) - (d)
P
AS1
AS0
P2
P1
P0
(2)
E1
(1)
E0
AD1
AD0
Y' Y
Y (real GDP)
goods market
(Y*)
R
MS
i2
i1
i0
E1
E0
MD2
MD1
MD0
(2)
(1)
Qm
money market

c) Explain, and show using relevant diagrams of the goods and money markets, the short-run effects of a monetary expansion (an increase in the money supply) on real GDP and the price level. Explain whether "crowding out" of investment exists here, and why or why not.

The short-run effects of a monetary expansion will also **increase the real GDP and price level**. When the central bank engages in monetary expansion by increasing money supply, it will then stimulate the aggregate demand of the economy because lower interest rates incentivize firms and households to make more investments and consumption of non-durable goods. Therefore, an inflationary gap is opened in the short run. At the initial price, there will be excess aggregate demand over aggregate supply, so the price level must rise. In addition, in the money market, since the money supply increases, excess supply of money shifts towards buying bonds, which pushes up bond prices and down the interest rate.

As shown in the first diagram below, this short-run process is shown as a rightward shift (1) of the AD curve (from AD_0 to AD_1). The real GDP rises from Y_0 to Y_1, the price level rises from P_0 to P_1, and the equilibrium moves from E_0 to E_1. In the second diagram, the rightward shift of the MS curve (MS_0 to MS_1), which reflects (1) in the first diagram. The interest rate falls from i_0 to i_1 first, but then the rising aggregate demand increases the money demand, so the money demand curve rises from MD to MD', and the interest rate rises slightly to I', still lower than i_0.

The crowding out of investment does not exist in this scenario because the falling interest rate incentivizes households and firms to make more investments and consumption, which could actually "crowd in" more investment.



d) Now use similar diagrams to explain the long-run effect of your fiscal expansion from part (b). Once the economy achieves a new long-run equilibrium with Y = Y*, explain any important differences from the initial long-run equilibrium.

As already shown in the diagrams in b), the new long-run equilibrium will be that both the price level and the new interest rate are higher than the original ones. In the goods market, after the economy reaches E1, wages and other factor prices will start rising because of the inflationary gap. This causes unit costs for firms to rise so that the aggregate supply of the economy starts reducing, which is reflected by the shift from AS0 to AS1. The adjustment (2) goes on until Y = Y* and price level rises from P1 to P2. In the money market, due to the rising price level, the need of holding money also rises. The MD curve rises again from MD1 to MD2, the interest rate rises further from i1 to i2.

The main difference from the initial long-run equilibrium is the composition of real GDP. Compare points E0 and E2. The higher price level at E2 (for a constant exchange rate and foreign prices) has led to a reduction in net exports as compared with point E0. In addition, by reducing private-sector wealth (real value of money and bonds), the higher price level has also led to a reduction in consumption. Thus, the increase in G has pushed up the price level and "crowded out" some private expenditure (exports and consumption). Also, interest rates are also higher at point E2, leading to a reduction in consumption, investment and net exports. Therefore, there has been a change in the composition of (an unchanged amount of) real GDP – more G but less C, I and NX.

e) Now use similar diagrams to explain the long-run effect of your monetary expansion from part (c). Once the economy achieves a new long-run equilibrium with Y = Y*, explain any important differences from the initial long-run equilibrium.

As already shown in the diagrams in c), **the new long-run equilibrium will be that the price level rises but the interest rate returns to the initial one**. In the goods market, after the economy reaches E_1, wages and other factor prices will start rising because of the inflationary gap. This causes unit costs for firms to rise so that the aggregate supply of the economy starts decreasing, which is reflected by the shift from AS_0 to AS_1. The adjustment (2) goes on until Y = Y* and price level rises from P_1 to P_2. In the money market, due to the rising price level, the need of holding money also rises. The MD curve rises again from MD' to MD'', bringing the interest rate from i' back to i_0.

In conclusion, the important differences from the initial long-run equilibrium is only the higher price level.

