

**Name:**  
**Section:**  
**T.A. Name:**

**180.101 ELEMENTS OF MACROECONOMICS**

**Fall, 2011**

**Final Examination**

**Prof. Louis J. Maccini**

**Time Allotment for the Exam: 100 Minutes**

**Total Points on the Exam: 230 Points**

**ANSWER KEY**

**INSTRUCTIONS**

(a) At the top of this page, write your name, section number and TA name. You will get a bonus of 5 points if both the section number and TA name are completed correctly.

(b) The exam contains **eight pages**. Writing is permitted on both sides of each page. Answer each question on the side of the page specified. There will be instructions on where to place answers to questions on each side of each page. Answers that are placed on the wrong page or the wrong side of a page will not be graded.

**QUESTIONS**

**NB: You may answer Question 1 on both sides of this page.**

**Question 1. (40 Points).** Describe and state the significance, during both normal times and the Great Recession, of each of the following:

- (a) (20 Points) The Discount Window and the Discount Rate
- (b) (20 Points) Quantitative Easing policies: QE1 and QE2

**Answer to Question 1-a:** The Discount Window and the Discount Rate

Description: The Discount Window is the office out of which the Fed makes loans to depository institutions, which are commercial banks and thrift institutions. The discount rate is the interest rate that the Fed charges depository institutions for these loans.

Significance: (i) Changing the discount rate is a tool of monetary policy, since lowering the rate encourages depository institutions to borrow from the Fed to cover reserve deficiencies, rather than sell off earning assets, and vice-versa.

**NB: You may continue your answer to Question 1 on this side of this page.**

(ii) Under normal conditions, changing the discount rate is decidedly secondary in importance as a tool of monetary policy after open market operations. Discount rate changes are used less actively and have a smaller impact than open market operations, and the total dollar amount of loans that the Fed makes to depository institutions is typically quite small.

(iii) During the Great Recession, the Fed lowered the Discount Rate to very low levels, to nearly zero, and provided substantial amounts of loans to depository institutions through the Discount Window.

**(c) Answer to Question 1-b: Quantitative Easing policies: QE1 and QE2**

Description: Quantitative Easing policies, such as QE1 and QE2, refer to unconventional monetary policies. QE1 refers to the Fed's purchase of very substantial amounts of mortgage-backed securities, which began in November, 2008 and eventually amounted to \$1.2 trillion. QE2 refers to the policy of the Fed purchasing long-term U.S. Government Bonds, which was begun in November, 2010, and which amounted to \$600 billion.

Significance: (i) In normal times, Quantitative Easing policies, like QE1 and QE2, are rarely done. They are not conventional monetary policies.

(ii) The Quantitative Easing policies were unconventional monetary policies that were undertaken to counter the Great Recession. QE1 and QE2 contributed to the massive injection of reserves into the commercial banking system during the Great Recession. Further, QE2 was designed to lower long-term interest rates to stimulate spending.

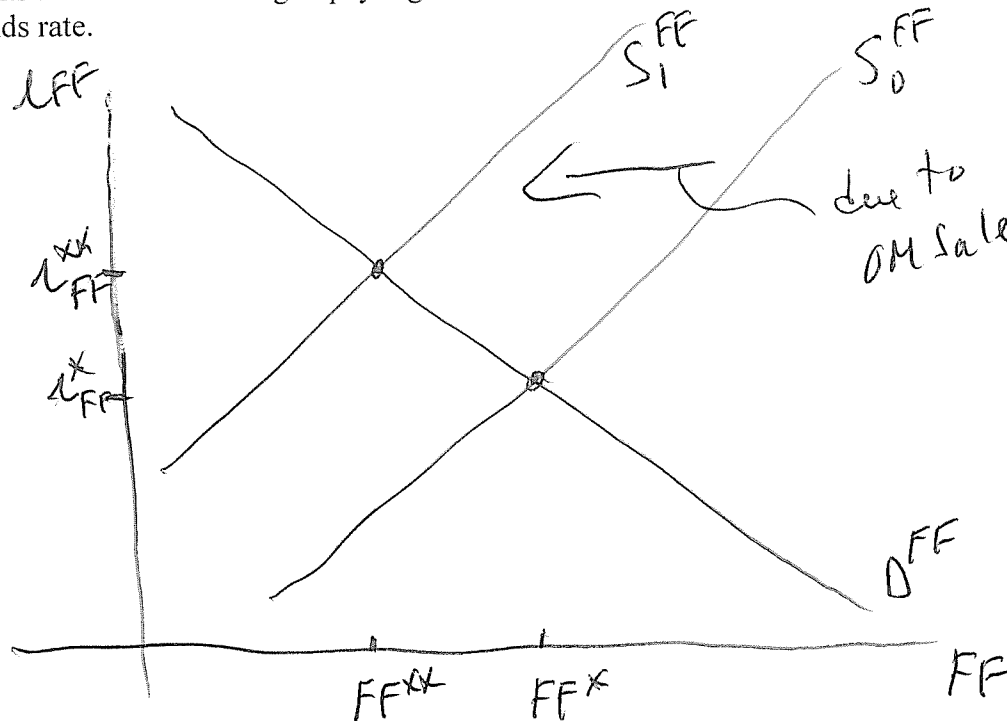
**NB: You may answer Question 2 on both sides of this page.**

