

## Problem Set #2: Monetary System and Inflation

### Econ 100B: Intermediate Macroeconomics

1) Explain how banks create money.

- In a system of fractional-reserve banking, banks create money because they ordinarily keep only a fraction of their deposits in reserve. They use the rest of their deposits to make loans. The easiest way to see how this creates money is to consider the bank balance sheets shown in Figure 4-1.

**Figure 4-1**

<p><b>A. Balance Sheet — Firstbank</b></p> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 50%; text-align: left;">Assets</th> <th style="width: 50%; text-align: left;">Liabilities</th> </tr> </thead> <tbody> <tr> <td style="border-top: 1px solid black; border-right: 1px solid black; padding: 5px;">Reserves \$1,000</td> <td style="border-top: 1px solid black; padding: 5px;">Deposits \$1,000</td> </tr> </tbody> </table>	Assets	Liabilities	Reserves \$1,000	Deposits \$1,000	<p>Money Supply = \$1,000</p>		
Assets	Liabilities						
Reserves \$1,000	Deposits \$1,000						
<p><b>B. Balance Sheet — Firstbank</b></p> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 50%; text-align: left;">Assets</th> <th style="width: 50%; text-align: left;">Liabilities</th> </tr> </thead> <tbody> <tr> <td style="border-top: 1px solid black; border-right: 1px solid black; padding: 5px;">Reserves \$200</td> <td style="border-top: 1px solid black; padding: 5px;">Deposits \$1,000</td> </tr> <tr> <td style="border-right: 1px solid black; padding: 5px;">Loans \$800</td> <td style="padding: 5px;"></td> </tr> </tbody> </table>	Assets	Liabilities	Reserves \$200	Deposits \$1,000	Loans \$800		<p>Money Supply = \$1,800</p>
Assets	Liabilities						
Reserves \$200	Deposits \$1,000						
Loans \$800							
<p><b>C. Balance Sheet — Secondbank</b></p> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 50%; text-align: left;">Assets</th> <th style="width: 50%; text-align: left;">Liabilities</th> </tr> </thead> <tbody> <tr> <td style="border-top: 1px solid black; border-right: 1px solid black; padding: 5px;">Reserves \$160</td> <td style="border-top: 1px solid black; padding: 5px;">Deposits \$800</td> </tr> <tr> <td style="border-right: 1px solid black; padding: 5px;">Loans \$640</td> <td style="padding: 5px;"></td> </tr> </tbody> </table>	Assets	Liabilities	Reserves \$160	Deposits \$800	Loans \$640		<p>Money Supply = \$2,440</p>
Assets	Liabilities						
Reserves \$160	Deposits \$800						
Loans \$640							

- Suppose that people deposit the economy's supply of currency of \$1,000 into Firstbank, as in Figure 4-1(A). Although the money supply is still \$1,000, it is now in the form of demand deposits rather than currency. If the bank holds 100 percent of these deposits in reserve, then the bank has no influence on the money supply. Yet under a system of fractional-reserve banking, the bank need not keep all of its deposits in reserve; it must have enough reserves on hand so that reserves are available whenever depositors want to make withdrawals, but it makes loans with the rest of its deposits. If Firstbank has a reserve-deposit ratio of 20 percent, then it keeps \$200 of the \$1,000 in reserve and lends out the remaining \$800. Figure 4-1(B) shows the balance sheet of Firstbank after \$800 in loans have been made. By making these loans, Firstbank increases the money supply by \$800. There are still \$1,000 in demand deposits, but now borrowers also hold an additional \$800 in currency. The total money supply equals \$1,800.
- Money creation does not stop with Firstbank. If the borrowers deposit their \$800 of currency in Secondbank, then Secondbank can use these deposits to make loans. If Secondbank also has a reservedeposit ratio of 20 percent, then it keeps \$160 of the \$800 in reserves and lends out the remaining \$640. By lending out this money, Secondbank increases the money supply by \$640, as in Figure 4-1(C). The total money supply is now \$2,440.
- This process of money creation continues with each deposit and subsequent loans made. The text demonstrated that each dollar of reserves generates  $(\$1/rr)$  of money, where  $rr$  is the reserve-deposit

ratio. In this example,  $rr = 0.20$ , so the \$1,000 originally deposited in Firstbank generates \$5,000 of money.

2) Write the quantity equation and explain it.

- The quantity equation is an identity that expresses the link between the number of transactions that people make and how much money they hold. We write it as Money Velocity = Price Transactions or  $MV = PT$ .
- The right-hand side of the quantity equation tells us about the total number of transactions that occur during a given period of time, say, a year.  $T$  represents the total number of transactions.  $P$  represents the price of a typical transaction. Hence, the product  $PT$  represents the number of dollars exchanged in a year.
- The left-hand side of the quantity equation tells us about the money used to make these transactions.  $M$  represents the quantity of money in the economy.  $V$  represents the transactions velocity of money—the rate at which money circulates in the economy.
- Because the number of transactions is difficult to measure, economists usually use a slightly different version of the quantity equation, in which the total output of the economy  $Y$  replaces the number of transactions  $T$ : Money Velocity = Price Output or  $MV = PY$ .  $P$  now represents the price of one unit of output, so that  $P Y$  is the dollar value of output—nominal GDP.  $V$  represents the income velocity of money—the number of times a dollar bill becomes a part of someone's income.

