180.101 Principles of Macroeconomics, Fall 2011

Second Term Exam : Practice Problems

1. Consider the Great Depression, which was a recession in which both output and prices fell. Using just those facts, can you make any conclusions as to whether a fall in aggregate demand or in aggregate supply was the primary cause of the recession? What about the recession and "stagflation" (low or negative output growth with rising prices) of the 1970s? Explain.

   In class, we discussed two general principles with respect to AD and AS. One principle was that shifts in the aggregate demand curve cause output and the price level to move in the same direction. The other principle was that shifts in the aggregate supply curve cause output and the price level to move in opposite directions.

   With that in mind, it seems that the Great Depression (in which output and prices both fell) was caused primarily by a shift of the AD curve (specifically, a leftward shift or adverse AD shock). On the other hand, the stagflation of the 1970s (in which output went down and prices went up) was caused primarily by an adverse AS shock.

2. Suppose that Americans become angry with the Australians because they have funny accents and drive on the wrong side of the road. As such, America declares war on Australia and, in preparation for the invasion, begins buying a lot of military equipment. At the same time, Australia begins sinking oil tankers shipping oil to the US.

   (a) Write down a model that will help you to analyze the effects of the war on output and prices in the US economy.

   The model is the AD-AS model, given by

   $$\begin{aligned} Y^d &= D(P, \overline{C}, \overline{I}, \overline{G}, \overline{TX}, \overline{TR}, t) \\ Y^s &= S(P, W, Z, TE, K) \\ Y^s &= Y^d. \end{aligned}$$

   (b) Explicitly identify the variables in your model that will be affected and state whether they increase or decrease.

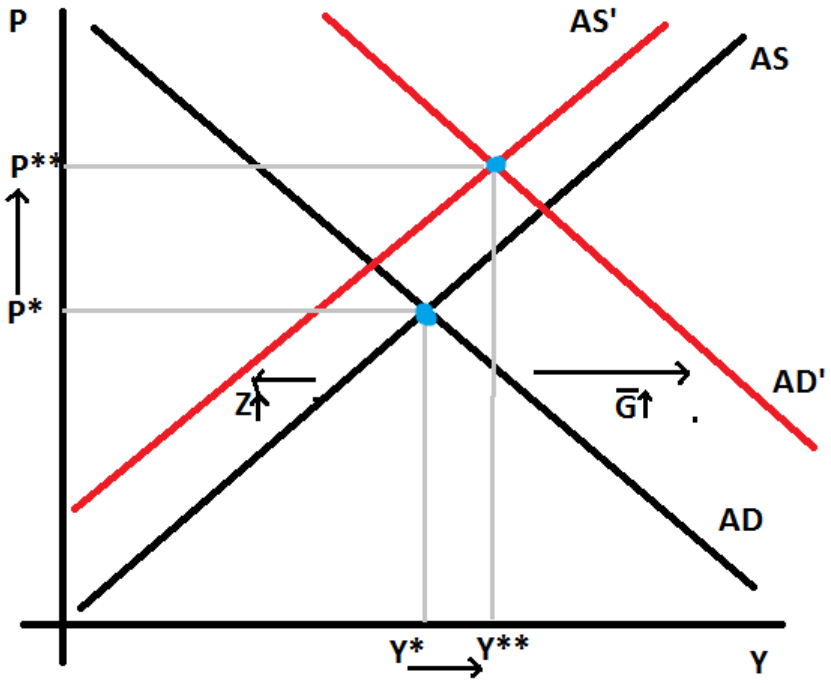
   An increase in government purchases of military equipment (final goods) is an increase in government expenditures, $\overline{G}$, and the sinking oil tankers means that less oil reaches the US, so that oil is more expensive in the US. Thus, we have an increase in $\overline{G}$ and in Z simultaneously.

   (c) Using the above, which curves shift, in what direction do they shift, and why? Remember to explain in intuitive/economic terms why the curves shift like they do (don't just refer to the equations).

   An increase in government purchases of military equipment (final goods) is an increase in government expenditures, $\overline{G}$, and the sinking oil tankers means that less oil reaches the US, so that oil is more expensive in the US. Thus, we have an increase in $\overline{G}$ and in Z simultaneously. The increase in government expenditures causes the AD curve to shift to the right, since when the government buys more goods and services, aggregate planned spending is directly increased so that at any given price level, more output is demanded. The increase in oil prices causes the AS curve to shift to the left because higher oil prices make production less profitable, so firms are not willing to produce as much, all else equal.