**Question 2: (40 Points)** “When the Fed undertakes an open market sale of government securities, it normally sells short-term U.S. government bonds. This pushes up short-term interest rates on U.S. government bonds, but does not affect the federal funds rate or the overall level of interest rates.” True, false, uncertain. Explain your answer in detail. Use graphs, wherever appropriate, to explain your answer.

**Answer to Question (2):** The statement is: “False”.

When the Fed undertakes an open market sale of government securities, it normally sells short-term U.S. government bonds. To sell them, the Fed must offer them at lower prices than the ruling market price. This raises the yield or interest rate on short-term U.S. government bonds. So, an open-market sale of government securities does push up short-term interest rates on U.S. government bonds

However, there are additional effects. When the Fed undertakes an open market sale of government securities, it drains reserves from the banking system. This affects the federal funds rate. To see this, consider the federal funds market. Because there is a decline in reserves in the banking system, there is a decline in federal funds. Because federal funds have become relatively more scarce, that drives up the federal funds rate,  $i_{FF}$ . See the diagram below, which shows that a decline in reserves in the banking system is captured by a shift to the left of the Supply Curve for federal funds. This raises the federal funds rate. The intuition is that fewer banks now have excess reserves, and so banks that have excess reserves can offer them at higher rates. More banks are now “Reserve Deficient” and thus need reserves to satisfy legal reserve requirements and are thus willing to pay higher rates to obtain them. Both forces push up the federal funds rate.



**NB: You may continue your answer to Question 2 on this side of this page.**

Consider next the financial markets for other financial assets. Examples are:

<u>Financial Instrument</u>	<u>Interest Rate</u>
Federal Funds	$i_{FF}$
U. S. Government Bonds	$i_{GB}$
Corporate Bonds	$i_{CB}$
Business Loans	$i_{LN}$
Mortgages	$i_{MORT}$
<u>Etc.</u>	<u>Etc.</u>
Average Interest Rate	$i$

This then sets off a chain reaction:

(i) Once banks and financial firms see interest rates on short-term Government Bonds rising, they sell off corporate bonds or longer term government bonds, which they must do by offering them at lower prices. This raises their yields or interest rates, etc.

(ii) Also, the open market sale of government bonds drained reserves from the banking system. Some banks that need reserves will sell off government and corporate bonds which further pushes up interest rates on these instruments.

(iii) Further, banks with fewer reserves can ask for higher interest rates on business loans and mortgages, because they will want to negotiate and consummate fewer loans and mortgages. This raises interest rates on business loans and mortgage rates. Etc.

(iv) Hence, the over-all level of interest rates,  $i$ , will rise.

