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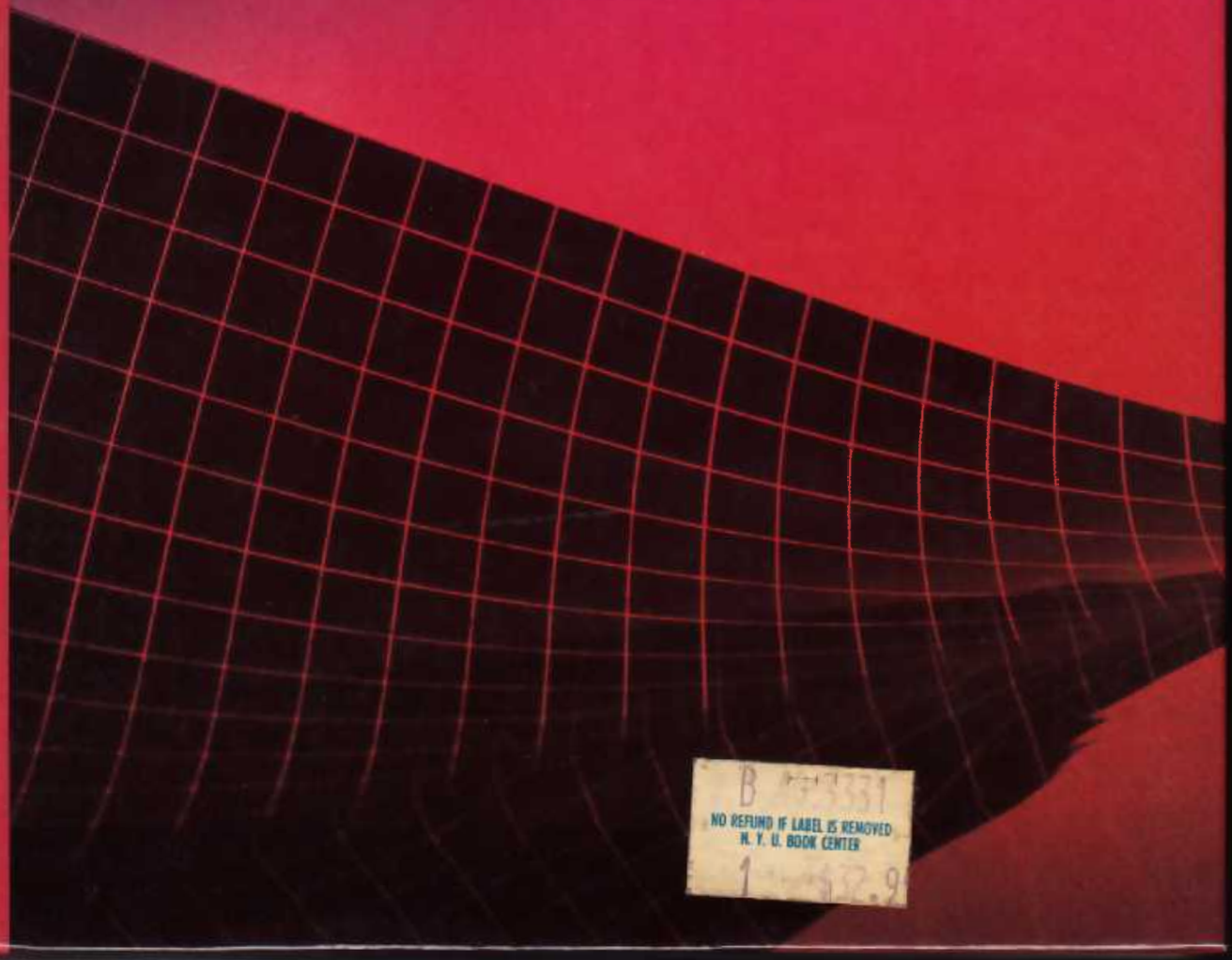
William F. Sharpe



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2

Securities and Markets

BROKERS AND DEALERS

When a security is sold, many people are likely to be involved. Although it is possible for two investors to trade with each other directly, the usual transaction employs the services provided by brokers, dealers, or markets.

A *broker* acts as an agent and is compensated via commission. Like a marriage broker or real estate broker, an investment broker tries to bring two parties together and to obtain the best possible terms for his or her customer. Many individual investors deal with brokers in large *retail* or "*wire*" *houses*—firms with many offices connected by private wires with their own headquarters and, through the headquarters, with major markets. The people in brokerage firms with prime responsibility for individual accounts are termed *account executives*, *registered representatives*, or (in the vernacular) *customer's men and women.*

Institutional investors deal with both large firms offering retail brokerage service and smaller firms that maintain only one or two offices and specialize in institutional business. There are also *regional* brokerage firms and *discount* brokers. The former concentrate on transactions in a geographic area; the latter provide "bare-bones" services at low cost.

An account executive's compensation is typically determined in part by the amount of commissions paid by his or her customers—an amount that is usually greater, the greater the *turnover* in an account. This provides some temptation to recommend changes in investors' holdings and, since the commission rates on various types of investments differ, to recommend particular types of changes. In the long run, account executives who encourage excessive churning should lose

customers. Nonetheless, such behavior may be advantageous for them in the short run.

It is a simple matter to open an account with a brokerage firm: simply appear at (or call) the local office. An account executive will be assigned to you and will take care of the formalities. Transactions will be posted to your account as they would to a bank account. You may deposit money, purchase securities using money from the account, add the proceeds from security sales to the account, borrow money, and so on. After the initial forms have been signed, everything can be done by mail or telephone. Brokers exist (and charge fees) to make securities transactions as simple as possible.

A broker acts as an agent for investors, but a *dealer* (or *market-maker*) buys and sells securities for his or her own account, taking at least temporary positions and maintaining at least small and transitory inventories of securities. Like a used-car dealer, a security dealer runs risks and ties up capital in order to make it easy for individuals to buy or sell on a moment's notice. Dealers are usually compensated by the *spread* between the *bid* price at which they buy a security and the *ask* price at which they sell it. The percentage spread is typically larger, the smaller the amount of trading activity and the greater the volatility in a security's price.

To facilitate the coming together of traders (be they investors, brokers, or dealers), physical locations or communications facilities or both are required. *Security exchanges* are physical locations where trading is done on a person-to-person basis (usually by brokers and dealers) under specified rules. Communications networks, formal or informal, are often termed *markets*. Some have clearly defined boundaries; others do not.

Often a firm or even an individual will play more than one role in this process. Most retail brokerage firms hold some inventories of securities and may thus act as dealers (but the law requires that they inform their customers if they do so). Some exchanges have *specialists*, who serve as brokers for some trades and as dealers for others. Brokers may employ other brokers, dealers may deal with other dealers, and so on.

TYPES OF ORDERS

Brokers will accept instructions of various types concerning the conditions under which a security is to be purchased or sold. Some of the procedures are institutionalized; others are simply agreements between the investor and his or her account executive.

By far the most common procedure is that used for a *market order*. The broker is instructed to buy or sell a stated number of securities at the best available price or prices (as low as possible for a

purchase, as high as possible for a sale). It is incumbent on the broker in such a situation to act on a "best-efforts" basis to get the best possible deal at the time.

In most cases there is fairly good information concerning the likely price at which a market order might be executed. If this is unacceptable, a *limit order* may be placed instead. Both a quantity and an acceptable price are specified. The broker is to purchase or sell the stated number of shares only at the indicated price or better (higher for a sale, lower for a purchase). If a limit order cannot be executed immediately, it is usually kept by the broker or placed by the broker on the books of another broker (e.g., an exchange specialist) to be executed as soon as the requisite price can be obtained.

Some limit orders are *day orders*—canceled if not executed by the end of the day they are placed. However, an investor may specify that an order be considered *good-till-canceled* (*GTC*) or that it be canceled immediately if not executed [this is termed a *fill-or-kill* (*FOK*) order].

A limit order "on the books" is executed only when a security's price becomes more favorable. A *stop-loss* order operates in the opposite direction. For example, a stop-loss order at $30 per share might be placed to *sell* 100 shares of a stock currently trading at $40 per share. As long as the price remains above $30, nothing happens. But as soon as the price reaches (or drops below) $30, the order is converted to a market order, to be executed on the best possible terms. A stop-loss order to *purchase* shares becomes a market order when the price reaches or rises above the level indicated.

The standard unit in which a stock is traded is termed a *round lot* (usually 100 shares). Any smaller quantity is an *odd lot*. An investor who wishes to purchase or sell an odd lot generally does business with a dealer instead of another investor. For example, certain brokerage firms will usually purchase an odd lot of a stock listed on the New York Stock Exchange at the price of the first round-lot transaction on the Exchange following receipt of the odd-lot order (possibly minus a small differential) or sell an odd lot for the same price (possibly plus a small differential).

MARGIN ACCOUNTS

A *cash account* with a brokerage firm is like a regular checking account: deposits (cash and the proceeds from security sales) must cover withdrawals (cash and the costs of security purchases). A margin account is like a bank account with overdraft privileges: within limits, if more money is needed, a loan is automatically made by the broker.

All securities purchased on margin must be left with the brokerage firm and registered in its name (i.e., "street name"). Moreover, the

account holder must sign a *hypothecation* agreement, which grants the broker the right to pledge margined securities as collateral for bank loans. Most firms also expect customers to allow them to lend securities to others who wish to sell them short (a procedure described in the next section). Such lending is done by the broker; the account holder is generally not even notified when it takes place.

The interest charged on loans advanced by a broker for a margin account is usually calculated by adding a service charge (e.g., 1%) to the broker's current *call money* rate. The latter is the rate paid by the broker to one or more banks for money used to finance margin purchases. Securities in margin accounts serve as collateral for the bank loans. The call money rate changes from time to time, and with it the interest charged for margin loans.

The Securities and Exchange Act of 1934 prohibits any broker (or bank) from making an initial loan for the purchase of a security in excess of the *loan value* of the collateral (e.g., the security to be purchased). This *initial margin* requirement differs for different types of investments—e.g., it is usually higher for stocks than for bonds—and is changed from time to time by the Board of Governors of the Federal Reserve System as an instrument of economic policy. Since 1934 the initial margin required for exchange-listed stocks has ranged from 40% to 100%. In 1983 it was 50%.

The *percentage margin* in an account can be calculated as follows:

$$\text{percentage margin} = \frac{\text{equity in the account}}{\text{market value of all positions}} \qquad \textbf{(2-1)}$$

For example, assume an investor wishes to buy 100 shares of ABC stock at $40 per share but has only $3,000. If a broker loans the remaining $1,000 for the purchase, the account's balance sheet will be:

100 shares of ABC at $40 per share = $4,000	Loan from broker = $1,000 Equity = $3,000

The percentage margin will be $3,000/$4,000, or 75%. If this exceeds the current initial margin requirement, the purchase can be made.

After the purchase, if ABC slips to $30 per share, the account's balance sheet will be:

100 shares of ABC at $30 per share = $3,000	Loan from broker = $1,000 Equity = $2,000

The percentage margin has fallen to \$2,000/\$3,000, or 66⅔%. If the price of the stock falls farther, and the margin with it, the broker may become nervous, since an additional sudden price decline could bring the value of the collateral below the amount of the loan. To protect against such an occurrence, a broker will require that margin be kept above a *maintenance margin* level. The New York Stock Exchange requires its member firms to insist on at least 25%, but many require a larger amount.

If an account falls below the maintenance margin requirement, the broker will issue a *margin call*, requesting the account holder to add cash or securities to the account or to sell some securities currently in the account; this will raise the numerator or lower the denominator of the fraction in formula (2-1), thus increasing the margin. If a customer does not act (or cannot be reached), in accordance with the terms of the original agreement the broker will sell securities from the account to restore the margin to the required maintenance level.

If ABC rises to \$50 per share, the picture will be brighter:

100 shares of ABC at \$50 per share = \$5,000	Loan from broker = \$1,000 Equity = \$4,000

Here the percentage margin is \$4,000/\$5,000, or 80%. If the initial margin requirement is 75%, the account's current equity can support positions worth \$5,333 (= \$4,000/.75); if desired, securities worth up to \$333 could be purchased and financed entirely with an additional loan from the broker. Alternatively, since only \$3,750 (= .75 × \$5,000) of equity is required to support positions worth \$5,000, an additional \$250 could be borrowed from the broker, taken as cash, and removed from the account.

When the percentage margin of an account falls below the initial margin requirement, no action need be taken. However, the account will be *restricted*. When an account is in this status, transactions will generally not be allowed if their net effect is to decrease the actual percentage margin; however, transactions occurring within a single trading day may be combined for this calculation.[1]

SHORT SALES

Most investors purchase securities first and sell them later. However, the process can be reversed: one can sell a security now and buy it back later. This is accomplished by borrowing certificates for use in

[1] To meet legal requirements, more than one type of account may have to be maintained and funds transferred between accounts from time to time to allow the maximum possible amount of margin loans.

the initial trade, then repaying the loan with certificates obtained in the later trade.

Any order for a *short sale* must be identified as such. The Securities and Exchange Commission has ruled that short sales may not be made when the market for the security is falling, on the assumption that the short-seller could exacerbate the situation, cause a panic, and profit therefrom—an assumption inappropriate for an efficient market with astute, alert traders. The precise rule is that a short sale must be made on an *up-tick* (for a price higher than that of the previous trade) or on a *zero-plus tick* (for a price equal to that of the previous trade but higher than that of the last trade at a different price).

At the end of the day on which a short sale is made, the seller's broker must borrow securities for delivery to the purchaser, unless the short-seller has already purchased them. Borrowed securities may come from the brokerage firm's own inventory or from that of another firm, but they are more likely to be securities held in street name for an investor with a margin account. Both the borrower and the lender have the option to terminate the agreement at any time—that is, the lender may call for securities or the borrower may return them.

To protect the security lender against default, the borrower (short-seller) must deposit cash equal to the value of the securities involved. Initially, the proceeds from the short sale must be deposited with the security lender. When the market value rises, more cash must be deposited; when it falls, some of the deposit may be removed—that is, the deposit is *marked to market*. When the securities are returned, the deposit is refunded.

The possible loss from a normal (*long*) position in a security is limited: only the original investment can be lost. But the potential loss from a short sale is unlimited, since a security's price can rise to several times its initial amount. Moreover, an increase in price can jeopardize the position of the lender of the security, since it may make it impossible for the borrower (short-seller) to buy the certificates required to pay back the loan. For this reason short-sellers are required to maintain a certain amount of equity in their accounts to serve as an additional cushion against adverse price changes.

Judicious use of accounts makes it possible to apply formula (2-1) to both long and short positions. For example, consider the following account:

Securities held long: market value = $100,000	Short positions: market value = $40,000
Cash deposited with security lenders = $40,000	Loan from broker = $30,000 Equity = $70,000

The current percentage margin is \$70,000/(\$100,000 + \$40,000), or 50%. Adverse moves greater than this amount in the positions (i.e., price declines for long positions, price increases for short positions) would wipe out the equity and place in jeopardy the loan from the broker or the loaned securities or both. For this reason all the rules concerning initial and maintenance margins, restricted accounts, and so on apply when short positions are maintained; the current market value of such positions is simply added to that of the long positions when computing the account's current margin.