(d) Draw a graph depicting any shifts of the curves. Remember to label the graphs and label any equilibrium points. What can we say about the effects of the war on US output? On US prices? (i.e., do they increase, decrease, stay the same, or is their change ambiguous?)

We can say that prices will definitely increase, since both favorable AD shocks (like an increase in $\overline{G}$) and adverse AS shocks (like an increase in Z) lead to increases in prices. The effect on output is ambiguous, since the increase in government spending increases output, but the increase in oil prices decreases it. As drawn on the graph, output increases, but it could just as easily have decreased if the rise in oil prices was larger or the increase in government spending smaller.



3. Continue with the previous question. Being ignorant of geography, the US mistakenly bombs New Zealand rather than Australia, destroying a large number of factories. From the perspective of New Zealand's economy:

(a) What variable is affected and how?

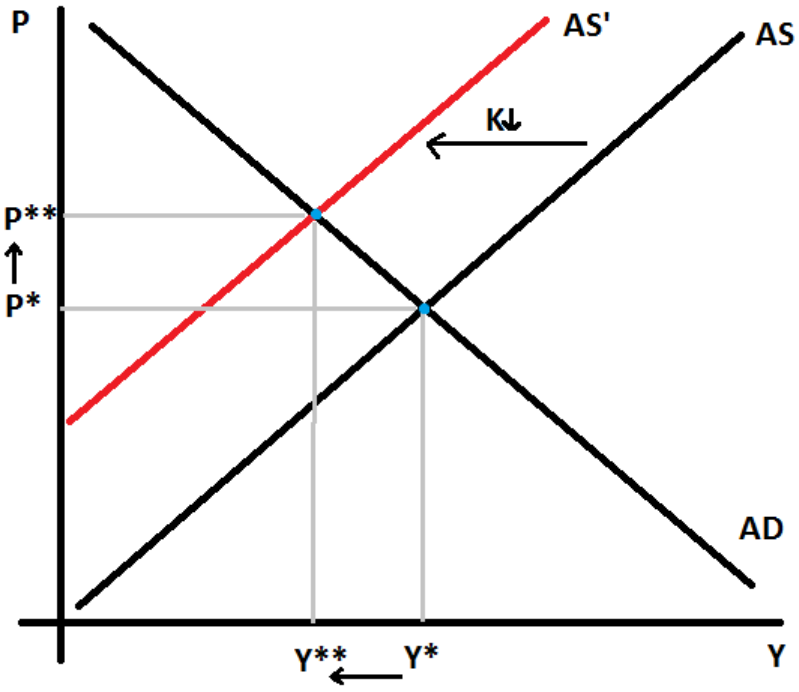
The destruction of factories can be represented in the AD-AS model by a decrease in New Zealand's capital, K.

(b) In the context of the AD-AS model, which curve(s) shift and how? Remember to explain in intuitive/economic terms why the curves shift like they do (don't just refer to the equations).

Capital is a variable determining the position of the AS curve and a decrease in capital causes the AS curve to shift to the left. Intuitively, all else equal, if a firm loses capital it is able to produce less output. The AD curve is unaffected in this question, since capital is the only variable which has changed (and capital does not affect the position of the aggregate demand curve).

(c) Depict this in a relevant diagram and discuss the effects on NZ's output and prices.

Output in New Zealand declines and the aggregate price level increases as a result of the bombing, consistent with an adverse aggregate supply shock. See the graph.



4. Suppose there is a closed economy operating under perfectly slack conditions; futher suppose that autonomous consumption is 370 billion zorkmids, autonomous planned investment is 230 billion zorkmids, and the marginal propensity to consume from disposable income is 0.85. The government taxes income at a rate of 20%, imposes a per capita tax of 3000 zorkmids on each of its 25 million citizens, purchases 500 billion zorkmids worth of goods and services, and distributes 5000 zorkmids to each of the poorest one-fifth of its citizens.

   (a) Write down a system of equations that will allow you to solve for the equilibrium level of output in the economy described above. Carefully explain what each equation represents.

   $E = C + I + G$: The expenditure schedule, which says that aggregate planned expenditure is the sum of consumption purchases, planned investment, and government purchases of goods and services.

