Homework 5:

The Monetary System and Inflation

Solutions

1. Be sure to read your copy of the Wall Street Journal every weekday, looking especially for items related to the material in this course. Find an article in this week's Wall Street Journal or other news source that is relevant to the topic of this homework assignment. Turn it in, or a copy of it, with your assignment, and write a brief summary of it (half a page to a page). Your summary should outline the main points of the article **and** explain why it is relevant to the homework topic, in this case "The Monetary System and Inflation."

2. You are going to use the following hypothetical financial information to measure the money supply in the US in 2000.

   Traveler's checks held by the public: $38 billion

   Bills and coins in circulation: $615 billion

   Bills and coins in vaults of commercial banks: $37 billion

   Demand deposits: $905 billion

   Savings deposits: $4 trillion

   Government bonds held by the public: $218 billion

   Government bonds held by the Federal Reserve Bank: $251 billion

   Amounts owed on credit cards: $279 billion

   Credit limits on credit cards: $514 billion

   Small time deposits: $2,321 billion

   Money market mutual funds: $2,956 billion

   Using this information calculate M1 and M2. Some of the above information is not used to calculate the money supply. Explain why.

   M1 = Currency (bills and coins in circulation) + Demand deposits + traveler's checks

   = $615 + $905 + $38= $1,558 billion

   M2 = M1 + Saving deposits + Small time deposits + Money market mutual funds

   = $1,558 + $4,000 + $2,321 + $2,956

   = $10,835 billion

   See Figure 1 in Chapter 11 of Mankiw.

Bills and coins in the vaults of commercial banks are part of their reserves, but they are not in the hands of the public and are not part of the money supply.

Credit card balances are not included in any money stock definition, because they are not considered to be a method of payment. Such transactions are just deferrals of payment to a future date. The amounts that are still available to be charged on credit cards (credit limits minus amounts owed) may well be regarded as a means of payment by many of us, but they are not included in any definition of the money supply.

Government bonds are not included in the money supply either. Bonds held by the public represent the amounts that the government owes us, and are part of our wealth, but they cannot be used as a means of payment and cannot be converted to cash easily enough to be included in the definitions of M1 and M2. The money supply does not include the bonds held by Federal Reserve, even though the Fed uses bonds to change the money supply by open market operations. Thus the bonds that the Fed holds now were presumably acquired through open market operations in the past, and the current money supply is in part a result of that, but that is already measured from the items included in the definitions of M1 and M2.

3. What are the options available to the Federal Reserve to increase the money supply? Explain how each works. How can the effectiveness of these policies be limited by the actions of banks and the public?

There are three tools available to the Fed for controlling the money supply:

Open Market Operations: These are operations whereby the Fed buys and sells bonds. In this case, since we want to increase the money supply, the Fed should buy back some of the government bonds that the treasury has issued in the past and are now held by the public. This directly increases the number of dollars in circulation, and will have an even bigger impact when people deposit some of this money that is newly in circulation. Banks can increase the impact of Open Market Operations by lowering their reserves (if they are above the federally imposed minimum)…see below.

Reserve Requirements: Banks keep some part of their deposits in reserve and do not loan these out. This reduces the banks' ability to create money. Therefore, if the Fed lowers the reserve requirement, presumably there will be more money that banks can loan. As a result, banks can create more money through loans.

Discount Rate: This is the interest rate that banks pay to the Fed, if they borrow from it. They may borrow money if they realize that they will not be able to meet the minimum reserve requirement. If the Fed decreases the interest rate that they charge to the banks, banks will have more incentive to loan money to the public and thus reduce their reserves, because the cost of borrowing from the Fed (if necessary) has decreased. By loaning more, banks will be creating more money, and the money supply will increase through the mechanism described above.