**NB: You may answer Question 3-a on both sides of this page.**

**Question 3: (75 Total Points)** Suppose the economy is operating under completely slack conditions, the government budget is in balance, but the outstanding national debt is high. The President and Congress agree that certain welfare programs must be cut by \$X billion. They also agree that any surpluses that arise in the government budget from the cut in welfare payments should be used to retire government bonds held by the private sector. Answer all of the following questions:

**Question 3-a: (20 Points)** Ignoring the retirement of government bonds, what will be the effect of the cut in welfare payments on real GDP? In your answer, be sure to: write down a model that includes a statement of the Aggregate Expenditure Schedule so that you can demonstrate shifts in the schedule; illustrate your answer with an Income-Expenditure diagram, labeling axes, curves and curve shifts appropriately, and explain carefully what is going on.

**Answer to Question 3-a:**

The model is:

$$Y = E$$

$$E = C + I + G$$

$$C = \bar{C} - b\bar{TX} + b\bar{TR} + b(1-t)Y$$

$$I = \bar{I} - \alpha i$$

$$G = \bar{G}$$

The Aggregate Expenditure Schedule, E, is:

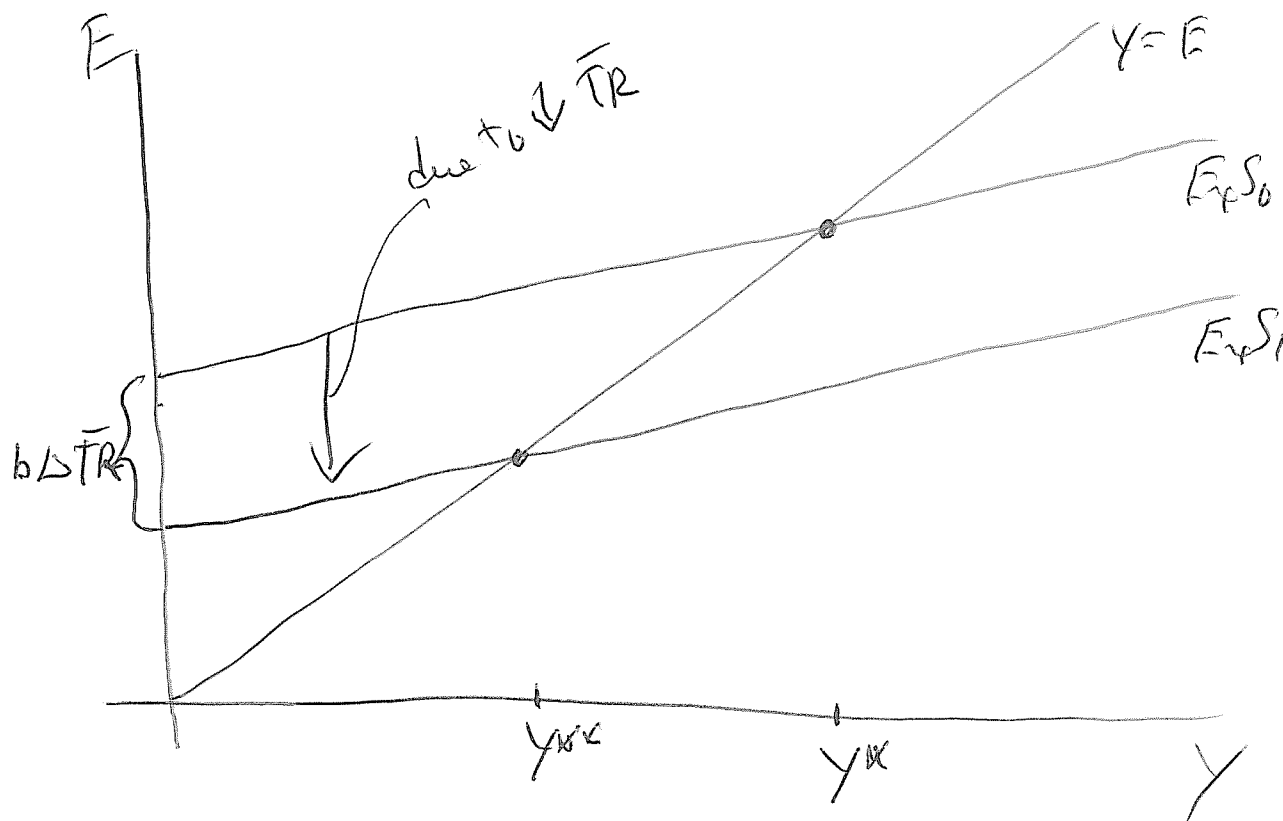
$$E = C + I + G$$

$$= \bar{C} - b\bar{TX} + b\bar{TR} + b(1-t)Y + \bar{I} - \alpha i + \bar{G}$$

$$= \underbrace{\bar{C} - b\bar{TX} + b\bar{TR} + \bar{I} - \alpha i + \bar{G}}_{\text{Effective Intercept}} + \underbrace{b(1-t)}_{\text{Slope}} Y$$