A short sale neither generates cash (since the proceeds must be deposited with the security lender) nor requires it. Subsequent price increases do require cash, while declines generate cash. Although margin is required for a short sale, this means only that assets must be kept in the account to guard against default on the loan of the borrowed securities.

At times securities may be lent only on the payment of a premium; at other times lenders may pay interest on the money deposited with them. Usually, however, securities are loaned "flat"—the lending broker keeps the deposits and enjoys the use of the money, and neither the short-seller nor the investor who owns the securities (in principle, but not in fact) receives any direct compensation.

During the period in which a security is "on loan," the borrower must pay to the lender amounts equal to the values of all the dividends or interest payments that would otherwise have been received. Such payments are not returned when the short position is *covered* (i.e., when securities are purchased and the loan repaid).

CONTINUOUS VERSUS CALL MARKETS

No market is ever truly continuous, for trades occur at discrete times. However, some markets are explicitly organized to group trades at specific times. In such *call markets*, when a security is called, all who wish to buy and sell are brought together. Enough time is allowed to elapse between calls (e.g., an hour or more) to accumulate a substantial number of offers to buy and sell. In some call markets there is an explicit *auction* in which prices are called out until the quantity demanded is as close as possible to the quantity supplied (this procedure is used by the Paris Bourse for major stocks). In other call markets, orders are left with a clerk between calls and "crossed" at a price that allows the maximum number to be executed (this procedure is used for some stocks by the Paris Bourse and the Tokyo Stock Exchange).

In a *continuous market* trades may occur at any time. While such a market could function with only investors and brokers, it would not be very effective, for an individual who wished to consummate a sale

or purchase very quickly would either have to spend a great deal of money searching for a good offer or run the risk of accepting a poor one. Since orders from investors arrive more or less randomly, prices in such a market would vary considerably, depending on transitory relationships between desired purchases and sales. Such a situation could be exploited by anyone willing to take temporary positions in securities, ironing out transitory variations in demand and supply and making a profit thereby. This is the role of a *dealer* or *market-maker*, whether officially identified as such or not. Only greed and avarice are required to attract such people, but in the pursuit of personal gain they generally reduce fluctuations in price unrelated to changes in value, thereby providing liquidity for investors.

In some markets dealers compete with each other in order to offer the best possible terms for a given security. The London Stock Exchange is, in essence, a physical location where dealers ("jobbers") take orders from brokers. In the over-the-counter market in the United States, dealers' bid and ask prices are communicated to brokers via a computer network. On the floor of the Chicago Board of Trade dealers in commodities mingle with brokers in the "pits."

The New York Stock Exchange, to facilitate a continuous market, assigns *specialists* to stocks. The specialist is allowed to deal for his or her own account, but only if no better offer is forthcoming from "the floor"—that is, from brokers acting for their customers or themselves. The specialist is allowed to make a profit but is also charged with maintaining a "fair and orderly market"—a requirement both ill-defined and difficult, if not impossible, to enforce. In return, specialists are allowed to maintain books of unexecuted limit (and stop-loss) orders. Whenever possible, a specialist executes orders from the book, crossing them with orders from the floor, or simply trading directly, using his or her own account, receiving in return a commission for serving as a "broker's broker."

INFORMATION-MOTIVATED AND LIQUIDITY-MOTIVATED TRANSACTIONS

There are two major reasons for security transactions. An investor may believe that a security has become mispriced—that is, that its value is outside the current range between (1) the total *proceeds* from a sale and (2) the total *cost* of a purchase. One who feels this way believes that he or she has information not known to (or understood by) the market in general and may be termed an *information-motivated* trader. On the other hand, an investor may simply want to sell securities to buy a new car, buy some securities with recently inherited money, alter a portfolio to better conform to a recent change in job, or the like. Such a person may be termed *liquidity-motivated*: although feeling

that value is also outside the proceeds/cost range, he or she does not presume that others in the market have evaluated the prospects for the security incorrectly.

Dealers can make money by trading with liquidity-motivated traders or with stupid information-motivated traders. But, on average, they can only lose money by trading with clever information-motivated traders. The larger a dealer's bid-ask spread, the less business he or she will do; but whatever the spread, when a clever information-motivated investor makes a trade, the dealer may expect to lose. In the absence of foolish investors, the very existence of a dealer market depends on investors' desires for liquidity. A dealer must select a bid-ask spread wide enough to limit the number of trades with customers possessing superior information, but narrow enough to attract an adequate number of liquidity-motivated transactions.

A dealer can take either a passive or an active role. For example, a bid-ask spread can be established and a tentative price set. As orders come in and are filled, the dealer's inventory (position) will vary and may even become negative when promises to deliver securities exceed promises to accept delivery. But any clear trend suggests that the price should be altered. In effect, a *passive dealer* lets the market indicate the appropriate price.

An *active dealer* tries to get as much information as possible and to alter bid and ask prices in advance to keep the flow of orders more in balance. The better a dealer's information, the smaller the bid-ask spread required to make a profit.

When there is competition among dealers, those who are not well informed either price themselves out of the market by requiring too high a bid-ask spread or go out of business after incurring heavy losses. In general, the interests of investors are best served by a market in which dealers with unlimited access to all sources of information compete with one another.

PRICES AS INFORMATION SOURCES

The usual description of a market assumes that every trader wishes to purchase or sell a known quantity at each possible price. All the traders come together, and in one way or another a price is found that clears the market—that is, makes the quantity demanded as close as possible to the quantity supplied.

This may or may not be an adequate description of the market for consumer goods, but it is clearly inadequate when describing security markets. The value of any capital asset depends on future prospects that are almost always uncertain. Any information that bears on such prospects may lead to a revised estimate of value. The fact that a knowledgeable trader is willing to buy or sell some quantity of a secu-

rity at a particular price is likely to be information of just this sort. Offers to trade may thus affect other offers. Prices may both clear markets and convey information.

The dual role of prices has a number of implications. For example, it behooves the liquidity-motivated trader to publicize his or her motives and thereby avoid an adverse effect on the market. Thus an institution purchasing securities for a fund intended to simply hold a representative cross section of securities should make it clear that it does not consider the securities underpriced. On the other hand, any firm trying to buy or sell a large number of shares that it considers mispriced should try to conceal either its motives, its identity, or both (and many do try). Such attempts may be ineffective, however, as those asked to take the other side of such trades try to find out exactly what is going on (and many succeed).

Since offers may affect other offers, the way in which a market functions can affect the prices at which trades are made. And different markets function in different ways. For example, the New York Stock Exchange specialist's "books" contain information on both the prices and the quantities specified in standing orders, but only the lowest ask price and the highest bid price and the quantities associated with each are revealed to the general market. In the over-the-counter market, dealers publicly announce bid and ask prices that are firm for small quantities, but they negotiate prices for larger quantities. Orders for some stocks on the Paris Bourse are placed in a book with both prices and quantities specified, while for other stocks the book contains only the prices of orders.

The extent to which standing orders are made public may thus affect the prices at which such orders are executed, the extent to which investors will place them with brokers, and the extent to which brokers will place them in a central "book" where they can be seen by others.

Some investors depend almost entirely on price for information about value. This raises the possibility that a clever trader could make money by placing orders to trigger foolish responses from such investors. While this may occur in isolated instances, it is limited by the presence of informed traders who use external information sources to assess value. Given a large enough number of people who study fundamental aspects, it is possible for most investors to assume that market price reflects value.

MAJOR MARKETS IN THE UNITED STATES

The New York Stock Exchange

Many individual investors maintain an account with a retail brokerage firm that is a member of the New York Stock Exchange, by far the most important stock exchange.

At the end of 1982, 1,499 stocks with a market value of $1.7 trillion were listed for trading on the New York Stock Exchange. In the course of that year 16.5 billion shares (worth $488.4 billion) changed hands on the Exchange. This compares with 4.2 billion shares traded on all other exchanges, and 8.4 billion shares traded over-the-counter using the NASDAQ system.[2] For the individual investor the New York Stock Exchange is the major market place for actively traded stocks.

The decision to list a company's stock on the Exchange is based on "(1) the degree of national interest in the company, (2) its relative position and stability in the industry, and (3) whether it is engaged in an expanding industry, with prospects of at least maintaining its relative position." The company must apply for listing and agree to provide certain information to the public. After listing, if trading interest in a security declines substantially, it may be *delisted* by the Exchange. Companies may apply for listing on more than one exchange, and under certain conditions an exchange may set up "unlimited trading privileges" for transactions in a stock already listed on another exchange.

The operation of the New York Stock Exchange is best described by example. Mr. A asks his broker for the current price of General Motors shares. The broker punches a few buttons on a televisionlike quotation machine and finds that the current bid and ask prices on the New York Stock Exchange are 61 and 61¼ and that the specialist in GM will buy at least 100 shares at 61 and sell at least 500 shares at 61¼ (either as dealer, for his own account, or as a broker, for an investor whose order is in the book). Moreover, the quotation machine indicates that the prices on the New York Stock Exchange are as favorable as any others available at present. Mr. A instructs his broker to "buy 100 at market." The broker transmits the order to his firm's New York headquarters, which communicates it to the "post" where General Motors is traded. Since the order is a small one, it will be "exposed" to the market via the Exchange's Designated Order Turnaround System (DOT).

The existence of a standing order to buy at 61 means that no one else is prepared to sell at that price; and the existence of a standing order to sell at 61¼ means that no higher price need be paid. This leaves only the gap between the two prices for possible negotiation. If Mr. A is lucky, another broker (for example, one with a market order to sell 100 shares for Ms. B) will "take" the order at a price "between the quotes" (here, at 61⅛). Information will be exchanged between the two brokers and the sale consummated.

If the gap between quoted bid and ask prices is wide enough, a little auction may even occur among brokers, with trades consummated at one or more prices between the specialist's quoted values.

[2] *The New York Stock Exchange Fact Book, 1983* and the *National Association of Securities Dealers 1982 Fact Book.*

What if no response had been forthcoming from the floor when Mr. A's order arrived? In such a case the specialist would "take the other side," selling 100 shares to Mr. A's broker. The actual seller might be the specialist or another investor, whose limit order is being executed by the specialist.

If the bid-ask spread on a stock is no larger than the standard unit in which prices are quoted (typically ⅛ of a point, or 12.5 cents), market orders are generally executed directly by the specialist.

If Mr. A places a limit order with his broker, the latter's representative will not even try to execute it if the stated price is outside the current bid-ask spread on the available markets. Instead, the order will likely be sent directly to the specialist who handles the stock at the NYSE, who will enter it in a "book" (probably computerized) for subsequent execution when possible. If there are several limit orders in the book at the same price, they are executed in order of arrival (i.e., first-in first-out).

It may not be possible to fill an entire order at a single price. Thus a broker with an order to buy 500 shares at market might obtain 300 shares at 61⅛ and have to pay 61¼ for the remaining 200. A limit order to buy 500 shares at 61⅛ or better might result in the purchase of 300 shares at 61⅛ and the entry of a limit order in the specialist's book for the other 200 shares. And so on.

Large orders (e.g., those for 1,000 shares or more) are typically handled by representatives on the floor of the Exchange, acting as agents for the brokerage firm, rather than indirectly, via the Designated Order Turnaround system.

Especially large orders (typically placed by institutional customers) are likely to be handled in the "upstairs dealer market." For example, the XYZ pension fund may wish to sell 20,000 shares of General Motors. It negotiates with major brokerage firms for the sale of the entire "block" at a fixed price (plus commission). The winning bidder buys all the shares for its own account, then proceeds to sell them in smaller units, as buyers are found.

Other Exchanges

Table 2-1 shows the total dollar value of stocks, options, rights and warrants traded on each of the active exchanges in the United States in 1981. Not surprisingly, the New York Stock Exchange dominates the list. Second in importance is the American Stock Exchange (AMEX), which lists shares of somewhat smaller companies of national interest (a few of which are also listed on the New York Stock Exchange). All the others (with the exception of the Chicago Board Options Exchange) are termed *regional exchanges,* since historically each served as the sole location for trading securities primarily of interest to investors in its region. However, the major regional exchanges now depend

TABLE 2-1
Total Dollar Value of Stocks, Options, Rights, and Warrants Traded on Active U.S. Exchanges, 1981

Exchange	Volume ($ billions)
New York	416.1
American	40.4
Midwest	24.7
Chicago Board Options	22.4
Pacific Coast	13.3
Philadelphia	11.4
Boston	2.4
Cincinnati	2.0
Spokane	.014
Intermountain	.001

SOURCE: U.S. Securities and Exchange Commission, *Annual Report, 1982*.

to a substantial extent on transactions in securities that are also listed on a national exchange.

A relative newcomer to the list is The Chicago Board of Options Exchange, which lists only stock options and dominates this portion of the market (accounting for approximately 54% of the volume in 1981).[3]

Other stock exchanges use procedures similar to those of the New York Stock Exchange. The roles of specialists and the extent of automation may differ, but the basic approach is the same.

Options exchanges and commodities exchanges utilize some procedures that differ significantly from those employed by stock exchanges. Commodities exchanges substitute daily price limits for the presence of a specialist with orders to maintain a "fair and orderly market." The Chicago Board Options Exchange separates the two functions of the specialist; a "board broker" is charged with the maintenance of the book of limit orders, with one or more registered "market-makers" assigned the role of dealer.

The Over-the-Counter Market

In the early days of the United States, banks acted as the primary dealers for bonds and stocks, and investors literally bought and sold securities "over the counter" there. Transactions are more impersonal

[3] U.S. Securities and Exchange Commission, *Annual Report, 1982*.

now, but the designation remains in use for transactions that are not consummated on an organized exchange. Most bonds are sold over-the-counter, as are mutual funds, many bank and finance stocks, and the securities of small (and some not-so-small) companies.

The over-the-counter market for stocks is highly automated. In 1971 the National Association of Securities Dealers (NASD), which serves as a "self-regulating" agency for its members, put into operation the NASD Automated Quotations System (NASDAQ). This nationwide communications network allows brokers to know virtually instantly the terms currently offered by all major dealers in securities covered by the system.

Dealers who subscribe to Level III of NASDAQ are given terminals with which to enter firm bid and ask prices for any stock for which they make a market. Such dealers must be prepared to execute trades for at least one "normal unit of trading" (usually 100 shares) at the prices quoted. As soon as a bid or ask price is entered for a security, it is placed in a central computer file and may be seen by other subscribers (including other dealers) on their own terminals. When new quotations are entered, they replace the dealer's former prices.

Most brokerage firms subscribe to Level II of NASDAQ for their trading rooms, obtaining terminals that can display the current quotations on any security in the system. All bid and ask quotations are displayed, with the dealer offering each quotation identified.

Level I of NASDAQ is used by individual account executives to get a feel for the market. It shows the highest bid and the lowest ask price for each security.

Stocks with larger trading volumes are classified as *National Market Issues*. Every transaction made by a dealer for such a stock is reported directly, providing up-to-date detailed trading information to NASDAQ users. For the less active issues, dealers report only total transactions at the close of each day.

NASDAQ is primarily a quotation system. Actual transactions are made via direct negotiation between broker and dealer. However, the system could easily be adapted to cross orders and thus provide "automatic execution."

To be included in NASDAQ, a security must have at least two registered market-makers and a minimum number of publicly held shares; moreover, the issuing firm must meet stated capital and asset requirements. At the end of 1982, 3,664 issues were included in the system.[4]

The NASDAQ system covers only a portion of the outstanding OTC stocks, and no bonds. Brokers with orders to buy or sell noncovered securities rely on quotation sheets and less formal communications networks to obtain "best execution" for their clients.