None of these policies can affect the fraction of money that the public chooses to deposit in banks, nor can the polices affect the fraction of their deposits that the banks choose to hold as excess reserves. These are the two main limitations of these policy instruments. If the banks prefer to keep high excess reserves, a decrease in the minimum reserve requirement may not be effective. If consumers are not depositing much money in the banks, and instead keep their extra money as cash in their pockets, then open market operations will be less effective in increasing the money supply. Consumers will then sell their bonds to the Fed, but they will not deposit much of the proceeds in banks.

4. Suppose that First National Bank acquires $600,000 in new deposits and initially uses part of this to make new loans of $400,000. The T-account of First National Bank, showing changes in its assets and liabilities, is as follows:

Assets		Liabilities	
Change in Reserves	$200,000	Change in Deposits	$600,000
Change in Loans	$400,000		

   a) Suppose that the Fed requires banks to hold 10 percent of deposits as reserves, and that prior to the changes shown above the First National Bank was satisfying that requirement exactly. How much in excess reserves does First National now hold, as a result of the changes listed above?

   If the required reserve ratio is 10 percent, then First National Bank's required reserves have risen by ($600,000) × (.10) = $60,000. Since the bank's total reserves have risen by $200,000, it now has excess reserves of $140,000.

   b) Assume that all other banks hold only the required amount of reserves and that the public holds no cash. If First National now decides to reduce its reserves to only the required amount, by how much will the economy's money supply increase?

   With a required reserve ratio of 10 percent, the money multiplier is 1/(.10) = 10. If First National lends out its excess reserves of $140,000, the money supply will eventually increase by ($140,000) x (10) = $1,400,000.

5. Let us visit the Island of Yap on which our friend Pacificus has set up a commercial bank. Pacificus fears bank runs, and so he wishes to keep at least 10% of all deposits in his safe, just in case somebody wants his/her deposits returned to him/her.

   Suppose that the original total value of stone wheels (used as money) on the island is 500 fei. The line for loans is endless. Once people have gotten their loan, they spend it immediately. Whomever they purchase goods and services from then shows up at the bank to deposit the money into their account.

a) Colobos, one of the more adventurous islanders, discovers an unknown rock in a hidden place. If he can chisel 5 more stone wheels worth a total of 100 fei out of that rock, and he then deposits those wheels in the bank, by how much will the amount of loans, deposits, and money supply increase? Be sure to calculate what the original money supply was.

The original money supply was 5000 fei, as shown in the first line of each category in the following balance sheet. That is, all of the initial 500 fei of stone wheels had been deposited in the bank and were therefore its reserves. With a 10% reserve ratio, this 500 fei of reserves supports deposits of 10×500=5000 fei. Since the only other asset the bank can hold, besides reserves, is loans, the loans must be 5000–500=4500.

When Colobos deposits his newly carved 100 fei of wheels, this initially (step 1 in the table) increases deposits by 100. Since the bank only wants to keep 10% of that, it increases reserves by 10 and lends out the remaining 90. But the recipients of the loans don't want to hold stone wheels, so they too deposit this amount, causing step 2 in the table. This process is repeated in ever smaller steps until a new balance is reached with all of the new stone wheels being held in reserves, which are now 500+100=600 fei. In the limit, the process stops when deposits are 10 times this, so that reserves are one tenth of deposits and the bank doesn't want to make any more additional loans. So at that point deposits have risen to 10×600=6000, and the money supply (which here is the same as deposits, since the public is holding no cash) has risen by 6000–5000=1000.

Assets			*Liabilities*		
Reserves		*500*	*Deposits*		*5000*
	1.	*+ 10*		*1.*	*+ 100*
	2.	*+ 9*		*2.*	*+ 90*
		…			*…*
Loans		*4500*			
	1.	*+ 90*			
	2.	*+ 81*			
		…			
		6000			*6000*

b) The media got wind of the increase in money supply, but nobody knows for sure where the extra money had come from. As a result, some islanders have become more suspicious of the bank's operation. Just to play it safe, Pacificus decides to increase his reserve-deposit ratio to 15 percent. What is the amount of loans that Pacificus needs to recall? (Hint: a recalled loan requires somebody else to withdraw money.)

