Lecture 2: Money II
The Supply of Money

Dr. Runchana Pongsaparn

12 January 2013

Outline

- Monetary base and money supply
  - Mathematical derivation of money multiplier (m)
- How the CB controls monetary base
  - Open market operations
  - Discount loans
- From monetary base to money supply
  - Money creation process
- M_d and M_s

Monetary Base and Money Supply

Money supply (M) **= currency (C) + checkable deposits (D) (closest definition = M1)**

M = C + D

Monetary base (MB) or high-powered money

= currency (C) + Reserves (R)

MB = C + R

- **The relationship between money supply (M) and monetary base (MB): M = m x MB**

where m is a money multiplier

- **Central Bank (CB)** controls money supply via manipulation on monetary base

Money multiplier

Additional factors:

- **Depositors: hold a combination of currency and deposits**

c = currency ratio = C/D

- **Banks: need to hold a certain proportion of deposits as reserves (R)**

r = required reserve ratio = RR/D (according to the regulation)

e = excess reserve ratio = ER/D (for liquidity management)

R = RR+ER

Money multiplier (contin'd)

- **To find money multiplier (m) in M = m x MB**

  R = RR + ER = rD + eD

  R = (r + e) D

  C = cD

- **By definition**

  MB = R + C

  = (r + e) D + cD

  MB = (r + e + c)D

  But

  M = D + C = (1 + c) D

  While D = MB / (r + e + c)

  Therefore, M = (1 + c) MB / (r + e + c)

  m = (1 + c)/(r + e + c), m > 1

Players in the Money Supply Process

- Central bank (CB)
- Banks (depository institutions; financial intermediaries)
- Depositors (individuals and institutions)
- Borrowers (individuals and institutions)

CB's Balance Sheet

Central Bank	
Assets	Liabilities
Government securities	Currency in circulation
Discount loans	Reserves

- Monetary Liabilities
  - Currency in circulation—in the hands of the public
  - Reserves—bank deposits at the CB and vault cash
- Assets
  - Government securities—holdings by the CB that affect money supply and earn interest
  - Discount loans—provide reserves to banks and earn the discount rate

Bank's Balance Sheet

Bank A	
Assets	Liabilities
Reserves - required reserves - excess reserves Cash items in process of collection	Deposits
Loans	Borrowings
Securities	Bank Capital
Other assets	

- **Commercial banks are required to maintain the required reserves on average over a fortnightly period. Currently, the reserve requirement ratio is 6% (Thailand)**

How the CB controls monetary base: I.I Open market purchase from a bank

Banking System	
Assets	Liabilities
Securities -$100	
Reserves +$100	

CB	
Assets	Liabilities
Securities +$100	Reserves +$100

- Net result is that reserves have increased by $100
- No change in currency
- Monetary base has risen by $100

How the CB controls monetary base: I.II Open market purchase from non-bank public

Banking System	
Assets	Liabilities
Reserves +$100	Checkable deposits +$100

CB	
Assets	Liabilities
Securities +$100	Reserves +$100

- Person selling bonds to the CB deposits the CB's check in the bank
- Identical result as the purchase from a bank

How the CB controls monetary base: I.II Open market purchase from non-bank public

Nonbank Public	
Assets	Liabilities
Securities -$100	
Currency +$100	

CB	
Assets	Liabilities
Securities +$100	Currency in circulation +$100

- The person selling the bonds cashes the CB's check
- Reserves are unchanged
- Currency in circulation increases by the amount of the open market purchase
- Monetary base increases by the amount of the open market purchase

I. Open Market Purchase: Summary

- The effect of an open market purchase on reserves depends on whether the seller of the bonds keeps the proceeds from the sale in currency or in deposits
- The effect of an open market purchase on the monetary base always increases the base by the amount of the purchase

How the CB controls monetary base: II. Making a discount loan to banks

Banking System	
Assets	Liabilities
Reserves +$100	Discount loans +$100
	(borrowing from CB)

CB	
Assets	Liabilities
Discount loan +$100	Reserves +$100
(borrowing from CB)	

- Monetary liabilities of the CB have increased by $100
- Monetary base also increases by this amount

Paying Off a Discount Loan from the CB

Banking System	
Assets	Liabilities
Reserves -$100	Discount loans -$100
	(borrowing from the CB)

CB	
Assets	Liabilities
Discount loans -$100	Reserves -$100
(borrowing from the CB)	

- Net effect on monetary base is a reduction
- Monetary base changes one-for-one with a change in the borrowings from the CB

From monetary base to money supply: Money creation process

- **Assume for simplicity**
  - **no currency holding (c = 0)**
  - **no excess reserve (e = 0)**
  - **reserve requirement is 10% of deposit (r = 0.10)**
- **Use a bank's balance sheet**

1. The central bank buys bonds from Bank A worth $100, its reserves increase by $100.

2. Bank A loans out this excess reserves of $100. By its act of lending, Bank A creates a checkable deposit for its borrower worth $100.

3. It borrower makes purchases by writing a check of $100. Deposits decrease along with reserves.

1. Bank A	
Assets	Liabilities
Securities -$100	
Reserves +$100	

2. Bank A	
Assets	Liabilities
Securities -$100	Checkable deposits +$100
Reserves +$100	
Loans +$100	

3. Bank A	
Assets	Liabilities
Securities -$100	
Loans +$100	

From monetary base to money supply: Money creation process (cont'd)

4. This check is deposited at Bank B. Bank B's reserves increases by $100 with an increase of $100 in deposits

5. With r = 0.10, Bank B only needs to set $10 aside for reserves, it makes $90 worth of loans.

6. This $90 is spent by Bank B's borrower, as a result $90 is deposited in Bank C

7. Bank C has an increase of $90 in deposits, it sets aside $9 for reserves and loans out $81 …. so on

Bank B		Bank B	
Assets	Liabilities	Assets	Liabilities
Reserves +$100	Checkable deposits +$100	Reserves +$10	Checkable deposits +$100
		Loans +$90	

Bank C		Bank C	
Assets	Liabilities	Assets	Liabilities
Reserves +$90	Checkable deposits +$90	Reserves +$9	Checkable deposits +$90
		Loans +$81	

	Increase in Reserves	Increase in Deposits	Increase in Loans
Bank A	0	0	100
Bank B	10	100	90
Bank C	9	90	81
and so on…			
Total	100	1000	1000

(Note: 100 (1 + 0.9 + 0.92 + …) = 100/(1- 0.9) = 1000)

- **MB (= C + R) increases by $100**
- **M (= C + D) increases by $1000**
- **m = M/MB = (C + D) / (C + R) = 1000 / 100 (as C = 0) = 10**

compare m = (1 + c) / (r + e + c) = (1 + 0) / (0.10 + 0 + 0) = 10

Factors determining the money multiplier (m)

- Changes in the required reserve ratio *r*
  - The money multiplier and the money supply are negatively related to *r*
- Changes in the currency ratio *c*
  - The money multiplier and the money supply are negatively related to *c*
- Changes in the excess reserves ratio *e*
  - The money multiplier and the money supply are negatively related to the excess reserves ratio *e*

Factors determining the money multiplier (m)

- The excess reserves ratio *e* is negatively related to the market interest rate
- The excess reserves ratio *e* is positively related to expected deposit outflows

Money demand and money supply: determination of interest rate