EE432 Monetary Theory and Policy

Lecture 8 The central bank balance sheet and the money supply process

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Outline

- The central banks balance sheet
- Changing the size and composition of the balance sheet
- The deposit expansion multiplier
- The monetary base and money supply

Chapter 17

The Central Bank Balance Sheet and the Money Supply Process

The central banks balance sheet

The Central Bank's Balance Sheet

Figure 17.1 The Central Bank's Balance Sheet

	Assets	Liabilities
Government's bank	Securities Foreign exchange reserves	Currency Government's account
Bankers' bank	Loans	Accounts of the commercial banks (reserves)

The Central Bank's Balance Sheet

- The *central bank's balance sheet* shows three ***basic assets***:
  - **Securities,**
  - **Foreign exchange reserves,** and
  - **Loans.**
- The **securities** and **foreign exchange reserves** are needed so that the central bank can ***perform its role*** as the ***government's bank***.
- The **loans** are a ***service*** *to* ***commercial banks***.

Assets

1. **Securities** are the **primary asset of most central banks**.
   - Traditionally, the central bank exclusively ***held Treasury securities***, which are virtually *free of default risk,* through *purchases and sales* known as ***open market operations***.

Assets

2. **Foreign exchange reserves** are the central bank's and government's ***balances of foreign currency.***
   - These are held in the form of **bonds** *issued by* ***foreign governments***.
   - These reserves are *used in* ***foreign exchange interventions***, when *officials attempt to change the market values of currencies*.

Assets

3. **Loans** are usually *extended to commercial banks*.
   - **Discount loans** are the **loans,** which central bank make *when* ***commercial banks*** *need short-term cash.*
   - Through its **liquid securities holdings**, the central bank *controls* ***the overnight rate*** and the availability of money and credit.

Liabilities

- On the **liabilities side** of the central bank's balance sheet, we see three major entries:
  - **Currency**,
  - The **government's deposit account**
  - The **deposit accounts** of the **commercial banks**
- The *currency and government's deposit* allow the central bank to ***perform its role as*** the **government's bank**, while the *commercial banks' deposits* allow it to ***fulfill its role as*** the **bankers' bank.**

Liabilities

1. **Currency**. Nearly all central banks have a monopoly on the **issuance of the currency** *used in everyday transactions*.
   - Currency *circulating in the hands of the nonbank public* is the ***principal liability*** **of most central banks**.

Liabilities

2. **Government's account**. Governments need a bank account which the ***government* deposits *funds (mostly tax revenue)*** into,

   and from which the ***government*** *makes* ***payments*** by shifting funds between its *accounts at* ***commercial banks*** *and the* ***central bank***

Liabilities

3. Commercial Bank accounts : Reserves

- *Commercial bank reserves* are the sum of: **deposits at the central bank**, *plus* **cash in the bank's *own vault***.
- the *commercial bank* can ***withdraw its deposits at the central bank***.
- **Vault cash** is part of reserves.

Liabilities

- **Commercial bank reserves** are the *most important* in **determining** the ***quantity of money*** and ***credit supply*** in the economy
- Central banks ***run*** their ***monetary policy operations*** through **changes in these reserves**.
- There are *two types of reserves*.
  - **Required reserves** that banks must hold
  - **Excess reserves**, which banks hold voluntarily.

The Monetary Base

- Together, **currency in the hands** *of the public* and **reserves** *in the banking system* make up the **monetary base**.
  - This is the privately held **liabilities of the central bank**.
  - It is also called **high-powered money**.
- The central bank can ***control*** the *size* of the **monetary base**.

Changing the size and composition of the balance sheet

Changing the Size and Composition of the Balance Sheet

- The *central bank can simply* **buy** *things* and then **create liabilities** *to pay for them*, which **increase the size** of its **balance sheet** as much as it wants.

