10 The Financial System

> MONEY, WHICH REPRESENTS THE PROSE OF LIFE, AND WHICH IS HARDLY SPOKEN OF IN PARLORS WITHOUT AN APOLOGY, IS, IN ITS EFFECTS AND LAWS, AS BEAUTIFUL AS ROSES.
>
> RALPH WALDO EMERSON

The first thing that comes to mind when most people think about the economy (or economics) is money: whence it comes, whither it goes. Probably no aspect of macroeconomics is more in the news than the financial system. We are deluged with daily reports of the state of the stock market, endless analyses of the Federal Reserve's monetary policy, speculations about expansions and consolidations among giant financial corporations, and stories about the financial solvency of foreign and local governments or industrial corporations. In this chapter, we examine the financial system's role in coordinating economic decisions and linking aggregate supply and aggregate demand. In the next chapter, we concentrate on the behavior of interest rates.

10.1 The Financial System and the Real Economy

10.1.1 THE ROLE OF MONEY AND FINANCE

Money and financial assets are not direct sources of economic welfare. We cannot eat them or build houses with them. If they are so important, it could only be because they affect the things that do govern our welfare: whether or not we have a job; how much we can consume now or in the future; how our government is financed; and the part that our country plays in the world.

Real Flows and Financial Flows

The financial system is an important linkage between aggregate supply and aggregate demand. Our analysis of aggregate supply in Chapters 6-9 concentrated on the activities of firms. Firms use labor and other factors of production supplied by households to produce goods and services, which in turn they supply to households. In Chapter 2 this was shown as the circular flow of goods and services (see Figure 2.2 in which this real circulation is shown as the solid clockwise loop crossing the production boundary in both directions). In a fundamental sense, the most economically significant action in the economy is this exchange of real factors of production for real goods and services. Nonetheless, only in rare cases do people work for food rather than money.

Any complex economy is more complicated than the circular flow of goods and services suggests. The workers and other suppliers of factors of production are unlikely to be satisfied with consuming only the product of the firms that employ them. You may work for baker, but man does not live by bread alone. Workers demand the value of their labor in money in order to choose for themselves what to consume. And firms must, as a result, sell their products to a variety of people rather than barter them to their own workers. As a consequence every real flow in the economy is matched by a counterflow of money (shown in Figure 2.2 as the dashed counterclockwise loop crossing the production barrier twice in the opposite direction to the loop representing the real flows).

How much households decide to spend clearly depends on their money incomes; how much firms can pay in wages and other factor payments clearly depends on their money sales. Money does not itself directly provide utility to the consumer or resources

to the firm, but any disruption in the monetary flow is bound to disrupt the real flows as well.

There is also another important monetary connection. In Chapter 2 we saw that not all income is spent on consumption goods in the current period. Since the value of incomes must necessarily equal the value of savings, the failure of households, for example, to use all their income for consumption could have disastrous consequences for the continuity of production, as firms would find themselves with stocks of unsold goods and, as a result, would cut back on production. Such dire problems could easily occur if households (or other savers) chose to keep their monetary savings in a cookie jar or under a mattress. But that is unlikely, most savers look for a safe place to lodge their savings and one that will provide them with interest or other return. As we saw in Chapter 2 (see Figure 2.3), **FINANCIAL MARKETS** serve to connect savers with excess purchasing power with borrowers with deficient purchasing power. Firms and individuals who borrow do so in order to spend. Investment and other spending using borrowed funds makes up the shortfall in aggregate demand caused by savings.

Once again, in a monetary economy whenever money flows in one direction, something of equal value must flow in the opposite direction. When savers transfer money to financial markets, they receive in return a **FINANCIAL INSTRUMENT** – that is, *a record (paper or electronic) that specifies the terms on which the loan of funds will be repaid*. There are a bewildering variety of financial instruments, though many are familiar to us all: checking accounts, savings accounts, corporate stocks, and government bonds. (The counterflow of financial instruments is not shown in Figure 2.3, but it is there in reality nonetheless.) Again, a disruption to the flow and counterflow of savings

and financial instruments is likely to disrupt the flows of real goods and services that ultimately matter for our welfare. Even in a smoothly flowing economy, the terms on which people and firms borrow and lend, particularly the rate of interest, will affect not only how much is saved and borrowed, but who does the savings and the borrowing.

We have isolated two aspects of the financial system: the monetary transactions system and financial markets. We now look at each in more detail, starting with money.

The Monetary Economy

For economists, "what is money?," has long been a vexed question. There is no doubt that a dollar bill is money. But what else, if anything, counts as money? Traditionally, money has been defined by its functions:

1. **means of transactions**: *we buy goods and services with money*;
2. **unit of account**: *values are expressed in as so many dollars in our ledgers*; and
3. **store of value**: *we can save for future purchases by laying money aside*.

The dollar bill and other **currency** (that is, banknotes and coins) are the most familiar means of transactions. Yet currency is used in only about 20 percent of personal transactions (checks and credit cards taking the other 80 percent) and in even fewer business transactions (wire transfers between bank accounts dominating other transactions media). For now it is enough to note that **MONETARY INSTRUMENTS** (i.e., currency and other transactions media) are essential to the efficiency of a complex economy.

The alternative to a monetary economy is barter: for example, I supply you with labor and you, in turn, supply me with food. The labor I supply would necessarily be

judged to be just worth the food you supply. The national accounts would still balance: income equals output; output equals expenditure. Barter, however, requires coordination. Each party has to know not only what it wants to buy and sell, but also what all the other parties want to buy and sell (a requirement sometimes referred to as the **DOUBLE COINCIDENCE OF WANTS**).

But an economy has to become only a little more complex than peasant farming before it becomes too complicated to keep track. One critical function of money is that it allows us to separate our plans from those of everyone else. All I need to know is what I want to sell (my labor) and what it earns and what I want to buy (food, shelter, and all varieties of things) and what it costs. (At each stage – buying and selling – there need be only a *single coincidence of wants*.) It is, for example, not important to me that my employer produce something that I want to consume. It is enough that I get paid and can buy what I want from some other producer. Money increases economic efficiency in part because it makes it easier to coordinate our individual plans.

The role of money as a unit of account may be as important – and perhaps more important – than its role as a means of transactions. Currency defines the unit in which the books are kept. Profits and losses, incomes and expenditures, are measured in dollars even when the currency itself is not directly involved. The ability to place values on vastly different real goods and services, to engage in bookkeeping, to account for economic performances, and to keep records that measure the successes and failures of economic enterprises, all in a common unit, is a fundamental building block of a modern economy.

Financial Instruments and Financial Intermediaries

Although currency and other monetary instruments can be used as stores of value, they are generally poor ones. Inflation eats away their value and other assets typically earn more interest. Various financial instruments are better stores of value.

All financial instruments are forms of **loans**. Each represents the transfer of resources to a borrower (usually in a monetary form) in exchange for a promise to repay on specified terms sometime in the future. The most primitive financial instruments are created when one person loans another money in exchange for an **IOU**.

Money plays a dual role. A loan can be thought of as the purchase of the financial instrument using money as a means of transactions. The loan is usually repaid using a monetary instrument. Some monetary instruments, such as checks, are themselves financial instruments in the sense that they are debt.

In most countries the **CENTRAL BANK** is a government-run bank whose customers are commercial banks. The **FEDERAL RESERVE SYSTEM** is the central bank of the United States. Commercial banks have accounts with one of the district **Federal Reserve Banks** (branches of the System). *The funds in these accounts* are **CENTRAL-BANK RESERVES**.

Suppose that I write a check to you for $150 against my account at Wells Fargo Bank. When you deposit it at Chase Bank, your account is credited $150. Chase then turns the check over to the Federal Reserve (or to a private clearing house). When the check is presented to Wells Fargo, it transfers $150 of central-bank reserves to Chase and debits my account by $150. Once these central-bank reserves have been transferred, my debt to you is terminated. It is then your bank, not me, which owes you currency on

demand or guarantees to honor your check up to the amount in your account by transferring central-bank reserves appropriately.

This illustrates another function of money:

4. **means of final payment**: *money terminates indebtedness*.

In our economy, only currency and central-bank reserves serve this function.[1]

Both the central bank and the commercial banks are examples of financial intermediaries – although the central bank is a special one, which is owned by the government and is not run principally for profit. A **FINANCIAL INTERMEDIARY** is *a firm whose business is buying and selling financial instruments or, equivalently, matching borrowers to lenders or savers to spenders*. Banks, mutual funds, insurance companies, investment trusts, stockbrokers, and pension funds are examples of the many types of financial intermediaries. Each financial intermediary specializes. Banks typically take business and personal deposits and make commercial and personal loans (e.g., mortgages, student loans, car loan, and credit cards). They can be seen as selling one financial instrument (checking and deposit accounts) to buy another (various loans).

The Flow of Funds

While money provides one source of efficiency (obviating the need for barter), the existence of specialized financial intermediaries provides another: the capacity of a monetary economy to separate the present from the future.

[1] Before 1964 U.S. coins with denominations higher than 5¢ were silver and most U.S. currency was convertible into silver. The dollar bill was then a form of debt and not technically a final means of payment, though it was rare that anyone would demand payment in silver on a large scale.

In a barter economy, if you want to consume more in the future than you earn (for example, you would like to prepare for retirement), you must store particular goods – either ones that you are sure to want or ones that you think that you can trade. You have to have a detailed plan.

In a monetary economy, you can set aside money or financial assets (that is, you can save) and delay the decision on exactly what to buy until the future actually arrives. Ultimately, all production is aimed at consumption. But in a monetary economy, we do not need a detailed plan for future consumption in order to prepare for it.

In a monetary economy the plans of different economic actors need not be coordinated. The various national-income-accounting identities of Chapter 2 show that the national income and product accounts must add up *ex post*. For example, the deficits of all sectors must sum to zero (equation (2.3): $[G - (T - TR)] + [I - S] + [EX - IM] \equiv 0$. Yet they need not be coordinated *ex ante*. A household does not attempt to discover firms' investment plans in order to make its own savings plans. The national accounts add up despite lack of coordination in part because they include *unplanned* investment. If a firm cannot sell everything it intends, it finds that its inventories of unsold goods, works-in-progress or raw materials rise, adding to its capital stock. This unplanned investment was an important element in determining aggregate demand (see Chapter 2, section 2.7).

Most investment involves one firm purchasing capital goods from another firm. Funds must change hands. Where do firms get the needed funds? Households and other savers ultimately provide the funds, but how do they get to the investors? Typically households do not save by lending money directly to, say, General Electric or Microsoft

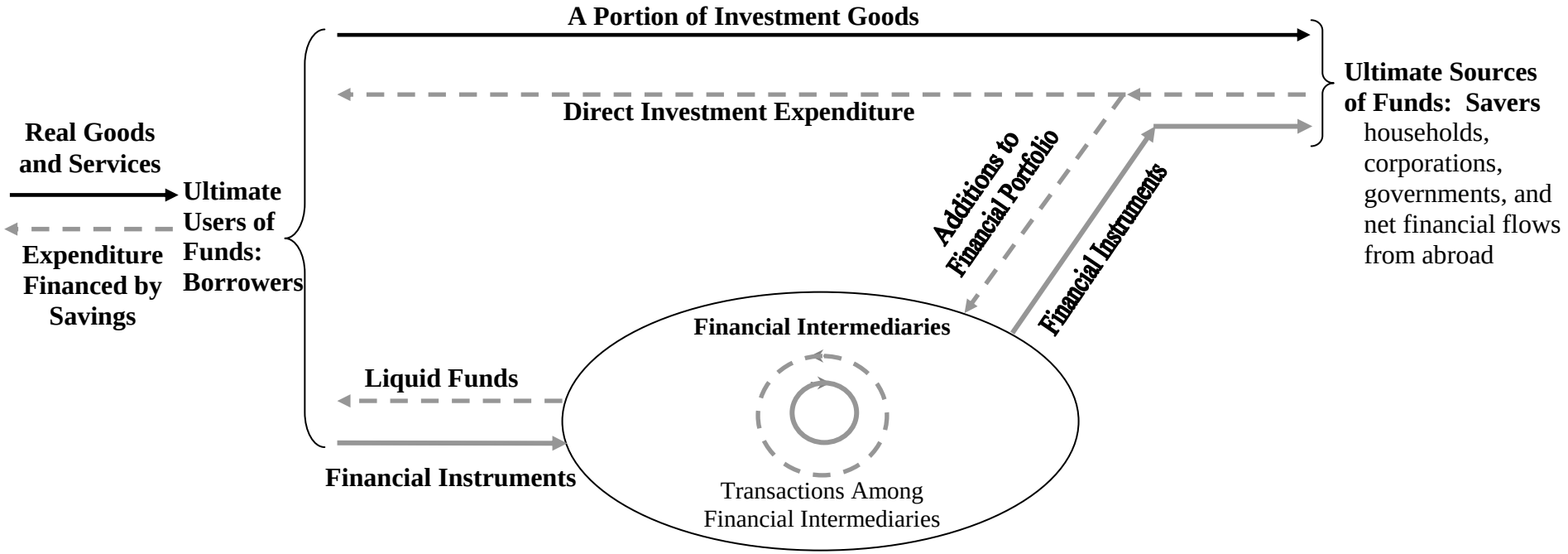
to support a new factory or office building. For the most part, savers put funds into a bank or a 401K plan or individual retirement account (IRA) or some other financial asset. How do these funds find their way to the firms doing the investing?