[4] *National Association of Securities Dealers 1982 Fact Book.*

The Third and Fourth Markets

Until the 1970s the New York Stock Exchange required its member firms to trade all NYSE-listed stocks at the Exchange and to charge fixed commissions. For large institutions this was both cumbersome and expensive. Typically, a brokerage firm with a large transaction to complete would serve as a *block positioner* (i.e., an "upstairs dealer"), seeking out institutions willing to take at least part of the other side of the trade but also prepared to take at least part for its own account. After both sides had been lined up, the block would be brought to the floor of the Exchange for formal execution, any public orders at the previously negotiated price would be taken, and the broker's buy and sell orders then crossed.

The requirement that NYSE member firms bring such blocks to the Exchange floor was at most a nuisance. But the required minimum commission rate was a serious problem, since it exceeded the marginal cost of arranging trades of such size. Brokerage firms that were not members of the Exchange faced no such restrictions and could thus compete effectively for trades in NYSE-listed stocks. Such transactions were said to take place in the *third market.*

Many institutions dispense with brokers and exchanges entirely for transactions in New York Stock Exchange-listed stocks and other securities. Trades of this type are sometimes said to take place in the *fourth market.* In the United States some of these transactions are facilitated by an automated computer/communications system called *Instinet,* which provides quotations and execution automatically.[5] A subscriber can enter a limit order in the computerized "book," where it can be seen by other subscribers who can, in turn, signal their desire to take it. Whenever two orders are crossed, the system automatically records the transaction and sets up the paperwork for its completion. Subscribers can also use the system to find likely partners for a trade, then conduct negotiations by telephone. A similar system, called *Ariel,* is used in the United Kingdom.

Some New York Stock Exchange-listed stocks are traded on other exchanges or through the NASDAQ system. However, most trades in such securities are at least formally made on the NYSE (over 78% in early 1982).[6]

THE CENTRAL MARKET

The *Securities Acts Amendments of 1975* mandated that the U.S. Securities and Exchange Commission move as rapidly as possible toward

[5] The use of an intermediary system makes it difficult to categorize such trades (perhaps they occur in a 3.5 market).

[6] *New York Stock Exchange Fact Book, 1983.*

the implementation of a truly nationwide competitive central securities market:

> The linking of all markets for qualified securities through communication and data processing facilities will foster efficiency, enhance competition, increase the information available to brokers, dealers, and investors, facilitate the offsetting of investors' orders, and contribute to best execution of such orders.[7]

Implementation of these objectives has proceeded in steps. In 1975 a *Consolidated Tape* began to report trades in New York and American Stock Exchange-listed stocks that took place on the two exchanges, on major regional exchanges, over-the-counter using the NASDAQ system, and in the fourth market using the Instinet system. Since 1976 this information has been used to produce the *composite stock price tables* published in the daily press.

Another step involves quotations. To obtain the best possible terms for a client, a broker must know the prices currently available on all major markets. To facilitate this, the Securities and Exchange Commission instructed stock exchanges to make their quotations available for use in a *Consolidated Quotations Service* (CQS). With the implementation of this system in 1978, bid and ask prices were made more accessible to those subscribing to quotation services. Increasingly, a broker is able to rely on electronics to determine the best available terms for a trade, thus avoiding the need for extensive "shopping around."

In 1978, the Intermarket Trading System (ITS) was inaugurated. This electronic communications network links seven exchanges (the NYSE, Amex, Boston, Cincinnati, Midwest, Pacific, and Philadelphia exchanges) and over-the-counter securities dealers, enabling brokers and dealers at various locations to interact with one another. In 1982, over 1,000 exchange-listed stocks were included on the system.

The final step in the process would be the establishment of a single centralized limit order book (CLOB), with associated procedures for linking markets electronically and the setting of rules concerning its use and disclosure. Other issues must be settled as well: should there be specialists, and if so, how should they operate? What requirements (if any) should be imposed on market-makers? Who should operate the central market system? And so on.

It is easy to envision a truly modern approach. For example, the centralized computer system might operate with a completely open book of orders. However, subscribers' computers could communicate with the central computer, interrogate it for information on recent trades in a stock and the current book, and automatically place, remove, or change orders based on such information. A subscribing firm could

[7] *Securities Acts Amendments of 1975,* section 11A.

program its computer system to maintain a private book, fill various types of orders (e.g., stop-loss) automatically, follow certain technical rules, alter its own limit orders based on changes in the market, and so on. Competition among brokerage firms would eventually weed out the bad ideas and institutionalize the good ones, but the central market's role would be limited to facilitating procedures of all types.

There are many long-entrenched and powerful institutions in the securities industry. The eventual nature of the central market will undoubtedly depend in part on the relative political power of the various vested interests. But the goals seem relatively clear, and on net, the changes are likely to benefit investors.

CLEARING PROCEDURES

Most securities are sold the "regular way," which requires delivery of certificates within five business days. On rare occasions a sale may be made as a "cash" transaction, requiring delivery the same day, or as a "seller's option," giving the seller the choice of any delivery day within a specified period (typically, no more than 60 days).

It would be extremely inefficient if every security transaction had to end with the physical transfer of certificates from the seller to the buyer. On a given day, a brokerage firm might sell 500 shares of American Telephone and Telegraph stock for Mr. A and buy 300 shares for Ms. B. The firm could deliver Mr. A's 500 shares to the buyer's broker and obtain Ms. B's 300 shares by accepting delivery from the seller's broker. But it would be much easier for the firm to transfer 300 of Mr. A's shares to Ms. B, send the other 200 to the buyer's broker, and instruct the seller's broker to deliver the 300 shares directly to the buyer's broker. This would be especially helpful if the firm's clients maintained their securities in street name, for the 300 shares kept within the firm would not have to be moved or have their ownership transferred on the books of the issuing corporation.

The process can be facilitated even more by a *clearing house*, the members of which are security brokerage firms, banks, and the like. Records of transactions made by members during a day are sent there. At the end of the day both sides of the trades are verified for consistency, then all transactions are netted out. Each member receives a list of the net amounts of securities to be delivered or received along with the net amount of money to be paid or collected. Every day each member settles once with the clearing house instead of many times with various other firms.

A centralized clearing house, operated by the National Securities Clearing Corporation, handles trades made on the New York and American stock exchanges and in the over-the-counter market. Some regional exchanges also maintain clearing houses. Not all exchange members

join such organizations; some choose to use the services of other members. Some banks belong, in order to facilitate delivery of securities which serve as collateral for call loans and so on.

By holding securities in street name and using clearing houses, brokers can reduce the cost of transfer operations. But even more can be done: certificates can be *immobilized* almost completely. The *Depository Trust Company* (*DTC*) accomplishes this by maintaining computerized records of the securities "owned" by its member firms (brokers, banks, and so on). Members deposit certificates, which are credited to their accounts. The certificates are transferred to the DTC on the books of the issuing corporation and remain registered in its name unless a member subsequently withdraws them. Whenever possible, one member will "deliver" securities to another by initiating a simple bookkeeping entry in which one account is credited and the other debited for the shares involved. Dividends paid on securities held by DTC are simply credited to members' accounts based on their holdings and may be withdrawn in cash.

The Securities Acts Amendments of 1975 instruct the Securities and Exchange Commission to develop a central system of this sort to eliminate the movement of stock certificates and possibly eliminate stock certificates entirely. Eventually, at dividend time, corporations' computers may deal directly with other computers that are in touch with still other computers in banks, brokerage firms, and so on. Moreover, the central market system may be integrated with the central clearing system, so that agreement of two parties to the terms of a transaction will automatically bring about the transfer of ownership required to complete the trade.

INSURANCE

In the late 1960s many brokerage firms were confronted with an unexpectedly large volume of transactions and a lack of proven computerized systems able to handle the workload. This gave rise to back-office problems and resulted in a rash of "fails to deliver"—situations in which a seller's broker did not deliver certificates to a buyer's broker on or before the required settlement date.

Worse yet, several brokerage firms subsequently failed, and some of their clients discovered for the first time that certificates "in their accounts" were not necessarily physically available. Such events led to serious concern about the desirability of any procedure that kept certificates out of the hands of the investor. To avoid erosion of investor confidence, member firms of the New York Stock Exchange spent substantial sums to cover the losses of failed firms or to merge them into successful firms. But such remedies were only temporary; insurance provided a more permanent solution.

The Securities Investor Protection Act of 1970 established the *Securities Investor Protection Corporation* (SIPC), a quasi-governmental agency that insures the accounts of clients of all broker-dealers and members of exchanges registered with the Securities and Exchange Commission against loss due to the firms' failure. Each account is insured up to a stated amount ($500,000 per customer in 1983). The cost of the insurance is supposed to be borne by the covered brokers and dealers through premiums, but up to $1 billion may be borrowed from the U.S. Treasury.

A number of brokerage firms have gone farther, arranging for additional coverage from private insurance companies.

COMMISSIONS

In the 1770s people interested in buying and selling stocks and bonds met under a buttonwood tree at 68 Wall Street in New York City. In May 1792 a group of brokers pledged "not to buy or sell from this day for any person whatsoever, any kind of public stock at a less rate than one quarter per cent commission on the specie value, and that we will give preference to each other in our negotiations."[8] A visitor to the New York Stock Exchange in the early 1970s could see this "buttonwood agreement" publicly displayed. This was not surprising, since the Exchange is a lineal descendant of the group that met under the buttonwood tree. And until 1968 the Exchange required its member brokers to charge fixed minimum commissions for stocks, with no "rebates, returns, discounts or allowances in 'any shape or manner,' direct or indirect."[9] The terms had changed, but the principle established 180 years earlier remained in effect.

In the United States most cartels designed to limit competition by fixing prices are illegal. But this one was exempted from prosecution under the antitrust laws. Before 1934 the Exchange was, in essence, considered a private club for its members. This changed with passage of the *Securities and Exchange Act of 1934,* which required most exchanges to be registered with and controlled by the Securities and Exchange Commission (SEC). The Commission, in turn, encouraged "self-regulation" by the exchanges of most of their activities, including the setting of minimum commissions.

After repeated challenges, the system of fixed commissions was finally terminated by the Securities Acts Amendments of 1975. Since May 1, 1975 (known in the trade as "May day"), brokers have been free to set commissions at any desired rate or to negotiate with custom-

[8] Wilford J. Eiteman, Charles A. Dice, and David K. Eiteman, *The Stock Market* (New York: McGraw-Hill Book Company, 1969), p. 19.

[9] Eiteman, Dice, and Eiteman, *The Stock Market,* p. 138.

ers concerning the fees charged for particular trades. The former procedure is more commonly employed in "retail" trades executed for small investors, while the latter is used more often by institutional investors and others who engage in large trades.

In the era of fixed commissions only competition in terms of prices was completely restricted. Brokerage firms that belonged to the New York Stock Exchange competed with one another by offering a panoply of services to customers. Large institutions were provided with security analysis, performance measurement services, and the like in return for "soft dollars"—brokerage commissions designated as payment for services rendered. Some brokers would accept as little as $3 in commissions in lieu of $2 in cash; apparently, up to two-thirds of the fixed commission rate ($2 out of $3) on such large orders was pure (marginal) profit.

Experience after May day provided confirmation. Rates for large trades fell substantially. So did those charged for small trades by firms offering only "bare-bones" brokerage services. On the other hand, broad-line firms that provided extensive services to small investors for no additional fee continued to charge commissions similar to those specified in the earlier fixed schedules. In succeeding years, as costs have risen, charges for smaller transactions have increased, while those for large trades have not.

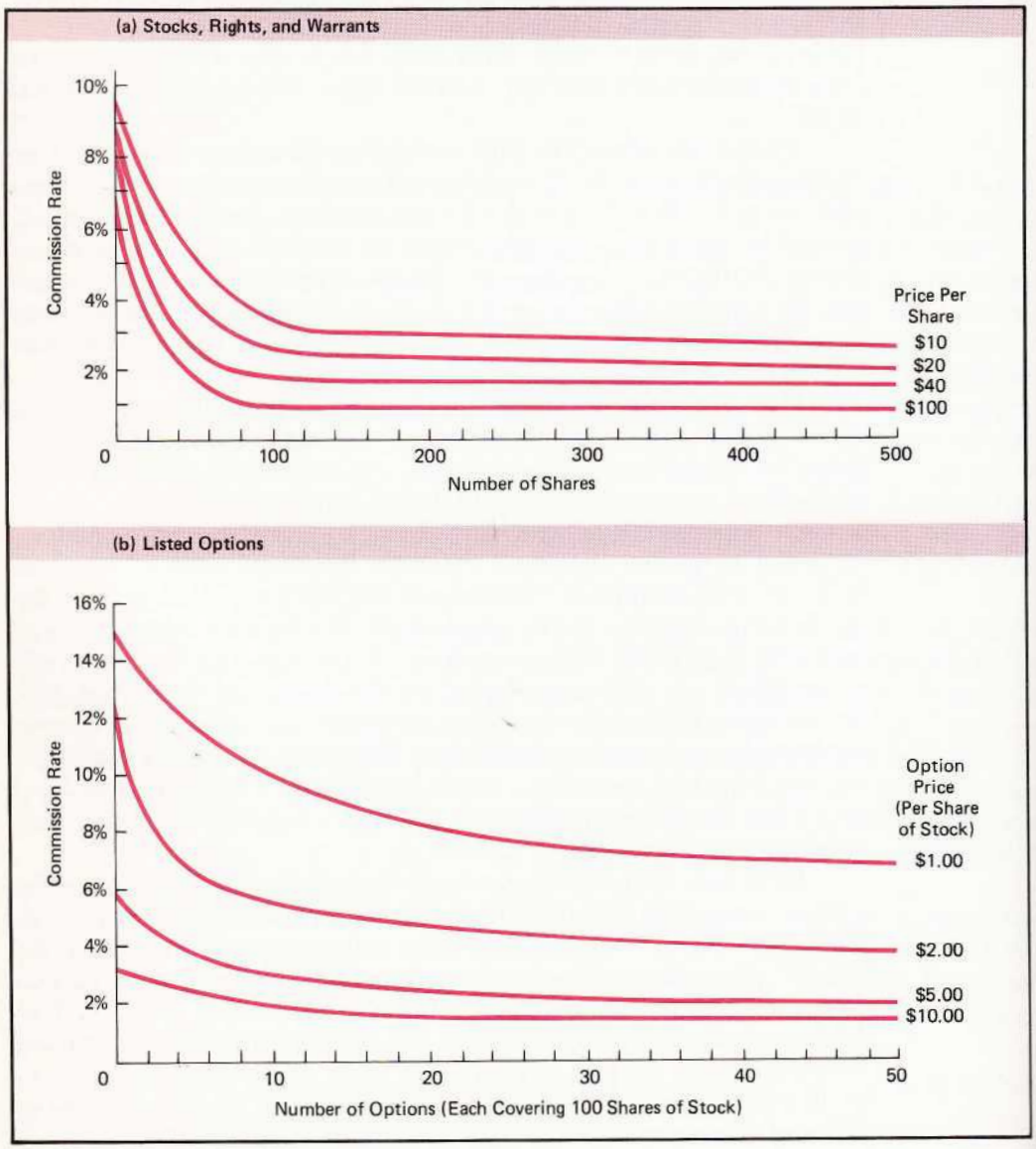
During the 1960s and 1970s a number of procedures were used to subvert the fixed commission rates: the third market prospered, regional exchanges invented ways to serve as conduits to return a portion of the fixed commissions to institutional investors, and so on.