   $C = 370 + 0.85Y_{dis}$: The consumption function, which says that aggregate consumption in this economy is determined by the sum of spending based on national income (with a marginal propensity to consume of 0.85) and autonomous consumption of 230 (billion zorkmids). Autonomous consumption represents the level of aggregate consumption that would occur in the economy even if no output was produced or income earned; it depends on any number of factors, including (but not limited to) consumer confidence.

   $I = 230$: Aggregate planned investment is autonomously fixed at 230 billion zorkmids, as given above. Planned investment does not change with income or any other variable in this system.

   $E = Y$: The equilibrium condition, which requires that in equilibrium, aggregate planned expenditure equals aggregate output. If this equation does not hold, then firms are either drawing down or building up their inventories in an unplanned way. Because this is not profit-maximizing, producers will change their output level.

   $Y_{dis} = 0.8Y - 50$: Disposable income is full income net of taxes and transfers. With income taxes equal to $0.2Y$, autonomous taxes equal to 75 billion zorkmids (3000 zorkmids

per capita times 25 million citizens), and autonomous transfers of 25 billion zorkmids (5000 zorkmids to each of the 5 million poorest citizens), the equation to the left can be generated. $G = 500$: Government spending is autonomously fixed at 500 billion zorkmids, as described above.

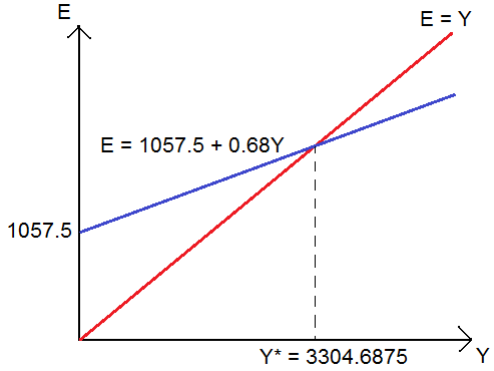
(b) Find the equilibrium levels of income, expenditure, and consumption in this economy, and explain why these are equilibrium levels (NB: Don't worry if your answers for this question aren't "clean" numbers; a calculator will help).

The general equation for equilibrium income or output in this environment is:

$$Y^* = \frac{1}{1 - b(1-t)}(\bar{C} + \bar{I} + \bar{G}) + \frac{b}{1 - b(1-t)}(\bar{TR} - \bar{TX}).$$

Substituting our specific parameter values into this equation, we find that equilibrium income is $\frac{1}{1-0.68}(370 + 230 + 500) + \frac{0.85}{1-0.68}(25 - 75) = 3.125 \cdot 1100 + 2.65625 \cdot -50 = 3304.6875$. Thus equilibrium income is 3,304,687,500,000 zorkmids. This also represents equilibrium expenditure in the economy, as in equilibrium aggregate expenditure equals aggregate income or output so that firms do are not building up or drawing down their inventories and thus are content to leave the level of output as is. Equilibrium consumption can be found by substituting equilibrium income into the equation for disposable income, and then substituting that value of disposable income into the consumption function. In particular, $Y^*_{dis} = 0.8 \cdot 3304.6875 - 50 = 2593.75$; $C^* = 370 + 0.85 \cdot 2593.75 = 2574.6875$. Thus equilibrium consumption is 2,574,687,500,000 zorkmids. This number can also be arrived at by recalling that $Y = C + I + G$, so that in equilibrium $C^* = Y^* - \bar{I} - \bar{G}$. It is the equilibrium level of consumption because it is the quantity of consumption that will occur at the equilibrium level of income.

(c) Draw a graph illustrating the model of equilibrium income determination, and briefly explain the concepts presented in it.

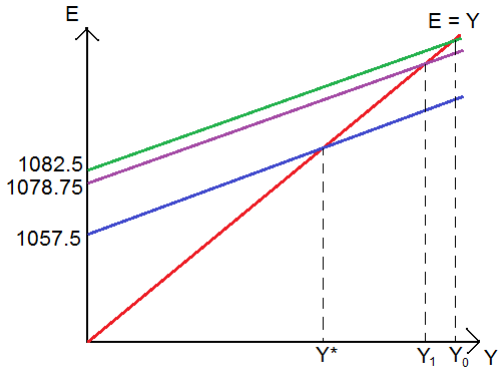


By plotting the expenditure schedule and the equilibrium condition, equilibrium output and expenditure in this economy can be seen graphically as the unique intersection of these two lines. In short, the equilibrium condition represents all of the potential equilibria in this economy: the combinations of aggregate expenditure and national income that would represent an equilibrium if they were to occur. The expenditure schedule represents that actual behavior of the agents in the economy: for any given level of output or income, how much will be spent in aggregrate. Thus the intersection of the lines, where both equations hold, is the equilibrium that can actually occur.