Figure 10.1 shows a simplified picture of the **FLOW OF FUNDS** from savers (corporate and government, as well as private) to firms making investments or to others needing funds to finance expenditure. The figure can be viewed, in part, as an elaboration of the oval marked "Financial Markets" in Figures 2.3-2.5 (Chapter 2).

Just as in the Circular Flow of Income diagram, the Flow of Funds diagram emphasizes that economic transactions are based on *quid pro quo* (see Chapter 3, section 3.1.1). The immediate **source of funds** feeding each monetary flow must receive something of equal value in return – the **use of funds**. Every flow of monetary funds in the diagram, must be matched by a counterflow of real goods or a financial instrument.

Money always flows from sources to uses (right to left in the diagram), while real goods and financial instruments always flow from uses to sources (left to right). At the top of the diagram, a portion of savings is shown as directly purchasing a portion of investment goods. For the most part, this corresponds to investment financed within firms themselves. If Caterpillar Company retains some of its profits (rather than distributing them to shareholders) in order to build a new engine plant, this is a form of corporate saving directly matched to a specific corporate investment. Similarly, if a household purchases a new automobile or puts a cash down-payment on a new house, it both saves and directly invests. In either case, the savings *quid* is matched to the investment *quo*.

Figure 10.1 The Flow of Funds



The financial sector connects the ultimate savers (sources of funds) with the ultimate borrowers (uses of funds). Every transaction is the exchange of money either for a real good or service or for a financial instrument. No matter how convoluted the channels through a variety of financial intermediaries, ultimately savings finds its way to the purchase of real goods and services.

Most savings is channeled through the financial intermediaries shown on the lower portion of the diagram. Some financial intermediaries deal with both the ultimate savers and the ultimate borrowers. Others may lend to the ultimate borrowers but only borrow from other financial intermediaries or borrow from ultimate savers but only lend to other financial intermediaries. Still others may only borrow from and lend to other financial intermediaries. The interior flows in Figure 10.1 labeled "Transactions Among Financial Intermediaries" only hints at the complexity of the financial system.

Although investment expenditure is probably the economically most important use for the funds generated from savings, there are other uses as well. When a consumer purchases an airline ticket on a credit card, he has in effect sold an IOU to the bank that issued the credit card. The funds that the bank pays to the merchant on his behalf are ultimately the savings of other consumers, firms, or governments. Similarly, although many governmental entities run surpluses and, so, are counted as savers, many others run deficits. Government purchases must be paid for, and the funds needed are raised by selling government IOUs – mostly to financial intermediaries – and receiving funds ultimately derived from savers in return.

10.1.2 The Flow of Funds Accounts

The flow-of-funds diagram (Figure 10.1) gives a reasonable schematic impression of the place of financial intermediaries in the macroeconomy. Practical economic analysis, however, requires numbers. The Federal Reserve collects these data for the United States in the **Flow of Funds Accounts**, which comprise 155 detailed accounts tracking the web of interrelationships among every type of financial intermediary. The flow of funds

accounts do for financial markets what the national income and product accounts do for the real economy.

As with other flow variables, the flow of funds can be likened to a stream of water. Savings flow through the network of financial intermediaries like the snowmelt from the high mountains running through a tangle of brooks and rivulets, creeks and rivers, until they reach the ultimate users like the water flowing into the sea. Stocks of financial wealth correspond to the standing waters – the lakes, ponds, pools, marshes, and reservoirs – along the way from mountain to sea. The particular financial instruments may keep turning over in the same way that the particular water molecules turn over in a lake. And just as the lake holds a standing stock of water, notwithstanding the turnover of the water molecules, individuals, productive firms, governments, and financial intermediaries retain standing stocks of financial assets. When the inflow of financial assets exceeds the outflow (that is when the outflow of funds exceeds the inflow or lending exceeds borrowing), the stock of financial assets held by a particular person, firm, or other organization rises.

In order to understand the flow of funds accounts, it will help to examine briefly the nature of real and financial wealth and some elementary principles of accounting.

Real and Financial Wealth

If you hold a financial instrument, it forms part of your wealth. Wealth takes many forms. To ancient or primitive people, wealth was measured in real goods: houses, land, gold, cattle, slaves, wives, cowrie shells, wampum, stocks of foodstuffs. **REAL WEALTH** comprises things that provide direct utility. It is often tangible (a house, a car, a gold

ring) sometimes it is not – for example, ownership of patent on a valuable invention is also real wealth. Real wealth is essentially a positive notion: you may own or not own a house or gold, but you cannot own less than nothing in the way of house or gold.

Financial wealth differ from real wealth in important ways. Financial instruments always involve two or more parties. They represent debt. For every owner of a financial instrument (the **creditor**), there must be someone who has promised to pay it off (the **debtor**). Unlike real wealth, financial wealth can be positive or negative. The creditor owns something of value; the debtor owes something. One's wealth is divided into **ASSETS** (positive wealth) and **LIABILITIES** (debts or negative wealth). Our assets include any real wealth owned and anything that others owe to us. Our liabilities include anything that we owe to others.

FINANCIAL WEALTH can be defined to be *claims to payment (or transfers) of something valuable at some future time*. While real wealth comprises intrinsically valuable goods, financial wealth is not intrinsically valuable. It has a real value in the sense that we sell it and use the proceeds to obtain goods. But it provides no direct services of its own.

The fact that financial assets are always a claim on someone else (and financial liabilities, an obligation to someone else) gives a social character to the financial system. Notice that the net value of financial wealth is always zero. If Jane holds John's IOU, and Jane and John marry and consolidate their wealth, then Jane's asset cancels John's liability.

The future orientation of financial assets is critical to the way in which they promote economic efficiency. A worker who does not wish to consume as much as he

can earn could lay away stocks of goods that he might need in the future. Aside from the difficulty of knowing just what he might need, it is costly and wasteful to keep real resources idle. Stocks of food deteriorate over time; clothes go out of style; and all goods must be stored, tying up space. It is easier to lodge savings with a financial intermediary and to purchase what is wanted later – billions of dollars will fit on a tiny microchip and those dollars are returned with interest.

Equally, the resources that might have been stored are available to others in the economy who need to use them now. The debtor needs real resources today and counts on being able to repay the value of those resources plus interest in future. The creditor needs real resources in future and is willing to part with them today for the promise of repayment. The real resources are kept busier and more productive because of the financial system.

Accounting and Balance Sheets

How can we measure wealth? Anyone who has tried to borrow money from a bank (anyone who has applied for a student loan, a car loan, or a mortgage) has had to fill in an application. One part of the application consists of a form on which one lists one's assets (things owned) in column A and one's liabilities (things owed) in column B. The difference between column A and column B is one's wealth or **NET WORTH**. The idea of net worth is simple: if one sold all of one's assets and used the proceeds to pay all of one's debts, net worth is whatever is left. *Net worth* is defined in the **FUNDAMENTAL IDENTITY OF ACCOUNTING** as

(10.1) $$\textit{Net Worth} \equiv \textit{Assets} - \textit{Liabilities}.$$

The loan application form is based on the rearrangement of this identity into the form

(10.2) $$\textit{Assets} \equiv \textit{Liabilities} + \textit{Net Worth}.$$

This equation can be represented as a **balance sheet**, which lists the assets and liabilities and calculates the net worth.

One form of the balance sheet – very much like the form on the typical loan application – is a table known as a **T-account**:

Assets	**Liabilities and Net Worth**
Things Owned	Things Owed
	Net Worth

The sum of the items in the left-hand column must add up to the sum of the items in the right-hand column, according to the fundamental accounting identity. It may at first seem odd to count net worth in same column as liabilities; yet it is the standard practice. One way to think of it is that your net worth is what you owe to yourself.

The fundamental accounting identity refers to stocks of wealth. It can also be re-expressed in terms of flows:

(10.3) $$\Delta\textit{Assets} \equiv \Delta\textit{Liabilities} + \Delta\textit{Net Worth}.$$

This form provides the basis for **DOUBLE-ENTRY BOOKKEEPING**. The adjective "double-entry" refers to the fact that we cannot change one term in the fundamental identity (one entry on the balance sheet) without changing one (or more) other terms if things are still to add up. The double-entry rule forces us to maintain consistency in our accounts and to recognize, for example, that we if we buy a car (adding to our assets) we are not richer if we had to borrow the money to make the purchase (adding to our liabilities).

As simple as it seems, the principle of double-entry bookkeeping is one of those ideas (like the button and stirrups for horse riders – also products of the Middle Ages) that appeared only after thousands of years of civilization. The great German poet, Goethe, ranked it "among the finest inventions of the human mind."[2] And a recent scholar claims that "[i]n the past seven centuries bookkeeping has done more to shape the perceptions of more bright minds than any single innovation in philosophy or science."[3]

Flow Accounts

The Federal Reserve's Flow of Funds accounts come in two major types: flow accounts and level (i.e., stock) accounts. The flow accounts correspond most nearly to Figure 10.1. They start with the flow version of the fundamental accounting identity (10.3) although they recast it in terms of sources and uses of funds. The change in assets is use and the change in liabilities and net worth is source, so that

[2] J.W. Goethe, *Wilhelm Meister's Apprenticeship*, book I, chapter 10.
[3] Alfred W. Crosby, *The Measure of Reality: Quantification and Western Society, 1250-1600.* Cambridge: Cambridge University Press, 1997.

(10.4) $$\Delta Assets \equiv Use \equiv Source \equiv \Delta Liabilities.$$

Table 10.1 is a consolidated version of the more complex flow-of-funds table called the Flow of Funds Matrix.[4] The main columns represent the various sectors of the economy, and the rows the changes to the real assets and financial instruments. Within each main column, there is a pair of subordinate columns – one for use and one for source. Each main column can be thought of as a T-account for a particular sector. The top four lines present gross flows for each sector. The next four lines give the details of the financial uses and sources – that is, the values in lines 5-8 add up to the value in line 3 (for uses) and line 4 (for sources).

For each sector, the accounts must balance in principle: sources must equal uses. In practice, because data collection is imperfect the accounts do not balance. For example, the sources for the Household and Nonprofit Organizations sector (lines 1 and 4) are $1,175 billion+ $900 billion = $2075 billion; the uses (lines 2 and 3) are $1444 billion + $842 billion = $2,286 billion. The difference, the *sector discrepancy*, is define as *sources – uses* = –$211 billion. The sector discrepancy is reported as a use and, when added to the other uses makes the accounts balance.

Similarly, for each instrument category sources must equal uses. The row sum for each instrument is reported in the main column labeled All Sectors. In principle the corresponding values in each of the two subordinate columns should be equal. In practice, they are not, and the difference is reported as the instrument discrepancy in the

[4] The complete set of detailed flow of funds accounts is available from the Board of Governors of the Federal Reserve System at http://www.federalreserve.gov/releases/Z1/Current/default.htm.