No legal restriction gave the New York Stock Exchange its monopoly power in the first instance. Instead, the situation has been attributed to the natural monopoly arising from economies of scale in bringing many people together (either physically or via modern communication technology) to trade with each other. The potential profits from such a monopoly are, of course, limited by the advantages it confers. The increasing institutionalization of security holdings and progress in communications and computer technology have diminished the advantages associated with a centralized physical exchange. The removal of legal protection for this particular type of price-fixing may thus have only accelerated a trend already under way.

Increased competition among brokerage houses has resulted in a wide range of alternatives for investors. Following May day, some firms "unbundled"—pricing execution and other services separately; others "went discount"—dropping almost all ancillary services and cutting commissions accordingly. Still others "bundled" new services into comprehensive packages. Some of these approaches have not stood the test of time, but just as mail-order firms, discount houses, department stores, and expensive boutiques coexist in retail trade, many different combinations are viable in the brokerage industry.

Figure 2-1 shows typical commission rates charged by retail brokerage firms for small to medium-sized trades. These rates are representative of those charged by full-line retail brokers that provide offices with quotation boards, research reports, account executives available for advice and information, and the like. They also apply to trades

FIGURE 2-1
Typical Commission Rates for Selected Transactions; Dollar Commission as a Percentage of the Value of the Order



made by customers whose volume of business is small. Discount firms with little but execution capability typically charge 30% to 70% less.

As in any other competitive industry, it behooves the customer to decide what is worth paying for and then shop around to obtain the best possible price.

TRANSACTIONS COSTS

Commission costs are only a portion of the total cost associated with buying or selling a security. Consider a "round-trip" transaction in which a stock is purchased, then sold during a period in which no new information causes investors to collectively reassess the value of the stock (more concretely: the bid and ask prices quoted by dealers do not change). The stock will typically be purchased at the dealers' ask price and sold at the bid price, which is lower. The *bid-ask spread* thus constitutes a portion of the round-trip transactions costs.

How large is the spread between the bid and ask prices for a typical stock? According to one study: approximately 30 cents per share for the securities of large, actively traded companies. This amounts to less than 1% of the price per share for most stocks of this type—a reasonably small amount to pay for the ability to buy or sell in a hurry.

But not all securities enjoy this type of liquidity. Shares of smaller firms tend to sell at lower prices but at similar bid-ask spreads. As a result, the *percentage* transactions cost is considerably larger. This is shown in Table 2-2(a). Stocks were assigned to *capitalization sectors*, based on the market value of outstanding equity. If the total market value of the shares of a company was less than $10 million, it was considered to be in sector 1; if the market value was greater than $1.5 billion, the company was included in sector 9; and so on. As the table shows, the higher the capitalization, the greater was the average price per share. Note also that the average spread in *dollars* was actually higher for the smallest capitalization stocks than for the largest. Most importantly, the *ratio* of the average spread to the average price was smaller, the higher the capitalization, falling from 6.55% for the smallest sector to .52% for the largest.

Brokerage commissions and bid/ask spreads represent transactions costs for small orders (typically 100 shares). For larger orders, one must consider the possibility of a *price impact*. The larger the order, the more likely that price will be higher (for a purchase) or lower (for a sale). The more rapidly the order is to be completed, and the more knowledgeable the individual or organization placing the order, the greater the price concession required by the dealer.

Table 2-2(b) provides estimates of average costs for transactions in the "upstairs dealer" market. All three sources of costs are included:

TABLE 2-2(a)
Common Stock Bid/Ask Spreads: Small Orders

	CAPITALIZATION						
Sector	From ($ millions)	To ($ millions)	Number of Issues	Percent of U.S. Market	Average Price ($)	Average Spread ($)	Spread Price
1 (small)	0	10	1,009	.36	4.58	.30	6.55%
2	10	25	754	.89	10.30	.42	4.07%
3	25	50	613	1.59	15.16	.46	3.03%
4	50	75	362	1.60	18.27	.34	1.86%
5	75	100	202	1.27	21.85	.32	1.46%
6	100	500	956	15.65	28.31	.32	1.13%
7	500	1,000	238	12.29	35.43	.27	.76%
8	1,000	1,500	102	8.87	44.34	.29	.65%
9 (large)	1,500	99,999	180	57.48	52.40	.27	.52%

Round-Trip Transactions Costs, Common Stock

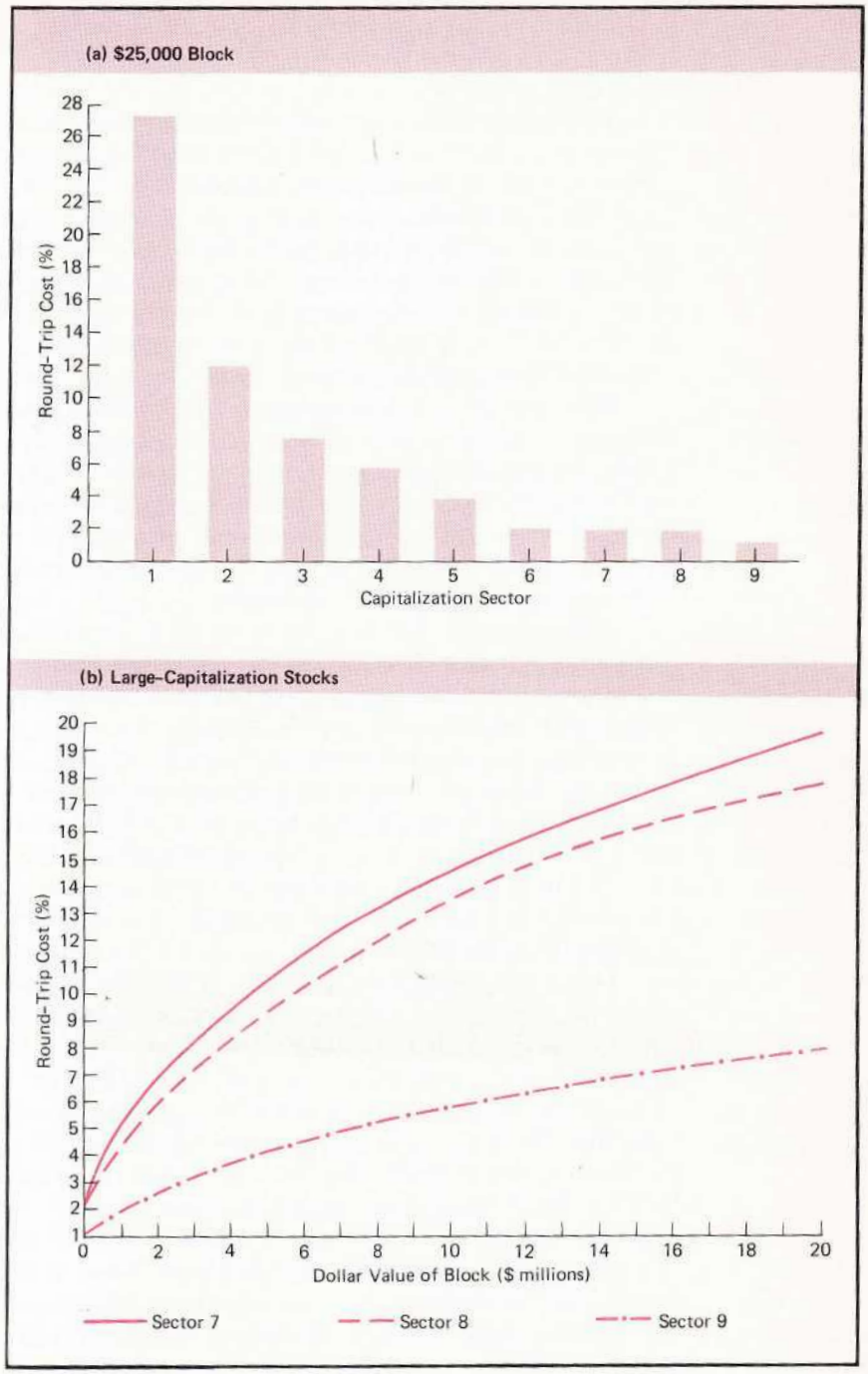
	CAPITALIZATION								
	Dollar Value of Block ($ thousands)								
Sector	5	25	250	500	1,000	2,500	5,000	10,000	20,000
1 (small)	17.3	27.3	43.8						
2	8.9	12.0	23.8	33.4					
3	5.0	7.6	18.8	25.9	30.0				
4	4.3	5.8	9.6	16.9	25.4	31.5			
5	2.8	3.9	5.9	8.1	11.5	15.7	25.7		
6	1.8	2.1	3.2	4.4	5.6	7.9	11.0	16.2	
7	1.9	2.0	3.1	4.0	5.6	7.7	10.4	14.3	20.0
8	1.9	1.9	2.7	3.3	4.6	6.2	8.9	13.6	18.1
9 (large)	1.1	1.2	1.3	1.7	2.1	2.8	4.1	5.9	8.0

SOURCE: Thomas F. Loeb, "Trading Cost: The Critical Link Between Investment Information and Results," *Financial Analysts Journal*, 39, no. 3 (May/June 1983), 39–44.

bid/ask spreads, brokerage commissions, and price concessions. The figures refer to the total cost for a "round trip"—a purchase followed by a sale.

Figure 2-2(a) plots the costs for transactions in blocks of $25,000 each. Values range from over 27% (for small-capitalization stocks) to 1.2% (for large capitalization stocks). Figure 2-2(b) shows the relationship between order size and transaction cost for each of the three largest-capitalization sectors. As indicated, the impact of a very large order on price can be substantial, and the impact is greater, the smaller the capitalization of the stock.

FIGURE 2-2
Round-Trip Transactions Costs



Investment Banking

New securities are said to be sold in the *primary market*. Some issuers deal directly with purchasers, but many rely on *investment bankers*, who serve as intermediaries between issuers and the ultimate purchasers of their securities.

Investment banking services are performed by brokers and dealers and, for tax-exempt general obligation bond issues, by banks. In some instances only a few large institutional investors are solicited, and the entire issue is sold to one or more of them. Such *private placements* are frequently used for bond issues. As long as relatively few potential buyers are contacted (e.g., less than 25), requirements for detailed disclosure, public notice, and so on may be waived, considerably reducing the cost of floating an issue. Such placements are often announced after the fact, via advertisements in the financial press.

When public sale is contemplated, much more must be done. Many firms may serve as intermediaries in the process. One, acting as the "lead" investment banker, will put together a *purchase group* or *syndicate* and a *selling group*. The former includes firms that purchase the securities from the issuing corporation and *underwrite* the offering; the latter includes firms that contact potential buyers and do the actual selling, usually on a commission basis.

The process begins with discussions between the issuing corporation and one or more investment bankers. Some issuers utilize *competitive bidding*, then select the investment banker offering the best overall terms. This procedure is used for many government bond issues and is required by law for securities issued by firms in certain regulated industries. However, many corporations maintain a continuing relationship with a single investment banker and *negotiate* the terms of each new offering with that firm. The investment banker is likely to be heavily involved in the planning of an offering, the terms involved, the amount to be offered, and so on, serving, in effect, as a financial consultant to the corporation.

Once the basic characteristics of an offering have been established, a *registration statement* is filed with the Securities and Exchange Commission, and a preliminary prospectus disclosing material relevant to the prospective buyer is issued. The actual price of the security is not included in the preliminary prospectus, and no final sales may be made until the registration becomes *effective* and a *final prospectus* issued, indicating the "offer" price at which the stock will be sold. The final prospectus may be issued as soon as, in the opinion of the Securities and Exchange Commission, there has been adequate disclosure and a reasonable waiting period has passed (usually, 20 days). The Commission, however, does not take a position regarding the investment merits of an offering or the reasonableness of the price.

A security issue may be completely underwritten by an investment

banker and the other members of the purchasing group. If it is, the issuing corporation receives the public offering price less a stated percentage spread (although underwriters will occasionally be compensated with shares, warrants, and so on). The underwriters, in turn, sell the securities at the public offering price or less and may take some of the securities themselves. Underwriters who provide this sort of *firm commitment* bear all the risk, once the price and underwriting spread have been determined.

Not all agreements are of this type. In the case of a rights offering an underwriter may agree to purchase at a fixed price all securities not taken by current stockholders; this is termed a *standby agreement*. In the case of a nonrights offering, members of an investment banking group may serve as agents instead of dealers, agreeing only to handle an offering on a *best-efforts* basis.

During the period when new securities remain unsold, the investment banker is allowed to attempt to "stabilize" the price of the security in the secondary market by standing ready to make purchases at or above the offering price. Such *pegging* may continue for up to ten days after the official offering date. There is a limit to the amount that can be purchased in this manner, usually stated in the agreement under which the underwriting syndicate is formed, since the members typically share the cost of such transactions. If there is to be any pegging, a statement to that effect must be included in the prospectus.

In any security transaction there may be explicit and implicit costs. In a primary distribution the explicit cost is the underwriting spread, and the implicit cost is any difference between the public offering price and the price that might have been obtained otherwise. The spread provides compensation for both marketing services and risk-bearing. The lower the public offering price, the smaller the risk that the issue will not be sold quickly at that price. If an issue is substantially underpriced, the investment banking syndicate can be assured that the securities will sell rapidly, requiring little or no support in the secondary market. Since many corporations deal with only one investment banker, and since the larger investment banking firms rely on each other for inclusion in syndicates, it has been alleged that issuers pay too much in spreads, given the prices at which their securities are offered. In other words, the returns to underwriting are asserted to be overly large relative to the risks involved, owing to ignorance on the part of issuers or the existence of an informal cartel among investment bankers.

Whether or not this is the case, a number of new issues do appear to have been underpriced. Figure 2-3 shows the *abnormal returns* for a group of common stock new issues. For each of the first 60 months after the initial offering (horizontal axis) the return over and above that of stocks of equal risk is shown (vertical axis). The leftmost point indicates the abnormal return obtained by an investor who purchased

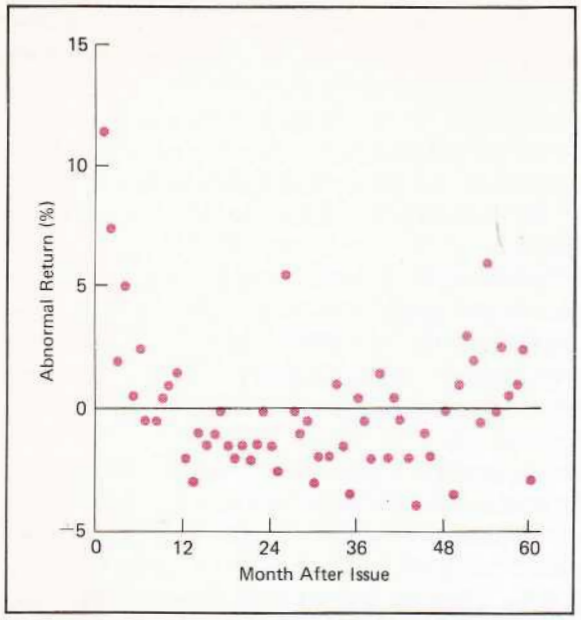


FIGURE 2-3
Abnormal Returns: 112 Common Stock New Issues, 1960-1969

SOURCE: Roger G. Ibbotson, "Price Performance of Common Stock New Issues," *Journal of Financial Economics*, *2*, no. 3 (September 1975), 252. By permission of North-Holland Publishing Co., Amsterdam.

such stock at its offering price and sold it for the bid price at the end of the month during which it was offered. The amount was substantial: 11.4% in a month or less (and significantly different from zero in a statistical sense). The remaining points show the returns that could have been obtained by an investor who was able to purchase the security at the bid price at the end of the next month. Some of these were positive, but only one was significantly different from zero. Moreover, none was large enough to overcome the transactions costs associated with in-and-out trades on the secondary market—that is, the fact that the ask prices, at which sales would be made, were 6% to 7% greater than the bid prices.

