Ec 370

Money and Banking

Chapter 14: The Money Supply Process - PART II

Xiang LI
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- In previous part: the Fed can supply the banking system with **reserves** via open market operation and discount loan
- when the Fed supplies the banking system with $1 of additional **reserves**, **deposits** will increase by **a multiple** of one dollar
  - this is called **multiple deposit creation**
- 2 models can explain multiple deposit creation:
  - a simple model
  - a general model

Part II: Control of Monetary Supply

Simple Model

- Step 1: the Fed bought the $100 million in bonds **with reserves** from the FN Bank

First National Bank	
Assets	**Liabilities+Capital**
Reserves: +$100m	Deposits
Securities: -$100m	Borrowings
Loans	Capital

- no increase in **checkable deposits**: no **additional required reserves** needed
- additional $100 million of reserves become **excess reserves**

Simple Model

- **Assumption 1: bank does not want to hold excess reserves because it earns little interest on them**

- Step 2: under Assumption I, bank put $100m of **excess reserves** into a **loan**, which can earn high interest for the bank

First National Bank	
Assets	**Liabilities+Capital**
Reserves	Deposits
Securities: -$100m	Borrowings
Loans: +$100m	Capital

Simple Model

- **Assumption 2: public does not want to hold any additional currency**
- Step 3: under Assumption 2, borrowers of First National Bank will deposit all 100m payment at other banks (say, Bank A)
- 100m of **checkable deposits** and **reserves** increases at Bank A

Bank A	
Assets	**Liabilities+Capital**
Reserves: +$100m	Deposits: +$100m
Securities	Borrowings
Loans	Capital

Simple Model

- 10% of the **additional checkable deposits** is **required** to be deposited in Bank A's vault or Bank A's account at the Fed
- $10m increase in **required reserves**, leaving Bank A 90m of **excess reserves**
- Step 4: under Assumption 1, Bank A turn 90m of **excess reserves** into a 90m of **loan**

Bank A	
Assets	**Liabilities+Capital**
Reserves: +$10m	Deposits: +$100m
Securities	Borrowings
Loans: +$90m	Capital

Simple Model

- Step 5: under Assumption II, borrowers of Bank A will deposit all 90m payment at other banks (say Bank B)
- 90m of **checkable deposits** and **reserves** increases at Bank B

Bank B	
Assets	**Liabilities+Capital**
Reserves: +$90m	Deposits: +$90m
Securities	Borrowings
Loans	Capital

Simple Model

- 10% of the **additional checkable deposits** is **required** to be deposited in Bank B's vault or account at the Fed
- 9m increase in **required reserves**, leaving Bank B $81m of **excess reserves**
- Step 6: under Assumption I, Bank B turn $81m of **excess reserves** to **loans**

Bank B	
Assets	**Liabilities+Capital**
Reserves: +$9m	Deposits: +$90m
Securities	Borrowings
Loans: +$81m	Capital

Simple Model

- Following the same reasoning, if all banks make loans for the full amount of their **excess reserves**, further increments in **checkable deposits** will continue (at Banks C, D, E, and so on)

Bank	Increase in Deposits($)	Increase in Loans($)	Increase in Reserves($)
First National	0.00	100.00m	0.00
A	100.00m	90.00m	10.00m
B	90.00m	81.00m	9.00m
C	81.00m	72.90m	8.10m
D	72.90m	65.61m	7.29m
E	65.61m	59.05m	6.56m
F	59.05m	53.14m	5.91m
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Total for all banks	1000.00m	1000.00m	100.00m

Simple Model

- the total increase in **deposits** from the initial **100m** increase in **reserves** is **1000m**, assuming **10% reserve requirement**

Bank	Increase in Deposits($)	Increase in Loans($)	Increase in Reserves($)
First National	0.00	100.00m	0.00
A	100.00m	90.00m	10.00m
B	90.00m	81.00m	9.00m
C	81.00m	72.90m	8.10m
D	72.90m	65.61m	7.29m
E	65.61m	59.05m	6.56m
F	59.05m	53.14m	5.91m
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Total for all banks	**1000.00m**	**1000.00m**	**100.00m**

Simple Model

- the increase is tenfold: the **reciprocal** of the **10% reserve requirement**

Bank	Increase in Deposits($)	Increase in Loans($)	Increase in Reserves($)
First National	0.00	100.00m	0.00
A	100.00m	90.00m	10.00m
B	90.00m	81.00m	9.00m
C	81.00m	72.90m	8.10m
D	72.90m	65.61m	7.29m
E	65.61m	59.05m	6.56m
F	59.05m	53.14m	5.91m
.	.	.	.
.	.	.	.
.	.	.	.
.	.	.	.
Total for all banks	**1000.00m**	**1000.00m**	**100.00m**

