Lectures 6 and 7

Chapter 10

- An overview of money
- Definition of money (M1)—$3.314 trillion in August 2016
- How banks create money – goldsmiths
- The modern banking system
- The money multiplier
- The Federal Reserve System
- The demand for money (opportunity cost of holding money is high when interest rates are high)
- Interest rates and security (bill and bond) prices
- How the Fed controlled the interest rate prior to 2008 (increased commercial bank

reserves in a world where no excess reserves were held)

- The Federal Reserve balance sheet
- How the Fed will control the interest rate in the future (increase the interest rate paid on commercial bank reserves)
- The relationship between short-term and long-term interest rates (helpful for getting a job on Wall Street)
- Stock prices

Modern Banking System
Money Multiplier

RRR = reserve requirement rate = .2

Commercial Banks

A		L	
Reserves	0	0	Deposits

Deposit of 100

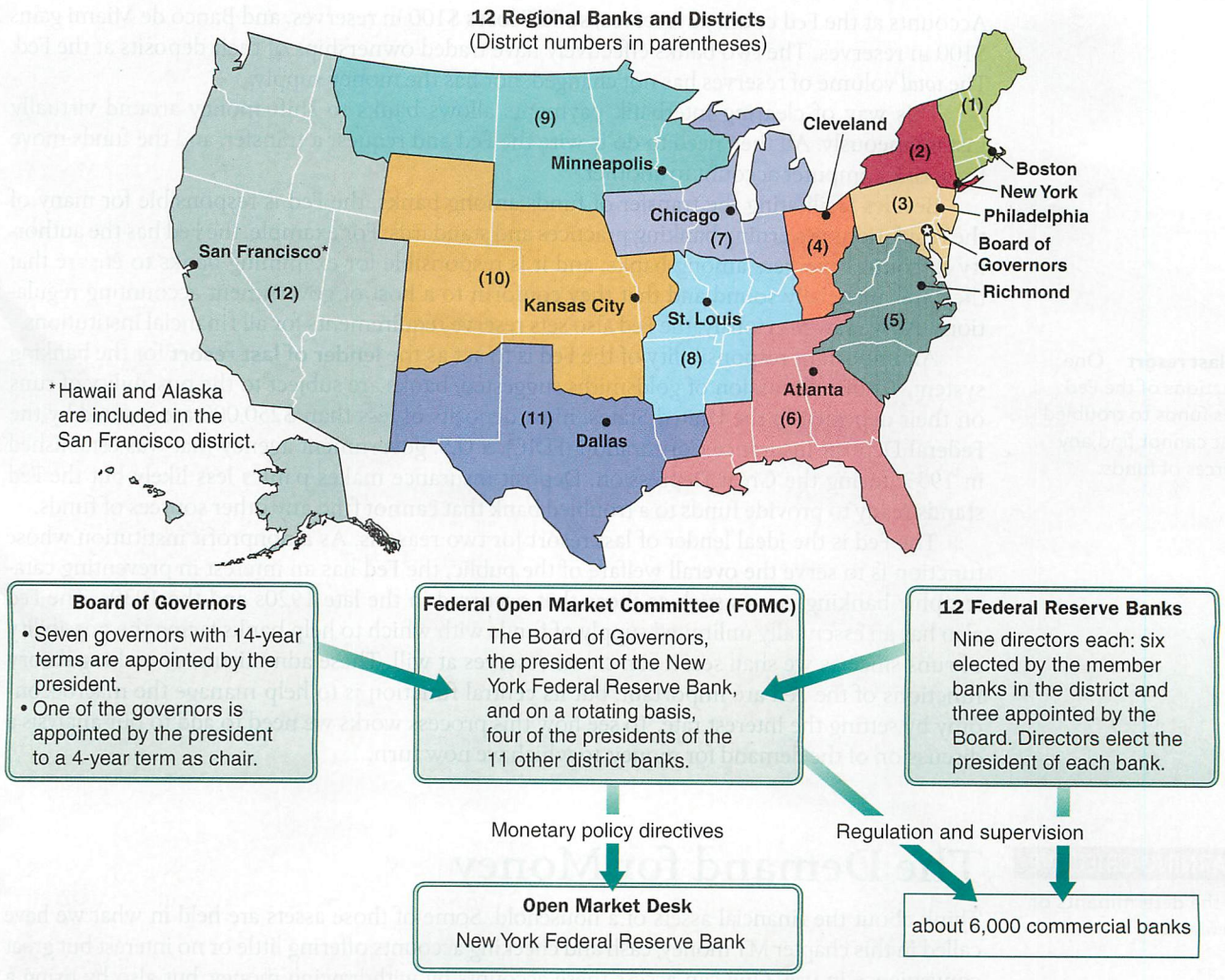
A		L	
Reserves	100	100	Deposits

Money multiplier

A		L	
Reserves	.100	500	Deposits
Loans	400		

$$\text{Money multiplier} = \frac{1}{RRR}$$

$$\frac{1}{.2} = 5$$



▲ FIGURE 10.4 The Structure of the Federal Reserve System

Functions of the Federal Reserve

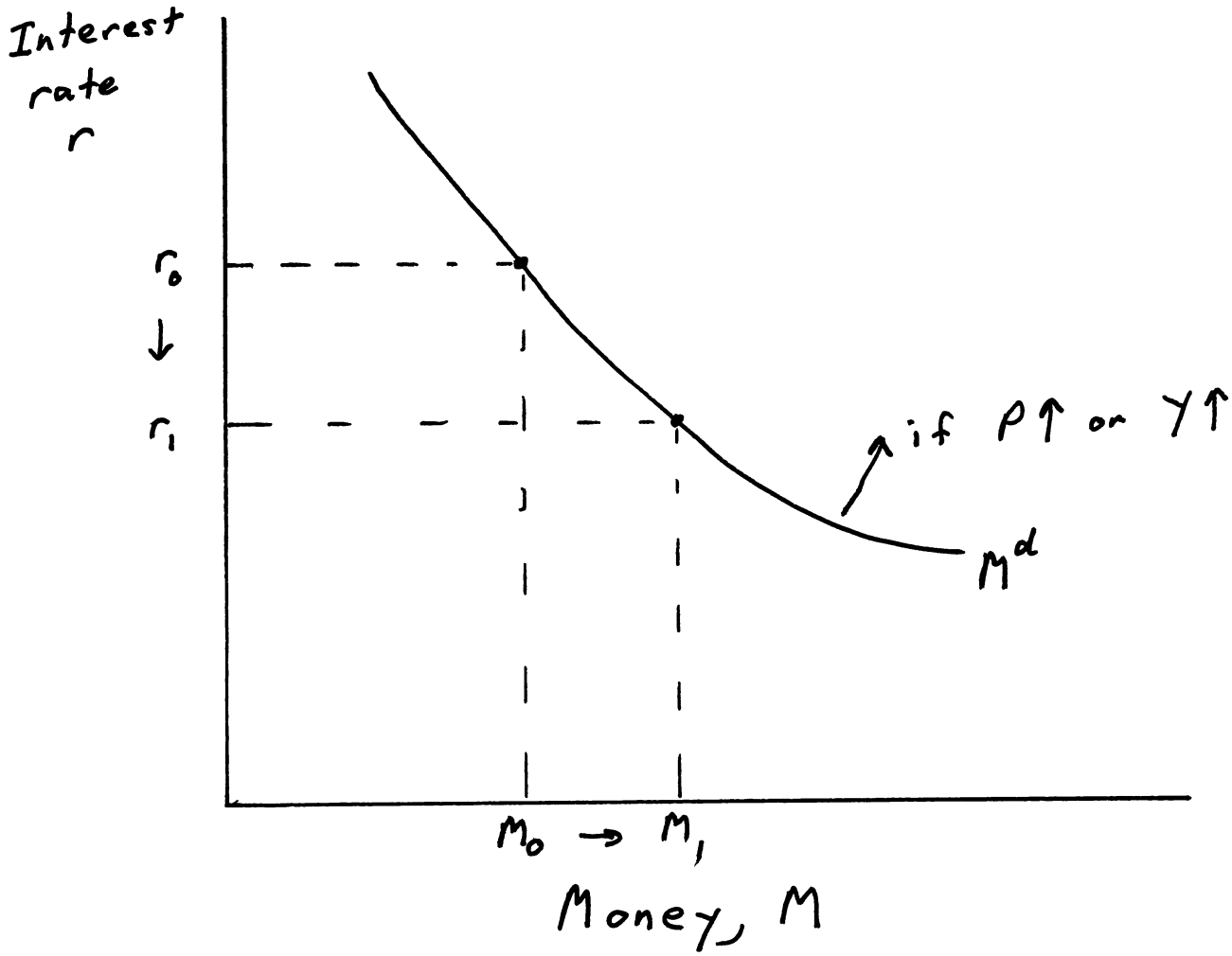
The Fed is the central bank of the United States. Central banks are sometimes known as "bankers' banks" because only banks (and occasionally foreign governments) can have accounts in them. As a private citizen, you cannot go to the nearest branch of the Fed and open a checking account or apply to borrow money.