Since no islander holds any currency (i.e. stone wheels) to make transactions, all stone wheels end up in the safe of Pacificus' bank. If the value of those stone wheels is now supposed to be 15% of all deposits, then 600 fei in reserves can now support only 4000 fei in deposits (since 600=0.15×4000). Since Pacificus only has two choices for what to do with a deposit (reserves or loans), the difference between deposits and reserves must be in outstanding loans equal to 4000–600=3400 fei. Previously (that is, after the process described in part (a) but while the reserve ratio was still 10%), loans were 6000–600=5400. Therefore, loans will have to decrease by a total amount of 2000 fei. This won't happen all at once, however. Initially, in order to try to raise reserves from 10% to 15% of his 6000 deposits, or in other words from 600 to 900, Pacificus will recall loans of 300. But to repay their loans, these borrowers will have to withdraw this 300 from their accounts, reducing both reserves and deposits by 300, and leaving Pacificus with no more reserves, but less deposits, than before. Repeating this process, he recalls still more loans, until eventually both deposits and loans have fallen by 2000.

6. The table below gives data on money stock and real and nominal GDP for 1995, and the money stock for 1996 through 1999. Assume that the growth rate in real GDP is 3% a year, and is constant.

	M1	Real GDP	Nom. GDP
1995	1000	$9,000	$9,000
1996	1100		
1997	1540		
1998	1925		
1999	2025		

(a) Calculate the velocity of money (V) for 1995.

From the quantity theory of money, we have $V = (P \times Y) / M$ where $P \times Y$ is nominal GDP. Therefore in 1995, $V = 9{,}000 / 1{,}000 = 9$.

(b) If we assume that the velocity of money remains constant, find nominal GDP for years 1996 through 1999.

If the velocity of money stays at 9, given the money supply in years 1996-99, we can easily find the nominal GDP (P x Y) using the quantity theory of money:

$$\text{Nominal GDP} = P \times Y = M \times V$$

Accordingly, nominal GDP in 1996 is 9 x 1100 = $9,900. Similarly nominal GDP will be $13,860 in 1997, $17,325 in 1998, and $18,225 in 1999.

(c) What is the rate of increase in prices between 1998 and 1999, measured by the GDP deflator? Compare this with the rate of increase in money supply, and the real GDP growth between 1998 and 1999. Do you observe the neutrality of

money?

Since the real GDP is growing at a rate of 3% a year, it will be 9,000 x (1 + 0.03)^3 = \$9,835 in 1998, and 9,000 x (1+ 0.03)^4 = \$10,130 in 1999.

The GDP deflator is the ratio of nominal GDP to real GDP times 100. Therefore, using your answers in part b, it is 17,325/9,835 = 176 in 1998, and 180 in 1999.

The inflation rate measured by the rate of increase in the price level given by the GDP deflator will then be: (180 – 176) / 176 =0.023≅3%

The rate of increase in the money supply between 1998 and 1999 is (2025-1925)/1925 = 5%. The rate of increase in real GDP is 3%. Note that the rate of increase in money supply is approximately the sum of the increase in real GDP and the inflation rate. That is we have the equation below

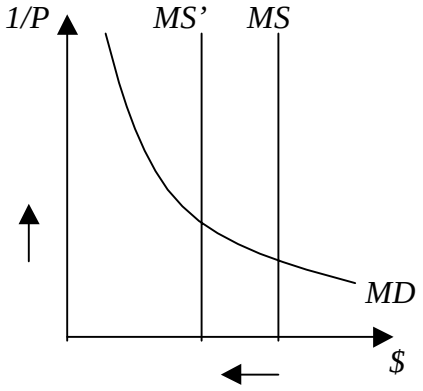
$$\%\Delta\text{Money supply} + \%\Delta\text{Velocity} \cong \%\Delta\text{Prices} + \%\Delta\text{Real GDP}$$

which would be exact if the changes were small.