Simple Model Formula

- **Assumption 1: banks hold NO excess reserves**
- **Assumption 2: Depositors hold NO currency**
- RR:required reserves
- R: reserves
- D: checkable deposits
- rr: required reserve ratio (10% in this example)

Simple Model Formula

- by Assumption 1: $ER = 0, R = ER + RR = RR$
- definition of RR: $RR = rr \times D$
- substitute for RR: $R = RR = rr \times D$
- rearrange: $D = \frac{1}{rr} \times R$
- taking changes at both sides simultaneously: $\Delta D = \frac{1}{rr} \times \Delta R$
  - ΔD: change in D
  - ΔR: change in R

Simple Model Formula

$$\Delta D = \frac{1}{rr} \times \Delta R$$

- impact of change in R on change in D is: $\frac{1}{rr}$
- $\frac{1}{rr}$ is called **simple deposit multiplier**
  - Since rr is normally less than 1, the simple deposit multiplier is greater than 1
  - if rr<1: $1 increase in reserves lead more than $1 increase in total deposit

TWO Critques about simple deposit multiplier:

- if banks choose to keep all or some of their **excess reserves**: assumption 1 violated
- if some of the loans are not deposited in banks but instead are withdrawn as **currency**: assumption 2 violated
- if either assumption 1 or assumption 2 is violated, the **full expansion** of deposits predicted by the simple model of multiple deposit creation does not occur

Factors that Determine Money Supply

(1) nonborrowed monetary base

- The money supply is positively related to the nonborrowed monetary base, MB_n, holding all other factors constant
- open market purchase, $MB_n \uparrow \Rightarrow$ R in the banking system $\uparrow \Rightarrow$ multiple deposit creation occurs $\Rightarrow$ D $\uparrow \Rightarrow$ money supply=M1=C+D $\uparrow$

Factors that Determine Money Supply

(2) borrowed reserves

- The money supply is positively related to the level of borrowed reserves, BR, holding all other factors constant
- lending to banks, BR $\uparrow \Rightarrow$ R in the banking system $\uparrow \Rightarrow$ multiple deposit creation occurs $\Rightarrow$ D $\uparrow \Rightarrow$ money supply=M1=C+D $\uparrow$

Factors that Determine Money Supply

(3) required reserve ratio

- The money supply is negatively related to the required reserve ratio rr, holding all other factors constant
- rr on checkable deposits $\uparrow \Rightarrow$ less excess reserves can be used to make loans $\Rightarrow$ multiple deposit expansion is reduced $\Rightarrow$ D $\downarrow \Rightarrow$ money supply=M1=C+D $\downarrow$

Factors that Determine Money Supply

(4) excess reserves

- The money supply is negatively related to the amount of excess reserves, holding all other factors constant
- banks's holdings of excess reserves $\uparrow \Rightarrow$ less loans can be made from excess reserves $\Rightarrow$ multiple deposit expansion is reduced $\Rightarrow$ D $\downarrow \Rightarrow$ money supply=M1=C+D $\downarrow$

Factors that Determine Money Supply

(5) currency holdings

- Holding excess reserves constant, the money supply is negatively related to currency holdings
- currency holding $\uparrow \Rightarrow$ less checkable deposits can be made $\Rightarrow$ multiple deposit expansion is reduced $\Rightarrow$ D $\downarrow \Rightarrow$ money supply=M1=C+D $\downarrow$

Factors that Determine Money Supply

- in the general model: all three players - the Fed, depositors, and banks - directly influence **money supply**

Variable	Change in Variable	Money Supply Responses	Reason
Federal Reserve System			
Nonborrowed monetary base, `$MB_n$`	↑	↑	More MB for deposit creastion
Required Reserve ratio, `$rr$`	↑	↓	Less multiple deposit expansion
Banks			
Borrowed reserves, `$BR$`	↑	↑	More MB for deposit creation
Excess reserves, `$ER$`	↑	↓	less loans and deposit creation
Depositors			
Currency holdings, `$C$`	↑	↓	Less multiple deposit expansions

General Model Formula

- **simple deposit multiplier** $\frac{1}{rr}$: impact of ΔR on ΔD
- **money multiplier** m: impact of ΔMB on ΔM
- To derive money multiplier m from $M = m \times MB$, let's denote:
  - m: money multiplier
  - M: money supply
  - MB: monetary base
  - $c = \frac{C}{D}$: currency-to-deposit ratio
  - $er = \frac{ER}{D}$: excess reserves-to-deposit ratio
  - $rr = \frac{RR}{D}$: required reserves ratio

General Model Formula

- $MB = R + C = RR + ER + C = rr * D + er * D + c * D.$
- $MB = D * (rr + er + c)$
- use M1 as money supply M:
  $M = M1 = C + D = c * D + D = D * (1 + c)$
- plug M and MB into $M = m * MB$:
  $D * (1 + c) = m * D * (c + er + rr)$
- money multiplier: $m = \frac{1+c}{c+er+rr}$
- Hence, $M = \frac{1+c}{c+er+rr} * MB$, and
  $\Delta M = m * \Delta MB = \frac{1+c}{c+er+rr} * \Delta MB$