Table 10.1
Flow of Funds Matrix: 2003 Flows
(billions of dollars)

		Sectors												
		Households and Nonprofit Organizations		***Nonfinancial Businesses***		***Government***		***Financial Sectors***		***Rest of World***		***All Sectors***		***Instrument Discrepancy***
	Gross Flows	*Use* (1)	*Source* (2)	*Use* (3)	*Source* (4)	*Use* (5)	*Source* (6)	*Use* (7)	*Source* (8)	*Use* (9)	*Source* (10)	*Use* (11)	*Source* (12)	*Use* (13)
(1)	***Gross Savings***	--	1,175	--	1,119	--	-137	--	212	--	514	--	2,884	--
(2)	***Gross Real Investment***	1,444	--	975	--	368	--	0	--	122	--	2,909	--	-26
(3)	***Financial Uses***	842	--	666	--	81	--	783	--	2,562	--	4,925	--	-212
(4)	***Financial Sources***	--	900	--	494	--	574	--	240	--	2,505	--	4,713	--
	Financial Flows													
(5)	***Monetary Instruments***	174	--	134	--	-1	1	-139	436	277	1	446	437	-8
(6)	***Debt Instruments***	144	857	32	302	54	514	1871	983	538	-16	2,640	2,640	--
(7)	***Corporate Equity Instruments and Business Credit***	260	42	150	68	--	--	279	440	39	108	720	687	-33
(8)	***Other Instruments***	264	1	349	123	35	32	543	646	-71	147	1,119	949	-170
(9)	***Sector discrepancy***	-210	--	-28	--	--	--	42	--	-29	--	-237	--	-237

Note: Sector and instrument discrepancies differ because of rounding.
Source: Board of Governors of the Federal Reserve System, Flow of Funds, Quarterly Release Z.1. Entries consolidate detail.

last column. The sum of all the sector discrepancies is equal to the sum of all the instrument discrepancies and is reported in the bottom right-hand cell – double-entry bookkeeping ensures that even the errors are consistent.

To see how the flow of funds accounts shed light on the complexity of the financial system look at the data for the Household sector. In 2003, this sector saved $1,175 billion. Some of these funds went to purchase investment goods – largely residential property and durable goods such as cars and clothes driers (which count as investment in the flow of funds accounts, although they are reported as consumption in the national income and product accounts). Gross investment exceeds gross savings, so where did the missing funds come from? Column 2, line 4 shows that $900 billion was raised through borrowing; line 6 shows that most of that ($857 billion) was raised through increasing debt. More detailed accounts (not presented here) show that most of this debt took the form of mortgages.

Notice that at the same time as the Household sector was becoming more indebted, it also increased its own holdings of financial assets (column 1, line 3) by $842 billion. Again, the more detailed accounts show that households mainly purchased time and savings deposits, government bonds, shares in mutual funds, and pension funds.

Together these flows illustrate that any one sector can change its holdings of financial assets in two ways:

- **NET ACQUISITION OF FINANCIAL ASSETS** *occurs when a sector saves more than it invests*;
- **PORTFOLIO REALLOCATION** *shifts funds from one financial instrument to another*.

Financial markets are always in flux, and both sorts of changes occur constantly.

A hypothetical example illustrates a pure portfolio reallocation. Suppose that purchase a house worth $250,000, but that you have no net savings this year. How would you do it? And how would it show up in the flow of funds accounts? Your purchase would increase gross investment for the Household sector (column 1, line 2) by $250,000. To keep the accounts balanced, other entries must change by equivalent amounts. Suppose that you had use $50,000 in your mutual fund for the downpayment. This would show up as a negative entry in column 1, line 7 (also line 3). Then if you borrowed the rest from a bank in the form of a mortgage, the entry in column 2, line 6 (also line 4) would rise by $200,000. The net effect of these transactions is that your total wealth remains unchanged. All that you have done is transform monetary instruments into a real asset. Your wealth can rise only if you have gross savings.

Your house purchase also illustrates another important feature of the flow of funds accounts. The balance sheets of the different sectors are interdependent. For example, the fall in your mutual fund holding (a negative use) must also show up as a fall in the source of that instrument in the financial sector (column 8, line 7 and line 4). Of course, if that were the end of it, your withdrawal would knock the accounts of the mutual fund (and the financial sector) out of balance. To give you $50,000, the mutual fund must make offsetting changes to its own portfolio – probably selling some of the stocks, bonds, or other financial instruments it holds. Similarly, the funds you raise through your mortgage must be provided by a bank, adding $200,000 to the debt assets of the financial sector (column 7, line 5). Once again, the bank has to make adjustments to other assets and liabilities to keep its own portfolio in balance. The adjustments made by

the bank and the mutual fund will force other financial intermediaries to make their own adjustments. The flow of funds table shows the net consequences of all of these changes.

Any one sector can, through borrowing, add to investment or build up its holdings of financial assets in excess of its gross savings. Yet since every financial asset must be matched somewhere in the economy by an equal liability, when we add up across sectors, sources exactly equal uses and there can be no net acquisition of financial assets.

Adding up across sectors also ensures that savings equals investment. But investment is the acquisition of new real capital goods. Investment adds to real wealth. In contrast, financial assets zero out. This does not make them unimportant. It is the existence of financial assets that allows those with excess savings to shift resources to those whose savings fall short of their needs, even when they have no direct acquaintance with those people or their needs. The flow of funds is thus an instrument for ensuring a flow of real resources into the parts of the economy that can use them most effectively. The financial system gives important support to economic growth and prosperity.

The Assets-and-Liabilities Accounts

The flow account (Table 10.1) traces the movements of financial instruments, the level or assets-and-liabilities account (Table 10.2) show the total holdings of each instrument by sector. The flow account focuses on the rivers and streams, the stock account on the lakes and pools. The tables are related. For example, the positive entry for use of monetary instruments for nonfinancial businesses in Table 10.1 (column 3, line 5) implies that the holdings of monetary assets by these businesses ($1,446 billion in Table 10.2, column 3, line 3) was $134 billion higher than in 2002. Similarly any positive entry in a

Table 10.2
Flow of Funds Matrix: 2003 Assets and Liabilities
(billions of dollars)

		Sectors												
		Households and Nonprofit Organizations		***Nonfinancial Businesses***		***Government***		***Financial Sectors***		***Rest of World***		***All Sectors***		***Instrument Discrepancy***
	Gross Financial Position	*Asset*	*Liability*	*Asset*	*Liability*	*Asset*	*Liability*	*Asset*	*Liability*	*Asset*	*Liability*	*Asset*	*Liability*	
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1)	***Total Financial Assets***	34,266	--	12,504	--	2,543	--	43,529	--	8,229	--	101,087	--	-2,405
(2)	***Total Liabilities and Equity***	--	9,603	--	29,711	--	7,280	--	46,065	--	5,368	--	98,682	--
	Financial Stocks													
(3)	***Monetary Instruments***	5,278	0	1,446	0	501	28	2,078	10,420	1,066	893	10,369	11,342	973
(4)	***Debt Instruments***	2,154	9,252	389	7,427	1,296	5,593	26,235	11,085	3,933	650	34,007	34,007	--
(5)	***Corporate Equity Instruments and Business Credit***	9,805	330	2,364	12,038	280	787	9,680	8,754	1,718	2,003	23,846	23,913	68
(6)	***Other Instruments***	17,029	21	8,305	10,246	502	950	5,553	15,805	1,512	2,476	32,865	29,420	-3,446

Source: Board of Governors of the Federal Reserve System, Flow of Funds, Quarterly Release Z.1. Entries consolidate detail.

source column in the flow table is reflected in a change in the corresponding liability column in the assets-and-liability table. The flow tables tell us what happens to savings and how portfolios are changing. The assets-and-liabilities tables give us a snapshot of the financial portfolios of the economy.

Some points worth notice in Table 10.2:

- First, the total volume of assets and liabilities (columns 11, row 1 and column 12, row 2) are huge – approximately nine times GDP.
- Second, the difference between total financial assets and total financial liabilities for households and nonprofit organizations – that is, the net worth of the sector – is huge: $24.6 trillion. In every other domestic sector, liabilities exceed assets. The rest of the world also shows positive net worth: $2.9 trillion. This makes sense. For-profit corporations are ultimately owned by people or organizations (e.g., colleges or the Red Cross) domestic or foreign, so that the asset value of any for-profit corporation is shown as a liability to the corporation and an asset to the Household or Rest-of-the-World sectors.
- Third, the Government sector is a large net debtor. More detailed accounts (not presented here) show that state and local governments are close to balance, so that the Federal government accounts for most of the negative net worth of the sector. About 4/5 of Federal government debt takes the form of Treasury securities (notes and bonds), which are included in the liabilities in column 6, row 4. Many of these bonds are held by state and local governments (included in the assets in column 5, row 4), but the lion's share are assets to the financial institutions (39

percent) and the rest of the world (38 percent) and are included in the asset columns for these sectors.

- Finally, fourth, all monetary instruments (row 4) are naturally the liabilities of the financial sector (or governmental organizations such as the Federal Reserve or the International Monetary Fund). Households hold half of the monetary instruments and the rest are distributed among the other sectors, including the financial sector itself (another bank or a mutual fund, for example, may itself have a bank account).

10.2 Principles of Valuation

A hydrologist might ask two questions about any natural water system: What forces move the water through it? And what are the effects of that movement? Similarly, the economist should ask of the flow of funds: What forces govern the flows of financial instruments? And what are the effects of these flows? Although we will study the answers to these questions in more detail in later chapters, we should give a preliminary answer here. The various players in financial markets allocate or reallocate their portfolios in search of the best combinations of risk and return (most often measured by interest rates). We shall study this process in detail in Chapter 11. The movements in financial assets affect the real economy because they affect expenditure decisions – both directly through the supply of funds and indirectly through the cost or opportunity cost of those funds (again most often measured by interest rates). The supplies of funds or the values of the various financial instruments are measured (for example, in Tables 10.1 and 10.2) in dollars. Any financial instrument is a promise to provide something of value in

the future, so the problem that arises immediately is how does the holder of an asset or the issuer of a liability or their accountants, the tax authorities, or anyone else know what value to place on any asset today?

10.2.1 PRESENT VALUE

The Principle of Similarity and Replacement

The valuation of real assets is fairly straightforward. It follows the **PRINCIPLE OF SIMILARITY AND REPLACEMENT**: What a car or a machine is worth is simply what it would cost to *replace* it with another of the *same or similar* design and in the *same or similar* condition. Anyone who has wanted to place a value on a used car has probably looked at the *Kelley Blue Book* (in print or online). It gives current prices for used cars based on make, model, and condition. The point is to identify as closely as possible cars that have been sold recently with the car that one wants to sell to establish as close a similarity as possible. Real estate appraisers or the experts at Sotheby's or on the *Antiques Road Show* value even unique assets, such as a particular house or piece of land or particular antique or painting, using the principle of similarity and replacement.

To say that this thing has the same value as that similar thing, which could replace it, is just a start. We can still ask, what determines the value of that other car or house or antique to which we compare *our* car or house or antique? Again, the universal answer to all economic questions is . . . supply and demand. The supply price of a car or a machine when new is just the cost of production (including profits). The price of land or an old painting is more problematic, as the supply is fixed and demand may frequently shift. In

some cases, we can form a guess about the value, but we will never know *exactly* what some things are worth until they are actually sold.

The valuation of financial instruments also relies on the principle of similarity and replacement. Because they are identical and can perfectly replace each other, two 10-year government bonds must have the same value. And that value is determined by supply and demand. It is the same with two shares in General Motors or of any pairs of identical financial instruments.

Financial instruments pose a special problem, since the benefits they provide to the creditor and the costs they impose on the debtor occur in the future, while the costs they impose on the creditor, who provides the funds, and the benefits they confer on the debtor, who uses the funds, occur today. The problem is that valuation must compare costs and benefits today with benefits and costs in the future, and the future has not yet arrived. How is either side to a financial transaction supposed to know how to value the asset without a crystal ball?