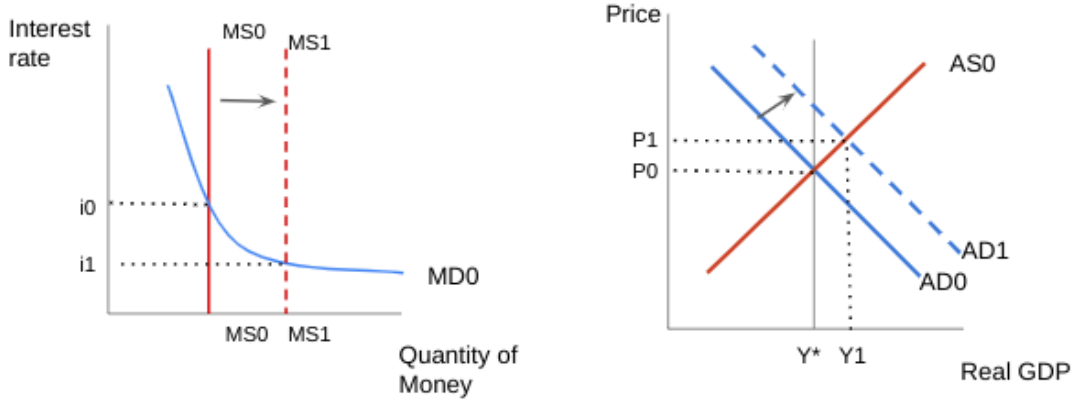
f) Explain in non-technical and intuitive terms the different long-run effects of monetary versus fiscal expansions. You should try to do this in one snappy paragraph of less than 150 words.

Both fiscal expansion and monetary expansion will lead to an increase in the aggregate demand and real GDP in the short run, which creates an inflationary gap causing wages and other factor prices to rise. In response, the rising unit costs for firms reduce the aggregate supply until the real output returns to original level. The long-run result is **that real GDP remains constant but overall price rises**, same for both fiscal and monetary expansions! But fiscal expansion leads to higher interest, which causes the crowding out of private investment, whereas in monetary expansion, the interest rate goes back to original, thus no real variables such as GDP, consumption, investment, etc, have changed.

Question 5: The Monetary Policy Transmission Mechanism.

Credited to Jimy Beltran, Linda Bui and Abigail Jackson

a) Using a diagram of the money market, and also an AD-AS diagram, describe and explain the three phases of the "monetary policy transmission mechanism".



Phase 1: A change in the money market (either a change in money demand or money supply) leads to a change of the equilibrium interest rate. As seen in the diagram above on the left, there is an increase in the money supply from MS0 to MS1 and the interest rate goes down from i0 to i1.

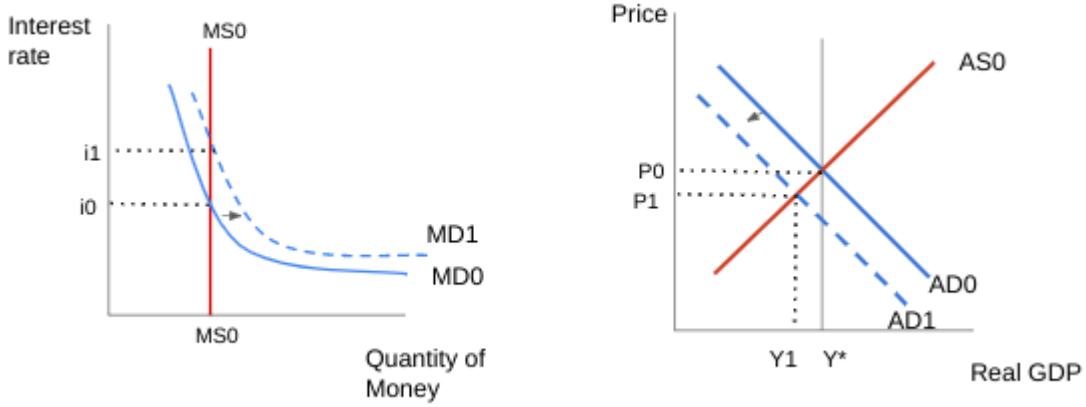
Phase 2: The change in the interest rate leads to a change in desired Investment as well as Consumption of big-ticket items. In the case demonstrated above (e.g. an increase in the money supply) the lower interest rate would lead to a stimulation of desired Investment and some consumption of big-ticket items.