1. **Open Market Operation**
   - *Buying or selling a security* initiated by the central bank.
2. **Foreign Exchange Intervention**
   - *Buy or sell foreign exchange reserves* initiated by the central bank.
3. **Extend a discount loan,** initiated by commercial banks.
4. *Decision by an individual* to ***withdraw cash*** *from their banks*

Open Market Operations

- When the *central bank* ***buys or sells securities*** *in financial markets*, it engages in **Open Market Operations (OMO)**

Figure 17. 2 Balance Sheet Changes after the Federal Reserve Purchases a U.S. Treasury Bond

A. Federal Reserve's Balance Sheet

Assets		Liabilities	
Securities (U.S. Treasury bond)	+$1 billion	Reserves	+$1 billion

B. Banking System's Balance Sheet

Assets		Liabilities
Reserves	+$1 billion	
Securities (U.S. Treasury bond)	–$1 billion	

Foreign Exchange Intervention

- If the **central bank** *buy* ***German government bonds*** *(securities)* from **commercial banks**.
- The **payment** is *credited directly* to the ***reserve account*** of the *commercial bank* from which the bonds were bought.

Figure 17.3 Balance Sheet Changes after the Federal Reserve Purchases a German Government Bond

A. Federal Reserve's Balance Sheet

Assets		Liabilities	
Foreign exchange reserves (German government bonds in euros)	+$1 billion	Reserves	+$1 billion

B. Banking System's Balance Sheet

Assets		Liabilities
Reserves	+$1 billion	
Securities (German government bonds)	–$1 billion	

Discount Loans

- Commercial banks ***ask for loans***

Figure 17.4 Balance Sheet Changes after the Federal Reserve Makes a Discount Loan

A. Federal Reserve's Balance Sheet

Assets		Liabilities	
Discount loans	+$100 million	Reserves	+$100 million

B. Banking System's Balance Sheet

Assets		Liabilities	
Reserves	+$100 million	Discount loans	+$100 million

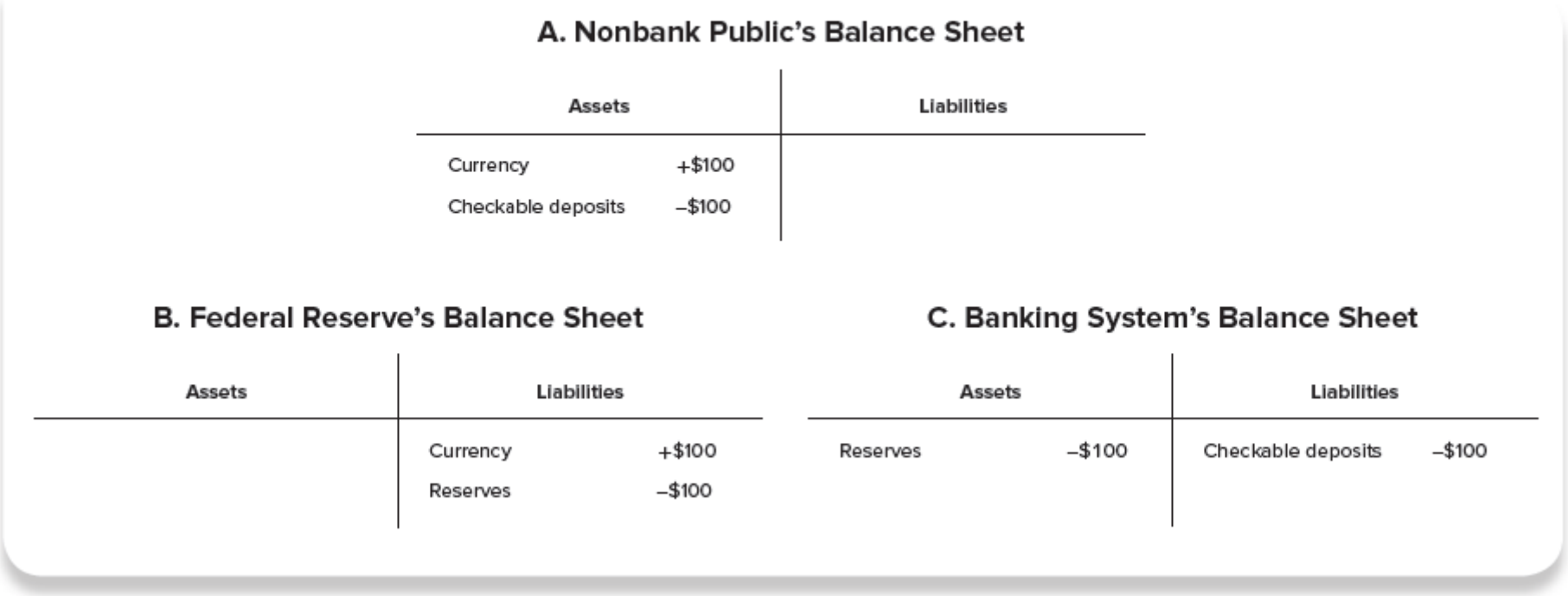
- For the commercial bank, it is a **liability** *matched by* an **increase in** the level of its **reserve account**.
- For the central bank, the **loan** is **an asset** that is created in exchange for *a credit to the commercial bank reserve account*, and **expands the monetary base**.