Two Key Concepts: Opportunity Cost and Present Value

The answer depends on two of the most important ideas in economics: *opportunity cost* and *present value*. The idea of opportunity cost should be familiar already. In the discussion of labor supply in Chapter 8, we defined the **OPPORTUNITY COST** *of any choice* as *the value of the best alternative choice that it forecloses*.

The idea of opportunity cost can be applied easily to financial assets. If you buy shares in a mutual fund, the opportunity cost is the benefit you might have gained by buying some other financial asset. One measure of the benefit of holding an asset is the

percentage **YIELD** or **INTEREST RATE**. If you put $100 into a bank account and, after a year, the account is credited with interest to the amount of $3, then the interest rate is 3 percent. Now suppose that instead of putting your $100 into the bank, you buy $100 worth of shares in a mutual fund. If the best alternative use of your funds were the bank account, then the opportunity cost of the shares would be 3 percent.

The idea of opportunity cost can be used to compare monetary values today with monetary values in the future. Imagine that a friend dates a check one year from today and writes it for the amount of $100 payable to cash. He then offers to sell the check (a simple 1-year bond) to you. What should you pay for it?

Assuming that the friend is trustworthy, the question is one of opportunity cost. You will pay an amount $\$X$ for the check in order to receive $100 in a year. During that year, your $\$X$ is tied up and cannot be used for other purposes. You have given up all the other opportunities it might have funded. If the best of those opportunities had been to earn, say, 6 percent in a bank deposit account, then 6 percent is the opportunity cost of lending the money to your friend. Unless the percentage yield on your $\$X$ is at least 6 percent, it would be better to put the money in the bank.

As a result, the most that you should be willing to pay for your friend's check is $\$X$, where the $100 received in a year is enough to pay you 6 percent more than you paid for the check. That is,

$$\$X + 0.06(\$X) = (1.06)(\$X) = \$100.$$

In other words, $\$X$ is the amount that, if you paid it, would make the $100 you are set to receive in a year 6 percent higher than what you paid. The second two terms of the expression can be solved to yield

$$\$X = \$100/1.06 = \$94.34.$$

You should be willing to pay no more than $94.34 for your friend's $100 check. And, since the bank account is your *best* alternative, your friend will accept no less. The present value of $100, one year in the future when a similar asset yields 6 percent, is $94.34.

The particular numbers in this example are not important. Instead of $100 let the future value be designated *FV*, and let the yield (or interest rate) on the best alternative asset be designated *r*. Then the equation above can be written as a general formula for the present value (*PV*) of a value received one year in the future:

(10.5) $$PV = \frac{FV}{1+r} \ .$$

In general, the **PRESENT VALUE** of an asset can be defined as *the value today of the future benefits it confers given the relevant opportunity cost*.

Think about some other examples. First, what is the present value of a Treasury bill, which pays $10,000 one year from today, if the best alternative asset yields 4 percent? According to equation (10.5), *PV* = $10,000/(1.04) = $9,615.38.

But what would it be if the $10,000 were paid *two* years in the future. In that case, the purchase price of the bond would be tied up for two years and would have to earn 4 percent interest (compounded) for both years: $1.04(1.04)PV = (1.04)^2\$10{,}000$. Therefore, $PV = \$10{,}000/(1.04)^2 = \$9{,}245.56$. Again, the formula can be written more generally for the present value of a value received two years in the future:

(10.6) $$PV = \frac{FV}{(1+r)^2} \ .$$

The same reasoning gives the general formula for the present values of a value received three, four, or more years in the future. If the number of years is *m*, then the present value is

(10.7) $$PV = \frac{FV}{(1+r)^m} \ .$$

Present value, as expressed in this simple formula, *is the single most important concept in financial economics*. It is what permits us to make economically sensible comparisons of values at one time with those at another. And it arises (as we shall see in later chapters) in many contexts beyond the valuation of financial assets.

Four Properties of Present Value

Several general points about present value are implicit in equation (10.7):

1. Because interest rates are always positive, $1 + r$ is greater than one, and the present value of a future value is always less than the future value itself ($PV < FV$).[5] In the case of a bond (or your friend's check), this means that one always pays less today than the future value of the bond. A future value is said to be purchased today at a **discount**. The computation of present values is sometimes referred to as *discounting*, and the yield that measures the opportunity cost as the **discount rate**. And, as a result, **present *discounted* value** is a synonym for "present value."
2. The fact that present value is less than future value has nothing to do with inflation. It is quite true that, when there is inflation, today's dollar will be less valuable tomorrow than it is today. But, discounting points to a different fact: *tomorrow's dollar is less valuable today than it will be tomorrow*. This is the result of opportunity cost, not inflation. The discount compensates the purchaser of the future value for the lost opportunity. (As we shall see in next section, inflation and discounting interact, but it is important to distinguish the separate effects of each.)

[5] Near the nadir of the recent Japanese depression, some short-term government bonds were quoted with slightly negative interest rates. This appears to reflect the risk and trouble of holding the alternatives (currency, subject to loss or theft, or bank accounts, subject to bankruptcy) rather than a negative financial yield. The exception proves the rule.

3. The further a value is pushed into the future, the less it is worth today. In equation (10.7), as *m* becomes greater, *PV* becomes smaller. The longer you have to wait for your money, the less you should be willing to pay for it today.
4. The higher the opportunity cost, the greater the discount, the lower the present value. In equation (10.7) as *r* become greater, *PV* becomes smaller.

10.2.2 Real and Nominal Value

All the calculations of value so far have been conducted in nominal terms. By now, of course, we are familiar with the idea that – for the most part – it is *real* rather than nominal values that should guide economic decisions. Most financial instruments are contracts set out in nominal terms. How do we think about them in real terms?

Consider the case of a simple loan. You borrow $100 from friend and repay him $105 in a year. What rate of interest did you pay? Clearly 5 percent. In general, the interest can be computed as $r_t = (FV_{t+1}/PV_t) - 1$, so that in the example of your loan $r_t = 105/100 - 1 = 5$ percent.

To figure the real rate of interest on the loan, we proceed by analogy and substitute the real or constant-dollar value of the each amount in place of the nominal value. The real rate of interest (*rr*) is, therefore,

$$rr_t = \frac{RFV_{t+1}}{RPV_t} - 1, \tag{10.8}$$

where the *R* prefix indicates *real*. Recall that to convert any nominal quantity into the dollars of a reference year (year 0), we divide by the price level in the current year and

multiply by the price level of the reference year (see Chapter 2, section 2.4.2, and the *Guide*, section G.9). Replacing each real quantity in equation (10.7) with the analogous nominal quantity converted to constant dollars gives

$$rr_t = \frac{FV_{t+1}\left(p_0 / p_{t+1}\right)}{PV_t\left(p_0 / p_t\right)} - 1. \tag{10.9}$$

Cancelling the base-period prices and rearranging terms yields

$$1 + rr_t = \frac{\left(\frac{FV_{t+1}}{PV_t}\right)}{\left(p_{t+1} / p_t\right)}. \tag{10.9'}$$

The numerator on the right-hand side of equation (10.9') is just the definition of one plus the nominal interest rate ($1 + r_t$). The denominator is just one plus the rate of inflation ($1 + \hat{p}_{t+1}$). (Notice the timing implied in the subscripts. If a bond is purchased at time t, it is the inflation rate over the subsequent year – that is, the inflation rate for time $t + 1$ – that is relevant since the bond pays off at time $t + 1$.) Equation (10.9') can then be rewritten as

$$1 + rr_t = \frac{1 + r_t}{1 + \hat{p}_{t+1}} \tag{10.10}$$

or

(10.10') $$1 + r_t = (1 + rr_t)(1 + \hat{p}_{t+1}) .$$

Going back to the example of your loan, imagine that the rate of inflation was 2 percent over the life of the loan, the equation (10.10) says that the real rate of interest $rr_t = (1.05)/(1.02) - 1 = 2.94$ percent.

A Useful Approximation

This last calculation is precisely correct, but equation (10.10) is more complex and cumbersome than it need be for many purposes. To simplify things, look at equation (10.10') and multiply out the right-hand side:

(10.11) $$1 + r_t = (1 + rr_t)(1 + \hat{p}_{t+1}) = 1 + rr_t + \hat{p}_t + rr_t(\hat{p}_{t+1}) .$$

Since typically interest rates and inflation rates are small – much less than one (that is, one hundred percent) – their product ($rr_t \times \hat{p}_{t+1}$) is even smaller, and usually can neglected with little error. Dropping the last term in equation (10.11) and subtracting one from each side gives

(10.11') $$r_t \approx rr_t + \hat{p}_{t+1}$$

or

(10.11") $$rr_t \approx r_t - \hat{p}_{t+1}.$$

We can use equation (10.11") to calculate the real rate of interest on your loan as approximately as $rr_t = 5 - 2 = 3$ percent.[6] The precise value is 2.94, so the error is 0.06 percentage points (that is 0.06/2.94 = 2 percent of the true answer). For many purposes, such a small error does not matter. But the errors will be larger if the nominal interest rates or the inflation rates or both are high. What works well as an approximation in a low inflation economy would be highly misleading in a high inflation economy, for which the precise formula (10.10) is preferred.

The Ex Ante Versus the Ex Post Real Rate

In the example, once your friend repays the loan, you can look at the CPI, compute the rate of inflation, and calculate the real rate of interest that you earned. As happens so often in economics, it is easy to calculate an important quantity after all of the action is past. This is the ***EX POST* REAL RATE OF INTEREST**. Unfortunately, the key economic decision is made when you agree to lend money to your friend, not after he repays the loan. What you really need is guide to your decision before any of the action has started. You need to know the *ex ante* real rate.

[6] Another way to justify equation (10.13') is to take logarithms of both sides of (10.12) to yield $\log(1+r_t) = \log(1+rr_t) + \log(1+\hat{p}_t)$. Then, using the fact (see the *Guide*, section G.11.2) that, for small *x*, $\log(1 + x) \approx x$, the expression can be rewritten $r_t \approx rr_t + \hat{p}_t$, which is the same as equation (10.13').

If you had a crystal ball and could see the future precisely, the *ex ante* and the *ex post* rates of interest would be the same. Unhappily, none of us has a crystal ball. The best that we can do is form expectations of what the real rate will turn out to be. The ***EX ANTE*** (OR **EXPECTED**) **REAL RATE OF INTEREST** can, then, be indicated by a superscript *e*, so that $rr_t^e \approx r_t - \hat{p}_{t+1}^e$. The relevant nominal rate of interest is the market rate agreed to in the loan contract and so is known with certainty. Only the rate of inflation is uncertain. The current price level is known, perhaps, but one can only guess the future price level.

The present value formulae can all be transformed into real terms. Each nominal dollar-denominated quantity is converted to constant dollars and each nominal yield is converted to a real yield. The *ex ante*/*ex post* distinction is important as soon as we consider unknown facts about the future. So, for example, equation (10.5) can be converted into an expression for real, *ex ante* present value:

$$RPV_t = \frac{RFV_{t+m}}{(1+rr_t^e)^m}, \tag{10.12}$$

where rr_t^e is the real opportunity cost expected to prevail over *m* periods starting at time *t*. Each present value calculation can be adapted as appropriate to apply to real values (*ex ante* or *ex post*). The key rule is: *do not mix and match*. When using real or constant-dollar values use real yields as the discount rate (opportunity cost). When using market or nominal values, use market or nominal yields.

10.3 The Main Financial Instruments

How can the general principles of valuation be applied to the different types of financial instruments? Tables 10.1 and 10.2 divide financial instruments into four broad categories. (More detailed flow-of-funds accounts divide them still further.) The three most important categories are debt, equity, and monetary instruments (see Figure 10.2). The largest items in the category of "other instruments" are pension funds and life insurance reserves, which themselves mainly consist of debt or equity instruments, and the equity of non-corporate businesses. So if we understand the valuation of the other categories, we have gone a long way toward understanding these as well.