On average, new issues of "unseasoned" securities appear to have been underpriced. Investors able to purchase a cross section of such shares at their offering prices might thus expect better performance than those holding other securities of equal risk. It is not surprising that such offerings are often rationed by the members of the selling group to "favored" customers. It is "not uncommon for underwriters to receive, prior to the effective date, public 'indication of interest' for five times the number of shares available."[10] Unfavored customers are presumably allowed to buy only the new issues that are not substan-

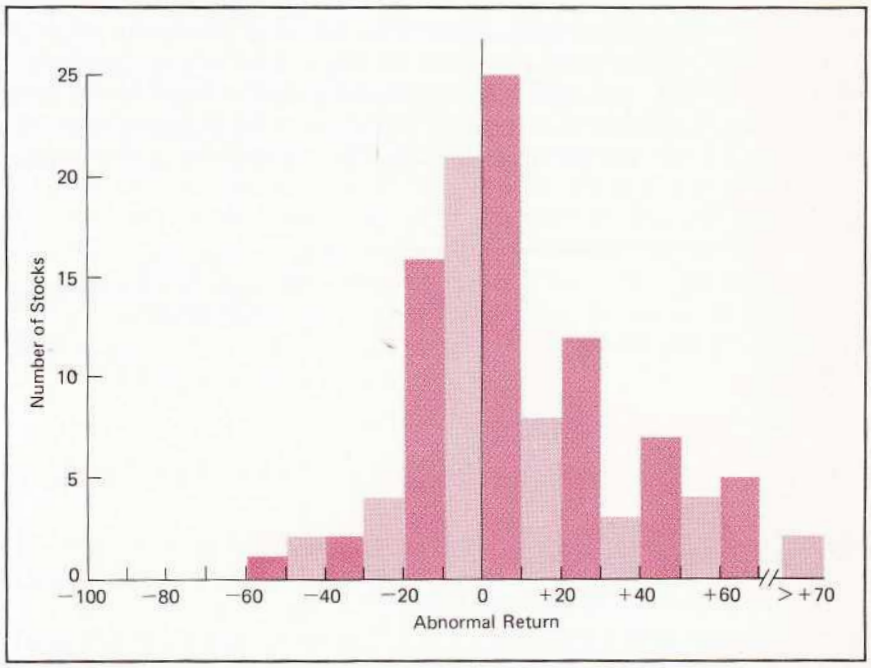
[10] Securities and Exchange Commission, *Report of Special Study on Security Markets*,

tially underpriced. And since costs may be incurred in becoming a "favored" customer, it is not clear that even such an investor obtains abnormally large returns overall.

While the return obtained by the purchaser of a new issue may be substantial on average, the amount may be very good or very bad in any particular instance, as Figure 2-4 shows. While the odds may be in the purchaser's favor, a single investment of this type is far from a sure bet.

A relatively recent change in regulations has made it possible for large corporations to foster greater competition among underwriters. Starting in 1982, the Securities and Exchange Commission allowed firms to register securities in advance of issuance under Rule 415. With such "shelf registration" (in which the firm registers securities, then places them on a shelf) securities may be sold up to a year later. With securities "on the shelf," a corporation can require investment bankers to bid competitively, simply refusing to sell shares if desirable bids are not forthcoming.

FIGURE 2-4
Abnormal Return from Offering Price to Bid Price at the End of the Offering Month, 112 Common Stock New Issues, 1960-1969



SOURCE: Roger G. Ibbotson, "Price Performance of Common Stock New Issues," *Journal of Financial Economics*, *2*, no. 3 (September 1975), 235-72. By permission of North-Holland Publishing Co., Amsterdam.

BLOCK SALES

An individual or institution wishing to sell a large block of stock can do so in either of two ways. A brokerage firm may be asked to find one or more buyers and perhaps to take some of the position itself, or the stock may be sold through a *secondary distribution*. An investment banking group buys the block from the seller and then offers the shares publicly at a stated price; in a typical case the shares are first offered after normal trading hours at the day's closing price. The buyer of shares in a secondary distribution usually pays no commission, and the original seller receives the total proceeds less an underwriting spread.

The Securities and Exchange Commission requires that a secondary distribution be registered, with public announcement and disclosure and a 20-day waiting period, if the seller has a "control relationship" with the firm that issued the securities. Otherwise the distribution may be unregistered.

The impact of the sale of a large block on a stock's price provides information on the resiliency of the capital market. As might be expected, the information that someone is selling tends to lower the price. But one would not expect a block sale to depress price so much that it later bounces back significantly, as the market "absorbs" the shares.

Figure 2-5 provides confirmation for this hypothesis. It shows the average price adjusted for market changes for 345 secondary distributions, with the price 25 days prior to the distribution taken as 1.0. On average, a secondary distribution leads to 2% to 3% once-and-for-all reduction in price. This is undoubtedly due to the information content of the fact that someone has decided to sell. Additional analysis of

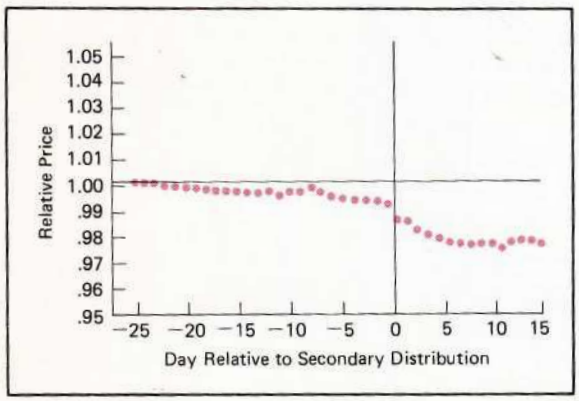


FIGURE 2-5
Prices for 345 Secondary Distributions, 1961-1965

SOURCE: Myron S. Scholes, "The Market for Securities: Substitution versus Price Pressure and the Effects of Information on Share Prices." *The Journal of Business*, 45, no. 2 (April 1972). 179-211. © 1972 by the University of Chicago. All Rights Reserved.

TABLE 2-3
Average Price Decline versus Type of Seller: 345 Secondary Distributions, 1961-1965

Type of Seller	Percentage Change in Adjusted Price from Ten Days before the Distribution to Ten Days after the Distribution
Corporations and officers	2.9
Investment companies and mutual funds	2.5
Individuals	1.1
Estates	.7
Banks and insurance companies	.3

SOURCE: Myron S. Scholes, "The Market for Securities: Substitution versus Price Pressure and the Effects of Information on Share Prices," *The Journal of Business*, 45, no. 2 (April 1972), 179-211. © 1972 by the University of Chicago. All Rights Reserved.

these results supports the assertion. The size of the decline was related to the identity of the seller—being the greatest for sellers likely to be information-motivated and smallest for sellers likely to be liquidity-motivated, as shown in Table 2-3.

A similar picture was obtained when blocks of stock traded on the New York Stock Exchange were examined. To select transactions likely to have been initiated by a seller, blocks sold on a "minus tick"—at a price below that of the previous trade—were used. Figure 2-6 shows the results. The vertical axis plots the average price, adjusted for market moves, relative to that 20 days before the block trade. There appears to be a once-and-for-all decline of about 2% due to the information content of the knowledge that someone wishes to sell a large block.

Examination of the price behavior during the day on which a block is sold does reveal a small price-pressure effect, however. As Figure 2-7 shows, a block sale appears to depress price temporarily by an average amount of about .7%.

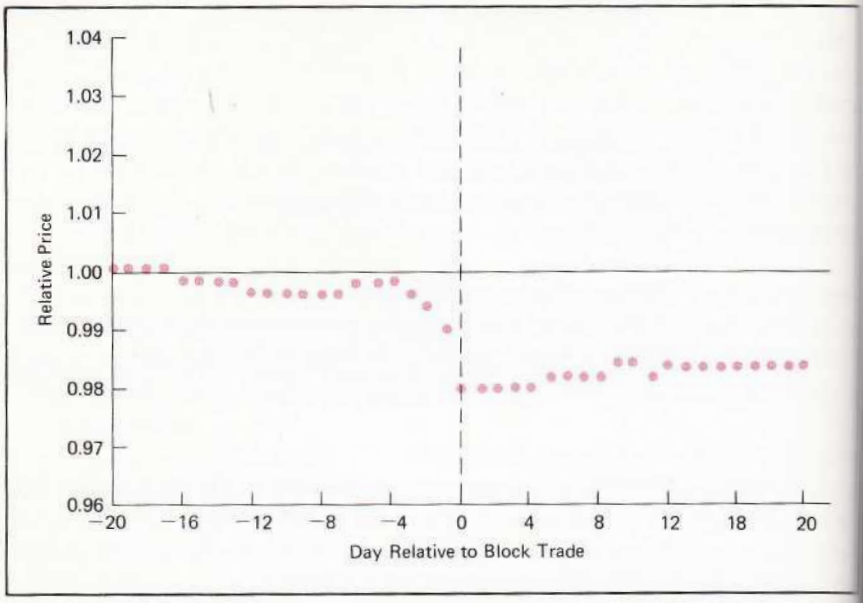
REGULATION OF SECURITY MARKETS

Directly or indirectly, security markets in the United States are regulated under both federal and state laws.

The *Securities Act of 1933* was the first major legislation at the federal level. Sometimes called the "truth in securities" law, it requires registration of new issues and disclosure of relevant information by the issuer and prohibits misrepresentation and fraud in security sales.

The *Securities Exchange Act of 1934* extended the principles of

FIGURE 2-6
Prices for 1,121 Large-Block Trades on Minus Ticks, Traded on the New York Stock Exchange, 1968-1969



SOURCE: Alan Kraus and Hans Stoll, "Price Impacts of Block Trading on the New York Stock Exchange," *The Journal of Finance*, XXVII, no. 3 (June 1972), 580.

the earlier act to cover secondary markets and required national exchanges and brokers and dealers to be registered.

Since 1934, both acts (and subsequent amendments to them) have been administered by the *Securities and Exchange Commission* (*SEC*), a quasi-judicial agency of the U.S. government. It is run by five Commissioners appointed by the President and confirmed by the Senate; each Commissioner serves for a five-year term. The Commission is aided by a large permanent staff of lawyers, accountants, economists, and others.

The SEC is the prime administrative agency for a number of other pieces of federal legislation. The *Public Utility Holding Company Act of 1935* brought such corporations under the Commission's jurisdiction. The *Bankruptcy Act of 1938* specified that the Commission should advise the court in any reorganization of a firm under Chapter X whenever there is substantial public interest in the firm's securities. The *Trust Indenture Act of 1939* gave the Commission power to insure that bond indenture trustees were free from conflict of interest. The *Investment Company Act of 1940* extended disclosure and registration requirements to investment companies. The *Investment Advisers Act of 1940* required the registration of most advisers and the disclosure of any

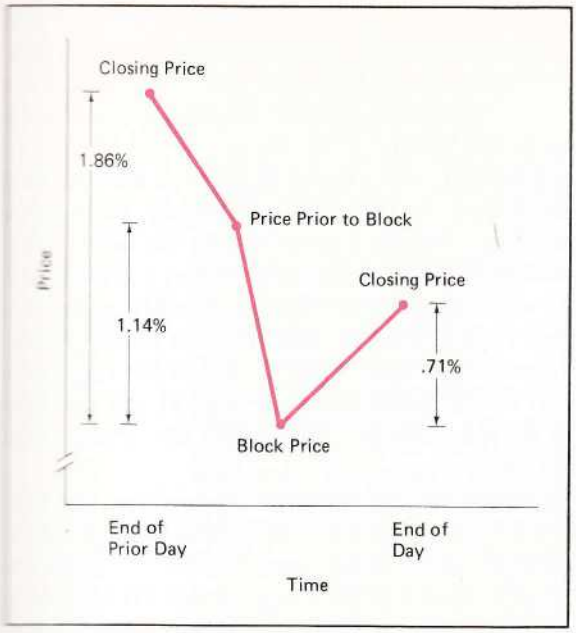


FIGURE 2-7
Within-Day Prices for 1,121 Large Block Trades on Minus Ticks, Traded on the New York Stock Exchange, 1968-1969

SOURCE: Alan Kraus and Hans Stoll, "Price Impacts of Block Trading on the New York Stock Exchange," *The Journal of Finance*, XXVII, no. 3 (June 1972), 575.

potential conflicts of interest. The *Securities Investor Protection Act of 1970* provided for the coverage of losses in the event of failure of a brokerage firm.

Federal securities legislation relies heavily on the principle of *self-regulation*. The SEC has delegated to exchanges its power to control trading practices for listed securities, while retaining, however, the power to alter or supplement any resulting rules or regulations. The Commission's power to control trading in over-the-counter securities has been delegated similarly to the *National Association of Securities Dealers* (NASD), a private association of brokers and dealers in OTC securities. In practice the SEC staff usually discusses proposed changes with both the NASD and the exchanges in advance, and few rules are formally altered or rejected by the Commission.

An important piece of legislation that makes security markets in the United States different from those in many other countries is the (Glass-Steagall) *Banking Act of 1933*, which separated commercial banking from investment banking. Because of this act, banks have not played as prominent a role in security markets in the United States as elsewhere. Recently, however, a major move has begun toward greater competition among financial institutions. Two key pieces of legislation were the *Depository Institutions Deregulation and Monetary Control Act* of 1980 and the *Depository Institution Act* of 1982. Many

banks now offer security brokerage services, retirement funds, and the like via subsidiaries of their holding companies. Long-standing limitations on rates paid on deposits and checking accounts have been removed, and so on. The line between commercial banking and investment activity is becoming more blurred every day.

Initially, security regulation in the United States was the province of state governments. Beginning in 1911, state *blue sky laws* were passed to prevent "speculative schemes which have no more basis than so many feet of blue sky."[11] While such statutes vary substantially from state to state, most of them outlaw fraud in security sales and require registration of brokers and dealers (and, in some cases, investment advisers) and of nonexempt securities. Some order has been brought by the passage in many states of all or part of the *Uniform Securities Acts* proposed by the National Conference of Commissions on Uniform State Laws in 1956.

Securities traded in interstate commerce, and brokers, dealers, and exchanges trading in interstate commerce, fall under the provisions of federal legislation (although some have been explicitly exempted under its terms). A considerable domain still comes under the exclusive jurisdiction of the states. Moreover, federal legislation only supplements state legislation, it does not supplant it. Some argue that the investor is overprotected as a result, while others suggest that regulatory agencies in general, and especially those that rely on "self-regulation" by powerful industry organizations, in fact protect the members of the regulated industry against competition, thereby damaging the interests of their customers, rather than promoting them. Both positions undoubtedly contain elements of truth.