Cash Withdrawal

- When **individual** *takes cash from an ATM*, it **changes** the **central bank's balance sheet**.
  - **shift** from **reserves** to **currency** on the central bank's balance sheet.

Cash Withdrawal

Figure 17.5 Balance Sheet Changes after a Private Person Withdraws Cash from His or Her Bank Account



A. Nonbank Public's Balance Sheet

Assets		Liabilities
Currency	+$100	
Checkable deposits	–$100	

B. Federal Reserve's Balance Sheet

Assets	Liabilities	
	Currency	+$100
	Reserves	–$100

C. Banking System's Balance Sheet

Assets		Liabilities	
Reserves	–$100	Checkable deposits	–$100

- **Individual assets** *shift* from checkable deposits to cash. For the **central bank**, the *change* comes in the *composition of liabilities*.
- By *withdrawing cash* from **commercial bank**, *individual* <u>*decreased*</u> the banking system's **reserves**.

The Deposit Expansion Multiplier

The Deposit Expansion Multiplier

- ***Central bank liabilities*** *form* the base on which the **supplies of money and credit** are built.
  - This is why they are called the ***monetary base***.
  - The central bank ***controls*** the *monetary base*.
- Our primary interest, however, is in the **broader measure of money** which are *multiples of the monetary base.*
  - M1.
  - M2.

Deposit Expansion in a System of Banks

- We start with the following assumptions:
  - **Banks** hold *no excess reserves*.
  - The **reserve requirement ratio** is **10%**.
  - **Currency holding** does not change when deposits and loans change.
  - *When a borrower writes a check*, **none** of the recipients of the funds **deposit them back in the bank** that *initially made the loan*.

Deposit Expansion in a System of Banks

- Suppose OBI company pays $100,000 to American Steel.
- **American Steel** deposits $100,000 into ***Second Bank***.
- **Second Bank's reserve account** at the Fed is *credited with $100,000*.
- Second Bank will **make a loan** of its *now excess reserves minus the 10% they are required to hold*.
- The **new loan** is *deposited into* ***Third Bank*** and the process continues.

Deposit Expansion in a System of Banks

Figure 17.7 Changes in Balance Sheets

A. Second Bank after American Steel's Deposit

Assets		Liabilities	
Reserves	+$100,000	American Steel's checking account	+$100,000

B. Second Bank after Extension of a Loan

Assets		Liabilities	
Reserves	+$10,000	American Steel's checking account	+$100,000
Loan	+$90,000		

C. Third Bank after Deposit and Extension of a Loan

Assets		Liabilities	
Reserves	+$ 9,000	Checking account	+$90,000
Loan	+$81,000		

Deposit Expansion in a System of Banks

Table 17.3 Multiple Deposit Expansion following a $100,000 Open Market Purchase Assuming a 10% Reserve Requirement

Bank	Increase in Deposits	Increase in Loans	Increase in Reserves
First Bank	$ 0	$ 100,000	$ 0
Second Bank	$ 100,000	$ 90,000	$ 10,000
Third Bank	$ 90,000	$ 81,000	$ 9,000
Fourth Bank	$ 81,000	$ 72,900	$ 8,100
Fifth Bank	$ 72,900	$ 65,610	$ 7,290
Sixth Bank	$ 65,610	$ 59,049	$ 6,561
.	.	.	.
.	.	.	.
.	.	.	.
The Banking System	$1,000,000	$1,000,000	$100,000

Deposit Expansion in a System of Banks

- We can *derive* a formula for the **deposit expansion multiplier**
- Let's being by *assuming* there is *only one bank and everyone must use it*.
- The **level of reserves**, then, is just the **required reserve ratio** r_D *times* its **deposits**.
- If **required reserves** are RR and **deposits** are D, then the **level of reserves** can be *expressed as*:

$$RR = r_D D.$$

Deposit Expansion in a System of Banks

- Any **change in deposits** creates a corresponding **change in reserves**:

$$\Delta RR = r_D \Delta D$$

- The **change in deposits** is:

$$\Delta D = \frac{1}{r_D} \Delta RR$$

- For *each dollar increase in reserves, deposits increase* by $(1/r_D)$.