10.3.1 DEBT

Debt instruments are promises to pay – IOUs. All debts are forms of loans. Some, such as ordinary bank loans (including mortgages) and credit card debt, reflect a direct relationship between the borrower and the lender for the life of the loan. In contrast, bonds are an impersonal form of loan in which the IOU is readily bought and sold on the open market.[7] Loans are about 14 percent of all financial assets and about 42 percent of the debt instruments shown in Table 10.2 and Figure 10.2. Bonds, on the other hand, are about 20 percent of all financial assets and about 58 percent of debt instruments. In contrast corporate equities (stocks or shares) are only about 15 percent of all financial assets. It is easy to sympathize with Sherman McCoy, the protagonist of Tom Wolfe's novel *Bonfire of the Vanities*, who as a bond broker sees himself as a "Master of the

[7] The line is becoming increasingly blurred as recently mortgages and other loans have been sold by the original lender and as their income streams have been used to guarantee bonds sold by banks.

Universe" but cannot get any respect at cocktail parties: bonds are bigger, but the stock market gets all the good press. The contrast is even starker when considering flows: corporate bonds raised over five times as much funds in 2003 as new issues of corporate equity.

What are Bonds?

Like other debt, bond is an IOU. Any debt may be represented as an IOU and, therefore, thought of as a bond. Your friend's post-dated check in the last section was a primitive bond. A mortgage, a credit card debt, or any loan could be thought of as a bond. The principles of valuation are the same whatever form the IOU takes. Still when we use the word "bond" we normally refer to financial instruments that are traded in highly organized markets. In this more limited sense, a **BOND** can be defined as *a promise to pay a definite stream of money in some fixed pattern, usually represented by a paper certificate or an entry in a broker's or government's books, that may be bought and sold on the open market*. A variety of financial instruments known by a bewildering array of names fit this definition: examples include short-term instruments such as Treasury bills, repurchase agreements, commercial paper, certificates of deposit, and bankers' acceptances; medium-term instruments, such as Treasury notes; and long-term instruments, such as debentures, Treasury bonds, and municipal bonds. These and other instruments differ in detailed ways that might be studied in a course on corporate or public finance or on money and banking, but at their core they all are similar.

Financial instruments traded on organized markets, especially longer-term instruments, are also known as **securities**. Hence, the U.S. government agency that

regulates the trading of financial instruments is called the Securities and Exchange Commission (SEC). The market for shorter-term financial instruments is often referred to as the **MONEY MARKET**. When financial professionals refer to *money* or *cash*, they generally mean short-term, interest-bearing instruments traded on the money market, and not notes, coins or checking accounts at banks.

Bonds are typically issued in uniform, fixed denominations so that they may be easily bought and sold. The ease of buying and selling, the so-called **LIQUIDITY** of the bond, helps to encourage people to make the loans.

The modern government bond market was created in Great Britain in the middle of the 18th century. Before that time, the government had financed its continental wars with loans from wealthy merchants and landowners, each one negotiated separately and on different terms. The national debt represented in these loans was consolidated and paid off with an issue of 3 percent perpetual bonds (known as "consols"). Because these bonds were issued in reasonably small denominations, the middle classes, as well as the rich, could afford to buy them, secure in the knowledge that they could be sold easily on the open market if the funds were needed.

The same principle applies to today's financial markets. Few could be persuaded to make private loans to the Ford Motor Company or to the Federal government. Yet, the same people may be willing to buy Ford or government bonds because they know that, if they need the funds, they will find a ready market.

The Mechanics of Bond Pricing

The price of a bond is just the present value of the future stream of income it delivers. The key to computing it is to know the stream of income and the relevant opportunity cost.

Most bonds are variations on the same general pattern. The key elements defining a bond are:

- The **face value** (***FV***): *the amount paid when a bond comes due or matures.* When bonds appear – as they do less and less frequently – in the form of a paper certificate, the face value is literally the value printed on the face of the certificate. The symbol "*FV*" is used both for future value and for face value, since the face value is, in fact, the future value of the bond at its maturity date.
- The **coupon** (**Cpn**): *regular payments to the holder of bond (usually quarterly, semiannual or annual).* In the past, bonds had small tags printed on their edges that indicated the amount and due date of one of these regular payments. To receive the payment, the bondholder would clip the coupon from the edge of the bond at the due date and send it to the issuer. As a result, wealthy people, who did not have to work but could live off the income from their financial portfolios, were sometimes known as "coupon clippers."
- The **coupon rate**: *the coupon expressed as a percentage of the face value – that is, the coupon rate = Cpn/FV.* If the face value of a bond is $5,000 and the coupon is $400 per year, then the coupon rate is 400/5,000 = 8 percent. The coupon rate is just another way of expressing the value of the coupon. It is *not* the interest rate or

yield that one earns on a bond unless one happens to pay the face value for the bond.

- The **market value** or **bond price** (**p_B**): *the actual price a bond commands on the current market.* The price of a bond is also its present value: $p_B = PV$.
- The **maturity**: *the date at which a bond pays off its face value and ceases to be a liability to its issuer or an asset to its holder*. While the maturity is a date, we shall often wish to indicate **time to maturity** by the variable *m*, which measures the number of periods until a bond matures. For example, if a 10-year bond pays semi-annual coupons, then at the time of purchase $m = 20$. The maturity of a bond is not a fixed number, but falls as the bond gets older. By 2005, a twenty-year bond issued in 1990 has a maturity of only five years
- The **yield to maturity** (***r***): *the rate of return earned if a bond is bought at the current market price and held until it matures and its face value is paid off*. Interest is received in the form of coupon payments and any premium of the face value over purchase price. The yield to maturity is expressed as a percentage of the purchase price. Because it is an interest rate, the yield to maturity is expressed as the variable *r*, the general symbol for a market rate of interest. The yield to maturity is also the opportunity cost of holding a bond. If there were sufficiently similar instruments with higher yields available, no one would hold the bond. And, if the bond had the higher yield, no one would hold the other instrument.

The different payments that are part of the bond contract – the coupons and the face value – are received at different times in the future. To figure the price today, each must be discounted to find its individual present value. For example, if today is time

$t = 0$, the present value of a coupon payment received four years from now is $PV = Cpn/(1 + r)^4$. The present value of the face value received seven years from now is $PV = FV/(1 + r)^7$. The price of the bond is just the sum of the present values of each of the parts of the bond.[8] In general, then, the price of a bond that pays m periods in the future can be computed as

$$(10.13) \qquad p_B = PV = \frac{Cpn}{1+r} + \frac{Cpn}{(1+r)^2} + \frac{Cpn}{(1+r)^3} + \cdots + \frac{Cpn}{(1+r)^m} + \frac{FV}{(1+r)^m}$$

The general formula can be written more compactly as:

$$(10.13') \qquad p_B = PV = \left[\sum_{t=1}^{m} \frac{Cpn}{(1+r)^t}\right] + \frac{FV}{(1+r)^m}.$$

This formula applies equation (10.5) to each of the parts of the bonds separately. It assumes that the coupon payments are all the same value, and that the first coupon payment is received at the end of the first period.

[8] In applying the formula in equation (10.4) the interest rate (yield to maturity) must be compatible with the frequency of the coupon payments. If coupon payments are received annually, then the interest rate is expressed at an annual rate. If the coupon payments are received semi-annually, then it must be expressed at a (simple) semi-annual rate: $r_{semi\text{-}annual} = r_{annual}/2$. Similarly, $r_{quarterly} = r_{annual}/4$, and $r_{monthly} = r_{annual}/12$.

Types of Bonds

The pricing of the two most common sorts of bonds is easily understood using the formula (10.13'). Most longer term government or corporate bonds are **coupon bonds**. Coupon bonds use the formula (10.13') exactly.

In the last subsection, we considered the pricing of the Treasury bill. The Treasury bill is a common example of a **pure discount (**or **zero-coupon**) **bond**. A pure discount bond does not pay a coupon. The price of the pure discount bond is found by setting *Cpn* to zero in formula (10.4') and setting *m* to the maturity of the bond. For example, the price of a one-year Treasury bill is:

$$p_B = \frac{FV}{(1+r)}. \tag{10.14}$$

The most common pure discount bonds are financial instruments such as Treasury bills and commercial paper whose maturities are less than one year. In recent years, however, dealers on the secondary markets have divided the coupon payment streams and the face values of government bonds and sold them separately. These are known as *Treasury STRIPS*.[9] Principal-only STRIPS have only a face value and so are priced as a pure discount bond.[10] When similar bonds yield 5.5 percent, a $5,000, 30-year principal-only STRIP would sell for $p_B = \$5{,}000/(1.055)^{30} = \$1{,}003.22$. In general, a pure discount

[9] The name is an acronym for *S*eparately *T*raded *R*egistered *I*nterest and *P*rincipal *S*ecurities chosen to reflect the colloquial description of the process of dividing the interest and principal as "stripping" the bond.
[10] The term "principal" refers to the original amount borrowed or the unpaid balance of a loan.

bond, maturing *m* periods from today is priced as

$$p_B = \frac{FV}{(1+r)^m} \tag{10.15}$$

In this chapter, we have looked only at the simplest sorts of bonds, which is enough for purposes of macroeconomic analysis. Courses in finance study different sorts of bonds in greater detail.

Prices and Yields

We observed earlier that the higher the opportunity cost measured by the interest rate on a similar asset, the lower the present value. This fact implies that bond prices and yields move inversely. This is obvious in equation (10.14). As *r* becomes higher, p_B becomes lower.

For example, when interest rates are 7.25 percent on similar assets, a $75,000 one-year certificate of deposit (a pure discount bond) would sell (using equation (10.5)) for p_B = $75,000/(1.075) = $69,767.44. But if the interest rate were to *rise* to 8 percent, it would sell for *less*: p_B = $75,000/(1.08) = $69,444.44.

Similarly, using equation (10.15), when competing interest rates were 9 percent, the price of a principal-only $1,000 Treasury STRIP maturing in 12 years would be: p_B = $1,000/$(1.09)^{12}$ = $355.53. But if the interest rate were to *fall* to 8.75 percent, then it would sell for *more*: p_B = $1,000/$(1.0875)^{12}$ = $365.47.

These examples presume that we know the yields on competing assets and use them to compute the price of the bond. We can also ask, given the price of the bond, what is its yield to maturity? Equations (10.14) and (10.15) can be solved for r:

$$r = \frac{FV}{p_B} - 1, \tag{10.16}$$

and

$$r = \sqrt[m]{\frac{FV}{p_B}} - 1. \tag{10.17}$$

In each of these formulae, as p_B rises (or falls), r falls (or rises). So, for example, if a one-year \$10,000 Treasury bill costs \$9,500, then its yield is given by equation (10.16): r = (\$10,000/\$9,500) – 1 = 5.26 percent. The yield, of course, moves inversely with price: if the price *rises* to \$9,600, the yield *falls* to r = (\$10,000/\$9,600) – 1 = 4.17 percent.

The same inverse relationship between bond prices and yields can be seen using equation (10.17). And, in fact, it applies to the more complicated general bond pricing formula. It is easy to see from equation (10.13') that any increase in the yield would result in a fall in the bond price and vice versa. It is harder to compute the yield from the bond price, because the solution is a polynomial of order m. High-school students learn to solve quadratic equations, but there are no simple general formulae for higher-order

polynomials. Nevertheless, the yields are readily computable using a spreadsheet program or a business calculator (see Problem 10.23).

The inverse relationship of bond prices and yields is so important that the general rule bears restating in a kind of mantra: *when bond prices rise, yields fall; when bond prices fall, yields rise; when yields rise, bond prices fall; when yields fall bond prices rise.*

Sometimes people – especially reporters in newspapers or on television – misunderstand the inverse relationship between bond prices and yields. Not infrequently, a reporter will say: "interest rates rose today causing bond prices to fall." The connection is not causal. It is definitional. Given the face value, coupon structure, and maturity of a bond, if one knows the price, one can compute the yield, and if one knows the yield, one can compute the price. The price and the yield are just different ways of packaging the same information. A rise in interest rates does not cause a fall in bond prices; it is the very same thing as a fall in bond prices.