Phase 3: A change in desired Investment leads to a change in aggregate expenditure, which leads to a change in aggregate demand. As seen in the diagram above on the right, the aggregate demand curve shifts to the right from AD0 to AD1.

b) Explain how changes in aggregate demand could be caused by a "shock" in the money market (which is not a change in monetary policy) which changes the equilibrium interest rate. Provide one example of such a shock.

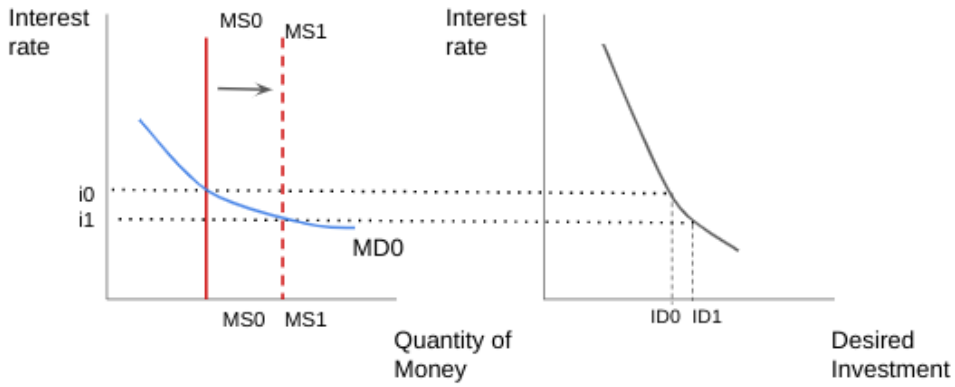
A shock in the money market can lead to a change in the money demand curve, which can affect the interest rate, which in turn can affect aggregate demand.

An example of a shock to the money market is a sudden change in the perception of the riskiness of domestic bonds (for example, if there is a threat of war). If investors suddenly see domestic bonds as riskier, they may move to sell those assets in exchange for money. As the preference for money holding increases, the demand for money goes up and the MD curve shifts to the right from MD0 to MD1. This leads to an increase in the equilibrium interest rate, which contributes to a decline in desired investment. This, in turn, leads to a decrease in aggregate demand, and the AD curve shifts from AD0 to AD1 in the goods market.



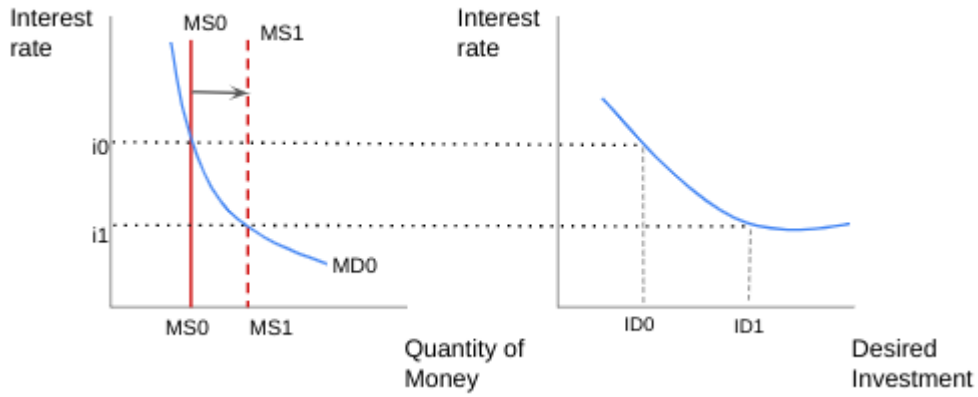
c) The traditional "Keynesian" view of the impact of monetary policy is based on the idea that money demand is highly sensitive to changes in the interest rate whereas desired investment is relatively

insensitive to changes in the interest rate. Show this situation with relevant diagrams and explain why this combination yields monetary policy that is quite weak.