(d) Everyone agrees that society would be better off if national income were higher, but the two major political parties disagree on how they should achieve this. The Flatheads argue

that the per capita tax should be cut by 1000 zorkmids, while the Squareheads think that the government should build a new monument to national greatness at a cost of 25 billion zorkmids. Which of these two policies will better achieve the politicians' goals? Explain carefully, using any relevant graphs as necessary.

If per capita taxes were cut by 1000 zorkmids for each of the 25 million citizens, this would decrease autonomous taxes by 25 billion zorkmids: $\Delta \bar{TX} = -25$. In contrast, the purchase of a new monument would increase government spending by 25 billion zorkmids: $\Delta \bar{G} = 25$. Mathematically, we can see that the Squareheads' proposal to increase government spending will have a greater effect on GDP because the multiplier on autonomous spending (3.125) is greater in magnitude than that for autonomous taxes (-2.65625), so an increase in government spending will generate more new income than would an equivalent cut in taxes. Economically speaking, this occurs because building the monument directly contributes to GDP, immediately boosting income; the multiplier process of one person's income being spent on consumption, which becomes another person's income which is subsequently spent, and so on, begins immediately with a direct change of 25 billion zorkmids. On the other hand, the tax cut does not directly increase GDP, but instead does so only once the citizens spend their additional disposable income in the form of consumption purchases. Thus the multiplier process only begins with an initial change of $25 \cdot 0.85 = 21.25$, and only this amount of money will work its way back to another citizen in the form of income to be spent, etc. Because of the lack of a direct component to boosting national income, the tax cut generates a smaller increase in GDP than a comensurate increase in government spending.



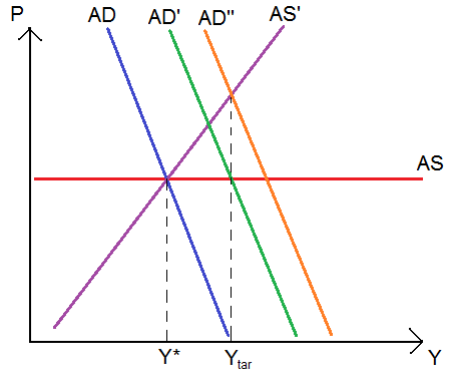
(e) Suppose the government wants to achieve a national income of 4000 billion zorkmids, and wants to achieve this by increasing government purchases. How much more should the government purchase in order to achieve this goal? Explain carefully, using any graphs as necessary.

In this case, we have a target level of equilibrium income of $Y^{**} = 4000$, and a current equilibrium level of income of 3304.6875. Thus the government's goal is to generate a change in equilibrium GDP equal to $\Delta Y^* = Y^{**} - Y^* = 695.3125$. The multiplier on autonomous government spending was calculated above as $\frac{\Delta Y^*}{\Delta \bar{G}} = 3.125$. Substituting in the desired change in equilibrium GDP, we can calculate the required change in government spending as: $\Delta \bar{G} = \frac{695.3125}{3.125} = 222.5$. The government can achieve its goal of a national income of 4 trillion zorkmids by increasing government spending by 222.5 billion zorkmids. [graph excluded]

(f) How would your answer to part (e) change if the economy were operating under ordinary supply conditions? Explain carefully and provide any relevant graphs that illustrate your

answer.

If the economy were operating under ordinary supply conditions, then a larger increase in government spending would be necessary to achieve GDP of 4 trillion zorkmids. Consider what would happen with an increase of only 222.5 billion zorkmids. In that case, the upward sloping supply curve represents the fact that firms would both increase production of output and raise prices in response to this increase in demand. They can safely and competitively raise prices because the factors of production are relatively scarce, so competing firms cannot quickly boost production and steal all of the firm's business after a price increase. When the aggregate demand curve shifts out due to the increase in $\bar{G}$, the economy's equilibrium moves up the aggregate supply curve. Economically, firms have increased prices and production. Meanwhile, the increase in prices means that consumers have lower real wealth, and thus will not purchase as much as they otherwise would. This cuts into the multiplier process described above, and the end result is that the increase of 222.5 billion zorkmids is insufficient to reach the target level of output. Because some of the increased demand is absorbed as price changes, a more expansionary fiscal policy (larger $\Delta\bar{G}$) is needed to achieve the 4 trillion zorkmid mark under ordinary supply conditions. Note also that the economy will undergo inflation due to this policy, as the price level will have increased.