A pure discount bond must always sell for less (or at least no more) than its face value. If that were not true, it would not earn a positive yield. The situation is more complex with coupon bonds. Consider a two-year bond with a face value of \$1,000 and a coupon rate of 5 percent paid annually. The coupon is \$50 (= $FV \times$ *coupon rate* = \$1,000 $\times$ 0.05). If the yield on similar competing assets is 7 percent, the price is p_B = \$50/(1.07) + \$50/$(1.07)^2$ + \$1,000/$(1.07)^2$ = \$963.84. The bond sells at a discount over its face value.

What happens when the yield on competing assets falls to 4 percent? Then p_B = \$50/(1.04) + \$50/$(1.04)^2$ + \$1,000/$(1.04)^2$ = \$1,018.86. Now the bond sells for a

premium over its face value. Does this violate the general rule that present value is always less than future value?

To see that it does not, notice that each of the individual parts of the payment stream – the coupons and the face value – obey the rule. Their present values are: $48.08, $46.23, and $924.56. To see why the sum of the parts is greater than the face value, think what income stream would be generated if the face value were placed in a bank account earning 4 percent interest. Each year the bank account would pay $40. But the bond pays $50 each year. The purchaser should be willing to pay more (that is, pay a premium over face value) to receive the higher income stream.

Similar reasoning also explains why the bond sells at a discount when yields are greater than its coupon rate. When interest rates are 7 percent, a bank account would pay $70 a year on a $1,000 deposit. The bond pays only $40 per year, so the shortfall in yield must be made up by a face value greater than the purchase price – just as with a pure discount bond.

A special case occurs when the yield on similar competing assets is exactly equal to the coupon rate on the bond. In this case, the bond price is exactly equal to the face value. These relationships are summarized in the rule: *When the yield is equal to the coupon rate, a bond sells at its face value; when the yield is greater than the coupon rate, it sells at a discount; when the yield is less than the coupon rate, it sells at a premium.*

10.3.2 MONEY

Monetary instruments (international and domestic) in the United States are a relatively small part of total financial assets – only about 10 percent in 2003. And money more

narrowly defined as currency and checking deposits is less than 2 percent. Yet, as we have seen, money is important in that it defines the unit of account, facilitates a significant number of transactions, and acts as the final link in most chains of financial transactions.

Historically, money in most countries was gold or silver. The United States left the gold standard internally in 1933 and internationally in 1973. Until 1964, most American coins were silver, and paper dollars were promises to pay silver coin. The gold and silver standards are examples of **COMMODITY MONEY**. In contrast, the dollar and most paper currencies today are examples of **FIAT MONEY**. They are money because the government has decreed them to be **legal tender**, which means that, if any debt is denominated as a certain number of dollars, paper dollars must be accepted as the final means of payment.

It is relatively easy to understand why commodity money is valuable. Monetary commodities have alternative uses. Gold is used in jewelry and microchips, and silver in jewelry, cutlery, photographic film. Both have many other uses. Despite the fact that old bills are turned into confetti for insulation or novelty gifts ("$1000 in a jar for only $4.99!"), fiat currency has virtually no intrinsic value. It is valuable partly because it is in short supply and partly because everyone regards it as valuable.

An illustration of the self-reinforcing nature of the value of fiat money was provided by a civil war in the Congo (formerly Zaire). On overthrowing the government, the rebels repudiated the old currency and created a few fiat currency. They printed huge amounts of the new currency to pay their expenses. The value of the new currency fell

rapidly, and many people would accept only the repudiated old currency in transactions – it was, after all, in limited supply and was familiar to them.

The government plays an important role in maintaining the value of a fiat currency. Contrary to the practice of the rebel government in the Congo, currencies are sound only when governments limit the supply so that it does not grow disproportionately to the need for hand-to-hand payments. Governments also reinforce the value of a fiat currency by paying its creditors in its currency or in assets immediately convertible into currency and by requiring that taxes be paid in the same way.

Hand-to-hand currency is the most familiar final means of payment. There is, however, another important one: central-bank reserves (see section 10.1.1). The value of central-bank reserves is tied directly to the value of currency. The Federal Reserve is always ready to exchange reserves for currency or currency for reserves. When a bank needs cash to fill its ATM machines, it withdraws the money from its account at the Federal Reserve in much the same way that you would at your local bank. One difference: it typically sends an armored car to cart the currency away.

For many years after a series of financial reforms in the wake of the Great Depression, it was illegal in the United States to pay interest on checking accounts. While this is no longer the case, many checking accounts still do not pay interest – their owners finding that the transactions services that they supply provide adequate compensation. Other checking accounts and time and savings deposits, as well as money-market mutual funds, do pay interest. Those financial assets that are frequently counted among monetary instruments usually share two properties. First, they can be converted into currency either on demand or at relatively short notice. Second, they are

capital secure: unlike a discount bond, which pays interest only implicitly from the fact that its price is below its face value, monetary instruments are always sold at their face values and any interest is paid explicitly.

Different financial instruments fulfill the traditional functions of money to different degrees. It is hard to know where to draw the line between money and non-money. The Federal Reserve, in fact, has four definitions of money or, as they are officially known, the **MONETARY AGGREGATES**. The narrowest focuses only on assets that serve as a final means of payment: the **MONETARY BASE** (**MB**) equals *currency plus central-bank reserves*. The other definitions focus on assets that can be held by the non-bank public and used in payments or turned quickly into assets that can be used in payments with increasingly less ease. The narrowest definition is known as M1. **M1** equals *currency plus checkable deposits plus travelers' checks*. Table 10.3 gives the definitions of the monetary base, M1, M2, and M3 monetary aggregates. A course in money and banking or financial economics would study these definitions and their uses carefully. In later chapters, we will refer only to the monetary base and, to a lesser extent, M1.

10.3.3 EQUITY

What are Stocks?

CORPORATE EQUITIES (also known as **STOCKS** or **SHARES**) are *fractions of the ownership of corporations*. The **corporation** is *an important legal structure in which the owners, the stockholders, have only limited liability*. This means that the shareholders are responsible for the actions of the corporation only up to the value of their shares. So, for

Table 10.3 The Federal Reserve's Monetary Aggregates

Monetary Aggregate	Definition	Value as of 31 December 2001 (billions)
Monetary Base (MB)	= Reserves of depository institutions (including reserve balances with the Federal Reserve Banks and eligible vault cash) + Currency held by the non-bank public	$ 634.4
M1	= Currency held by the non-bank public + Travelers' checks + Demand deposits due to the non-bank public + Other checkable deposits	$1,179.3
M2	= M1 + Savings deposits (including monetary market deposit accounts) + Small-denomination time deposits (less than $100,000) + Retail money-market mutual funds	$5,454.8
M3	= M2 + Large-denomination time deposits (greater than $100,000) + Institutional money funds + Repurchase agreements issued by depository institutions + Eurodollar deposits of U.S. residents at foreign branches of U.S. banks and all Canadian and U.K. banks	$8,031.0

Sources: "Aggregate Reserves of Depository Institutions and the Monetary Base," Federal Reserve Statistical Release H.3 (502), 29 August 2002. "Money Stock Measures," Federal Reserve Statistical Release H.6 (508), 29 August 2002.

example, if a corporation goes bankrupt, its shares may become valueless, its shareholders would lose their equity. Although the firm's creditors could seize the firm's capital and financial assets in order to recoup their losses, they would have no claim on the shareholder's house, car, or other assets.

Shares are not debt but a claim to the net worth of the firm. Shares carry the right to vote on the directors and senior management of the corporation, as well as on certain aspects of its legal structure. Most shareholders do not attend the annual meetings of firms or vote directly. Instead, they cede their right to vote by proxy to the management – or rarely, to an insurgent group that wishes to replace or redirect the management. Voting is important not because it is always exercised but because the threat always exists that it will be exercised if the management does not please the shareholders – either directly or indirectly as disgruntled shareholders sell the stock to buyers who want to shape management decisions.

Corporations earn profits. These profits may be used to add to the capital stock or financial assets of the firm, in which case they are referred to as **retained earnings**. Or they may be distributed as **dividends** to the stockholders in proportion to the number of shares each holds. Most shares take the form of **common stock**, which carry full voting rights but no promise of any particular dividend payment. Sometimes companies issue **preferred stock**, which usually carries some guaranteed payment in exchange for some limitation on voting rights. Preferred stock is something like a cross between common stock and a corporate bond.

The Mechanics of Stock Pricing

In principle, the value of a share is equal to the present value of firm divided by the number of shares outstanding (N). The present value depends on the expected profits of the firm (Π_t^e). Once again, financial markets (and economists) are hampered by the lack of crystal ball. No one knows what profits firms will earn in the future. At best we can make educated guesses.

Ideally, the **stock price** ($\boldsymbol{p_S}$) should follow a present value formula:

$$p_S = (1/N)\left[\sum_{t=1}^{\infty} \frac{\Pi_t^e}{(1+r)^t}\right]. \tag{10.18}$$

The term in square brackets is the present value of the firm: the profits expected in each future period are discounted appropriately and added together. Multiplying by ($1/N$) turns this value into a value per share.

Although the stock price formula is similar to the bond price formula, there are some differences. First, instead of summing up returns over a fixed number of periods (m) as in equation (10.13'), the returns are summed up over an infinite future. There is no assumption that a corporation exists forever, only that the date of its demise is not known.[11] In any case, the discount factor, $(1 + r)^t$, becomes very large as t becomes

[11] Most businesses disappear or are absorbed into other businesses at some point. Some are nonetheless remarkably old. The oldest continuously functioning firm is the Japanese construction company Kongo Gumi. Founded in 578, it is a family company that specializes in the construction of temples. Other old firms include: England's Faversham Oyster Fishery Company, founded in 1189; and the Swedish paper manufacturer Stora Enso, founded in 1288. Perhaps, the oldest firm structured from the beginning in a corporate form with shareholders is the Hudson Bay Company, founded in 1670 as a trading company and once master of substantial parts of what is now Canada (about 10 percent of the world's land area). It is now a department store.

large, so that profits earned even moderately far in the future make only a small contribution to the stock price. For example, at an interest rate of 5 percent, one dollar thirty years in the future is worth only 23 cents (= $1/(1.05)^{30}$), and one hundred years in the future, less than 1 cent. Little is lost if we ignore returns that accrue far in the future.[12]

The second difference is that the future income stream of bonds is known, while that of stocks is only expected. There is no absolute certainty, of course, that a bond will pay the contracted amounts, but what it promises is perfectly clear. If the market feels that a bond is at risk of not paying off, then the demand and the market price will be lower and, as we already know, the yield to maturity would be higher. There is no way to calculate *ex ante* the yield to maturity of stock, because the stock does not promise any definite payments. The most that can be said is that, *if* any profits are earned and *if* any are distributed, then they will be distributed in equal amounts per share.

One result of the uncertainty about future earnings of corporations is that the stock price can easily change with shifting assessments of a company's prospects. If a drug company discovers a new treatment for cancer, market expectations are likely to revise expected future profits upward – even if it will take several years for those profits actually to show up – and, according to equation (10.18) its stock price will rise.

And it works equally well the other way round. On September 30, 2004 the drug maker Merck announced that it was withdrawing its highly profitable Vioxx arthritis drug because of dangerous side effects. Merck's share price fell from $45 to under $35 the

[12] It is, of course, possible actually to add an infinite number of future returns in the same way as a the returns on the consol or perpetual bond can be added (the *Guide*, section ##).

same day and fell to under $27 within a few days more. This was a reaction to the implications of its decision for *future*, rather than current, revenues and costs.

Similarly, it is the importance of *future* profits that explains why startup companies that have never had a dollar of profit may nevertheless have a high share price.

Stock Prices and Yields

Computing the yield of a bond *ex ante* is relatively easy because we assume that it will pay the coupons and face value in full at the promised time. While it is easy to compute the yield of a stock *ex post* when the actual profits and prices are known, it is hard to compute it *ex ante*. The yield any stock market analyst, economist, or purchaser would assign depends on the expectations each holds for future profits, which cannot be known in advance. Still, some measures are widely cited in the financial press as indicators of stock yields.