3) Explain how each of the following events affect the money base, the money multiplier, and the money supply.

a. The Federal Reserve buys bonds in an open-market operation.

- When the Fed buys bonds, the dollars that it pays to the public for the bonds increase the monetary base, and this in turn increases the money supply. The money multiplier is not affected, assuming no change in the reservedeposit ratio or the currencydeposit ratio.

b. The Fed increases the interest rate it pays banks holding reserves.

- When the Fed increases the interest rate it pays banks for holding reserves, this gives banks an incentive to hold more reserves relative to deposits. The increase in the reserve deposit ratio will decrease the money multiplier. The decline in the money multiplier will lead to a decrease in the money supply. Since banks are holding more reserves (because they are making fewer loans), the monetary base will increase.

c. Rumors about a computer virus attack on ATMs increase the amount of money people hold as currency rather than demand deposits.

- If consumers lose confidence in ATMs and prefer to hold more cash, then the currencydeposit ratio will increase, and this will reduce the money multiplier. The money supply will fall because banks have fewer reserves to lend. The monetary base will increase because people are holding more currency, but will decrease because banks are holding fewer reserves. The net effect on the monetary base is zero.

d. The Fed flies a helicopter over the Santa Cruz Boardwalk and drops newly printed \$100 bills.

- If the Fed drops newly minted \$100 bills from a helicopter, then this will increase the monetary base and the money supply. If any of the currency ends up in the bank, then there will be a further increase in the money supply. If people end up holding more currency relative to deposits, then the money multiplier would fall.
- 4) The economy has a monetary base of 1,000 \$ 1 bills. Calculate the money supply in scenarios (a)-(d) and then answer part (e)
- a. All money is held as currency
    - If all money is held as currency, then the money supply is equal to the monetary base. The money supply will be \$1,000.
  - b. All money is held as demand deposits. Banks hold 100 percent of deposits as reserves.
    - If all money is held as deposits, but banks hold 100 percent of deposits on reserve, then there are no loans. The money supply will be \$1,000.
  - c. All money is held as demand deposits. Banks hold 20 percent of deposits as reserves.
    - If all money is held as deposits and banks hold 20 percent of deposits on reserve, then the reserve-deposit ratio is 0.20. The currency-deposit ratio is 0, and the money multiplier will be  $1/0.2$ , or 5. The money supply will be \$5,000.
  - d. People hold equal amounts of currency and demand deposits.
    - If people hold an equal amount of currency and deposits, then the currency- deposit ratio is 1. The reserve-deposit ratio is 0.2 and the money multiplier is  $(1 + 1)/(1 + 0.2) = 1.67$ . The money supply will be \$1,666.67.
  - e. The central bank decides to increase the money supply by 10 percent. In each of the above four scenarios, how much should it increase the monetary base?
    - The money supply is proportional to the monetary base and is given by  $M = mB$ , where  $M$  is the money supply,  $m$  is the money multiplier, and  $B$  is the monetary base. Since  $m$  is a constant number defined by the currency-deposit ratio and the reserve-deposit ratio, a 10-percent increase in the monetary base  $B$  will lead to a 10-percent increase in the money supply  $M$ .
- 5) Suppose that the money demand function takes the form  $\left(\frac{M}{P}\right)^d = L(i, Y) = \frac{Y}{5i}$
- a. If output grows at rate  $g$ , at what rate will the demand for real money balances grow (assuming constant nominal interest rates)?
    - If output  $Y$  grows at rate  $g$ , then real money balances  $\left(\frac{M}{P}\right)^d$  must also grow at rate  $g$ , given that the nominal interest rate  $i$  is a constant.
  - b. What is the velocity of money in this economy?
    - To find the velocity of money, start with the quantity equation  $MV = PY$  and rewrite the equation as  $V = (PY)/M = (P/M)Y$ . Now, note that  $P/M$  is the inverse of the real money supply, which is equal to real money demand. Therefore, the velocity of money is  $V = (5i/Y)Y$ , or  $V = 5i$ .
  - c. If inflation and nominal interest rates are constant, at what rate, if any, will velocity grow?

- If the nominal interest rate is constant, then the velocity of money must be constant.
- d. How will a permanent (once-and-for-all) increase in the level of interest rates affect the level of velocity? How will it affect the subsequent growth rate of velocity?
- A one-time increase in the nominal interest rate will cause a one-time increase in the velocity of money. There will be no further changes in the velocity of money.