In the graph above, the shift from AD to AD' due to the increase in government spending of 222.5 billion zorkmids is sufficient to reach the target level of income under perfectly slack conditions AS. However, under ordinary supply conditions AS', this policy is insufficient, and a larger shift in the ADC to AD" (from even greater government spending) is necessary to reach the target.

5. Which of the following are considered part of the U.S. money supply using M1 measures?

   (a) A \$10 bill you carry in your wallet.

   (b) A \$100 traveler's check you bought from Bank of America but did not use.

   (c) A \$100 bill in a bank's vault.

   (d) The +\$373.45 balance in your checking account.

   (e) A share of General Motors stock worth \$40.

The \$10 bill is part of currency in circulation. The \$100 traveler's check is just like currency, except that it has a form of insurance tied to it. The +\$373.45 in your checking account is a demand deposit. So, all of these are considered part of M1.

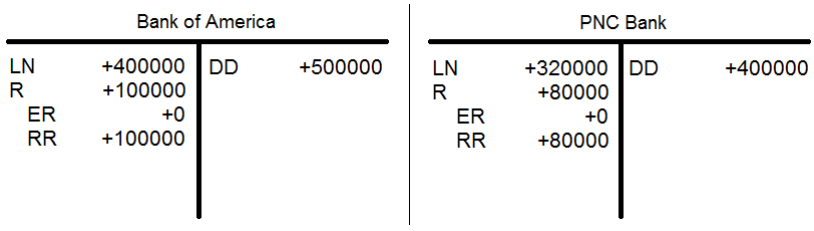
A $100 bill in a bank's vault is not 'money in circulation' among the public; it is being stored by the banking system, so is 'out of circulation'. A share of stock cannot be used directly for payment for goods and services; it is not 'liquid' money. So, these are not examples of M1.

6. Explain what is meant by a bank being "fully loaned up". Why do we believe it to be a reasonable assumption that banks strive to be fully loaned up?

   A bank is fully loaned up when it has loaned out all of its excess reserves and holds only the quantity of reserves required by law– it cannot loan out any more funds. It cannot hold less than this level of reserves (at least not for very long) because the central bank requires that banks hold a certain percentage (the required reserve ratio) of their deposits as cash on hand or in their reserve account; in the U.S., the Federal Reserve requires banks hold 10% of demand deposits as reserves. A bank does not want to hold much more than required reserves because reserves do not accrue any interest (revenue for the bank), whereas funds that are loaned out (as mortgages, business loans, loans to banks, purchases of stocks and bonds, etc) do return a positive interest rate. Banks seek to maximize profit, so any unused funds represent lost opportunities to make money.

7. Assume that banks fully loan up and there is no "cash drain". If the required reserve ratio is 20%, how will the money supply change (eventually) if Steve deposits $500,000 into his checking account at Bank of America? Carefully explain your answer, using any diagrams as necessary.

   When Steve deposits the $500,000 into his account at Bank of America, the bank now has $500,000 more in reserves, of which $100,000 are required reserves (20% of the increase in demand deposits of $500,000) and the remaining $400,000 are excess reserves. Bank of America wants to earn a positive return on as much of its assets as possible, so it will loan out all of the $400,000 to some firm, who will spend the cash to purchase new machinery. The manufacturer of the machinery will then deposit the $400,000 into their account at some other bank, say PNC. PNC will see that its reserves have increased by $400,000, of which $80,000 are required reserves (20% of the $400,000 increase in demand deposits) and $320,000 are excess reserves. PNC Bank will want to loan out all of their excess reserves, and this cycle of deposits, loans, and spending will repeat indefinitely until (arbitrarily close to) all of the $500,000 is represented by required reserves. Using a geometric series argument, the total increase in deposits is $\$500,000 \cdot \frac{1}{1-(1-0.2)} = \$2,500,000$. However, Steve's initial deposit of $500,000 took currency out of circulation, and thus no new money was created in that step. The total change in the money supply is thus $\Delta M = \$2,000,000$.