A common measure is the **dividend yield**, defined as *the ratio of the latest dividend paid to the stock price*. The dividend yield is something like an interest rate, but it can be highly misleading. A corporation does not have to pay out all of its profits as dividends. It may choose to use retained earnings to invest in its own real capital or to purchase financial assets that would yield a better return for its shareholders.

Tax laws actually discourage firms from paying dividends. Corporate profits are taxed. If after the corporate taxes are paid, the firm distributes the profits as dividends, they are taxed a second time as personal income. To avoid this double taxation, the firm

can pay a small dividend – or none at all. In the extreme case, a highly profitable firm would have a zero dividend yield.

Even though the firm pays little or no dividend, the shareholder still benefits. Increasing profits raise the share price according to equation (10.18), so that anyone who buys a share at low price and sells it at a higher price earns a so-called **capital gain**.[13] Capital gains are taxable only when the stock is actually sold (the capital gain is then said to be *realized*). And, even then, it is taxed at a lower rate than ordinary income. Shareholders' preference for capital gains implies that the dividend yield is likely to be highly misleading as a measure of stock yield.

A somewhat better measure considers all of the profits (also known as **earnings**) – both dividends and retained earnings. The ratio of earnings to the share price provides a rough measure of the yield. The financial press typically refers to the inverse of the **earnings/price ratio**, the so-called **price/earnings** or **P/E ratio**. For example, if a corporation earns $2.30 per share on a share price of $34.50, then the earnings/price ratio is 6.67 percent, and the P/E ratio is 15 (= 1/0.067).

Although the earnings/price ratio provides a better measure of stock yields than the dividend yield, it is still imperfect. A start up company with no current earnings might nevertheless be expected to be highly profitable in time. Its earnings/price ratio would be zero, yet according to equation (10.18), its stock price could be large.

Equation (10.18) is an ideal statement of the stock price. The object of operating a corporation is to earn profits for the shareholders, and the equation relates the stock

[13] "Capital" is used here in the sense common in the world of corporate finance to mean equity or net worth rather than, as we generally use it in macroeconomics, to mean the physical means of production.

price to this objective. Factors that are reasonably related to the prospects of the firm to earn profits are known as **FUNDAMENTALS**. Stock prices are highly volatile. Changing assessments of a firm's fundamentals explains much of this volatility. Values depend on expectations of future earnings, and expectations can shift rapidly. News that affects those expectations is often absorbed by market traders in a matter of minutes.

Non-fundamental factors may matter as well. Imagine that some participants in the stock market expect profits to improve and so bid up the price of a stock. Other traders, who may not agree with this assessment of the fundamentals, may nevertheless expect the price to rise because of the "irrational exuberance" (to borrow Alan Greenspan's famous phrase) of the optimistic traders. They would buy the stock in anticipation of the capital gain, and their demand would itself help ensure the increase in the stock price. Their expectation is not based on fundamentals, but is a self-fulfilling prophecy. When the prices of stocks or other assets are bid up independently of the fundamentals, the market is said to experience a **BUBBLE**. History provides a number of examples of rapid rises in the price of financial or real assets that some interpret to be out of proportion to the fundamentals. The most famous ones are probably the "Tulip Mania" and the "South Sea Bubble."

In Holland, in the middle of the 17th century a fad for tulips resulted in some bulbs selling for the equivalent of hundreds of dollars, and one rare bulb trading for over $20,000. The prices of tulip bulbs collapsed suddenly in 1637. The story generally

concludes that many traders who had bought bulbs at high prices expecting to resell them at even higher prices were ruined, but the evidence on this point is disputed.[14]

The South Sea Company was a trading company formed in 1711. It was expected to profit from a monopoly on English trade with Spanish America, but never did. In 1720 its involvement in the finance of the British government's debt started a frenzy of trading in the company's shares, which rose from £100 to £1000 per share in a matter of months. In September 1720, the share price collapsed and many shareholders were ruined. Sudden collapse is characteristic of bubbles, since the high prices are sustained by expectations of capital gains ungrounded in fundamentals. If anyone believes that the price will fall, the best strategy is sell quickly, which of course brings on the very fall in prices that was feared. Capital losses as well as capital gains result from self-fulfilling expectations.

More recently, Japan experienced extraordinary rises in its stock market and property markets in the 1980s. Many U.S. cities in the late 1990s and early 2000s witnessed property booms seemingly out of proportion to fundamentals. And, of course, the rapid increase of stock prices in the United States in the 1990s, in which P/E ratios rose to unprecedented heights, followed by a collapse (especially in internet or "dot.com" stocks) was widely regarded as a bubble.

Nevertheless, it is impossible to say with certainty that any particular run up in asset prices is truly a bubble rather than the result of an optimistic assessment of the fundamentals. Some economists argue that all of the famous examples of bubbles

---

[14] See Peter M. Garber, *Famous First Bubbles: The Fundamentals of Early Manias*. Cambridge, MA: MIT Press, 2001.

floating to stratospheric heights and then bursting were really just radical reassessments of the fundamentals, not materially different from the collapse of Merck's share price on the news about Vioxx – clearly a fundamental.

Stock Market Indexes

There are, of course, thousands of individual stocks. Some are traded on organized markets such as the New York Stock Exchange, the American Stock Exchange, or the National Association of Securities Dealers Automated Quotation System (NASDAQ). Others – usually the shares of small or "closely-held" companies are traded only privately. Macroeconomists are more interested in the common movements of stock prices than in the fate of any individual share price. Just as we capture such aggregate movements in the price indices for real goods, such as the CPI or PPI, stock prices are reflected in a variety of indices. The most famous index is the *Dow Jones Industrial Average*. In 1896, Charles Dow began publishing the average price of the shares of twelve industrial companies. Over the years, the group of companies contributing to the average has grown to thirty. Some companies have been added and others dropped from time to time. And the exact method of calculation have changed. Dow Jones also calculates averages reflecting the share prices of transportation companies and utility companies.

There are other well known averages and many less well known ones. Among the most important are the *Standard and Poor's* (*S&P*) *500*, which tracks the share prices of 500 large firms in the United States; the *New York Stock Exchange Composite Index*,

which tracks every share on that exchange; and the *Russell 2000 Index*, which tracks the shares of 2000 smaller companies.

10.4 Financial Markets and Aggregate Demand

In most of this chapter we aimed to understand how financial markets work and how financial instruments are valued relative to the opportunity costs reflected in interest rates. This is just a beginning on which to build our understanding of the role of money and financial markets in the macroeconomy. The many rates of interest are clearly the key variables. We must understand in more detail what determines them and how they behave. This is the subject of Chapter 11. We also need to know how interest rates and the supply and demand for financial asset affects aggregate demand. Although this is the subject of most of the rest of the book, it may be useful to give a preview here.

Aggregate demand, as we already know, is the sum of investment, consumption, net exports, and government expenditure on goods and services. Consider the interaction between each of them and financial markets and interest rates in turn.

- *Investment*. If firms could always borrow freely, so long as they were willing to pay the price, then investment would represent a conceptually simple choice: which earns more, the capital good purchased through investment or a financial instrument purchased as an alternative? This is just a question of opportunity cost. When the opportunity cost, the relevant rate of interest is high, the firm is more likely to purchase the financial instrument; when it is low, the capital good. If firms cannot borrow freely – for example, if banks will only lend them a limited amount even at a high rate of interest for fear of bankruptcy –the firm's

investment may also be limited. Then, any policy on the part of banks or the government that increases the available funds (increases the supply of financial instruments) increases the level of investment and aggregate demand. These issues are taken up in Chapters 12, 13, 17, and 18.

- *Consumption*. People frequently wish to consume in a pattern quite different from the pattern of their incomes. People may wish to consume more when young (e.g., paying for college) but earn more when old. Or people may wish to consume a relatively steady amount even though their incomes are variable month to month or year to year. Just like firms with investment, if people could borrow and lend freely, then they would borrow when their incomes were relatively low with the intention of paying back when their incomes were relatively high. The interest rate affects consumption because it is the price of borrowing. But also like firms, many consumers find that they cannot borrow whatever they like even if they are willing to pay the price. In that case, the availability of funds (the supply of relevant financial instruments – e.g., credit card debt) may determine whether people can consume as much as they like today. These issues are discussed in Chapter 14.
- *Net exports*. When the United States runs a balance-of-payments deficit, foreigners acquire American financial instruments. If comparing U.S. interest rates to their own domestic interest rates, the foreigners are willing to hold the newly acquired assets, then the situation is sustainable. But if they find that U.S. interest rates are too low, then they will try to sell their assets, driving down their price (that is, raising U.S. interest rates) and depreciating the exchange rate. This

process stops only when everyone is happy with their portfolios. The change in the exchange raises the price of imports to Americans and lowers the price of American exports to foreigners, acting to reduce the balance-of-payments deficit. International issues are discussed in Chapter 16.

- *Government spending*. When the government runs a budget deficit, it must issue government bonds to pay for it. The increase in the supply tends to reduce the price of those bonds (raising their interest rates). Since other actors in the economy can buy these bonds, the higher interest rates represent higher opportunity costs for other real and financial assets. Government deficits may, therefore, affect investment, consumption, and net exports, and they may result in portfolio adjustments throughout the financial system that have more indirect effects. Government fiscal policy is discussed in Chapter 18.

In addition to any incidental effects, the government may deliberately use the financial system to affect the components of aggregate demand. It may choose its fiscal policy partly with an eye to the effect on interest rates. More directly, monetary policy involves the buying and selling of financial assets in order to change relative supplies and demands and, therefore, the interest rates of different financial assets with the object of altering aggregate demand. Monetary policy is discussed in Chapters 11 and 17.

Summary

1. The flow of all real goods and services (final and intermediate goods, as well as factors of production) is matched by a monetary counterflow.

2. Financial markets serve to connect savers (the ultimate sources of funds) with borrowers (the ultimate users of funds). Money flows from sources to uses and is matched by a counterflow of financial instruments that represent the indebtedness of the users.

3. Currency and, to different degrees, some other financial assets serve as monetary instruments. Money acts as a means of transactions, a unit of account, a store of value, and a means of final payment.

4. The central bank (in the United States, the Federal Reserve System) serves as a bank for banks. Funds held in the central bank known as central-bank reserves serve to settle debts among different banks – a means of final payment.

5. A financial intermediary is a firm whose business it is to buy and sell financial instruments, serving as part of the chain that connects savers to borrowers.

6. The Flow of Funds Accounts trace the financial interactions of the various sectors in the economy.

7. Financial wealth is held in the form of financial instruments. It differs from real wealth (both tangible and intangible goods that provide enduring services) in that for every positive holding (credit or asset) there must be a negative holding (debt or liability) somewhere in the economy, so that financial wealth always adds up to zero across the entire economy (including the foreign sector).

8. The fundamental identity of accounting states that *Assets* ≡ *Liabilities* + *Net Worth*. The identity can be represented in various ways, including in balance sheets and T-accounts. It is the basis of double-entry bookkeeping – so called because any change

to a balance sheet must always be accompanied by one or more other changes in order to maintain the fundamental identity.

9. For any sector, flows of funds can either add to wealth (net acquisition of financial assets) or alter the forms in which wealth is held (portfolio reallocation). Adding up across all sectors, only additions to real wealth increase net wealth in the economy (i.e., there is no net acquisition of financial assets for the economy as a whole, including the foreign sector).

10. The principle of similarity and replacement states that when two goods are so similar that one can serve as a replacement for the other, then there values must be equal. Identical financial instruments must, therefore, have the same value, so that to value one we need only know the value of the other.

11. The opportunity cost of any choice is the value of the best alternative choice that it forecloses. The opportunity cost of a financial asset can be measured as the yield or interest rate on a closely related alternative asset.

12. The present value (*PV*) of any future value (*FV*) is the amount of money that would have to be placed in the alternative asset whose yield (*r*) measures the opportunity cost to give the same future value. For *m* periods in the future: $PV = FV/(1 + r)^m$.

13. The real rate of interest is the nominal (or market) rate of interest adjusted for the rate of inflation. Approximately, $rr \approx r - \hat{p}$. The *ex ante* real rate uses the expected value of inflation; the *ex post* real rate uses the actual value of inflation.