As we will see shortly, the Fed is responsible for monetary policy in the United States, but it also performs several important administrative functions for banks. These functions include clearing interbank payments, regulating the banking system, and assisting banks in a difficult financial position. The Fed is also responsible for managing exchange rates and the nation's foreign exchange reserves.[5] In addition, it is often involved in intercountry negotiations on international economic issues.

Clearing interbank payments works as follows. Suppose you write a $100 check drawn on your bank, the First Bank of Fresno (FBF), to pay for tulip bulbs from Crockett Importers of Miami, Florida. How does your money get from your bank in Fresno to Crockett's bank in Florida? The Fed does it. Both FBF and Banco de Miami have accounts at the Fed. When Crockett Importers receives your check and deposits it at Banco de Miami, the bank submits the check to the Fed, asking it to collect the funds from FBF. The Fed presents the check to FBF and is instructed to debit FBF's account for the $100 and to credit the account of Banco de Miami.

[5] *Foreign exchange reserves* are holdings of the currencies of other countries—for example, Japanese yen—by the U.S. government. We discuss exchange rates and foreign exchange markets at length in Chapter 19.

The Demand for Money



BOND PRICES & INTEREST RATES

One year bond, coupon = 1, face value = 100

$$P = \text{Price of bond} = \frac{1}{1+r} + \frac{100}{1+r} = \frac{101}{1+r}$$

If $r = .02$, $P = 99.02$

If $r = .01$, $P = 100.00$

If $r = .005$, $P = 100.50$

—

Two year bond, coupon = 1, face value = 100

$$P = \frac{1}{1+r} + \frac{1}{(1+r)(1+r)} + \frac{100}{(1+r)(1+r)}$$

If $r = .01$, $P = 100$

If $r > .01$, $P < 100$

If $r < .01$, $P > 100$

—

If $r = .05$, how much is \$20,000 to be paid 50 years from now worth?

$$\frac{\$20,000}{(1.05)^{50}} = \$1,744$$

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CONSOL: $P = \frac{1}{r}$

If \$20,000 per year forever and $r = .05$

$$P = \frac{\$20,000}{.05} = \$400,000$$

Fed Balance Sheet (p. 205)

September 15, 2016

$ billions

Assets		Liabilities	
Gold	11	1,471	Currency in circulation
U.S. Treasury securities	2,464	342	U.S. Treasury Deposits
Federal Agency Debt	22	2,349	Reserve Balances
Mortgage-backed securities	1,763	365	OTHER + NET WORTH
OTHER	267		
TOTAL	4,527	4,527	