A decline in welfare payments is a decline in autonomous transfer payments, which shifts down aggregate planned expenditure by  $b\Delta\bar{TR}$ , that is, by the MPC times the decline in transfer payments. It shifts the Aggregate Expenditure Schedule from  $ExS_0$  to  $ExS_1$ . If the retirement of bonds is ignored, this would reduce real income from  $Y^*$  to  $Y^{**}$  through multiplier effects. See the diagram below.

NB: You may continue your answer to Question 3-a on this side of this page.



**NB: You may answer Question 3-b on both sides of this page.**

**Question 3-b: (30 Points)** Now, assume that the government uses any surpluses that arise in the government budget from the cut in welfare payments to retire bonds held by the private sector. What will be the effect on real GDP? Use the model you specified in Question 3-a, along with any necessary extensions, to demonstrate shifts in the Aggregate Expenditure Schedule. Illustrate your answer with an Income-Expenditure diagram, labeling axes, curves and curve shifts appropriately. And explain carefully what is going on.

**Answer to Question 3-b:**

(i) Beginning from a balanced budget, the decline in welfare payments and thus the decline autonomous transfers creates a budget surplus in which case government receipts exceed government spending. Since the government has excess receipts, it can retire or buy back government bonds. If the government retires bonds held by the private sector, then it is buying government bonds in government bond markets from financial firms and private individuals, not the Fed. This raises the price of government bonds and thus lowers the interest rate on government bonds.

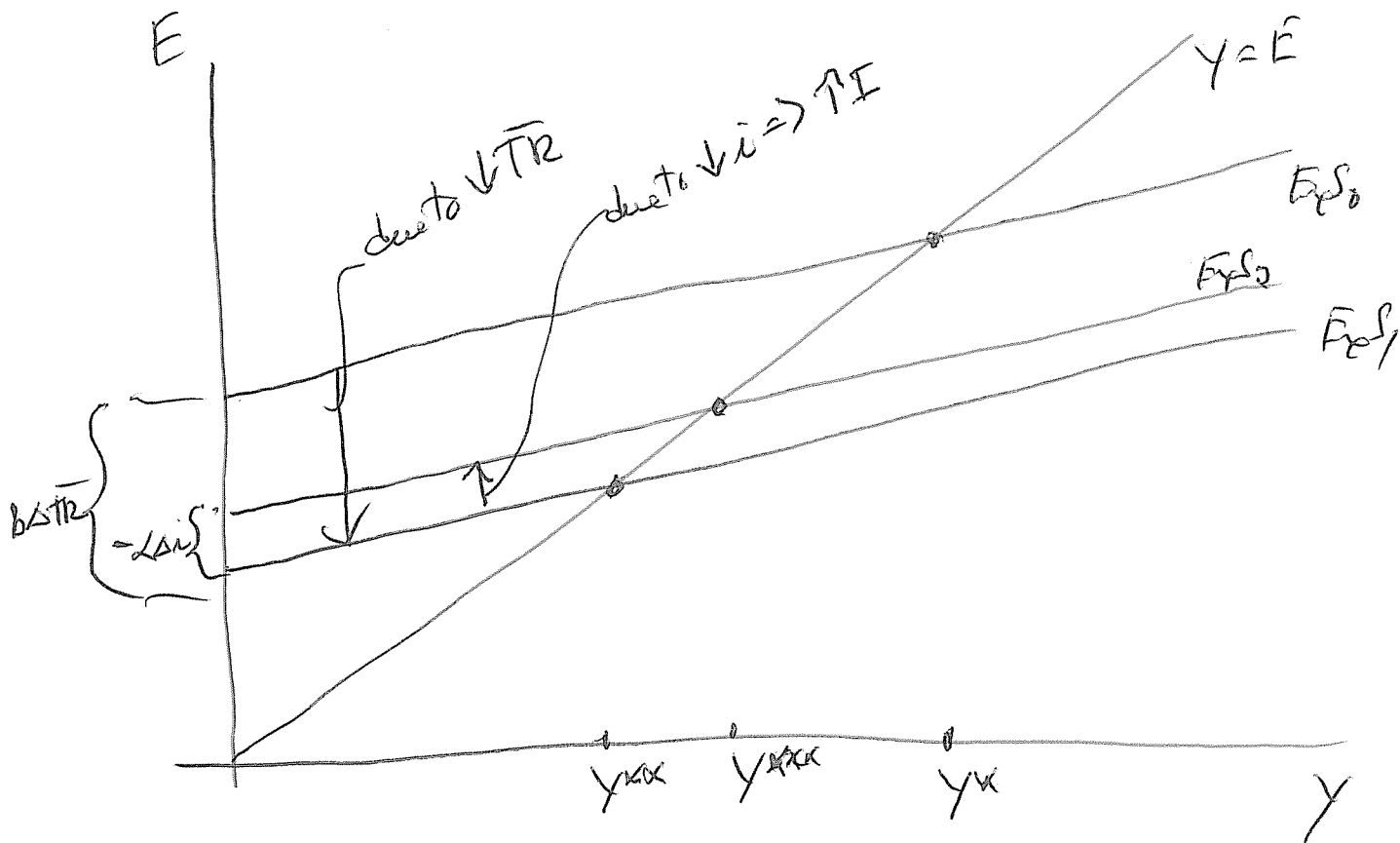
(ii) Through a chain reaction process, lower interest rates on government bonds encourage financial firms to purchase corporate bonds and other securities which lowers their interest rates, encourage banks to lower interest rates on various loans; etc. As a result, the over-all level of interest rates falls; that is,  $i$  falls.