14. A bond is a an IOU in a standardized form that can be bought and sold on financial markets. Different bonds are distinguished by their issuer (governments or corporations) and their structure (coupon, face value, and maturity).

15. The bond price is the present value of the bond. Bond prices and yields always move inversely according to the formula for present value.

16. Money may take the form of commodity money (e.g., gold or silver) or fiat money, which refers to a set of financial instruments specialized for use in transactions. Different financial instruments are included in different official definitions of money. In the United States, the definitions run from the narrowest, the monetary base (currency plus central-bank reserves), to M1 (currency plus checkable deposits), to M2 and M3 (wider definitions that include various short-term, interest-bearing, capital-secure financial instruments.

17. Corporate equity (stocks or shares) are ownership rights in corporations that can be bought and sold on financial markets. Corporate equity is valued according to market expectations of the present value of the future profits of firms (the fundamentals). It may also sometimes be valued for the self-fulfilling expectation that it will increase in value (a bubble).

Key Concepts

financial markets
financial instrument
monetary instruments
double coincidence of wants
central bank
Federal Reserve System
central-bank reserves.
financial intermediary
flow of funds
Flow of Funds Accounts
real wealth
assets
liabilities
financial wealth
net worth
fundamental identity of accounting
double-entry bookkeeping
net acquisition of financial assets

portfolio reallocation
principle of similarity and replacement
opportunity cost
yield (interest rate)
present value
ex post real rate of interest
ex ante (or expected) real rate of interest
bond

money market
liquidity
yield to maturity
commodity money
fiat money
monetary aggregates
monetary base (*MB*)
corporate equities (or stocks or shares)
fundamentals
bubble

Suggestions for Further Reading

Some basic sources:

Stephen D. Smith, Raymond E. Spudeck, *Interest Rates: Principles and Applications*. New York: Harcourt Brace, 1993.

Marcia Stigum, *The Money Market*. New York: McGraw-Hill, 1989.

Introduction to Flow of Funds. Washington, D.C.: Board of Governors of the Federal Reserve System, 1980.

Some historical background on financial markets is found in:

Peter L. Bernstein, *Capital Ideas: The Improbable Origins of Modern Wall Street.* New York: Free Press, 1993.

The existence of financial bubbles has been hotly debated for over 150 years::

Charles MacKay, *Extraordinary Popular Delusions and the Madness of Crowds*, 1841.

Charles P. Kindleberger**,** *Manias, Panics, and Crashes: A History of Financial Crises*, 4th edition. New York: Wiley, 2000.

Peter M. Garber, *Famous First Bubbles: The Fundamentals of Early Manias*. Cambridge, MA: MIT Press, 2001.

Problems

Data for this exercise are available on the course website under the link for Chapter 10 (**insert web link here**). Before starting these exercises, the student should review the relevant portions of the *Guide to Working with Economic Data*: sections G.10, G.17.

Problem 10.1. Suppose that you buy a car for $12,000. Consider the effects on different balance sheets of alternative ways of financing your purchase. (Show your answers on a T-account and identify increases with a "+" (decreases with a "–" and the dollar value and type of instrument – e.g., "+$1,800 stocks" or "–$500 credit card balance").

How is your balance sheet affected by financing your purchase through (remember balance sheets must always balance):
(a) a loan from your credit union?
(b) a check written on your bank account?
(c) $2,000 withdrawal from your money-market mutual fund and a $10,000 on your credit card account with your bank?
(d) winning the car in a raffle?

Problem 10.2. Now consider the effects of the car purchase on the balance sheets of financial intermediaries. What are the effects on the T-accounts of each financial intermediary in Problem 10.1 if the funds supplied to you are:
(a) raised by the credit union through additional deposits?
(b) by the bank by selling a $10,000 certificate of deposit (i.e., an interest-bearing IOU of the bank).
(c) by the bank by a reduction in its reserves and by the mutual fund by the sale of some holdings of Treasury bills?

Problem 10.3. Suppose that you finance the car purchase in Problem 10.1 through a $12,000 loan from your father, who took the funds from his checking account. What are the effects on each of your T-accounts from your purchase? What would be the effect on your family's T-account – treating your father and yourself as a single unit?

Problem 10.4. Think about the economic activities of different financial actors. Create a T-account and list on the appropriate side the kinds of goods and financial instruments that are likely to appear as assets or liabilities of:
(a) households.
(b) a non-financial corporation (e.g., the Ford Motor Company).
(c) a bank.

Problem 10.5. Give three examples of different types of financial intermediaries and explain who they are likely to raise money from (i.e., who is the source of their funds) and who are they likely to lend money to (i.e., what is the use of their funds). In each case, what features make the financial intermediary different from other types of intermediaries.

Problem 10.6. Consider a flow-of-funds table like Table 10.1 but referring to 2004. Imagine that the Federal government ran a deficit in 2004 of $500 billion dollars. How would that deficit be reflected in the table (i.e., which cells would change – give the column and row numbers – by how much) if the deficit were financed by:
(a) foreign purchases of U.S. government debt?
(b) new savings by households held in mutual funds and purchases by the mutual funds of the U.S. government debt?

Problem 10.7. For each of the scenarios in Problem 10.6, take Table 10.2 as the starting point and state how the 2004 asset-and-liability table would be different (i.e., indicate the column and row numbers and dollar values of any cell that would have changed).

Problem 10.8. Suppose that you earn $100 and decide to keep it in your non-interest-bearing checking account. Thinking of your actual situation, what would you regard as a good estimate of the opportunity cost of your action?

Problem 10.9. Using a spreadsheet and presenting your results on a single graph, calculate the present value of $1 for every year from the present (0) up to 100 years in the future, for each of the discount rates 0 percent, 1 percent, 5 percent, and 10 percent. What conclusions can you draw from your graph for the relationship of present value to: (i) how far in the future returns are received? (ii) the rate of discount? "Infinity is less than a lifetime." Comment with respect to your graph.

Problem 10.10. Using both the exact and the approximate formulae, what is the real rate of interest when:
(a) the market rate of interest is 7 percent and the rate of inflation is 2 percent?
(b) the market rate is 35 percent and inflation is 29 percent?
(c) the market rate is 4 percent and inflation is 2 percent?
(d) the market rate is 24 percent and inflation is 2 percent?
Comment on what your calculations suggest about when it is best to use the exact or the approximate formula.

Problem 10.11. Using the exact and the approximate formulae, what is the market rate of interest when:
(a) the real rate of interest is 2 percent and the inflation rate is 3 percent?
(b) the real rate is 2 percent and the inflation rate is 14 percent?
(c) the real rate is 10 percent and the inflation rate is 3 percent?
(d) the real rate is 3 percent and the inflation rates is 6 percent?

Problem 10.12. Using the exact and the approximate formulae, what is the rate of inflation when:
(a) the real rate of interest is 4 percent and the market rate is 8 percent?
(b) the real rate is 4 percent and the market rate is 4 percent?
(c) the real rate is –1 percent and the inflation rate is 8 percent?
(d) the real rate is 4 percent and the inflation rates is 40 percent?

Problem 10.13. Using monthly data, measuring inflation as the annual growth rate (current period over 12 months previous) in the CPI (actual and expected) and the yield on 1-year Treasury bills as the market interest rate, calculate the *ex post* and *ex ante* real rates of interest and plot them on the same graph. How do they differ? What factors might account for the difference?

Problem 10.14. Redo Problem 10.13 but use the actual rate of inflation over the preceding year instead of the survey-based expectations as the best estimate of expected future inflation. Are there important differences in the this graph compared to that in Problem 10.13?

Problem 10.15. Redo Problem 10.14 using the 10-year bond rate. How does the real rate on 10-year bonds compare to that on 1-year bonds?

Problem 10.16. Calculate the bond price of the following pure discount bonds:
(a) a $1,000 bond maturing in 1 year when yields on similar assets are 3 percent;
(b) a $1,000 bond maturing in 2 years when yields on similar assets are 5 percent;
(c) a $5,000 bond maturing in 10 years when yields on similar assets are 11 percent.

Problem 10.17. Calculate the yield on the following pure discount bonds:
(a) a $75,000 bond maturing in 1 year with a price of $70,754.72;
(b) a $1,000 bond maturing in 5 years with a price of $862.61;
(c) a $5,000 bond maturing in 10 years $1,283.37.

Problem 10.18. U.S. Treasury bills are pure discount bonds sold with face values of $10,000. Calculate the price for a Treasury bill that:
(a) matures in 3 months when on similar assets are 4 percent;
(b) matures in 6 months similar assets are 2 percent;
(c) matures in 9 months when yields on similar assets are 7 percent;
(d) matures in one week when yields on similar assets are 5 percent.
(Remember that the yields are quoted at annual rates and that time and interest rates must be expressed in compatible units).

Problem 10.19. Calculate the yield on a 3-month Treasury bill sold at $9,878.76. (Remember that the yields are quoted at annual rates and that time and interest rates must be expressed in compatible units).

Problem 10.20. Calculate, showing your work, the price of the following 2-year bonds when the yields on similar assets are 4 percent and the bonds have $100 face values and annual coupons of:
(a) 3 percent;
(b) 4 percent;
(c) 5 percent.
Comment on the relationship between the prices that you calculate and the face values of the bonds.

Problem 10.21. Repeat Problem 10.20, but assume that the coupons are paid semi-annually. (Recall that coupon rates are annual and that time and interest rates must be expressed in compatible units – see footnote 8).

Problem 10.22. Using the *price* function in *Excel* (or the equivalent in another spreadsheet or business calculator), calculate the price of 10-year bond with a face value of $100 and a semi-annual, 5-percent coupon when similar assets are yielding:
(a) $108.18;
(b) $100.00;
(c) $92.56.
Comment.

Problem 10.23. Using the *yield* function in *Excel* (or the equivalent in another spreadsheet or business calculator), to calculate the relevant prices, what is the capital gain or loss from an initial yield of 5 percent:
(a) on a 5-year pure discount going to a yield of (i) 4 percent or (ii) 6 percent;
(b) a 5-year bond with 5-percent annual coupons going to a yield of (i) 4 percent or (ii) 6 percent.
Comment.

Problem 10.24. A *consol* (or *perpetuity*) is a bond that pays a coupon expressed as a percentage of its notional face value, but never matures (i.e., it pays its coupon forever). What is the value of a 3-percent consol with a face value of $1000 when the yields on other long-term bonds are 4 percent? (Hint: use the bond price formula, equation (10.13'), setting $m = \infty$. Notice that the term involving *FV* will be infinitely small and can be dropped. Then write out the equation, expanding the first few terms of the summation involving *Cpn* (of course, since it goes on forever you cannot write them all out). Now multiply the resulting expression (equation (1)) by *r* to get equation (2). Subtract equation (2) from (1) noting which terms cancel out. You should get an equation with a finite number of terms that can be solved for $p_{B.}$) Can you write a general formula for the price of consol? Can you write a general formula for the yield of a consol, given its price?

Problem 10.25. Imagine that you are a shareholder in Orbit3, a company whose sole purpose is to win a prize for the for the first private spacecraft to orbit the earth three times. At the time that you purchase your shares, all the expenses of the firm up to the point of the prize mission have already been paid. If your firm wins, it earns $100 million. There are 1,000,000 shares. The relevant opportunity cost is 20 percent. Once the prize mission is over, the spacecraft becomes valueless and the firm will be disbanded.
(a) Based on fundamentals what should be the price of share in Orbit3, assuming that it has no rivals and you are 100 percent confident of winning the prize one year from today?
(b) How would you expect the share price to change under the conditions in (a) as the you get closer and closer to the date of receiving the prize? Be specific.
(c) How would you expect the price to change today if it were announced that another company, SpaceFirst, entered the picture and was generally regarded as having a 50-50 chance of beating Orbit3 to the prize?
(d) What would happen to the share price of Orbit3 if SpaceFirst's only ship blew up on the launch pad during a test, setting back their efforts by at least two years?
(e) What would happen to Orbit3 share price if SpaceFirst actually had a successful launch anytime during the current year?

Problem 10.26. Look up the share price, dividend, and P/E ratio of a firm