Excess Reserves = 2,349 − 100 = 2,249

↑ Reserve balances above

↑ Required reserves

M1 growth, annual rate

11.0 %	3 months
13.5 %	6 months
9.0 %	12 months

Term structure of Interest Rates

Sept. 2, 2016

1-year	r_1	0.0057
2-year	r_2	0.0074
3-year	r_3	0.0085
5-year	r_5	0.0113
10-year	r_{10}	0.0156
30-year	r_{30}	0.0226

$$(1+r_1)(1+r^e_{1+1}) = (1+r_2)^2 \Rightarrow \quad r^e_{1+1} = 0.0091$$

$$(1+r_2)^2(1+r^e_{1+2}) = (1+r_3)^3 \Rightarrow \quad r^e_{1+2} = 0.0191$$

On Sept. 4, 2015, $r^e_{1+1} = 0.0102$. Actual value turned out to be 0.0057 (see above)

Stock Prices

$$\text{Stock price} = SP_0 = \frac{DIV^e}{(1+r_1)} + \frac{DIV^e_{+1}}{(1+r_1)(1+r^e_{1+1})}$$

$$+ \frac{DIV^e_{+2}}{(1+r_1)(1+r^e_{1+1})(1+r^e_{1+2})}$$

$$+ \cdots$$

If sell in $+T$, expected present value of sale is

$$\frac{SP^e_{+T}}{(1+r_1)(1+r^e_{1+1})(1+r^e_{1+2}) \cdots (1+r^e_{1+T})}$$

- Commercial banks hold both Treasury securities (call them "bills") and reserves. The reserves are deposits with the Fed. The Fed can increase reserves by buying bills from the banks. If the Fed buy 100, reserves of the banks go up by 100 and holdings of bills goes down by 100. So far no change in the money supply. But if the reserve requirement is 0.2, the banking system can make loans of up to 500. Deposits have gone up by 500, and reserves have gone up by 100. The loans are in the form of deposits in the banking system. These are checking accounts, so the money supply has gone up by 500. If the demand for money schedule is downward sloping, the increase in the money supply lowers the interest rate. Conversely, if the Fed sells bills to the banks, reserves decrease, and loans (and thus demand deposits) must decrease. This lowers the money supply, thus leading to an increase in the interest rate.

- If the banks hold excess reserves and the Fed sells bills to them, they just pay for these out of excess reserves. They don't need to contract loans because they are not fully loaned up. In this case selling bills to the banks does not increase the interest rate. If the Fed wants to increase the interest rate in this case, it must increase the rate it pays commercial banks on

their reserves. How does this work? Say the rate paid on reserves goes up by 50 basis points. How does the bill rate increase by 50 basis points, which is what the Fed wants to happen? Say that the bill rate did not increase. As the bills that the banks hold come due, they will not want to roll them over because they can now get a higher interest rate on their reserves. So the demand for bills falls, thus driving down the price of bills, thus increasing the bill rate. The new equilibrium is where the increase in the bill rate is 50 basis points.

- Discounting. Say the two-year interest rate is .05 and I have $90.70 today. If I invest this amount today in an account earning 5 percent interest, at the end of the year I have $95.24 (1.05 times 90.70). I keep the money in the account for the second year, and at the end of the second year I have $100.00 (1.05 times 95.24). So I am indifferent between having $90.70 today or $100.00 two years from now if the interest rate is 5 percent. Note that 90.70 equals 100.00 divided by (1.05)x(1.05).

- At any one time people have expectations about future interest rates, say future one-year interest rates. (We backed out some of these rates in class.) These

expectations are changed by surprise changes in Fed behavior. If expected future interest rates increase, long-term bond prices decrease and stock prices decrease because the future discount rates have increased.