8. Suppose for this question that all banks hold on to an additional 5% of deposits beyond the required level.

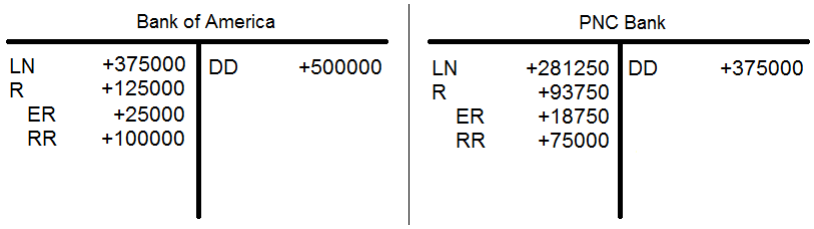
   (a) Why would banks ever choose to act in this way, given your answer to quesiton 6?

   While there are various reasons why banks would want to hold on to a *small* amount of excess reserves (protect against an expected level of withdrawals, or leaving money available

for a purchase of assets or offering a loan), holding a whole 5% more of deposits would not be justified by these reasons. The most likely reason for such a large holding of excess reserves is that there is a poor economic or lending environment in which the bank does not believe that there are sufficiently safe places to invest their money: potential borrowers are perceived as riskier, or stocks and bonds appear too volatile, etc. In this case, a bank might feel that it is better served by simply holding cash than unwisely risking its money. Note that this belief may or may not be justified by facts, but it is the current subjective opinion of the bank's managers.

(b) How would your answer to question 7 change in this situation? Explain carefully, using appropriate diagrams.

In this case, Steve's initial deposit would still increase required reserves by \$100,000, but Bank of America would *choose* to hold on to an additional \$25,000 in excess reserves. Thus it would only loan out \$375,000, and only this quantity of money would work its way to PNC Bank. When PNC Bank received this deposit, \$75,000 will be required reserves (20% of the deposit), while the bank will want to hold on to an additional 5% of the deposit as excess reserves (\$18,750). So only \$281,250 would be loaned out. In this way, the deposit creation process continues but is dampened or slowed down. Money is being taken out of the financial system at a faster rate. Using a geometric series to calculate the total change in deposits, this situation acts *as if* the required reserve ratio were 25%, so the change in the money supply will be $\$500,000 \cdot \frac{0.75}{0.25} = \$150,000$. Again, the initial deposit is not newly created money.



9. Suppose the money supply is \$3.2 trillion and the required reserve ratio is 10%. The Federal Reserve decides to use open market operations to increase the money supply by \$500 billion. What can the Fed do to carry out the planned increase? What if the required reserve ratio is 15%?

Because of the money multiplier process, an injection of reserves by the Fed into the banking system will eventually increase the money supply by *more* than that injection of reserves. Thus, we must compute the initial increase in reserves that the Fed must carry out in order to eventually achieve a \$500 billion increase in the money supply.

Substitute the desired change in the money supply (\$500 billion) and the money multiplier ($\frac{1}{0.10} = 10$) into the equation for the change in the money supply. Then, solve for the initial increase in bank reserves (R) that is required:

$$500 = 10 * R$$

So:

$$R = \frac{500}{10} = 50$$

Thus, the Fed must inject 50 billion of reserves into the banking system in order to achieve a $500 billion increase in the money supply over time. In other words, it must generate an increase in demand deposits by $50 billion. (Remember that every $ that is put in a bank as demand deposits on the liabilities side is an extra $ of reserves on the assets side.) The Fed can accomplish this by purchasing government bonds worth 50 billion from members of the public (e.g. Bill Gates and Warren Buffett). The payment for these bonds will be credited as an increase in demand deposits for Gates and Buffett at their respective banks. And there will be a corresponding increase in reserves for these banks. If there is no withdrawal from demand deposits, and all excess reserves are loaned out, this injection of reserves of $50 billion will lead to an increase in the money supply over time by $500 billion.

If the required reserve ratio is 15% (so that the money multiplier $= \frac{1}{0.15} \approx 6.67$), the Fed will need to increase initial deposits by $\frac{500}{6.67} = 75$ billion. It can do this by buying government bonds worth $75 billion from the public. (Note that when banks are required by law to hold a higher fraction of demand deposits as reserves, they cannot loan out as much. So the money creation process is dampened. Thus, the initial injection of reserves by the Fed has to be larger to achieve a given increase in the money supply.)