(iii) A lower level of interest rates makes it less costly for business firms to borrow to finance purchases of new plant & equipment and for households to purchase new houses. There will thus be an increase in investment spending which shifts the aggregate expenditure schedule upwards to  $ExS_2$ . Technically, investment and aggregate expenditure shift upwards the aggregate expenditure schedule by  $-\alpha\Delta i$ . The lower level of interest rates has thus increased private investment spending. This can be termed “crowding-in”, or “crowding-out in reverse”, but a specific term is not necessary for the answer provided that there is a recognition that investment has increased.

(iv) Hence, the decline in aggregate expenditure is reduced, and thus the ultimate decline in real income is to  $Y^{***}$ , which is higher than  $Y^{**}$ . See the diagram below.

(v) Extra-credit: Since the economy is operating under completely slack conditions, it may be in a recession. In this case, the decline in interest rates may not increase investment very much because business firms have considerable excess capacity and can increase output to meet higher demand without increasing the capital stock very much. This would be captured in the model by assuming that  $\alpha$  is small or negligible, so that the upward shift in the aggregate planned expenditure schedule is small or negligible. NB: In this case, the answer must recognize that, for investment to not be stimulated very much,  $\alpha$  must be small or negligible.

NB: You may continue your answer to Question 3-b on this side of this page.



**NB: You may answer Question 3-c on both sides of this page.**

**Question 3-c: (25 Points)** What will be the effects on the government budget and the national debt of the retirement of government bonds? Will the reduction of the national debt be of the same dollar magnitude as the cut in welfare payments? Use a statement of the government budget and its relationship to the national debt to answer these questions. And explain carefully what is going on.

**Answer to Question 3-c:**

The Federal Budget is defined as the excess of spending over tax receipts. Government spending includes government purchases, transfer payments, and interest payments. Government Receipts are tax revenues and include both autonomous taxes and income taxes. In symbols, the Government Budget is

$$\text{Bud} = \underbrace{\overline{G} + \overline{TR} + \overline{InP}}_{\text{Spend}} - \underbrace{\overline{TX}}_{\text{Rec}} = \overline{G} + \overline{TR} + \overline{InP} - \overline{TX} - tY$$

When  $\text{Bud} > 0$ , the budget is in deficit. When  $\text{Bud} < 0$ , the budget is in surplus. And when  $\text{Bud} = 0$ , the budget is in balance.