This combination yields weak monetary policy because a change in interest rates is unlikely to have a big impact on investment, which means that monetary policy will not be able to effectively stimulate aggregate demand, nor have a considerable impact on GDP/output. This can be seen in the graphs above. The money demand curve has a flat slope, meaning that a large shift in the money supply is required to bring about a considerable change in the interest rates from i0 to i1. In contrast, the slope of the investment curve is steep, meaning that changes in interest rates will have a smaller impact on desired investment (from IDo to ID1) compared to changes in the money supply. This is part of the reason why Keynes argued for fiscal policy to stimulate aggregate demand. Monetary policy will have little effect on investment as a key component of aggregate demand.

d) The traditional "Monetarist" view of the impact of monetary policy is based on the idea that money demand is quite insensitive to changes in the interest rate whereas desired investment is highly sensitive to changes in the interest rate. Show this situation with relevant diagrams and explain why this combination yields monetary policy that is quite strong.



This combination yields strong monetary policy because a smaller change in the money supply leads to a significant change in interest rates, which can have a significant impact on Investment, which, in turn, impacts aggregate demand and GDP. This can be seen in the graphs above. The money demand curve is

quite steep, meaning that small changes in the money supply will lead to significant changes in interest rates. This can be seen with a significant change in interest rates (i0 to i1) as a result of a change in money supply (MS0 to MS1). The desired investment curve has a flatter slope, which means that a change in interest rates then leads to a considerable shift in desired investment from ID0 to ID1. Thus, this increase in money supply and reduction in interest rates can have a strong effect on aggregate demand and can then lead to significant changes in GDP/output in the short run, rendering monetary policy a strong instrument.

e) In an open economy in which financial capital flows in response to differences in national interest rates, explain how a monetary expansion works, in part, by causing a depreciation of the domestic currency.

A monetary expansion leads to an increase in the money supply, which leads to a decrease in the equilibrium interest rate. This lowering of interest rates leads to capital outflows as investors sell their domestic assets in search of higher-yield assets elsewhere. These capital outflows can lead to a depreciation of the currency, which means that domestic exports become cheaper to the rest of the world while imports become more expensive for domestic consumers. This leads to an increase in net exports, which contributes to an increase in GDP. As such, a monetary expansion can stimulate the short-run increase in GDP in part through a currency depreciation.

Question 6. Money Neutrality, or Not.

Credited to Jimy Beltran, Linda Bui and Abigail Jackson

A senior government official is wondering about the impact of a central-bank-created increase in the interest rate, intended to "slow down" the economy and reduce inflation. He has heard of the concept of "neutrality" of monetary policy but doesn't really see how this can be true. Isn't it obvious that changes in interest rates have a powerful effect on investment, employment, and real GDP? He asks you to explain this, without graphs and without equations. In particular, answer the following questions:

a) Explain how and why a monetary contraction (which raises interest rates) is likely to lead to a reduction in investment, employment, and real GDP in the short run—a period of (say) 1-3 years.

A monetary contraction is likely to lead to a reduction in investment, employment and real GDP in the short run because of several factors. Firstly, reducing the money supply and raising interest rates mean there is a higher cost of borrowing. It is more expensive for firms to borrow to invest in their businesses, hire workers or purchase capital investments. Secondly, there is reduced consumption. Similarly, higher interest rates mean it is more expensive for consumers to borrow money for big-ticket purchases like homes or other durable goods. A higher interest rate can also depreciate assets, which can decrease both consumer wealth and confidence. When the central bank introduces a monetary contraction, they intend to do so with the near future in mind. Businesses may view this contraction as a signal that an inflationary period is

forthcoming, and they are likely to reduce their investments in response to this. Since investment is the most volatile component in aggregate expenditure, the impact of a decline in confidence is critical. The decline in confidence, leading to reduced investments and consumption, would lead to a decrease in aggregate demand in the short run, and a reduction in employment and output. This unemployment is also a result of firms reducing their workforce and output, thereby leading to a reduction in real GDP in the short run.

b) The word "likely" was underlined in the previous question. Are there some conditions under which monetary policy is particularly weak and so there would be little or no effects from the policy action, even in the short run? Explain them.