Problems

1. New York Stock Exchange specialists are expected to make trades to maintain a "fair and orderly market." This is sometimes taken to mean that they should trade for their own accounts as required to avoid sudden and substantial price changes. Under what conditions would this be desirable? Under what conditions would it be profitable for the specialist?
2. What dangers are associated with placing a market order? A limit order?
3. Ted Turner wants to buy 100 shares of Silicon Valley Products, which is currently selling for $31 per share. Assume that initial margin requirements permit him to borrow 40% of the current stock price, and maintenance margin regulations require him to have a 25% equity position in the account at all times. If he borrows

[11] *Hall* v. *Geiger-Jones Co.*, 242 U.S. 539 (1917).

initially as much as possible in buying the 100 shares, at what price would he be subject to a margin call?

4. Some time after Ted Turner bought Silicon Valley Products, Sally Stanford sold 100 shares short at $31 per share. Initial margin on short sales was then 50%, and maintenance margin regulations required that she have an equity position equal to 40% of the value of the shorted stock. If she put up as little cash as possible at the time she sold SVP short, at what price would she be subject to a margin call?
5. What is the justification for the rule that short sales should not be made in falling markets? What is the counterargument?
6. As a practical matter, who gets the proceeds from a short sale? What are the costs of such a sale to the short-seller?
7. Commissions on large trades are typically a smaller percentage of the value of the trade than are commissions on small trades. Is this discriminatory?
8. There is some evidence that stocks of companies with small amounts of stock (measured by market value) outstanding "do better" than other stocks, taking such things as differences in risk into account. If this is so, should one hold only small-capitalization stocks? Could this situation prevail in an efficient market of sophisticated investors?

4

The Valuation of Riskless Securities

TIME AND RISK

In this world, it seems, nothing is riskless. Philosophically this may well be an appropriate position. However, some securities are clearly less risky than others, and as a useful first step in understanding valuation it is worthwhile to consider investments that are totally riskless, whether or not such extreme examples really exist.

In terms of *dollar* returns, the obvious candidates for this classification are the instruments representing the debt of the U.S. government. Since the government can print money whenever it chooses, the promised payments are virtually certain to be made on schedule. However, the ability and perhaps too frequent willingness of the government to create money raises the possibility of only partially predictable increases in the overall level of prices, with attendant uncertainty as to the purchasing power of the promised payments. While U.S. government bonds may be riskless in terms of dollar returns, they may be quite risky in terms of *real* returns—that is, purchasing power.

This source of risk can be dealt with. For example, a number of governments have issued bonds whose payments are adjusted to compensate for changes in an index of their country's overall price level.

Of course, not all government debt is riskless with respect to nominal payments, let alone purchasing power, as holders of the bonds of Czarist Russia will testify.

Despite these important questions, in this chapter we will assume that there are securities whose returns are certain, and we will consider the factors that determine their values. To the extent that inflation is relevant, we will assume that its magnitude can be predicted. Such abstractions make it possible to focus on the impact of *time* on security valuation. Having accomplished this, we will then be in a position to expand our view to include *risk* as well.

To begin with the simplest possible case, let us analyze the plight of Robinson Crusoe. Poor Mr. Crusoe has been shipwrecked on an uninhabited island with little but a store of 20 bushels of corn. His knowledge of shipping leads him to expect to be saved in two years. In the meantime he must decide how much corn to eat this year and how much to plant (i.e., invest) to obtain corn to eat next year. In keeping with the goals of this chapter, we assume the island is not subject to the vagaries of nature that plague most farmers; Crusoe can be certain of the results of whatever planting he undertakes.

After carefully surveying the island, Crusoe decides that there are 20 plots of arable land, each capable of taking one bushel of corn. The plots differ in exposure, soil quality, and so on. This is shown in Table 4-1, in which the plots are listed in decreasing order of yield. The best plot offers a return of 36% on an investment of one bushel of corn; the worst plot offers a negative return of −2%.

TABLE 4-1
Productivity of Crusoe's Land

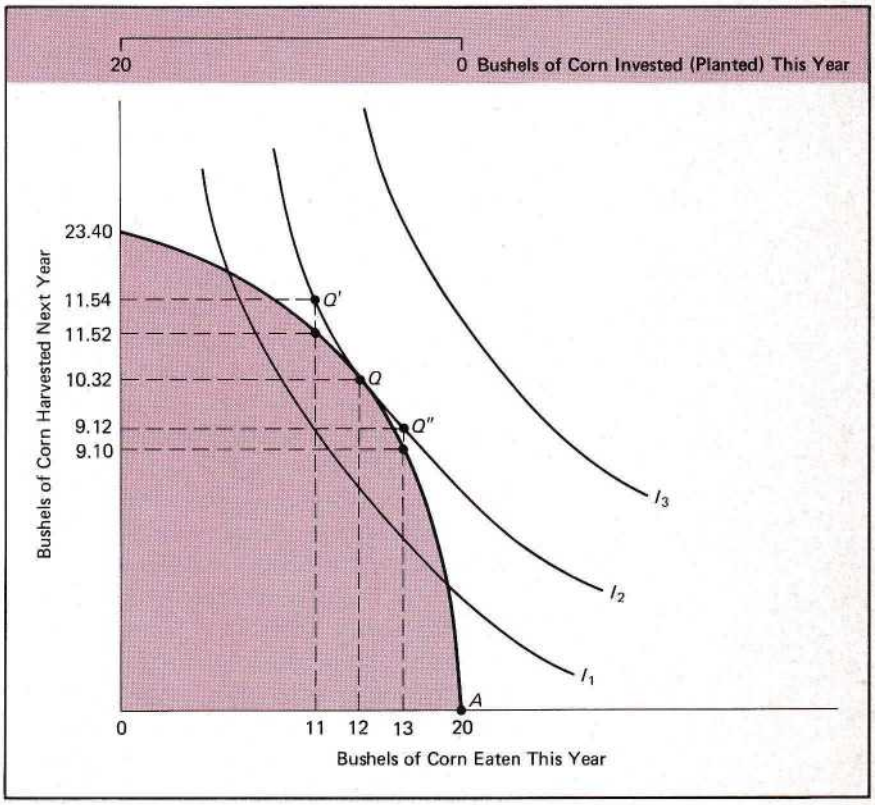
Plot Number	Bushels of Corn Planted This Year on Plot	Yield in Bushels of Corn Harvested Next Year on Plot	Return on Investment on Plot (%)	Cumulative Yield from This Plus All Previous Plots
1	1	1.36	36	1.36
2	1	1.34	34	2.70
3	1	1.32	32	4.02
4	1	1.30	30	5.32
5	1	1.28	28	6.60
6	1	1.26	26	7.86
7	1	1.24	24	9.10
8	1	1.22	22	10.32
9	1	1.20	20	11.52
10	1	1.18	18	12.70
11	1	1.16	16	13.86
12	1	1.14	14	15.00
13	1	1.12	12	16.12
14	1	1.10	10	17.22
15	1	1.08	8	18.30
16	1	1.06	6	19.36
17	1	1.04	4	20.40
18	1	1.02	2	21.42
19	1	1.00	0	22.42
20	1	.98	−2	23.40

The shaded region in Figure 4-1 shows Crusoe's alternatives. He could, of course, eat all 20 bushels of corn this year, leaving him nothing to eat next year; this strategy plots at point *A* in the field. If Crusoe chooses instead to plant one of his bushels of corn, reducing the amount eaten to 19 bushels, he can look forward to eating next year; the amount will be 1.36 bushels if he uses the best plot of land, keeps the birds from eating the corn, and so on.

If Crusoe chooses to invest two of his bushels of corn, he will, unhappily, get less than twice as great a return. The incremental investment of one additional bushel of corn today yields only 1.34 bushels of corn next year. Why? Because poorer land must be used. This is simply a special case of the more general principle of diminishing returns. The more invested in an economy, the smaller is likely to be the return on each additional unit of investment. Since Crusoe is the entire economy of his island, the situation is quite typical.

The shaded region in the figure portrays all the productive opportunities shown in Table 4-1 for this simple economy. Which point will

FIGURE 4-1
Consumption and Investment Selection



Crusoe choose? The answer clearly depends on his feelings about present versus future consumption. These feelings can be shown graphically by a series of *indifference curves*, each of which connects combinations among which Crusoe is indifferent. For example, he considers any combination on curve I_1 as good as any other on that curve. Similarly, he considers any combination on curve I_2 as good as any other on that curve. Of course, he would prefer a combination on I_2 over one on I_1, and a combination on I_3 over one on either I_2 or I_1. To keep from cluttering up the figure, only three of Crusoe's indifference curves have been drawn; many more could, of course, be added.

What will Crusoe do? From his available opportunities he will pick the one he prefers. Graphically, this is the opportunity on the highest (best) indifference curve, and it lies at a point where the curve touches but does not cut (i.e., is tangent to) the opportunity region. In the figure, this is shown by point Q: Crusoe chooses to eat 12 bushels of corn this year, invest (plant) 8 (20 − 12) bushels of his initial stock, and look forward to harvesting 10.32 bushels, all of which he will eat next year while waiting for his ship to come in.

What is the return on Crusoe's investment? He plants eight bushels of corn and harvests 10.32 bushels a year later. The rate of return is thus:

$$\frac{10.32 - 8}{8} = .29$$

or 29% per year.

This is the *overall* or *average* return on investment in the economy as a whole. But it is not the *incremental* or *marginal* rate of return. And the latter corresponds to the interest rate in a complex economy, as we will see.

Look closely at the area around point Q in Figure 4-1. What would happen if Crusoe decided to eat one more or one less bushel of corn this year? If he decided to eat one less bushel, the return on the extra bushel planted (invested) would be 20%—he could plan to eat 1.20 (11.52 − 10.32) bushels more next year. However, it would take 1.22 (11.54 − 10.32) bushels to keep him as happy as he is with combination Q, as shown by point Q'; for this reason he will not make the change. Looking the other way, the figure shows that if one more bushel were eaten this year, next year's consumption would be reduced by 1.22 (10.32 − 9.10) bushels, while Crusoe would be willing to reduce it by only 1.20 (10.32 − 9.12) bushels, as shown by point Q''; thus he will not make this change either.

While the effect of a change depends on both the type of change (up or down) and its magnitude, in the region of the chosen point the marginal effects are fairly similar. In this case Crusoe chooses a situation in which the marginal rate of return on investment is about 21%

per year. Moreover, after he chooses the best available combination, the rate at which he is willing to trade present for future consumption is also about 21%.

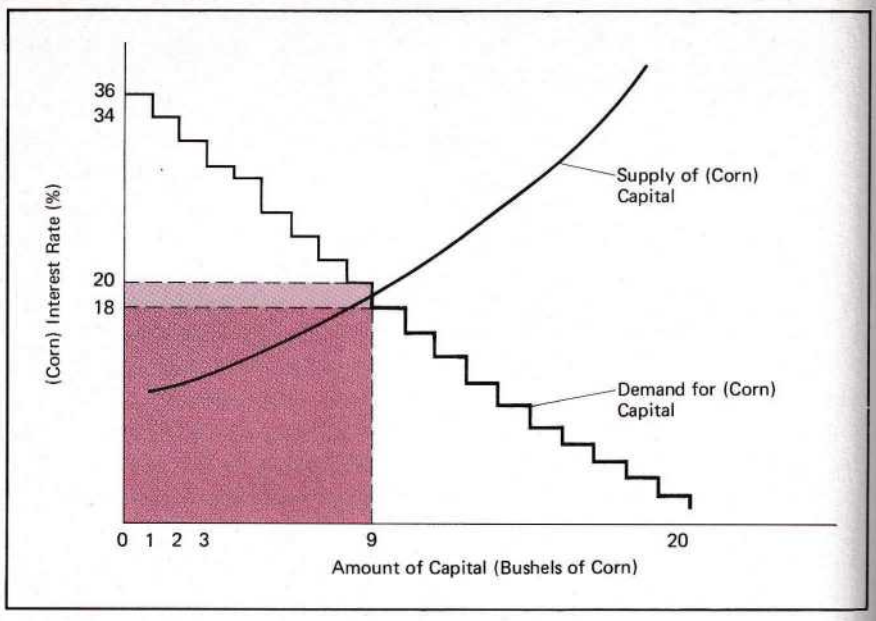
INVESTMENT AND INTEREST

Let us move a step closer to reality by assuming that Crusoe is not alone. He has been preceded by Mr. Friday, who owns all the land on the island outright. However, Crusoe owns all the corn. If no one else were to intrude, the final outcome could depend on bargaining, cheating, skulduggery, or even war. To avoid such unpleasantries, let us assume that one of the clerks from the Paris Bourse is scheduled to drop by and "call out" a rate at which Crusoe and Friday can trade present corn for corn one year hence. Moreover, let us assume that both Crusoe and Friday take this rate as given, and they engage in no form of ruse trying to obtain a better rate by concealing their true desires. While this is hardly likely to be the case with two traders in a very small market, it is quite representative of most people's situation in a developed economy: for example, the interest rate at the local savings and loan is not likely to be affected by the magnitude of any single person's transactions. Since we are using Crusoe and Friday only to illustrate more complex economies, it makes sense to avoid diversion into matters of gamesmanship and potential violence.

Given a rate at which Friday can get corn, how much will he take? Assume that Crusoe will provide corn at a (corn) interest rate of 31%. In other words, for every bushel Friday takes, he must pay back 1.31 bushels next year. Referring to Table 4-1, one bushel clearly makes sense; Friday can clear a profit of .05 bushels (1.36 − 1.31) using his best plot of land. A second bushel will add .03 bushels (1.34 − 1.31) to his profit, if he plants it on his second-best plot. A third bushel will add another .01 bushels (1.32 − 1.31) to his profit. But any more would clearly be unprofitable. At an interest rate of 31%, Friday will take three bushels of corn. Figure 4-2 shows this, as well as the amount he will take at other interest rates. Not surprisingly, this is simply the information from Table 4-1, plotted in a different form. It shows the *marginal efficiency of* (*corn*) *capital* and is also the *demand for* (*corn*) *capital*. The lower the interest rate, the more investment will be profitable for producers such as Friday and the greater will be the quantity of capital demanded.

How much (corn) capital will Crusoe offer at various interest rates? The answer depends on his initial stock and his attitudes toward present versus future consumption. However, the situation shown in Figure 4-2 is typical: the higher the interest rate, the greater the amount of present consumption people are willing to forego in favor of future consumption. The *supply-of-capital* curve is upward-sloping.

FIGURE 4-2
Demand and Supply of Capital



As in Paris, our visiting clerk wants to maximize the amount invested. Since this will be the smaller of (1) the amount Friday will take and (2) the amount Crusoe will provide, the appropriate interest rate, as shown in Figure 4-2, is about 19%. At this rate Crusoe will wish to supply nine bushels of corn in return for 10.71 (9 plus 19% of $9 = 1.9 \times 9$) bushels next year. Moreover, at this rate Friday will wish to take just nine bushels, knowing he will obtain a total yield of 11.52 bushels, leaving .81 bushels ($11.52 - 10.71$) in profit for his undertaking (not much, but a welcome supplement to his usual diet of fish). Having arranged such a compatible situation, the clerk can steal silently away and return home.