Beginning from a balanced budget, a decline in welfare payments by \$X billion reduces autonomous transfers,  $\overline{TR}$ , by \$X billion. But, because real income falls, income tax revenues,  $tY$ , fall, and thus the budget does not decline by \$X billion. Hence, in general the decline in the budget will be less than the decline in welfare payments in absolute value. Only in the extreme case where the marginal tax rate is zero,  $t = 0$ , and nothing else changes, will the decline in the budget be \$X billion.

Because the government is retiring or buying back government bonds, the national debt will be reduced. Formally,

$$\Delta ND = \text{Bud}$$

After the decline in welfare payments, the government will be running a surplus and thus  $\text{Bud} < 0$ . The Government is using the surplus funds to retire or buy up government bonds so that  $\Delta ND < 0$  and the national debt is thus declining. Because in general the decline in the budget is less than the decline in welfare payments in absolute value, the decline in the national debt will be as well.

Extra Credit: Observe that the decline in interest rates will reduce interest payments, which will also affect the budget surplus. In effect, beginning from a balanced budget, the decline in welfare payments by \$X billion will not in general produce a budget surplus of \$X billion.

**NB: You may continue your answer to Question 3-c on this side of this page.**

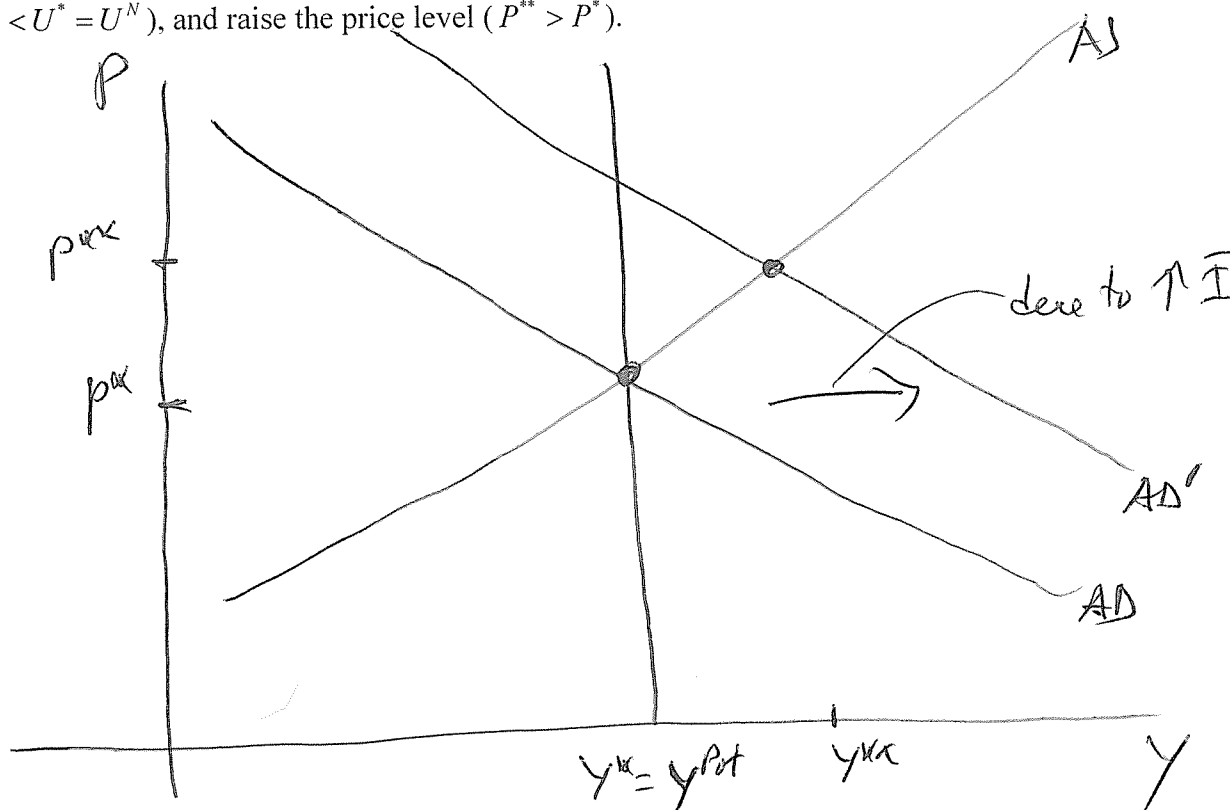
**NB: You may answer Question 4-a on both sides of this page.**