7. Use the diagram of Money Supply and Money Demand to illustrate the direction of the long-run effects of the following changes in the economy on the price level and the real interest rate, according to the quantity theory of money.

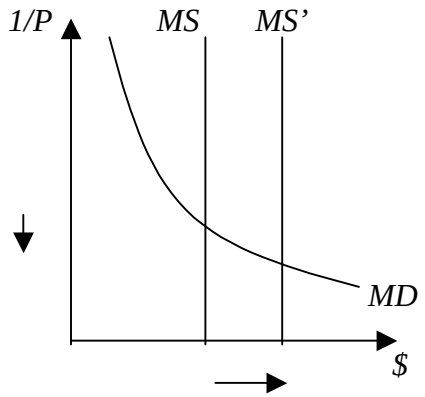
   (a) The Fed increases the minimum reserve ratio.

   When the Fed increases the minimum reserve ratio, the amount of money that the banking system creates due to fractional reserves banking will decrease. Therefore, the money supply will decrease. This will increase the value of money, and decreases the price level. Because of the neutrality of money, this change will not affect the real interest rate.



   (b) The Fed prints more money and uses it to buy government bonds from the public.

This will increase the money supply. Consequently, this will decrease the value of money, and increases the price level. Because of the neutrality of money, this change will not affect the real interest rate.



9. Suppose that the price level in the United States is expected to rise by 5% over the next year. What are the costs associated with this expected inflation? What other costs will the United States face if the inflation unexpectedly turns out to be 10%?

Inflation does not have much of an effect on purchasing power. The important assumption behind this statement is that most people earn their income from selling goods, and services. As a result, an increase in the price of goods and services (inflation) also increases the income. Consequently, there will not be any change in real income (purchasing power).

Inflation is a tax for people who are holding money because it decreases in value. You can avoid this by holding less money, and by going to the bank more often. Any cost associated with holding less money is called shoe-leather costs.

Furthermore, companies will also have to change their prices more often due to inflation. Any costs associated with more frequent price changes are called menu costs.

Inflation will also cause tax distortions. Many tax laws ignore inflation, and it looks as if you have made more profit within a year, even if the value of the money actually decreased. Inflation exaggerates your capital gains, and you end up paying a higher tax. Inflation also creates confusion and inconvenience.

Unexpectedly higher inflation has additional costs. It will reduce the real interest rate, may even lead to negative real interest rates. This causes redistribution of wealth, where borrowers will be made better off, lenders worse off.

10. We have mentioned the possibility of a "run" on a bank: people trying to withdraw more from their deposits than the bank actually has, since it has loaned out the rest. In principle, such a run could happen not just to a single bank, but to the whole banking system.

    a) Use data that you find either in the Wall Street Journal or on the web to determine what is the largest fraction of their deposits that the U.S. public could try to withdraw from U.S. commercial banks before they would run out. (Suggestions: Every Saturday the Wall Street Journal publishes a small item reporting "Federal Reserve Data" that includes assets and liabilities of commercial banks in the U.S. These data come from the web site of the Federal Reserve Board, table H.8.)

    As of Feb 15, 2007, when these answers were written (yours will be slightly different), Table H.8 of the Federal Reserve Statistical Release (at http://www.federalreserve.gov/releases/H8/Current/) reported that in January 2007 the "cash assets" of the commercial banks in the U.S. were $308.9 billion, while the "transaction deposits" (apparently the same as demand deposits) were $669.5 billion. Therefore the highest fraction people could try to withdraw without their running out is 308.9/669.5=46.1%

    b) What do you think would actually happen if more people than this were to try to empty their checking accounts?

    If more than this tried to empty their checking accounts, the banks would be unable to provide the cash to some of them. This could cause a run on the banking system, with other depositors trying to withdraw their money as well, even though they had not wanted to before. However, because the Fed stands behind the banks as "lender of last resort," and because the deposits are insured by the FDIC, banks should be able to tell their depositors that their money is safe and to get enough cash to satisfy them within a short time from the Fed.