THE INTEREST RATE

In the real world, there can be a little Friday and a little Crusoe in each of us. We all own some assets (if nothing else, ourselves) that can be invested or consumed. Further, most of us engage to some extent in production. However, this does not alter the key conclusions reached in the previous section. *In a free economy, interest rates will adjust until the total amount of capital demanded by producers equals the amount that owners of wealth are willing to supply*. Demand depends, at base, on productive opportunities, supply on preferences for present

versus future consumptions and on the ownership of wealth. Both affect the outcome and together determine the interest rate.

This is often difficult to see, since the day-to-day forces affecting interest rates appear to relate more to government policy, flotations of new securities by corporations, and so on. While such activities do impact real interest rates, they are usually only ripples on the surface; the underlying forces of productive opportunities and preferences for present versus future consumption are the major determinants.

Two extreme cases illustrate the influence of demand and supply conditions. At one end of the spectrum are the interest rates paid to depositors (investors) by savings and loan associations. These change fairly frequently, but no single association is likely to adjust its rate as the demand and supply for its funds varies from day to day. As in any other competitive industry, rates are fairly consistent from firm (association) to firm (association). Only when overall demand changes relative to supply will firms find it desirable to change interest rates. And this does happen from time to time. Within any limits allowed by government regulation, demand and supply determine the rates paid by savings and loans.

At the other end of the spectrum lie the 90-day Treasury bills sold by the U.S. government every week. Each bill entitles the holders to receive $1,000 ninety days from the date of issue. The quantity issued (supplied) each week depends primarily on the government's financing needs. Individuals and businesses can bid for (demand) the bills. The effective interest rate thus depends directly on the bid prices (demand) relative to the quantity available (supply). Not surprisingly, the resulting values vary from week to week.

MONETARY VERSUS REAL INTEREST RATES

In real economies there is, of course, more to life than corn. One can trade present corn for future corn, present wheat for future wheat, present wine for future automobiles, and so on.

Modern economies gain much of their efficiency through the use of money—a generally agreed-upon medium of exchange. Instead of trading present corn for a future Honda, as in a barter economy, the citizen of a modern economy can trade his corn for money (i.e., "sell" it), trade the money for future money (i.e., "invest" it), then trade the future proceeds for a Honda (i.e., "buy" it). The rate at which he or she can trade present money for future money is the *monetary* interest rate—usually called simply *the* interest rate.

In periods of changing prices the monetary interest rate may prove a poor guide to the real return obtained by the investor. While there is no completely satisfactory way to summarize the myriad of price changes that take place in such periods, most governments attempt

to do so by measuring the cost of a specified mix of major items. The "overall" price level computed for this representative combination of items is usually termed a *cost-of-living index* or *consumer price index*. Whether or not it is relevant for a given individual depends to a major extent on the similarity of his or her purchases to the mix of goods and services used to construct the index. Moreover, such indices tend to overstate increases in the cost of living and understate decreases for people who do begin by purchasing the chosen mix of products. There are two reasons for this. First, improvements in quality are seldom taken adequately into account. Perhaps more important, little or no adjustment is made in the mix as relative prices change. The rational consumer can reduce the cost of attaining a given standard of living as prices change by substituting relatively less expensive goods for those that have become relatively more expensive.

Despite these drawbacks, cost-of-living indices provide at least rough estimates of changes in prices. And such indices can be used to determine an overall *real* rate of interest. For example, assume that during a year in which the monetary rate of interest is 8%, the cost-of-living index increases from 121 to 124. This means that the combination of goods and services that cost \$100 in some base year cost \$121 at the beginning of the year and \$124 at the end of the year. The owner of such a bundle could have sold it for \$121 at the start of the year, invested the proceeds at 8% to obtain $1.08 \times 121 = \$130.68$ at the end, then purchased $130.68/124 = 1.05387$ bundles. The real interest was thus 5.387%.

These calculations can be summarized in the following formula:

$$\frac{C_0 \times (1 + i_m)}{C_1} = 1 + i_r$$

where:

C_0 = cost-of-living index at the beginning of the year

C_1 = cost-of-living index at the end of the year

i_m = the monetary interest rate, expressed as a decimal number (e.g., .08)

i_r = the real interest rate, expressed as a decimal number (e.g., .05387)

An alternative version is:

$$\frac{1 + i_m}{1 + c} = 1 + i_r$$

where

$1 + c = C_1/C_0$

c = the change in the cost of living, expressed as a decimal number

In this case, $C_1/C_0 = 124/121 = 1.02479$, so prices increased by about 2.5% ($c = .02479$).

For quick calculation, the real interest rate can be estimated by simply subtracting the rate of change in the cost of living from the interest rate:

$$i_r \approx i_m - c$$

where $\approx$ means "is approximately equal to." In this case, the quick calculation results in an estimate of $.08 - .02479 = .05521$ or 5.521%, reasonably close to the true value of 5.387%.

Sad to say, in this world the fact of inflation seems to be fairly predictable, but its precise magnitude is hard to estimate in advance. For this reason we defer further discussion of real versus monetary interest rates until Chapter 10. Suffice it to say here that it may be best to view the expected real interest rate as determined by the underlying forces described in earlier sections, with the monetary interest rate approximately equal to this amount plus the likely change in prices.

FORWARD RATES

Unlike Robinson Crusoe, most of us make plans extending well beyond the coming year: no ship is likely to come in and solve all our economic problems. People thus consider investments that will pay off next year, those that will pay off in the following year, and so on. Since interest rates are associated with investments, and investments differ in longevity, there are thus many interest rates, not just one.

To take a simple case, assume that two U.S. government bonds can be purchased at present. The first matures in a year, at which time the holder will receive $1,000. The second matures in two years, at which time the holder will receive $1,000. Although U.S. bonds of such duration entitle the holder to periodic interest payments, we will ignore this for now to keep the calculations simple. The prices asked by dealers for the two bonds are:

One-year bond: $934.58

Two-year bond: $865.35

It is a simple matter to determine the effective interest rate on the one-year bond. An investment of $934.58 will pay $1,000 one year hence. The return is thus:

$$\frac{1{,}000 - 934.58}{934.58} = .07$$

—that is, an interest rate of 7% per year.

But what is the interest rate on the two-year bond? Or should one even think of an interest rate in this case? Three approaches merit discussion.

The first is the simplest of all. One simply expresses the rate in terms of the actual life of the bond:

$$\frac{1{,}000 - 865.35}{865.35} = .1556$$

or 15.56% for two years. The obvious disadvantage of this measure is its inability to provide comparisons among bonds of different maturities. Moreover, it cannot be used for even a single bond with intermediate interest payments. It is little used, and with good reason.

A second method calculates the so-called "yield-to-maturity." This is the single interest rate (with interest compounded at some specified intervals) that, if paid by a bank on the amount invested, could enable the investor to obtain all the payments made by the bond in question. For example, assuming annual compounding at a rate r [expressed as a decimal), an account with \$865.35 invested initially would grow to $(1 + r) \times \$865.35$ in one year. Leaving this total intact, the account would grow to $(1 + r)[(1 + r) \times \$865.35]$ by the end of the second year. The interest rate we seek must bring the account to \$1,000 at the end of the second year. In other words, r must be selected so that:

$$(1 + r)^2 \times 865.35 = 1{,}000$$

or

$$1 + r = \sqrt{\frac{1{,}000}{865.35}}$$

The required value of r is .07499, so the yield-to-maturity of this bond is 7.499% per year.

Yield-to-maturity is the most commonly used measure of a bond's return. It can be computed for any investment, and it facilitates comparisons among investments of different lives and other characteristics. However, it has some serious drawbacks. In the attempt to express a complex instrument's return in a single number, it raises the possibility of serious oversimplification. It is thus desirable to look behind the yield-to-maturity to examine the fundamental determinants of value. The third method does just this.

The payment on a two-year bond can be considered the result of investment for two years at two potentially quite different rates. Thus the initial investment of \$865.35 could have grown to $(1 + r_1) \times \$865.35$ at the end of the first year, and this total could then have grown to $(1 + r_2) \times [(1 + r_1) \times 865.35]$ at the end of the second year. We could thus describe the bond with any of the many pairs of one-

year rates r_1 and r_2 that would let the account grow to \$1,000 at the end of the second year. We need only select a pair of values that satisfies the equation:

$$(1 + r_1)(1 + r_2)865.35 = 1{,}000$$

The yield-to-maturity is simply a special case of this in which a further requirement is imposed: that the rates be the same.

But there is no reason for the rates to be the same. In fact, they seldom are. This case is no exception. We know from the price of the one-year bond that the interest rate for money loaned now and paid back a year from now is 7%. The appropriate value for r_1 is thus .07. But what is the value of r_2? The answer can be determined readily. We seek the value that will make:

$$1.07(1 + r_2)865.35 = 1{,}000$$

It is .08 or 8%. This is the implied *forward rate* for year two: the interest rate for money loaned a year from now and paid back two years from now, *with the contract made now*. It is important to distinguish this from the rate for one-year loans that will prevail for deals made a year from now (the *spot* rate at that time). A forward rate applies to contracts made for a period "forward" in time. By the nature of the contract, the terms are certain now, even though the actual transaction will occur later. If, instead, one were to wait until next year to borrow money, the terms might prove better or worse than today's forward rate; in any event future spot rates are generally not perfectly predictable.

Forward contracts are sometimes made explicitly. For example, a contractor might obtain a commitment from a bank for a one-year construction loan a year hence at a fixed rate of interest. *Financial futures markets* (discussed in Chapter 17) provide standardized agreements similar to forward contracts. For example, in January 1984 one could contract to pay \$976.08 in September 1984 to purchase a 90-day U.S. Treasury bill that would pay \$1,000 in December 1984.

PRESENT VALUE

Given the interest rates determined in the market at any given time, it is fairly straightforward to find the present value of any investment offering future payments with certainty. As before, let us use r_1 to represent the interest rate on a one-year loan maturing in a year, and r_2 to represent the forward interest rate on a one-year loan maturing in two years. Similarly, r_3, r_4, . . . will represent one-year loans maturing in three, four, . . . years. Thus r_1 is today's spot rate and r_2, r_3, . . . are forward rates. As before, all values are expressed as decimals.

By proper use of existing instruments it is possible to arrange for P dollars today to grow to F_2 dollars in two years, where P and F_2 satisfy the equation:

$$[(1 + r_1)(1 + r_2)]P = F_2$$

By extension, if we let t represent any year, P dollars today can be made to grow to F_t dollars t years from now, where P and F_t satisfy the equation:

$$[(1 + r_1)(1 + r_2) \cdots (1 + r_t)]P = F_t$$

[The term in the brackets is simply a shorthand representation of the product of all the terms from $(1 + r_1)$ to $(1 + r_t)$, inclusive.]

This equation can be used to find the *present* value, P, that is equivalent to a future value of F_t, received t years in the future. Simple rearrangement provides the answer:

$$P = \left[\frac{1}{(1 + r_1)(1 + r_2) \cdots (1 + r_t)}\right] F_t$$

or:

$$P = d_t F_t \qquad \textbf{(4-1)}$$

The term in brackets (d_t) is the *discount factor* for year t. The multiplication of F_t by d_t is termed *discounting*: converting the given future value into an equivalent present value. The latter is equivalent in the sense that P present dollars can be converted into F_t dollars in year t via available investment instruments, given the currently prevailing interest rates. An investment promising F_t dollars in year t with certainty should sell for P dollars today. If it sells for more, it is overvalued; if it sells for less, it is undervalued. These statements rest solely on comparisons with equivalent opportunities in the marketplace. Valuation of riskless investments thus requires no assessment of individual preferences, only careful analysis of available opportunities in the market.

The simplest and, in a sense, most fundamental characterization of the structure of the market for default-free bonds is given by the current set of discount factors, known as the *discount function*. With this set of values it is a simple matter to value a riskless bond that provides more than one payment, for it is, in effect, a package of bonds, each of which provides only one payment. Each amount is simply discounted using formula (4-1), and the resultant present values summed. For example, take a bond paying a coupon of $100 at the end of the current year and $1,000 at maturity, two years hence. Assume the values from our previous example hold. Thus:

$$d_1 = \frac{1}{1 + r_1} = .9346 = \frac{1}{1.07}$$

TABLE 4-2
Present Value of a Bond

Time	Payment ($)	Discount Factor	Present Value ($)
One year hence	100	.9346	93.46
Two years hence	1,000	.8654	865.40
		Total present value:	$958.86

and

$$d_2 = \frac{1}{(1+r_1)(1+r_2)} = .8654 = \frac{1}{1.07 \times 1.08}$$

The present value of the bond is thus $958.86, as shown in Table 4-2.

No matter how complex the pattern of payments, this procedure can be used to determine the value of a riskless bond of this type. The general formula is:

$$PV = \sum_t d_t F_t$$

where

PV = present value
F_t = the (certain) payment to be made at time t
d_t = the present value of a dollar paid (with certainty) at time t
$\sum_t$ = the sum of all relevant values (e.g., $d_1F_1 + d_2F_2 + d_3F_3 + \cdots$)

YIELD-TO-MATURITY

As we have seen, if P dollars grows to F_t dollars in year t:

$$[(1+r_1)(1+r_2)\cdots(1+r_t)]P = F_t$$

or

$$[(1+r_1)(1+r_2)\cdots(1+r_t)] = \frac{F_t}{P}$$

The yield-to-maturity, also called the internal rate of return, is the constant rate of interest that would have the same effect. In this case, we must find a value r for which:

$$[(1+r)(1+r)\cdots(1+r)]P = F_t$$

where there are t values of $(1 + r)$ in the brackets. Simplifying:

$$(1+r)^t = \frac{F_t}{P}$$

Since we know that F_t/P will also equal the product of the true interest rates, we can simply find the value of r that satisfies:

$$(1+r)^t = (1+r_1)(1+r_2)\cdots(1+r_t)$$

Taking the tth root of each side:

$$(1+r) = \sqrt[t]{(1+r_1)(1+r_2)\cdots(1+r_t)}$$

This shows that $(1 + r)$ is a kind of average of the values $(1+r_1)$, $(1+r_2)$, and so on. It is called the *geometric mean*, as contrasted with the more common *arithmetic mean* or simple average. The two values will usually differ; recall that in our earlier example the yield-to-maturity was 7.499%, while a simple average of the two rates would be 7.5%. In more realistic examples the two rates can differ by a substantial amount.

For more complex (and common) cases in which payments are made at different times, it is more difficult to calculate the yield-to-maturity. Generally a trial-and-error procedure must be followed. The goal is to find a value of r that will discount all future payments to present values that sum to the present price. The discount factors are, for payments one year hence:

$$\frac{1}{1+r}$$

for payments two years hence:

$$\frac{1}{(1+r)(1+r)}$$

for payments t years hence:

$$\frac{1}{(1+r)^t}$$

An example will show how the process works. In this case we wish to analyze a bond that will pay \$100 one year hence and \$1,000 two years hence. Imagine that it sells for \$930. What is its yield-to-maturity?

To get started, let us guess 10% and calculate the implied present value. The results are shown in Table 4-3. The present value is too small. We have discounted the payments by too much. Clearly a lower interest rate is in order. Let us guess 5%. The results are shown in Table 4-4. Now the present value is too large. We have not discounted the future payments enough. We need to try some rate between 5% and 10%.