Yes, there are some conditions in which monetary policy is weak and there would be minimal effects from policy action, even in the short run. From a Keynesian perspective, there is a situation where a change in money supply is not effective, where the situation is one where the money demand curve is flatter, related to a steeper investment curve, where changes in monetary policy and changes in interest rates may have a marginal impact. This may be when interest rates were already very low so raising them is unlikely to make a huge difference. In other words, firms and consumers are less sensitive to changes and are less likely to reduce their spending and investment. In such cases, monetary policy has less of an impact and alternatives like fiscal policies may need to be pursued to slow down the economy.

c) Now explain why the short-run effects from the monetary contraction are likely to disappear over the longer run—a period of (say) 4-5 years and more.

In the long run, these short-run effects from monetary contraction are likely to disappear due to adjustments that take place in the markets and economy. With a decline in aggregate demand due to higher interest rates, firms will begin to lay off employees. Prices in the economy as well as output will decline in the short term due to declining demand. They will continue to adjust to equilibrium demand-supply levels for goods and services back at potential output levels. As this progresses, interest rates will decline again, which reduces the cost of borrowing and may reinvigorate firms' investments. Likewise, consumers' spending may increase with a lower cost of borrowing. Lower interest rates can also help increase net exports as the domestic currency may depreciate as a result. Altogether, this can lead to greater stimulation in economic growth and job creation. Moreover, it is all other factors (i.e. interest rates, GDP, etc.), except the price level, which will return back to what it was prior to the monetary contraction. Therefore, these short-run effects disappear in the long run in 4-5+ years as it is likely the economy will continue to grow.

d) The government official then asks you about the role of wage and price flexibility in your answer to part (c). Does this relate to the underlining of the word "likely"? Explain.

There is a role for wage and price flexibility in the longer run. While in the short run wages and prices are slow to adjust to economic changes as they are more rigid and sticky with a contractionary force. In fact,

since wages are slower to adjust, the decreased aggregate demand can lead to more unemployment than a reduction in wages. As well, if prices are more rigid, this may lead to an excess supply for firms and a build-up of inventories. Over time and a longer-term period, they are more flexible because firms and workers are able to adjust to new economic realities through firms reducing inventories or workers accepting new wages rather than being unemployed. Its role does relate to the "likely" as the degree of flexibility over time will depend on various factors like the degree of price stickiness. Wages and price flexibility play an important role in offsetting the short-run effects of a monetary contraction because it allows the economy to adjust to changes in economic conditions.

e) The government official has heard that long-run money neutrality is less likely if "hysteresis" exists. Explain the concept of hysteresis, provide some intuitive examples, and explain how it connects to the idea of long-run money neutrality.

Credited to Jack Burnham, Anmol Gupta, Caroline Wilson

Hysteresis refers to the lagged effects that persist after the initial causes that gave rise to the effects have been removed. Applied to the neutrality of money, hysteresis means that changes in the supply of money will have an effect on variables such as GDP over the long term.

The first example of hysteresis would be that as the interest rate (the "price of money") declines due to an increase in the money supply, firms will then be encouraged to invest (as the price of investing is lower), leading to a growth in the capital stock (such as investment in new types of technology) which then changes the trajectory of the economy's growth over the long-run, even after interest rates rise again.

Another example of hysteresis would be that if the interest rate increases (the "price of money") due to a decrease in the money supply, prompting a recession as aggregate demand falls, firms will be forced to lay off workers. If these workers are unemployed for a long period (such as eight months to a year), then it is natural to assume that their skills will have degraded. This decline in skills will limit the growth of the economy in the long-run, even after the recession ends, as these workers may be less productive than they would have been otherwise.

The concept of hysteresis suggests that the supply of money is non-neutral, even in the long run, as in both of these examples, the supply of money has an impact on the long-term growth rate of GDP.