General Model Formula

$$m = \frac{1 + c}{c + er + rr}$$

- holding other variables constant, $rr \uparrow \Rightarrow m \downarrow$
- holding other variables constant, $er \uparrow \Rightarrow m \downarrow$
- when $er + rr < 1$: $c \uparrow \Rightarrow m \downarrow$
  - in normal times: $er \approx 0$
- when $er + rr > 1$: $c \uparrow \Rightarrow m \uparrow$
  - during financial crisis: er is large

General Model Formula

$$m = \frac{1 + c}{c + er + rr}$$

- Simple deposit multiplier is a special case of money multiplier
- when er=0 and c=0: $m = \frac{1}{rr}$
- er=0 is Assumption 1 in the simple model
- c=0 is Assumption 2 in the simple model

Application: the Great Recession

- There were 14 trillion dollars of residential mortgages and commercial mortgages. If default rate is 5%, then 700 billion dollars of banks' **assets** will become toxicate
- In Oct 2008, to unlock frozen credit markets, a bailout bill was passed so that the Treasury Department can inject $700 billion of **capital** in many banks (partial ownership)
- https://www.youtube.com/watch?v=xK8G5x8pxIQ
- Such a move would quickly strengthen banks' **balance sheets** and hopefully persuade them to **resume lending**. In a coordinated action, the Fed reduced their benchmark interest rates by one-half percentage point
- Did banks actually resume lending?

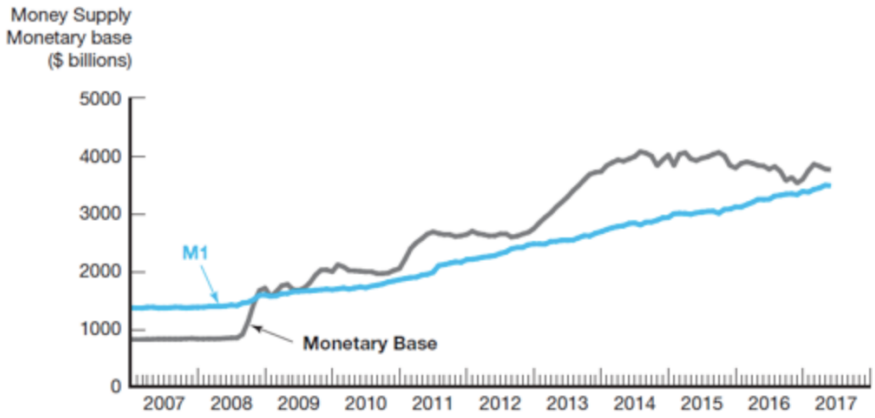
Application: the Great Recession

- during 07-09 financial crisis: the Fed initiated lending programs and large-scale asset-purchase programs (**quantitative easing**) in an attempt to bolster the economy
- these purchases of securities had led to a fivefold increase of the Fed's balance sheet and an over 350% increase in the **monetary base**
- Such a massive expansion of the monetary base could potentially lead to a large expansion of the **money supply**
- $M = m * MB$: **if m is constant**, then $\Delta M = m * \Delta MB$

Application: the Great Recession

- However, when the **monetary base** increased by more than 350%, the **M1 money supply** only rose by only 150%: $\Delta M \neq m * \Delta MB$

Figure 1 M1 and the Monetary Base, 2007–2017



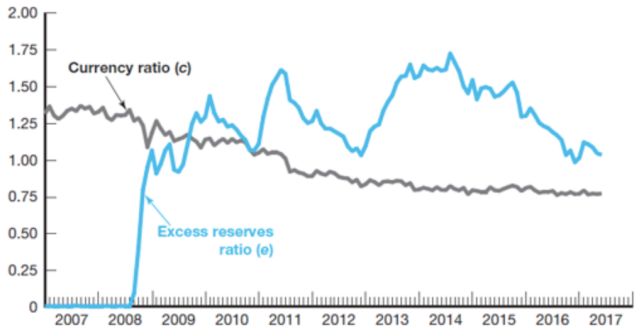
The money supply rose by only 150% despite the increase in the monetary base of over 350%.

- This is because the **money multiplier** fell by around 50%: m is not constant

Application: the Great Recession

- during crisis, instead of turning excess reserves to loans and lend out, banks are willing to hold huge excess reserves
- er $\uparrow$ so that er+rr>1
- plus, currency ratio had a slight downward trend
- when e+rr>1: c $\downarrow \Rightarrow$ m $\downarrow \Rightarrow$ increase in M < increase in MB

Figure 2 Excess Reserves and Currency Ratio, 2007–2017



The currency ratio *c* was relatively steady during this period, whereas the excess reserves ratio *e* rose by a factor of over 1,000.