And so it would go, until the calculated present value came sufficiently close to the actual price of the bond. Here, this will happen when the discount factors are computed at a rate of about 9.21%; this is the bond's yield-to-maturity.

TABLE 4-3
Present Value of a Bond at 10%

Time	Payment ($)	Discount Factor at 10%	Present Value ($) Using a Discount Factor of 10%
One year hence	100	.9091	90.91
Two years hence	1,000	.8264	826.40
		Total present value:	$917.31

Happily, computers are good at trial-and-error. One can describe a very complex series of payments to a computer and get an answer concerning yield-to-maturity in short order. In fact, some hand-held calculators come with built-in programs to find yields-to-maturity (and do present-value and compound-interest calculations). To calculate yield-to-maturity one simply enters the number of days to maturity, the annual payment, and the present price, then presses the key or keys that indicate yield-to-maturity is desired. The lights blink as the calculator engages in its trial-and-error procedure, then in a few seconds the answer appears.

DURATION

Most bonds provide "coupon" (interest) payments in addition to a final ("par") payment at maturity. Depending on the relative magnitudes of these payments, a bond may be more or less like others with the same maturity date. A measure of the average time prior to the receipt of payment is obtained by calculating the bond's *duration*. This is simply a weighted average of the lengths of time prior to the payments, using the relative present values of the payments as weights.

The bond analyzed earlier provides an illustration. Recall from

TABLE 4-4
Present Value of a Bond at 5%

Time	Payment ($)	Discount Factor at 5%	Present Value ($) Using a Discount Factor of 5%
One year hence	100	.9524	95.24
Two years hence	1,000	.9070	907.00
		Total present value:	$1,002.24

TABLE 4-5
Calculating the Duration of a Bond

(1) Time (Years from Now)	(2) Present Value of Payment ($)	(3) Present Value of Payment as Proportion of Present Value of Bond	(4) Column 1 Times Column 3
1	93.46	.0975	.0975
2	865.40	.9025	1.8050
	$958.86	1.0000	1.9025

Table 4-2 that the payment of $100 one year hence had a present value of $93.46, while the final payment of $1,000 two years hence had a present value of $865.40, making the total present value of the bond $958.86. As shown in Table 4-5 this bond has a duration of 1.9025 years.

Bonds of similar duration are more likely to react in similar ways to changes in interest rates than are bonds of similar maturity but different durations. This should not be surprising. Maturity measures only the time over which a bond provides payments; it takes no account of the pattern of those payments over time. Duration takes both factors into account and thus measures a bond's characteristics more accurately.[1]

COMPOUNDING

Thus far we have concentrated on annual interest rates and assumed that funds are compounded annually. This is often appropriate, but for more precise calculations a shorter period may be more desirable. Moreover, some lenders explicitly compound funds more often than once each year.

Compounding is, of course, the payment of "interest on interest." At the end of each compounding interval, interest is computed and added to principal. This sum becomes the principal on which interest is computed at the end of the next interval. The process continues until the final compounding interval is reached.

No problem is involved in adapting our formulas to compounding intervals other than a year. The simplest procedure is to count in units of the chosen interval. Thus, if quarterly compounding is to be used

[1] As we will see in Chapter 12, even more accurate measures can be obtained.

r_t can represent the rate of interest per quarter for a three-month loan due t quarters from now, with terms contracted now.

The yield-to-maturity can also be calculated using any chosen compounding interval. If payment of P dollars now will result in a receipt of F dollars ten years from now, the yield-to-maturity can be calculated using annual compounding by finding a value r_a that satisfies the equation:

$$(1 + r_a)^{10}P = F$$

since F will be received ten annual periods from now. The result, r_a, will of course be expressed as an interest rate per year.

Alternatively, yield-to-maturity can be calculated using semiannual compounding, by finding a value r_s that satisfies the equation:

$$(1 + r_s)^{20}P = F$$

since F will be received 20 semiannual periods from now. The result, r_s, will be expressed as an interest rate per semiannual period. It can be doubled to give an annualized figure; better yet, an annualized value can be computed on the assumption of semiannual compounding—that is:

$$1 + r_a = (1 + r_s)^2$$

To reduce the massive confusion caused by the many different methods that can be used to express interest rates, the Federal Truth-in-Lending Act requires every lender to compute and disclose the *annual percentage rate* (*APR*) implied by the terms of a loan. This is simply the yield-to-maturity, computed using the most frequent time between payments on the loan as the compounding interval. While some complications arise when payments are required at irregular intervals, the use of APR's has clearly simplified the task of comparing lenders' terms.

Semiannual compounding is commonly used to determine the yield-to-maturity for bonds, since interest payments are usually made twice each year. Most preprogrammed calculators and computers use this approach.

THE BANK DISCOUNT METHOD

Despite the truth-in-lending law, other methods are still used to summarize interest rates. One time-honored procedure is the "bank discount" method. If someone "borrows" $100 from a bank, to be repaid a year hence, the bank will discount the interest of, say $8 and pay the borrower $92. According to the bank discount calculation, this is an interest rate of 8%. Not so. The borrower only receives $92, for which he or she must pay $8 in interest. The true interest rate (APR) must be based

on the money the borrower actually gets to use. In this case the rate is 8.7%, since:

$$\frac{8}{92} = .087$$

It is a simple matter to convert an interest rate quoted on a bank discount basis to a true interest rate. If the bank discount rate is r_d, the true rate is simply:

$$\frac{r_d}{1 - r_d}$$

where both values are expressed as decimal numbers. The previous example provides an illustration:

$$\frac{.08}{1 - .08} = .087$$

CONTINUOUS COMPOUNDING

When we compute an investment's return, the compounding interval can make a difference. For example, regulations may limit a savings institution to paying a fixed rate of interest but make no specifications about the compounding interval. For example, in early 1975 the legal limit on interest paid by savings and loan companies on deposits committed from six to ten years was 7.75% per year. Initially, most companies paid "simple interest"—thus $1 deposited at the beginning of the year would grow to $1.0775 by the end of the year. But then some enterprising companies announced that they would pay 7.75% per year, compounded semiannually. This meant that $1 deposited at the beginning of the year would grow to $1.03875 at the end of six months, and the total would then grow to 1.03875 × 1.03875, or 1.079 by the end of the year: an increase of 7.9%. This procedure was considered within the letter, if not the spirit, of the law.

Before long, other competitors offered 7.75% per year compounded quarterly (i.e., 1.938% per quarter), giving an effective increase of 7.978% by the end of one year. Then others offered to compound monthly (at .646% per month), for an effective increase of 8.031%. The denouement was reached when one company offered *continuous compounding* at an annual rate of 7.75%. This rather abstract procedure represents the limit approached as interest is compounded more and more frequently. If r represents the annual rate of interest (in this case, .0775) and n the number of times compounding takes place per year, the effective rate of increase, r_e, is given by:

$$\left(1 + \frac{r}{n}\right)^n = 1 + r_e$$

Thus with semiannual compounding:

$$(1.03875)^2 = 1.079$$

With quarterly compounding:

$$(1.01938)^4 = 1.07978$$

and so on. As the compounding interval grows shorter, the number of times compounding takes place (n) grows larger, as does the effective rate, r_e.

Mathematicians can prove that as n grows larger, $[1 + (r/n)]^n$ becomes increasingly close to e^r, where e stands for the number 2.71828 (to five-place accuracy). In this case, $e^{.0775} = 1.0806$ or an effective rate of 8.06% per year.[2]

A more general formula for continuous compounding can also be derived. At an annual rate of r, P dollars will grow to F_t dollars t years from now, with continuous compounding, if the values satisfy the equation:

$$e^{rt}P = F_t$$

Similarly, the present value of F_t dollars received t years hence at an annual rate of r, continuously compounded, will be:

$$P = \frac{F_t}{e^{rt}}$$

The discount factor (d_t) is thus $1/e^{rt}$ or e^{-rt}. These formulas can be used for any value of t, including fractional amounts (e.g., $t = 2.5$ for two years, six months).

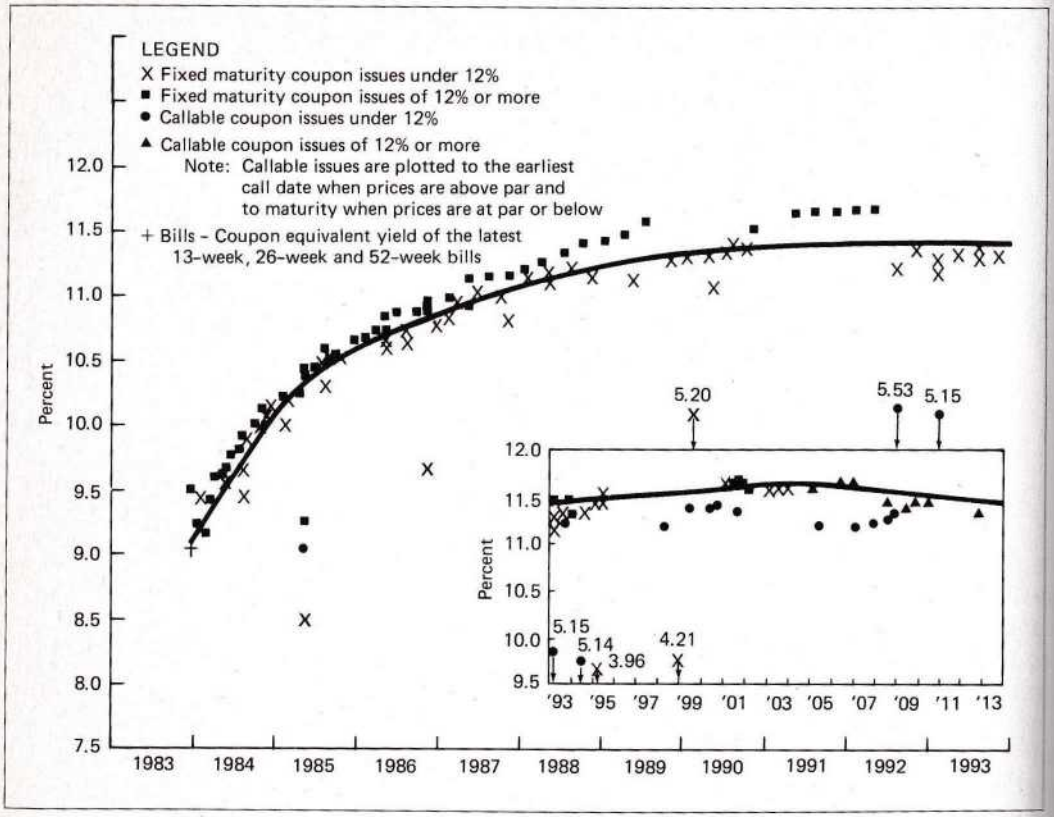
Continuous compounding is sometimes used for the analysis of interest-rate formation and change because the formulas lend themselves to algebraic treatment more readily than do those describing periodic compounding. The use of continuous compounding in practice is, however, relatively rare.

THE YIELD CURVE

At any time riskless securities will be priced more or less in accord with a set of discount factors and the associated implied forward interest rates. There is no necessary relationship among these rates. At some times rates are higher, the farther in the future the period to which they apply; at other times they are lower; at still other times, the same. It obviously behooves the security analyst to know which case prevails at present.

[2] Tables of natural logarithms may be used for such calculations. The natural logarithm of 1.0806 is .0775, and the antilogarithm of .0775 is 1.0806.

FIGURE 4-3
Yields of Treasury Securities, September 30, 1983 (based on closing bid quotations)



Note: The curve is fitted by eye and based only on the most actively traded issues. Market yields on coupon issues due in less than three months are excluded.

This is, unhappily, easier said than done. Only the bonds of the U.S. government are clearly riskless in dollar terms, and even they are not usually considered riskless in real terms. Moreover, such bonds differ in tax advantages, the ability of the government to select the effective date of maturity, and other features. Despite these problems, the U.S. Treasury Department summarizes the approximate relationship between short- and long-term yields with a *yield curve* in each issue of the *Treasury Bulletin*. This provides an estimate of the current *term structure* of interest rates. Figure 4-3 shows an example.

Unfortunately, the yield curve does not relate forward interest rates to the applicable time periods. Instead it plots the yield-to-maturity for actual bonds versus their maturity.[3] As the figure shows, the relationship is less than perfect. Part of the imperfection is due to

[3] Or, in some cases, the earliest date at which they can be "called" by the government.

differences in taxability and the like. Part is due to the fact that yield-to-maturity figures represent averages of actual forward rates and thus obscure the underlying determinants of bond prices.

Historically, a "rising yield curve" such as that shown in Figure 4-3 is the most common: long-term yields exceed short-term, implying that forward rates are higher, the farther in the future is the period for which a contract is drawn. Rising yield curves tend to be associated with periods of normal or low short-term interest rates.

When short-term interest rates are fairly high, the yield curve may be "flat," implying that all forward rates are roughly the same.

In periods of very high short-term rates the yield curve may be "falling" throughout or even "humped." A downward-sloping curve implies that forward rates are generally smaller, the farther in the future is the period for which the contract is drawn.

The determinants of the yield curve are many and complex. Moreover, risk may play a role. For this reason, we will defer further discussion until Chapter 12.

The current yield curve provides some information on the manner in which bonds are priced in the market. More fundamental values are the discount factors and associated forward rates, for they can be used to evaluate any investment. If the investment is truly riskless, its value can be determined directly. If it is risky, additional aspects must be taken into account. But that is the subject of the next three chapters.

Problems

1. Explain why the indifference curves in Figure 4-1 cannot cross.
2. a. In August 1979 one could buy a U.S. Treasury bill that would pay $1,000 in six months for a price of $954.10. What was the effective interest rate on the bill, expressed as a rate per six months?
   b. At the same time one could buy a U.S. Treasury bill paying $1,000 in twelve months for $910.10. What was the effective interest rate on this bill, expressed as a rate per twelve months?
   c. Assume that you wanted to express the return on the twelve-month bill in terms of an interest rate per six months, compounded every six months. What would be the resulting yield-to-maturity expressed as a rate per six months?
   d. Given the prices of these bills, can you determine the implicit forward rate for the second six-month period? If so, what is it (expressed as a rate per six months)?
3. A savings account that yields 8% per year compounded monthly has a higher effective annual yield than an account that offers 8% per year compounded quarterly. An account that offers 8% per year compounded daily has an even

higher effective yield. What would be the effective yearly yield (the yield equivalent to a one-time yearly compounding) for an account offering 8% per year with continuous compounding?

4. The Beneficent Loan Company has agreed to lend you funds to complete the last year of an M.B.A. program. The company will give you $10,000 today if you agree to repay the loan four years from now with a lump-sum payment of $20,164. What annual rate of interest is Beneficent charging you?
5. Assume default-free bonds are currently priced in accordance with the following set of discount factors:

Year (t)	Discount Factor (dt)
1	.9259
2	.8534
3	.7829
4	.7150

a. What are the implicit forward rates of interest?
b. What is the present value of a 10% coupon four-year bond that pays $100 in each year up to and including year 4 plus an additional $1,000 in year 4?
c. What is the present value of a 5% coupon four-year bond that pays $50 in each year up to and including year 4 plus an additional $1,000 in year 4?
d. What are the durations of the two bonds in (b) and (c)? What accounts for the nature of the difference in the two values?