**Question 4: (75 Total Points)** Suppose the economy is at a normal level of unemployment and thus at a potential level of output. Suppose then that, due to forecasts of higher future demand, business firms increase autonomous investment spending. Answer all of the following questions:

**Question 4-a: (20 Points)** If no other changes occur, what effect will the increase in autonomous investment spending have on real income, the price level, and unemployment in the short-run? Illustrate your answer with an Aggregate Demand-Aggregate Supply diagram, labeling axes, curves and curve shifts appropriately, and explain carefully what is going on.

**Answer to Question 4-a:**

Suppose the economy begins at the normal employment rate, the normal unemployment rate, and thus real income and output are at a normal or potential level. The economy is thus at Full Employment where  $Y^* = Y^N = Y^{Pot}$ . Now, an increase in autonomous investment spending is a positive demand shock, which shifts  $AD$  to the right to  $AD'$ . This induces business firms to raise the level of employment, reduce unemployment, and thus raise the level of output. If no other changes occur, this would tend to raise the level of real income and output above normal or potential levels ( $Y^{**} > Y^* = Y^{Pot}$ ), reduce the unemployment rate below the normal level ( $U^{**} < U^* = U^N$ ), and raise the price level ( $P^{**} > P^*$ ).



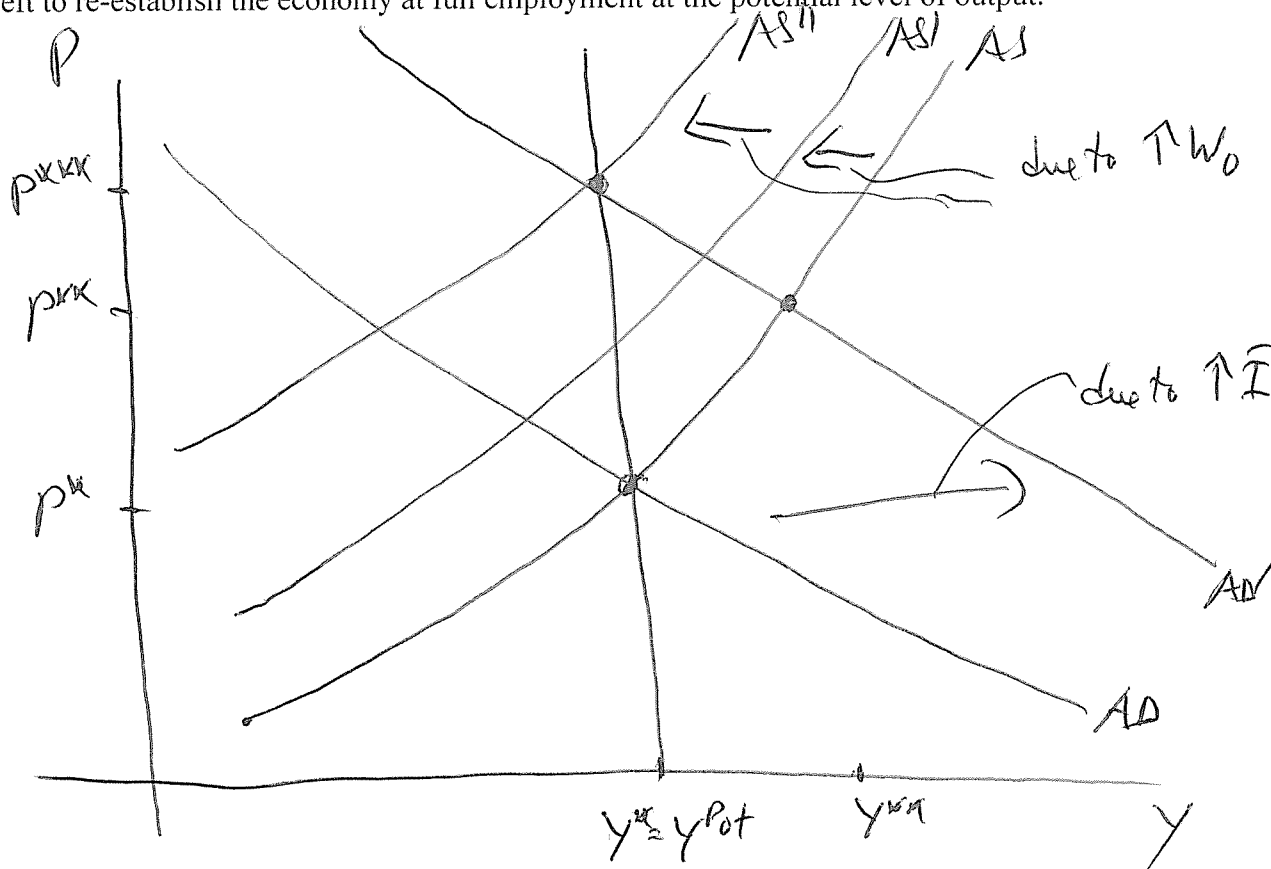
**NB: You may continue your answer to Question 4-a on this side of this page.**