The Monetary Base and the Money Supply

The Arithmetic of the Money Multiplier

- The ***money multiplier*** shows how the **quantity of money** is ***related to the monetary base***.
- If we label the **quantity of money *M*** and the **monetary base *MB***, the **money multiplier *m*** is defined as:

$$M = m \times MB$$

The Arithmetic of the Money Multiplier

- We will start with the following relationships:
  - **Money** equals **currency, *C***, plus **checkable deposits, *D***,
  - The **monetary base *MB*** equals **currency** plus **reserves in the banking system** *R*, and
  - **Reserves** equal **required reserves *RR*** plus **excess reserves *ER***.

$$M = C + D$$

$$MB = C + R$$

$$R = RR + ER$$

The Arithmetic of the Money Multiplier

- We know that **banks** holdings of ***required reserves*** *depends on* the **required reserve ratio r_D.**
- The amount of **excess reserve** a bank holds *depends on* the ***costs and benefits of holding them***.
  - The ***higher the interest rate*** **on loans**, the ***lower banks' excess reserves***, and
  - The *greater* banks' *concern* over the ***possibility of deposit withdrawals***, the ***higher their excess reserves***.

The Arithmetic of the Money Multiplier

- Labeling the **excess reserve-to-deposit ratio {*ER/D*}**, we can rewrite the reserve equation as:

$$R = RR + ER$$
$$= r_D D + \{ER/D\}D$$
$$= (r_D + \{ER/D\})D$$

- Banks ***hold reserves*** as a ***proportion of their deposits.***

The Arithmetic of the Money Multiplier

- The **currency-to-deposit ratio, {C/D},** is the *fraction of deposits that people hold as currency.*

$$C = \{C/D\}D$$

- The **decision of how much currency to hold** depends on the costs and benefits as well.
  - The **cost of currency** is the *interest it would earn on deposit*.
  - The **benefit** is its *lower risk and greater liquidity*.

The Arithmetic of the Money Multiplier

- Putting this all together, we can see to following.

$$MB = C + R$$
$$= \{C/D\}D + (r_D + \{ER/D\})D$$
$$= (\{C/D\} + r_D + \{ER/D\})D$$

- The **monetary base** has three uses:
  - **Required reserves**
  - **Excess Reserves**
  - **Cash in the hands** of the nonbank public

The Arithmetic of the Money Multiplier

- We can do the same with the **equation for money**.

$$M = C + D$$
$$= \{C/D\}D + D$$
$$= (\{C/D\} + 1)D$$

The Arithmetic of the Money Multiplier

- We can use the **equation for *MB*** to ***solve for deposits***:

$$D = \frac{1}{\{\mathrm{C/D}\} + \mathrm{r_D} + \{\mathrm{ER/D}\}} \times MB$$

- And **substituting D** into the **money equation**:

$$M = \frac{\{C/D\} + 1}{\{\mathrm{C/D}\} + \mathrm{r_D} + \{\mathrm{ER/D}\}} \times MB$$

The Arithmetic of the Money Multiplier

The **quantity of money** in the economy *depends on:*

1. The **monetary base**, which is controlled by Fed,
2. The **reserve requirement**,
3. The ***bank's desire to hold excess reserves***, and
4. The nonbank **public's demand for currency**.

The Limits on the Central Bank's Ability to Control the Quantity of Money

- The **various factors** *affecting the quantity of money change* over time.
  - **Market interest rates** affect the *cost of holding both excess reserves and currency*.
  - As **interest rates increase**, we expect to see **{*ER*/*D*} and {*C*/*D*} fall**.
    - This **increases the money multiplier** and **the quantity of money.**

End of lecture