**NB: You may answer Question 4-b on both sides of this page.**

**Question 4-b: (25 Points)** Are there forces at work that will drive the economy back to the potential level of output and the normal level of unemployment? If so, describe the forces at work and show what effects they will have on real income, the price level, and unemployment. Illustrate your answer with the Aggregate Demand-Aggregate Supply diagram, labeling axes, curves and curve shifts appropriately, and explain carefully what is going on.

**Answer to Question 4-b:**

The economy is now in an Inflationary Gap. Since  $U^{**} < U^N$ , the number of job openings exceeds the number of unemployed workers. This would tend to raise money wage rates since, given that the number of job openings exceeds the number of unemployed workers, business firms will need to raise wage rates to recruit workers. Increases in money wage rates represent increases in the cost of production, which would shift AS to the left. This would tend to reduce the level of real income and output, raise the price level, reduce the level of employment and thus raise the unemployment rate. Eventually, in principle, the AS curve would shift sufficiently to the left to re-establish the economy at full employment at the potential level of output.



**NB: You may continue your answer to Question 4-b on this side of this page.**

**NB: You may answer Question 4-c on both sides of this page.**

**Question 4-c: (30 Points)** Once the economy returns to the potential level of output and full employment, what effects will have occurred on the price level, which measures the cost of living? Construct a fiscal policy that will offset the effects on the price level. What are the consequences of that fiscal policy for real income, the price level and unemployment? Discuss any policy trade-offs that policy makers face under these circumstances. Illustrate your answer with the Aggregate Demand-Aggregate Supply diagram, labeling axes, curves and curve shifts appropriately, and explain carefully what is going on.

**Answer to Question 4-c:**

- (i) Once the economy returns back to full employment and the potential level of output, the price level, which measures the cost of living, will be higher in the new equilibrium. This is the ultimate effect of the increase in autonomous investment spending.
- (ii) To offset the increase in the price level, the government can conduct a contractionary fiscal policy:  $\downarrow \overline{G}$ ,  $\downarrow \overline{TR}$ ,  $\uparrow \overline{TX}$ , or a  $\uparrow t$  to shift the aggregate demand curve to the left. This would produce a lower price level.
- (iii) However, it would create a Recessionary Gap, with a lower level of output and a higher unemployment rate. Given that wage rates tend to be “sticky” downwards, this may create a substantial period of unemployment.
- (iv) Hence, policy-makers face a trade-off: They can reduce the price level and thus the cost of living back towards the prior level, but then the unemployment rate will stay above normal levels for a potentially substantial period of time. Policy-makers thus face a difficult trade-off between accepting a high cost of living or a high unemployment rate for an extended period, both of which have social costs.

NB: You may continue your answer to Question 4-c on this side of this page.

